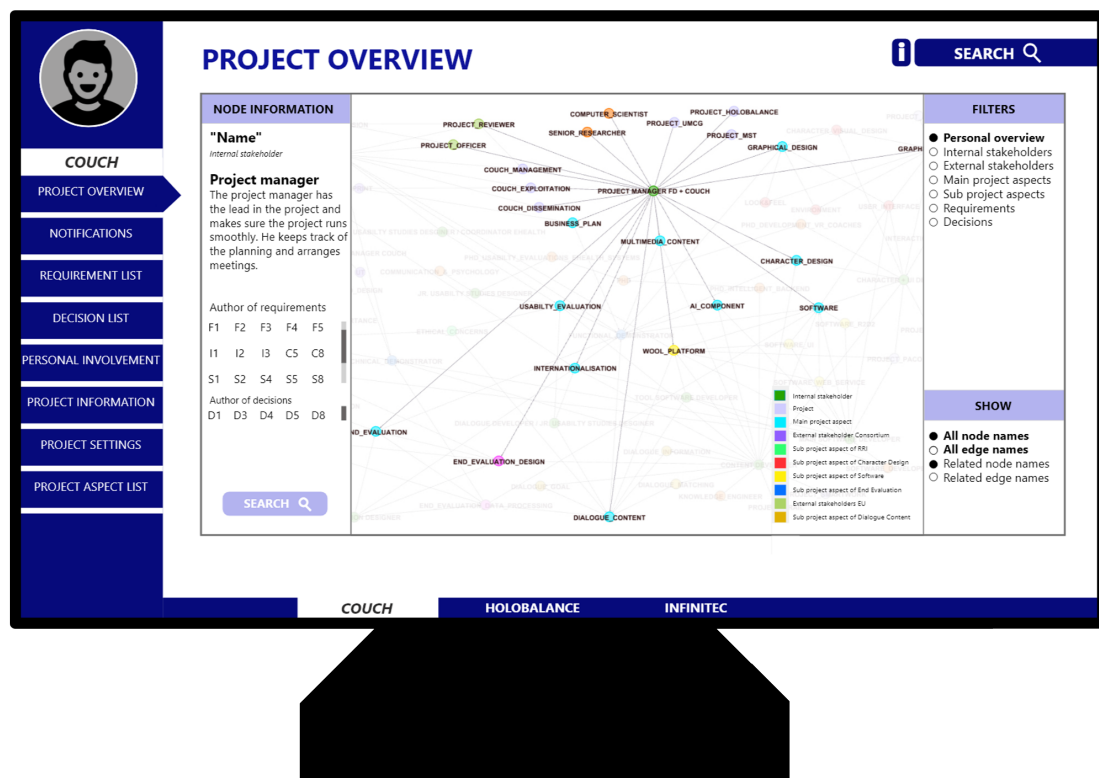


# Designing a Project Management Support Tool

for development projects that are part of European eHealth research projects



**Master thesis**

Vera van den Groenendal

Industrial Design Engineering – DPM 1691

June 12, 2020





Master thesis Industrial Design Engineering

## ***Designing a Project Management Support Tool***

*for development projects that are part of European eHealth research projects*

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## **Preface**

In front of you lies my master thesis, a piece a work that I am pretty proud of. It contains a 45 EC workload that I worked on for about fourteen months. I executed my research at Roessingh Research and Development (RRD) a research institute in Enschede.

In 2017 I organised an excursion to RRD for Optimus because I was interested in the company. This excursion was a success and RRD seemed an interesting and nice company. That is why I asked them if they had a spot available for me to do my master graduation assignment. This request ended in an invite to meet with Harm, we discussed about the assignment and that is how it all started. I could do a master assignment in the field of management and product development for a company that is involved in healthcare products and services.

During this master assignment I learned a lot, not only about my thesis topic but also about myself. In the end I was able to work an full-time work week, in which I knew when I had to take a break and was able to handle stress. Fourteen months that ended strangely due to the COVID-19 measures, when I had to work from home, Skype with not only my supervisors, but also with my family and friends. Luckily, I was able to continue my assignment without adaptations.

Finishing this assignment would not have been possible with the support of others. I want to thank Roessingh Research and Development for the opportunity to execute my master thesis there.

I want to thank all the stakeholders that I interviewed for their time, feedback and useful insights.

A special thanks to my company supervisor Harm, for the weekly meetings, that gave me ideas, cleared my head, showed me opportunities, gave me critical but supporting feedback and motivation.

Of course also a special thank you to Roy, for guiding me through this final master assignment, introducing me to Synthetic Environments, thinking along, keeping me on track, providing me with feedback and useful insights.

A great thank you to Renske, for reading my entire thesis concept and providing it with critical and supporting feedback.

And last but not least, thank you Bas, for all your love, your emotional support, your comforting words, your listening ear, and feedback!

This thesis made it once more clear that I am on the right track, that I choose the right study and I am curious about what the future holds.

Enjoy reading!

Vera van den Groenendal

## **Summary**

The project management of a development or research project can be supported by project management tools. This master thesis focusses on "Designing a Project Management Tool that Supports the development project that is part of an European eHealth research project".

This thesis is executed at Roessingh Research and Development (RRD). RRD is involved in multiple European eHealth research projects where RRD is mostly responsible for the development of a service or product. The development of such service or product is based on the European research but can be seen as an individual development project. These European projects require collaboration with multiple partners, the internal stakeholders are often only partly involved in a project and all stakeholders have their own goals within the project. This complicates the project management. This thesis researches how to design a tool that can support the project management of the development part of a research project.

Council of Coaches is one of RRD's current European eHealth research projects. This project serves as case study for the development of the Project Management Support Tool (PMST). A management support tool is first built based on the Council of Coaches project (this tool is called CMST). The CMST is adjusted and generalised so the improved tool (PMST) supports development projects that are part of an European eHealth research projects. The PMST is proposed to RRD to support their European research projects in the eHealth department.

The project management of RRD's research projects is analysed to determine strengths, weaknesses and opportunities. The PMST's potential lies in supporting the project management team, improving project documentation, stimulating stakeholder collaboration, supporting project communication, supporting the decision-making process, handling emerging new requirements and supporting effective and efficient knowledge sharing.

The Project Management Support Tool is IT-based and supports multiple projects with their project management at the same time. It is possible for the users to use the PMST for multiple projects simultaneously. All the user input is saved and the PMST builds up a database. The available data is combined into understandable and relevant information for the user.

The PMST includes characteristics of Synthetic Environments (SE) to structure these complex research projects and to support the stakeholders with their project activities. A SE is a combination of virtual and real elements describing an alternative setting of a real life situation. In this case the PMST creates an environment for the project that has SE characteristics. The PMST visualises the influence of a project update in the project overview, which allows the user to evaluate this change and decide whether or not to implement the update. Building a SE focusses on involving all stakeholders, including their opinions and documenting their requirements and decisions.

In the PMST the internal stakeholders of a project can document decisions and requirements. The users (who are internal stakeholders of a project) add information to the PMST, and the PMST presents this information in clear overviews and lists. Included are the rationale behind a requirement/decision, which requirement/decision is related to what project aspects/requirements/decisions, which stakeholders are involved in a certain project task and the author. The project overview is based on actor networks and includes all stakeholders, project aspects, requirements and decisions mentioned. Filters and graphical elements support the visualisation and can present information in different structures. This allows the user to analyse information from different perspectives. The PMST personally supports each stakeholder with notifications about requested actions and actions of other users.

Integrating and combining characteristics of Synthetic Environments, requirement engineering and decision-making support systems into the designed PMST has proved to be of added value. All decisions and requirements can effectively and efficiently be documented and managed in the PMST. This allows for easy adding and updating of certain decisions or requirements. By adding more information to the PMST, the PMST reinforces over time.

A feature to set goals for and evaluate the project (management) is included, this will provide very useful insights to the internal stakeholders that they can use in their (next) projects. Next to that, the PMST present an overview of all RRD's research projects, visualising how these projects are related and which stakeholders are involved.

A mock-up of the PMST is designed to provide an example of how the PMST could look like and function. The PMST design is positively evaluated by the potential users. Thus, when the PMST will be developed according to the proposed design, the project management of RRD's research projects will be improved and the stakeholders will be better supported. With the PMST the project management of a development project within European eHealth research project will be supported and reach maturity and grow excellence over time.

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## **Samenvatting**

Het projectmanagement van ontwikkelings- en onderzoeksprojecten kan worden ondersteund door gebruik te maken van projectmanagement tools. Deze masterscriptie focust op het ontwerpen van een projectmanagement tool die een ontwikkelingsproject binnen Europese eHealth onderzoeksproject kan ondersteunen.

Deze masterscriptie wordt uitgevoerd bij Roessingh Research and Development (RRD). RRD is betrokken bij meerdere Europese eHealth onderzoeksprojecten waarbij RRD met name verantwoordelijk is voor de ontwikkeling van een service of product. De ontwikkeling van zo'n service of product is gebaseerd op het Europese onderzoek en kan gezien worden als een opzichzelfstaand project. Deze Europese onderzoeksprojecten vereisen samenwerking met meerdere partners, de interne betrokkenen zijn vaak maar deels betrokken bij een project en alle belanghebbende hebben eigen doelen binnen het project. Dit bemoeilijkt het projectmanagement. Deze masterscriptie onderzoekt hoe een tool kan worden ontworpen die het projectmanagement van een ontwikkelingsproject binnen een onderzoeksproject kan ondersteunen.

Council of Coaches is een van de huidige projecten waar RRD aan werkt. Dit project wordt als casestudie gebruikt voor de ontwikkeling van de Project Management Support Tool (PMST). Er is eerst een projectmanagement tool ontwikkelt gebaseerd op het projectmanagement van Council of Coaches (CMST genoemd). De CMST is daarna aangepast zodat de herziene versie: de PMST het project management van de meeste Europese eHealth onderzoeksprojecten van RRD kan ondersteunen.

Het projectmanagement van de onderzoeksprojecten van RRD is geanalyseerd zodat de sterke punten, zwakke punten en kansen duidelijk worden. De potentie van de PMST zit in het ondersteunen van het projectmanagementteam en de interne stakeholders (belanghebbenden). Door middel van het verbeteren van projectdocumentatie, het stimuleren van communicatie, het stimuleren van samenwerking tussen de betrokkenen, het ondersteunen van het maken van beslissingen, het verwerken van nieuwe eisen en het ondersteunen van efficiënte en effectieve kennisdeling.

De PMST wordt door IT ondersteund en kan het projectmanagement van meerdere projecten tegelijkertijd ondersteunen. De gebruiker kan de PMST dan ook voor meerdere projecten tegelijkertijd gebruiken. Alle input die de gebruiker invoert in de PMST wordt opgeslagen in een database. Deze input wordt gecombineerd in begrijpbare en relevante informatie voor de gebruiker.

De PMST bevat kenmerken van Synthetic Environments (SE) om deze complexe onderzoeksprojecten te structureren en de stakeholders te ondersteunen bij hun projectactiviteiten. Een SE is een combinatie van virtuele en reële elementen die een alternatieve setting van een reële situatie beschrijven. In dit geval creëert de PMST een omgeving voor het project, die SE kenmerken heeft. Hiermee kan de PMST de invloed van de projectaanpassing visualiseren in een projectoverzicht, waardoor de gebruiker deze aanpassing kan evalueren en kan beslissen of de aanpassing al dan niet moet worden geïmplementeerd. Het ontwerpen van een SE richt zich op het betrekken van de meningen van alle stakeholders en het documenteren van hun eisen en beslissingen.

In de PMST kunnen de interne stakeholders van een project hun beslissingen en eisen documenteren. De gebruikers (het projectmanagement team en de interne stakeholders) voeren informatie in over de eisen en beslissingen, onder anderen de rationaal achter een eis/beslissing, aan welke projectaspecten de eis/beslissing is gerelateerd, welke stakeholders betrokken zijn bij een bepaalde projecttaak en de auteur. De PMST presenteert deze informatie in duidelijke overzichten en lijsten. Het projectoverzicht is gebaseerd op Actor-netwerken en bevat alle stakeholders, projectaspecten, eisen en beslissingen. Filters en grafische elementen ondersteunen de visualisatie en

presenteren informatie in een bepaalde structuur. Hierdoor kan de gebruiker de informatie vanuit verschillende perspectieven analyseren. De PMST geeft de gebruiker persoonlijke meldingen over acties die moeten worden uitgevoerd of acties die zijn gedaan door andere gebruikers.

Het is gebleken dat het van toegevoegde waarde is om de kenmerken van Synthetic Environments, requirement engineering en beslissingsondersteunende systemen te combineren en integreren in het ontwerp van de PMST. Alle beslissingen en vereisten kunnen effectief en efficiënt worden gedocumenteerd en beheerd in de PMST. Dit maakt het makkelijk om bepaalde beslissingen of eisen toe te voegen en bij te werken. Door meer informatie aan de PMST toe te voegen, groeit de database van de PMST en kan deze meer en gedetailleerdere informatie bieden.

Er is een functie toegevoegd die helpt bij het stellen van doelen voor project(management) en om deze te evalueren. Dit levert nuttige inzichten op voor de interne stakeholders, zij kunnen deze inzichten gebruiken in hun (volgende) projecten. Daarnaast presenteert de PMST een overzicht van alle onderzoeksprojecten van RRD. Dit overzicht visualiseert hoe deze projecten gerelateerd zijn aan elkaar en welke stakeholders erbij betrokken zijn.

Er is een mock-up van de PMST gemaakt die weergeeft hoe de PMST eruit zou kunnen zien en kunnen functioneren. Het ontwerp van de PMST is door potentiële gebruikers positief geëvalueerd. Als de PMST wordt ontwikkeld volgens het voorgestelde ontwerp, zullen de stakeholders van een project worden ondersteund en zal het projectmanagement van de onderzoeksprojecten van RRD worden verbeterd. Met de PMST kan het projectmanagement van een ontwikkelingsproject binnen een Europees eHealth onderzoeksproject worden ondersteund.

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## ***Abbreviation list***

RRD	Roessingh Research and Development
PMST	Project Management Support Tool
CMST	Council of Coaches Management Support Tool (for RRD)
SE	Synthetic Environment
COUCH	Council of Coaches
FD	Functional Demonstrator
TD	Technical Demonstrator
WP	Work Package

## ***Glossary***

### **Roessingh Research and Development (RRD)**

In the context of this report, Roessingh Research and Development (RRD) refers to the eHealth department of Roessingh Research and Development. RRD is a large research institute, researching a wide range of health related topics. RRD is the host institution of the master thesis assignment.

### **Project Management Support Tool (PMST)**

The project Management Support Tool that is developed to support the project management of a development project that is part of an European eHealth research projects. The PMST is developed for the eHealth department of Roessingh Research and Development.

### **Council of Coaches Management Support Tool (CMST)**

The development of the CMST is used as case study in the research. The CMST is developed for the eHealth department of Roessingh Research and Development to support the management of their development part of the European research project that is called Council of Coaches.

### **Synthetic Environment (SE)**

A Synthetic Environment (SE) is a combination of virtual and real elements. A Synthetic Environment's potential is to increase communication and collaboration in multidisciplinary development projects, to offer insights to make proper predictions about the effectiveness of a (new) Synthetic Environment in specific development phases (Damgrave R. , 2017).

### **RRD's research projects**

RRD's research projects refers to part of the European eHealth research project that is executed by RRD. This mainly involves the development of a service or product based on the findings of the research.

### **Council of Coaches (COUCH)**

Council of Coaches (COUCH) is a European research project. This project aims at developing a autonomous virtual council of coaches to support people with achieving their health goals. The project is executed by a consortium of seven partners. Roessingh Research and Development is one of the (leading) partners of this project.



**Functional Demonstrator (FD)**

The Functional Demonstrator (FD) is the prototype of the Council of Coaches project. The Functional Demonstrator is mainly developed by Roessingh Research and Development using currently available technologies to proof the principle of COUCH.

**Technical Demonstrator (TD)**

The Technical Demonstrator (TD) is developed within the COUCH project and represents the future way of virtual coaching by including beyond state of the art technology.

**Project**

For the scope of this thesis, “project” can refer to the Council of Coaches project, the development of the Functional Demonstrator of Council of Coaches or RRD’s European eHealth research projects.

**Project life cycle**

A project life cycle refers to all the phases a project goes through, from initiation to closure.

**Project management**

Project management refers to the approach and structure of a project that determines how the project is executed. Project management includes among others: project workflow, project communication, project documentation and project presentation.

**Project management team**

The leading person(s) of a project who manage the project management to make sure the project is well executed and they take responsibility for the project outcome.

**Stakeholder(s)**

Stakeholders are the people or organisations involved in a certain project. Their involvement can vary from only providing funding, to being a developer, a user or someone who is only involved in a small part of the project.

**Internal stakeholder(s)**

The internal stakeholders are the people who (work at Roessingh Research and Development) are involved in the development project of one of the European eHealth research projects.

**External stakeholder(s)**

The external stakeholders are all involved people in a certain development project of one of the European eHealth research projects who are not the internal stakeholders. In this thesis this could for example be the project partners or the eHealth department coordinator/director.

**User(s)**

Users are the people who actually use a product or service, when it is developed and available. Users are also a group of stakeholders. In this thesis user(s) can refer to the user(s) of COUCH (FD development), user(s) of the CMST or user(s) of the PMST.

**Project aspects**

Project aspects of a project include: hardware, software, information, knowledge, environment, workflow, working methods, ethical aspects, legal aspects, profit, society, design stages, development stages, exploitation stages, resources, management aspects, project goals, project milestones, project planning.

**Project elements**

Project elements refer to, the project's stakeholders (internal and external), the project aspects, requirements and decisions.

**Project collaboration**

Project collaboration refers to working together as a team to reach a certain goal together, preferably in an efficient and effective way.

**Project communication**

Project communication refers to exchanging information, ideas, thoughts and feelings by words or other methods.

**Project documentation**

Documenting project related aspects, e.g. information (ideas), documents, requirements and decisions.

**Project information**

All relevant information that is related to a project (COUCH, COUCH FD development, CMST or PMST).

**Decision-making**

The process of identifying and choosing possibilities based on the values, preferences and beliefs of the decision-maker(s).

**Ad hoc decisions**

Ad hoc decisions are decisions made in an unanticipated situation, often rather quickly by only one or two persons without consulting all relevant stakeholders. The impact/consequences of the decision have not been properly considered.





# CHAPTER

Introduction

# 1

## 1. Introduction

The project management of a development project or a research project, can be encountered as a difficult task. Especially when there are multiple partners involved, when internal stakeholders are only partly involved and when stakeholders have their own goals within the project. This complicates the project management. When the project management is structured and is lead well, it will likely result in better project outcomes. However, choosing the right approach to manage a project is not simple. The approach depends on several factors, e.g. the type of project, the size of the project, the involved stakeholders and the available tools. The project management team is responsible to choose the right method at the start of a project, but the question remains "How to determine the right method?". Activities that the chosen project management approach should support are stakeholder collaboration, project communication and project documentation on all project levels throughout the whole project life cycle. Next to that, this approach should fit the available budget, should not be time consuming and should improve the quality of the project outcome.

The scientific research institute Roessingh Research and Development (RRD)<sup>1</sup> is a small to medium sized enterprise (SME), with 45 employees. RRD is involved in multiple research projects, varying from European to national research projects. Their employees have various backgrounds, related to different healthcare or technology sectors. Their disciplines vary from rehabilitation medicine, movement sciences, biomedical sciences, physiotherapy, psychology and computer sciences. They focus on two main research fields, namely eHealth and rehabilitation technology. In the field of eHealth, they aim to help people with chronic diseases to live as long as possible, independently with the use of smart technologies. In the field of rehabilitation technology, they develop smart systems that adapt to the requirements, wishes and capacities of the user.

Council of Coaches (Op den Akker et al., 2018) is one of the current projects of the eHealth department. Council of Coaches<sup>2</sup> shortly COUCH, is a European project executed by a consortium of seven partners. Roessingh Research and Development (the eHealth department) is leading partner, together with the University of Twente. Within the COUCH project, a virtual coaching platform is being designed; an autonomous council that assists people in achieving and maintaining a healthy lifestyle. The council's goal is to assist (older) adults to live a healthier life. The focus lies on the physical, cognitive, mental, and social well-being of the user. The coaches will hold conversations with the user and discuss about the best plan to reach the user's personal health goal. The coaches are developed with state of the art technologies using embodied conversational virtual agents. The coaches get to know the user through profiling and sensing, where a central knowledge base is connected to save all this data. This way, the system receives relevant data on the user and its behaviour in daily situations.

The project management team of Council of Coaches is open to new approaches that would help managing the projects successfully. Currently, the internal stakeholders encountered some struggles regarding the project management and RRD is therefore open to a new project management approach. It is preferred to design a project management approach that is applicable to most of the European eHealth research projects because such an approach could support the management of all projects of the eHealth department. In addition, profiting from the reuse of knowledge gained in previous projects can be stimulated. As a result, the approach can become both, a short term support and a long term strategy that strives for constant improvement of the project management. The objective of this research is to design a Project Management Tool that Supports the development projects that are part of European eHealth research projects.

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1 <http://www.rrd.nl/>

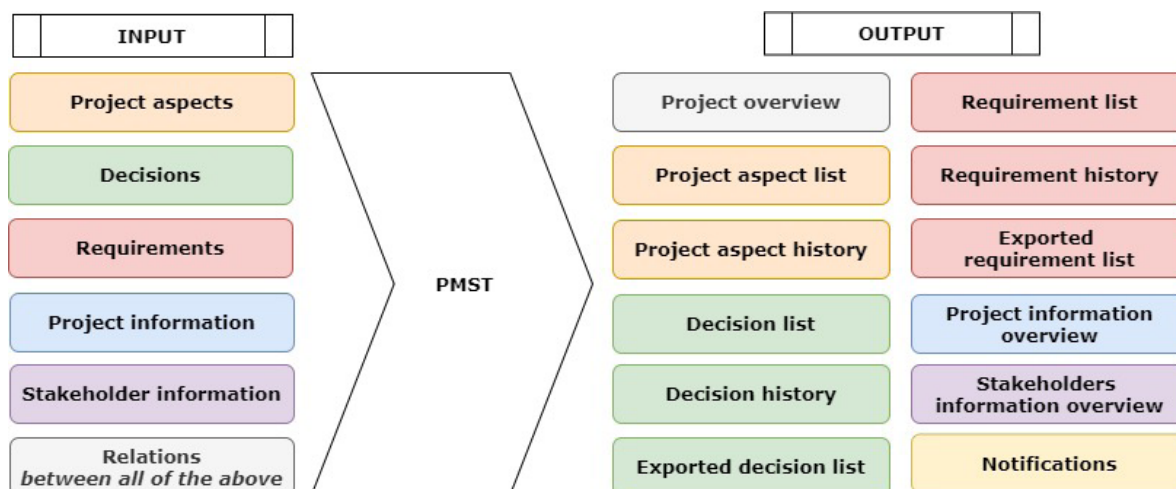
2 <https://council-of-coaches.eu/>

It is expected that a great opportunity lies in the development of a project management tool that includes Synthetic Environment (SE) characteristics. Besides SEs, this thesis will look into other theories that might be interesting to incorporate in this new tool design e.g. actor networks, requirement engineering and decision-making support systems.

A Synthetic Environment (SE) is a combination of virtual and real elements describing an alternative setting of a real life situation. The virtual elements are added to describe possible project scenarios. This offers insights to make proper predictions about the effectivity of (new) SE in specific development phases (Damgrave, 2017). An actor network is a method to model complex life cycles using already available information. The information is structured dynamically to represent the current status and possible future scenarios (De Lange et al., 2014). Including an actor network in the tool to create the SE will be looked into.

Requirement engineering includes all activities that are related to the requirements of a system, e.g. designing, analysing, documenting, validating and maintaining (Pohl, 1994). There are multiple approaches that could support requirement engineering, these will be researched. Decisions can be made conscious and unconscious, and have expected and unexpected influence/impact anywhere in the project life cycle (Lange et al., 2016). Decision-making support systems should help decision-makers to take the consequences of these decisions into consideration, to make sure the impact of a decision is preferred (De Lange et al., 2014).

The final Project Management Support Tool (called PMST) is an IT based tool that supports multiple projects with their project management at the same time. It is possible for the users to use the PMST for multiple projects simultaneously. All the user input is saved and the PMST builds up a knowledge database from which the users can profit. Figure 1 gives an preview of the information that the users have to put in the PMST in order to receive useful output. The primary user of the PMST is the project management team, the secondary users are the internal stakeholders and the tertiary users are external stakeholders, e.g. the eHealth coordinator. The primary and secondary users are able to enter information into the PMST. Per project, the PMST creates several lists, and one project overview to combine and present this information in a clear and understandable way to the users. The users point out the relations between input elements, these relations are mentioned in the list and made visible in the project overview. Requirements and decisions are documented efficiently and effectively so these can be managed easily. The information captured by the PMST evolves over time because new elements are added, or input information is updated. This thesis elaborates on the research that is done in order to design the PMST, explains the design process and presents the functions and features of the PMST extensively.



**Figure 1.** Visual representation of the input and output of the Project Management Support Tool

### 1.1. Research Objective

The research objective of this master thesis is formulated as follows:

*"To design a Project Management Tool that Supports the development project that is part of an European eHealth research project".*

The tool will be called Project Management Support Tool, abbreviated PMST. This tool is developed for Roessingh Research and Development.

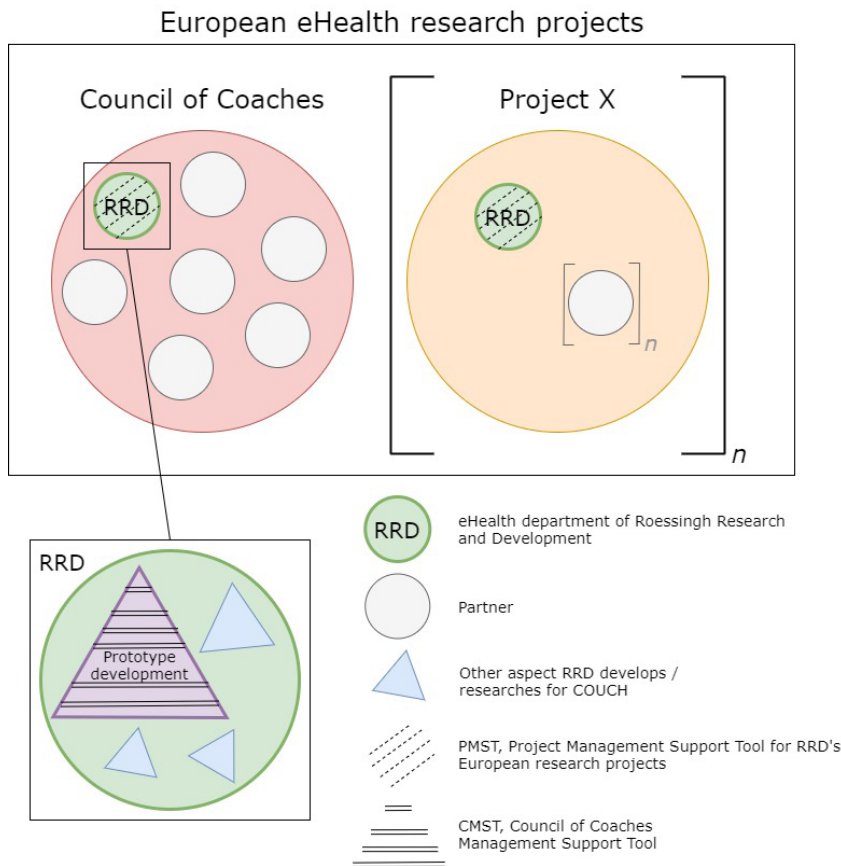
In order to reach this objective, five sub questions (SQ) are defined:

- SQ1 What are the characteristics of RRD's European eHealth research projects?
- SQ2 Would integrating Synthetic Environment characteristics into the PMST design result in a PMST of greater value, if so, how should this be realised?
- SQ3 What other theories, methods or frameworks could support the design of the PMST?
- SQ4 How could a project management support tool for the Council of Coaches project of RRD look like?
- SQ5 How would the PMST support the project management of RRD's European eHealth research projects?

### 1.2. Scope

This research focuses on designing a tool that will support the project management of development projects that are part of European research projects. This research is executed at Roessingh Research and Development, the eHealth department of RRD is involved in multiple European researches and often responsible for the development of a service or project. Therefore this thesis focusses on the European research projects that are executed by RRD. The development of a service or product (part of an European research) can be seen as a development project on its own. The development of the prototype of Council of Coaches, the "Functional Demonstrator", is an example of an aspect of such development project. This prototype development is the case study of this research, that represent a development project within a research project. A project management support tool will first be built based on the project Council of Coaches (CMST) and later be adjusted and generalised so the tool could support multiple development projects that are part of the European research projects (of RRD). This final tool is referred to as the Project Management Support Tool (PMST). Figure 2 shows RRD's involvement in European research projects and highlights the development projects which are the focus of the CMST and PMST.





**Figure 2.** Scope of the Council of Coaches Management Support Tool and scope of the Project Management Support Tool for RRD's European eHealth research projects

### 1.3. Research Approach

The goal of this research consists of two sub-goals and is stated as follows: "To (1) design a tool that facilitates how Roessingh Research and Development should develop, configure, compose the best fitting project management support tool for the Council of Coaches project (specified on the development of the Functional Demonstrator), called CMST, and (2) redesign the CMST so it becomes a tool that supports project management of development project of European research projects for eHealth applications (for Roessingh Research and development), called the PMST".

In order to design a Project Management Tool that Supports Roessingh Research and Development's European eHealth Research Projects, information about these type of projects, possible supportive frameworks, methodologies or theories are required. Designing a tool for all RRD's European eHealth Research Projects is rather complex, due to variety, large project sizes and limited information access, therefore the case study is introduced. The case study represents one of the current projects and is therefore tangible. At the start of this research the problems and opportunities are rather vague. These problems and opportunities will become clear by analysing the case study through reading project information, observing project management, interviewing stakeholders (Chapter 2 and 3) and more. It is therefore not possible to follow a predefined method, thus is chosen for the heuristic design approach. The heuristic design approach allows for continuously exploring of the project and possible methods, designing and evaluating of the developed tools.

Knowing the ins and outs of the COUCH project (management), it is interesting to look into the possibilities for improvement. Would a Synthetic Environment indeed be of added value, what are the possibilities for requirement engineering and decision-making support systems and how could these be implemented. What are other interesting frameworks, tools or literature research that can be used to develop a support system for the COUCH project management? In order to decide on that, knowledge about the possibilities is necessary. A background research about related theories, based on the findings of the project analysis, is executed to gather this information (Chapter 4). The information from the background research will be used to find solutions to the problems found in the project analysis. A design brief (Chapter 5) is written to point out the opportunity spaces of the CMST and PMST and provide a design approach. A goal, functionalities and requirements can be set for the Council of Coaches Management Support Tool. Now the CMST can be designed specifically for the project management of COUCH (Chapter 6), it is kept in mind that the PMST eventually will support the project management of multiple research projects. Regularly acquired feedback from the project manager, and from important stakeholders, can be used as input to optimise the CMST. A mock-up will be designed to demonstrate the (main) functions and features of the tool. The results of the evaluation (Chapter 7) are incorporated in the final design of the CMST (Chapter 8).

The CMST is an example of a project management support tool of one of RRD's European eHealth research projects. The CMST will be redesigned so the tool will not be COUCH specific anymore but can manage multiple projects. In order to redesign the CMST, the information of the project analysis and background theories have to be re-evaluated, to design a more suitable solution to support the management of multiple projects. The functions and features from the CMST should be checked for matching usefulness. By incorporating these "new" insights, the PMST can be designed (Chapter 9).

While designing the CMST and PMST, it is assumed that the tool(s) eventually will be used correctly, neglecting the thresholds that might arise during the implementation e.g. stubbornness of stakeholders to adapt their working methods.

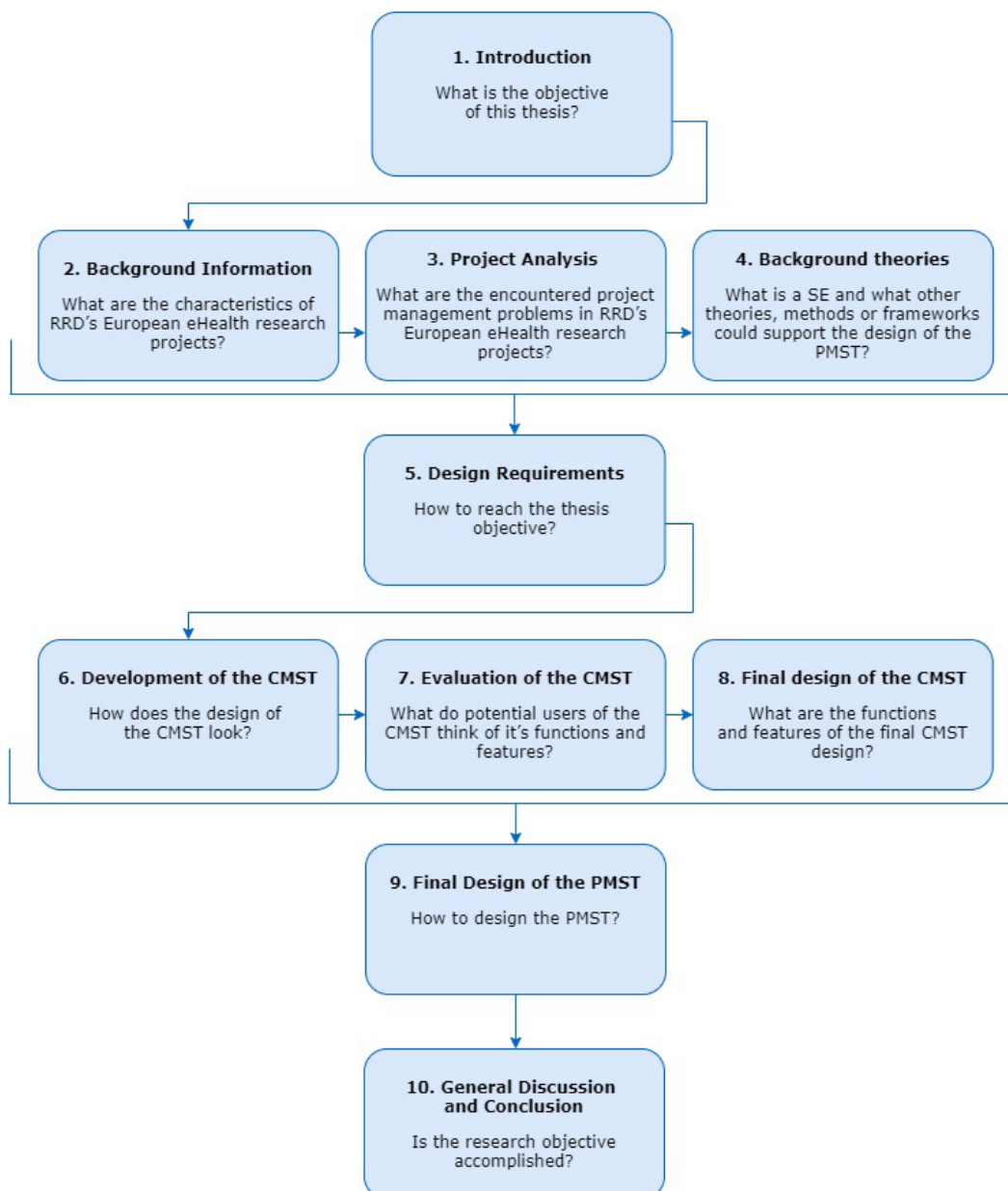
#### **1.4. Deliverables**

The deliverables of this research are specified below. The deliverables state the aim of this research and the crucial and necessary elements:

- A design suggestion for the Council of Coaches Management Support Tool (CMST); a complete, understandable, flexible but robust tool that support the project management of COUCH. The CMST is a virtual presentation of the COUCH project. The CMST documents, combines and presents all involved stakeholders, project aspects, requirements and decisions.
- A design suggestion for the Management Support Tool for development projects that are part of European eHealth research projects (PMST); a complete, understandable, flexible but robust tool that support the project management of development projects. The PMST is a virtual presentation of the development project. The PMST documents, combines and presents all involved stakeholders, project aspects, requirements and decisions.
- Discussion and recommendations on both suggested tool designs.
- A mock-up of CMST/PMST, to demonstrate how the CMST/PMST could work.
- This report, which contains the collected work of this thesis.

### 1.5. Reading guide

The chapters of this thesis present the research and design process that is executed to design the CMST and the PMST. Each chapter will answer a certain sub research question. These questions are illustrated in Figure 3. All chapters can be read separately from each other, except Chapter 9: the PMST design, that builds on the information provided in Chapter 8: the CMST design. In section 8.2 the functions and features are explained and often refer to a figure. Most of these figures are also a video that can be played with Adobe Flash Player. If the figure is a video as well, the outline of the figure is blue.



**Figure 3.** Thesis chapter overview, including the main question that is answered in each chapter





# CHAPTER

Project Background  
Information

# 2



## 2. Project Background information

Knowledge has been gathered about the RRD's European eHealth research projects and their project management in general (section 2.1). Detailed information is gathered about the COUCH project (management). A summary of the background information of the Council of Coaches project (management) is given in section 2.2. Section 2.3 zooms in on the part of COUCH that is researched at RRD: the development of the COUCH prototype.

### 2.1. RRD's European eHealth Research Projects

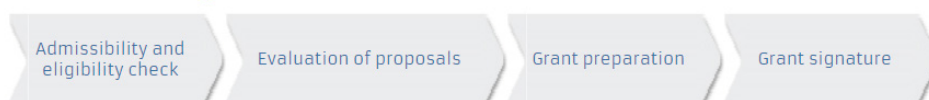
European research projects are projects that are related to a topic proposed by the European Commission. The specific topics, or calls for proposals, are related to eHealth, and therefore interesting for RRD. These topics are researched by a consortium of institutes or companies, that received a grant from the European Commission to finance their research. Most of RRD's (current) eHealth projects are European research projects. In addition, most of them are funded by the Horizon 2020 programme. Horizon 2020 is a programme that provides 80 billion euros of funding over seven years (2014-2020). It is the biggest European Research and Innovation programme. Next to the 80 billion euro of funding, it attracts private investments because of the promised breakthroughs, discoveries and brings ideas from lab to market<sup>3</sup>. Figure 4 illustrates the steps an interested company or institute has to take, in order become a partner of a Horizon 2020 project. Moreover, it shows the steps to be taken for funding and the evaluation process done by the European commission. Finally, it sums up management related actions each consortium has to follow once accepted in the programme.

#### Grants

##### Applying for funding



##### Evaluation & Grant signature



##### Grant management



**Figure 4.** European Research Projects, Horizon 2020: Grants' workflow<sup>4</sup>

European research projects are executed with multiple European partners. The number of partners differs. For the Horizon 2020 programme, the minimum of three partners is obliged<sup>4</sup>. The number of researchers per partner involved, can differ a lot. It is possible that employees are only partly involved in the research. All projects have one or sometimes two project manager(s) that are responsible for the smooth execution of the project. Per partner there is one person who takes responsibility for the deliverables of that partner. He or she is the coordinator of that partner and represent it's work to the whole consortium. At RRD this coordinator is the project manager of the development project that is executed.

<sup>3</sup> <https://ec.europa.eu/programmes/horizon2020/what-horizon-2020>

<sup>4</sup> [https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-partners\\_en.htm](https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-partners_en.htm)

These multidisciplinary research projects require clear, effective and efficient communication and documentation. All partners have to keep each other up-to-date. However, communication is mainly online, due to the geographical distance between partners. During the project it is only possible to meet a few times in real life (typically twice a year). The project communication of Council of Coaches (see section 2.2) is an example of how partners communicate in such large research projects. Of course, it will differ per project but the general idea is the same. That someone of RRD is project manager of the consortium, like in Council of Coaches is rather an exception.

As partner the company or institute is involved in the whole project. In practice this means that each partner is mainly busy with its own part of the research project. For RRD this is often the development of a service.

## **2.2. Council of Coaches**

In the introduction a short explanation of the project Council of Coaches (COUCH) is given. This chapter elaborates on the project, the Council of Coaches platform and the project management. Later, there will be zoomed in specifically on the COUCH prototype, called the Functional Demonstrator (FD). The prototype is mainly developed by RRD, to collect end-user feedback to improve COUCH.

### **2.2.1. The Goal**

The main goal of COUCH's virtual coaching platform is to motivate older adults to change their lifestyle into a healthier one. COUCH is therefore introducing a new concept of virtual coaching, namely a council of coaches instead of one-on-one virtual coaching. COUCH provides a set of coaches (virtual agents) who all have their own expertise that covers different health domains. Together with the user, the coaches will be chosen. Their coaches' goal is to empower and motivate the user. This personalised council discusses with each other and with the user, about his or her lifestyle and how it can be improved in a motivating and fun way.

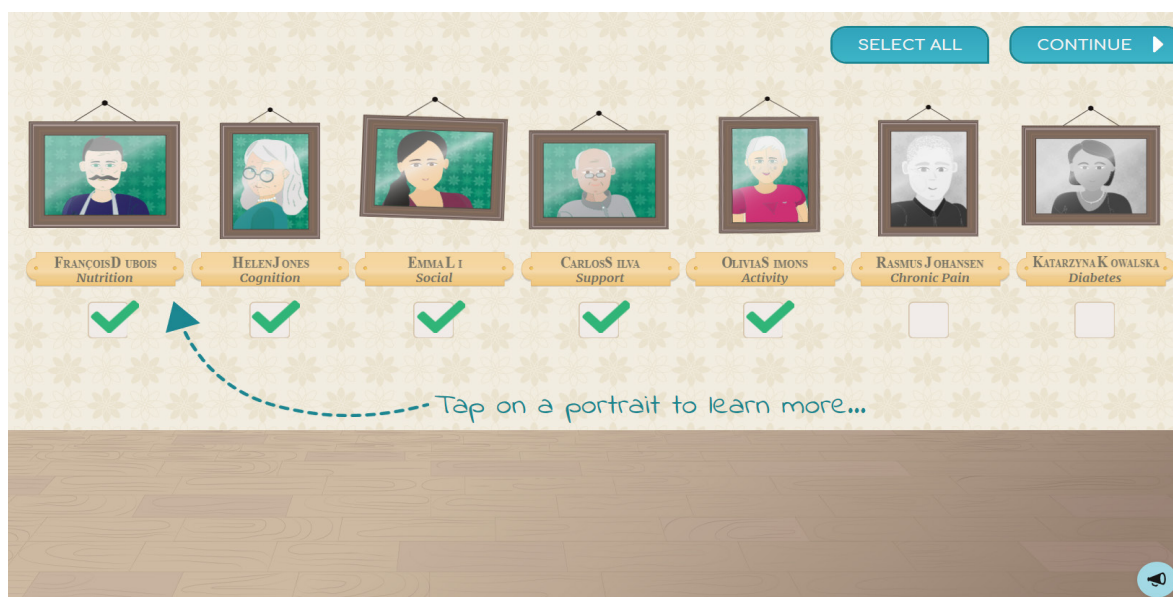
### **2.2.2. The Target Group**

COUCH targets older adults with age related impairments, people with Diabetes Type 2 and Chronic pain. Both chronic disorders are characterised by the fact that they affect people in multiple health domains. COUCH will support the target group with self-management of their health goals. The system gathers user data via sensors (e.g. Fitbit) and via conversations the coaches have with the user. With this data the coaches give personalised advice. The coaches are programmed in such a way that the user feels comfortable with them, understands them and trusts them with personal information, and listens to their advice. Seven coaches are included in the project platform, out of which a maximum of six can be added to the council simultaneously. The seven coaches are: a physical activity coach, a diet coach, a social coach, a cognitive coach, a chronic pain coach, a diabetes coach and a peer coach, see Figure 5. The target group is the main stakeholder, and together with other stakeholders (e.g. caretakers) they are interviewed at the beginning of the project. The stakeholders' needs and expectations are analysed, and the results were the input for the development of COUCH<sup>5</sup>.

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5 <https://council-of-coaches.eu/results/public-documents/d2-2-report-on-user-and-stakeholder-needs-and-expectations/>

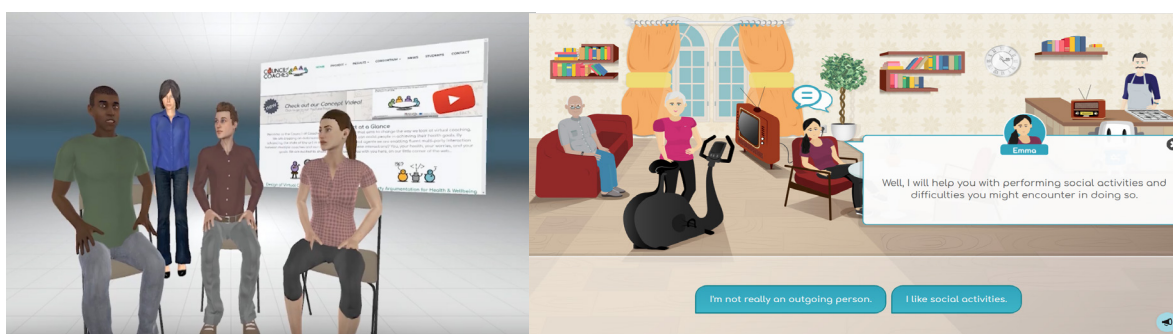




**Figure 5.** A screenshot of the Functional Demonstrator showing the coach selection window

### 2.2.3. The Virtual Coaching Council

Two versions of COUCH are simultaneously developed; one is the Technical Demonstrator (TD) and the other the Functional Demonstrator (FD), see Figure 6. The TD of COUCH is developed with beyond state-of-the-art technology. It represents the future way of virtual coaching. The FD on the other hand, is the beta version of COUCH. For this version, readily available technologies are used, so it will result in a more stable and robust prototype, used to demonstrate core principles of coaching with multiple virtual coaches. The Functional Demonstrator can be used for usability studies and for the end evaluation to test the impact of COUCH on the users' daily life.



**Figure 6.** Screenshot of the Technical demonstrator (left) and Functional demonstrator (right) to illustrate the difference

The influence that coaches of the Technical Demonstrator have on the user, is made possible with beyond state-of-the-art technology. To stimulate visual comfort, the coaches are real-time interactive 3D embodied virtual agents. To make the user relate to them, a multi-party dialogue system is integrated in the virtual agents. The dialogue system is connected to a database: the Knowledge Base. The Knowledge Base saves all data, e.g. all user information and contextual information, dialogue information and sensor data. This data is among others integrated in the dialogues to provide the right information.



The Dialogue and Argumentation Framework<sup>6</sup> makes it possible for the coaches to interact with each other and to act and react on the user's response. The goal is to closely resemble real dialogues, and therefore this framework is developed to allow realistic and natural responses.

In order to realise relevant content for the dialogues, information about the user's behaviour is necessary. To gather this information, a Holistic Behaviour Analysis Framework<sup>7</sup> (HBAF) is developed. This framework gathers information by sensing, identifying and quantifying human behaviour. This data is saved to create relevant dialogues, useful arguments and smooth interactions between the user and the coaches. All data is saved in the central Knowledge Base. Next to the real-time measurements that are done, the virtual coaches also gather information via the dialogues. This is called virtual sensing and has the advantage of extracting information from the user, that cannot be done via traditional sensors. For example, data about memory loss or task engagement.

Each coach has a unique personality that matches with its expertise. It makes them more human and therefore more relatable. The character characteristics appear in the way coaches say things, this is based on human-to-human interactions. The coaches have weekly meetings with the user, these meetings are meant to discuss how it is currently going, and emphasize the user's behaviour.

#### **2.2.4. Project Workflow**

The project Council of Coaches (COUCH) has started in September 2017 and will be finished in August 2020. The consortium exists of seven partners from different institutes across Europe, each with their own expertise. Before the project started, a project proposal was written and handed in to the European Commission requesting a contribution. The commission approved and granted this project proposal. In this proposal the project idea is explained, and a plan for smooth execution is worked out. A Gantt chart was made for the project and seven milestones were planned over the project's life span. Next to that, Work Packages are defined, that cover different research topics of the project. Per Work Package, deliverables are set and tasks are defined. The deliverables are mostly written reports that are published on their website: <https://council-of-coaches.eu/results/public-documents/>. Except for a few, all documents are accessible for everybody, so the positive impact of COUCH can be read. Table 1 shows all partners, and the Work Package they are leading. The Work Packages are divided into tasks per partner, including corresponding working hours. Every partner divides these tasks among their internal stakeholders. Each internal stakeholder keeps a log, to defend their working hours to the consortium and to the European Commission. This working method is almost the same for all European research projects RRD is, or has been involved in.

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6 <https://council-of-coaches.eu/project/features/argumentation/>

7 <https://council-of-coaches.eu/project/features/behaviour/>

**Table 1.** Overview of the Consortium and Work Packages of Council of Coaches

Partner	Country	Work Package (WP)
The University of Twente, Centre for Monitoring and Coaching (CMC)	The Netherlands	CMC is the coordinator of COUCH and therefore leads WP1; Management. Next to that, they lead WP 4; User behaviour Sensing, Modelling and Analysis and WP 9; Ethics Requirements.
Roessingh Research and Development (RRD)	The Netherlands	RRD is responsible for WP 3; Coaching Strategies and Knowledge Base.
The Danish Board of Technology Foundation (DBT)	Denmark	DBT is expert in Responsible Research and Participatory Design and therefore leading WP 2.
Sorbonne University (SU)	France	SU leads WP 6; Human-Computer Interfaces.
University of Dundee (UDun)	United Kingdom	The Centre for Argument Technology is partner of the consortium and leading WP 5; Dialogue and Argumentation Framework.
Universitat Politècnica de València (UPV)	Spain	UPV is leading WP7; Continuous Integration and Demonstration, which is one of their main fields of research.
Innovation Sprint (iSPRINT)	Belgium	iSPRINT is responsible for WP 8; Dissemination and Exploitation.

### 2.2.5. Project Communication

The project management team of COUCH, introduced several ways to keep each other up-to-date. The main lead is the project proposal, to make sure everybody is on the same page especially in the beginning. The project proposal includes: the research objectives, concept and methodology, ambition, expected impact and measures to maximise the impact, the work plan, the management structure, milestones and procedures. Because the project proposal is a compact summary of the project idea, changes, fine-tuning, and discussions are necessary. Discussing and updating each other will therefore mainly be done in meetings. Several meetings are set up by the project management team. The first two years, weekly Skype meetings with all partners were held, later this changed into a meeting once per six weeks. In principle all members of the consortium are invited to these Skype meetings. In practice at least one person from each Work Package is present. The coordinator of each partner are also present. The Work Packages are clearly defined and divided, and therefore an ideal common thread for these Skype meetings. Updates are mostly given per Work Package, by one of the members responsible for that specific Work Package. Afterwards, ongoing issues or questions can be discussed. These meetings are rather short and to the point, therefore to discuss about a certain topic more elaborately, extra (Skype) meetings are held with the related consortium members, e.g. Work Package meetings. Besides these meetings, mailing contact has been kept, for short questions, simple clarifications or sharing interesting documents between consortium members, for example. The consortium shares a Dropbox with project documents, e.g. the Work Packages deliverables.

Internal meetings are organized within consortium partner institutes to discuss the project. Plus Roessingh Research and Development has monthly meetings with the University of Twente (Centre for Monitoring and Coaching) to update each other about what is going on in more detail, since their project topics are closely related and they are both located in Enschede. RRD uses also some project management tools internally to communicate with each other about the project. They use the Issue Tracker from GitLab; to communicate who is solving a certain software development issue. Next to that, they have created their own RRDWiki with general information about all the RRD projects: project at a glance, work plan and planning.

### 2.3. Council of Coaches: the Functional Demonstrator

The design of the Functional Demonstrator (FD) and the Technical Demonstrator (TD) are established by combining all the initial designs. The initial designs include the virtual appearance of the coaches, the body language and the spoken dialogues the coaches will perform, the extraction of

information from sensor data and the translation of that to behaviour information which can be stored in a knowledge base and used in a coaching strategy. Input for combining the initial designs and platforms are the end user interviews, the executed exploitation workshop, and ethical interventions<sup>8</sup>.

One of the main differences between the TD and the FD are the agents. For the FD the 3D embodied virtual agents are replaced by 2D cartoon-looking coaches, as shown in Figure 7. This is done to develop a working beta version. The FD is built in such a way that it can be easily adapted, updated and scaled if new insights are found. It consists of a robust HTML/JavaScript web client. Nevertheless, the idea of multi-coaching sessions is still beyond state of the art and this is also reflected in the FD. With the Functional Demonstrator the consortium aims to show the impact of multiple domain coaching. This is mainly realised by developing a dialogue feature, so the coaches can discuss with each other about what is best for the user. Information about the user is gathered via several technologies. This information is used as basis for the discussions and to keep the conversation with the user ongoing. Keeping the discussion ongoing is something which is not possible with only one coach, that is why multiple coaching is innovative. The coaches' main goal is to persuade the user to adopt a healthier lifestyle (Reidsma, Bruijnes, Huizing, Klaassen, Konsolakis, Weusthof, van Loon, et al., 2019).



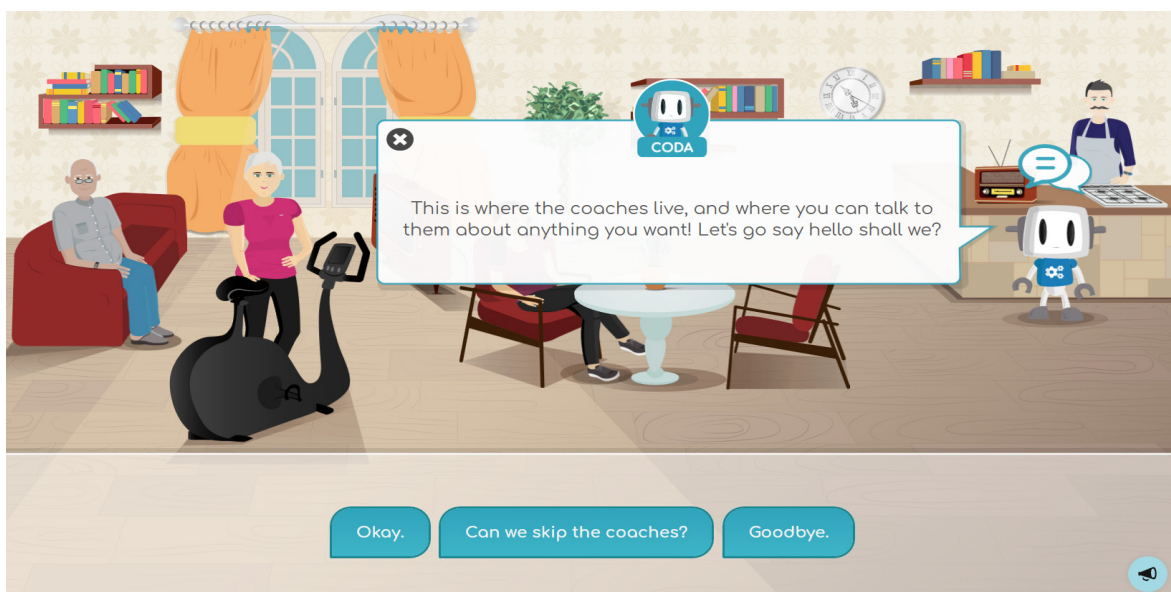
Figure 7. A screenshot of the Functional Demonstrator showing the Council of Coaches living room

The dynamic dialogues are made possible by the WOOL dialogue platform<sup>9</sup>; reading and executing dialogue definitions. The WOOL dialogue platform is based on the YARN dialogue language. This dialogue language is modified by RRD so the tool is easy to learn, without requiring learning a specific language and facilitate scripted dialogues with a statement-reply structure. The Knowledge base is connected to WOOL, to store values and perform more complex operations (Reidsma, Bruijnes, Huizing, Klaassen, Konsolakis, Weusthof, Baños, et al., 2019).

<sup>8</sup> <https://council-of-coaches.eu/results/public-documents/d1-4-first-periodic-report/>

<sup>9</sup> <http://www.woolplatform.eu/>

The coaches of the FD are made attractive by creating graphically well-designed cartoon coaches. They have their own background story, similar to the coaches of the TD. They are designed in such a way that the user can empathize with them. The coaches are positioned in a living room, to increase the feeling of comfort of the user when using the Council of Coaches FD, see Figure 7. Coda, the friendly robot, displayed on the right side in Figure 8, is introduced to help the user with the standard necessities: setting up an account, choosing the coaches, guiding the user and giving some extra clarifications. Some fun features are incorporated to keep the user motivated, to use the tool. For example, a recipe book is included so the diet coach can guide the user through in selecting what to cook for dinner.



**Figure 8.** A screenshot of the Functional Demonstrator showing Coda, the Council of Coaches Assistant that supports the user with using the application

## 2.4. Conclusion

Roessingh Research and Development participates in multiple European research projects, related to eHealth. European research projects are executed by a consortium of European partners. The number of partners differs, but it always includes a lot of stakeholders. Internal stakeholders can also be only partly involved in the research. At the start of a project, the project proposal and the project plan define the main characteristics of a project, e.g.: goal, planning, task division and deliverables. The project proposal is written by all partners to apply for the European funding.

Council of Coaches is one of the European eHealth research projects RRD is currently working on. Together with six other partners they work on developing a platform that will assist people in achieving their health goals. The platform includes multiple virtual health coaches, all with their own expertise. COUCH introduces a new concept of virtual coaching, because the user will be coached by multiple virtual coaches instead of one-on-one virtual coaching.

RRD is mainly responsible for the development of the council's prototype: the Functional Demonstrator (FD). The FD is developed with already available technologies, resulting in a robust prototype that can be used for usability tests and evaluations determining the impact of COUCH.

One of the researchers of RRD is project manager of COUCH (together with two other stakeholders) and is the manager/coordinator of the internal development of the prototype. His approach on managing the development of the prototype (FD) will be analysed, and is the case study of this research. RRD's project management of COUCH's prototype is based on project management of COUCH (consortium level).

The Project Management Support Tool for RRD focusses on these parts of the European research that are executed at RRD. These "sub" projects almost always include the development of a service, like the Council of Coaches prototype. Further research can therefore also look into methods and tools that are used in product development.

The project management tools that RRD uses are Gantt charts (for planning), Issue tracker (for software development) and RRDWiki (with general project information).

The project manager thought of a suitable and useful way of project management, but is this the most fitting solution? What are the pros and cons of the current the project management approach and who are involved? These questions will be analysed in Chapter 3, both for the case study (COUCH) and development project of European eHealth research projects in general. The analysis will give insights in possible users of a certain tool, and how they could profit from such a tool. When it is known where the opportunities lie, research will be done about Synthetic Environments and its added value will be considered.



# CHAPTER

Project Analysis

# 3

### 3. Project Analysis

This chapter analysis the COUCH project management. Analysing the COUCH project management provides more detailed information on how the project is executed, this will support the tools' design processes. Being able to see the strengths, weaknesses and opportunities of a project management approach, show room for improvement. This analysis becomes a starting point for the development of the tools, that focus on supporting the project management.

#### 3.1. Actor Network

One of the functions of the tools should be documenting and communicating (e.g. representing) information in an understandable and clear way so the user can profit from that information. The information that is gained from the stakeholder interviews (section 3.2), should also be documented and communicated via the tool, therefore, this section will focus on ways to represent information.

Models are a great way to represent the captured information or knowledge. Models visualise information in a simplified way, sometimes manipulated to present the information clearly. A model is ideal to help understand, communicate and reuse certain information (Martins & Falbo, 2008). A flexible approach to represent information in a model, is by creating a network or graph. By defining entities (nodes) and relations (edges) a network can be built. That network can, when supported by IT solutions represent information in for example an hierarchical structure, a classification structure or a taxonomy. The main advantage of this flexible approach is thus that the information in this network can take up any representation form. As a result, updating or changing the structure takes little effort and there is no reconfiguration needed. The preferred structure can be determined when all information is included in the network, this is a key advantage. The main disadvantage of structuring information in a graph is that the visualisation becomes less clear when adding more entities or relations. This results in a cluttered overview and complicates extracting information. A solution to this cluttered visualisation could be to add filters that structure the information according to a certain hierarchy, classification or taxonomy that is preferred by the reader (Lange, 2018).

An actor network is a method to model complex life cycles using already available information. The information is structured dynamically to represent both, current status and possible future scenarios (De Lange et al., 2014). Actors could use different concepts, definitions, names and have different opinions on cases. It is important to make sure the actors can communicate without any uncertainties about the topic they are discussing. When they correctly understand each other they can point out their own perspective on that matter. An actor network encourages decisions support to equalise the difference, so actors come to a mutual understanding (De Lange et al., 2014) (Damgrave & Lutters, 2018). Connecting only the actors (stakeholders) in one network is not that useful, but by incorporating other aspects of a project it would be. Providing the actor relationships with meta data would be even more beneficial, also creating relations with project information, project tasks, requirements and decisions would support the information overview. The overview will show the influence that the elements have on each other and what elements are already included and could be reused or have multiple purposes. The actor network provides transparency in the project and the actor network provides transparency in the project and it is flexible; changes or updates can be made, costing (almost) no effort (E. Lutters et al., 2014).



The actor network was designed for two reasons, 1) to have a clear visualisation of the project that helps to understand the project structure better, and 2) to check whether an actor network could be a beneficial feature of the tool. It is chosen to map the project aspects and stakeholders in an already available tool, called Gephi 0.9.2. It is a software tool that allows visualisation and exploration for all kinds of networks<sup>10</sup>, including actor networks. It has a low learning curve which allows for quick trying out its potential.

### 3.2. Internal Stakeholder Interviews

Stakeholder interviews with RRD's internal stakeholders of the Council of Coaches project are held. The goal of these stakeholder interviews is to get a better understanding of the COUCH project: the involved stakeholders and their relations to each other and to the project. These interviews are about involvement in the COUCH project and about the development of the prototype: "the COUCH Functional Demonstrator". The information gathered and related to COUCH, is also used as input for the development of a management support tool for RRD's research projects.

The stakeholder interviews results are mainly illustrated in an actor network, which contributes to the project analysis. The information gathered from the stakeholder interviews includes:

- Actors (internal stakeholders, external stakeholders; including users)
- Stakeholder information (background, research field, involved projects)
- (Sub) project aspects (related to: hardware, software, information, knowledge, environment, workflow, working methods, ethical aspects, legal aspects, profit, society<sup>11</sup>)
- Relations between: stakeholders, stakeholder information, (sub) project aspects

The interviews were held with several highly involved stakeholders of the prototype development, pointed out by the project manager. The interviews were held per internal stakeholder in an informal way. The stakeholders are among others asked about the project aspects they are working on, including: what, why and with who. A set of questions was set up to make sure all necessary information would be requested in the end. A visual representation of the project can be designed. After each interview the list with questions was improved if necessary. This resulted in the final interview structure, which can be found in Appendix A. For each question of the Internal stakeholder interview, an explanation is given including why the question is important. The stakeholders were among others asked about their job at RRD, their role and tasks in the COUCH project, if they set any requirements, how they make decisions and about their involvement in other projects.

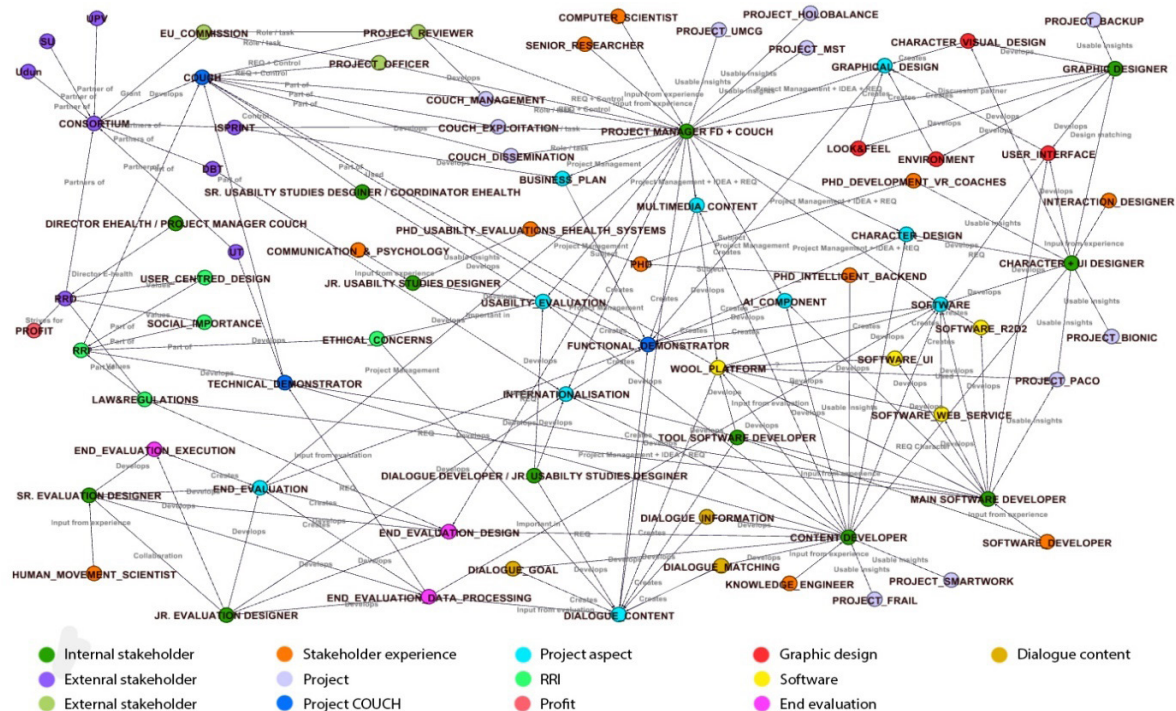
#### 3.2.1. Results of the internal stakeholder interviews

From the interviews it can be concluded that most of the stakeholders point out the same relations, and describe the same sub development parts and other project aspects of the Functional Demonstrator. This is a positive outcome since this means that they share the same working methods and have the same opinions or views on the project.

The information received from the interviews combined with information from the project analysis are visualised through project mapping. A first draft of the project mapping is made in Gephi 0.9.2 and is shown in Figure 9. This overview visualises the relations between project elements: all internal stakeholders, external stakeholders, the project aspects they are working on, general project aspects, their expertise and other projects they are working on. These project elements are represented as nodes, the colours define a certain category. Relations between these elements are defined as edges. The edges' arrow point out the direction of the relation and includes information

<sup>10</sup> <https://gephi.org/>

<sup>11</sup> Adjusted aspect list of a SE (Damgrave, 2017) with regard to the COUCH project aspects.



From the interviews, a few questions are not represented in the overview in Figure 9, because it

9 7 9 7 1 1 9 1 9 9 9

Question 7 is about collaborations within the project and who is proposing requirements and how do stakeholders make decisions. The first two sub questions are visualised in the overview; the latter is not. Most people answered that they base their decisions on the requirements that were set at the beginning (if possible) or on their own knowledge they gained in their studies, other projects, literature, or from other people or from experience or based on standardised procedures. "Own knowledge" as input for decisions was mentioned most often.

Question 8 asks about the resources necessary for the internal stakeholders to do their jobs. This question focusses on software rather than hardware. For the best possible solution, it is necessary to use the most suitable software. It appeared that the internal stakeholders thought these decisions through in most cases, and so chose the best software for the job. Even a personalised dialogue editor is developed to fulfil the specific requirements for the software of the COUCH prototype. Only once it was mentioned that the software was chosen because it was already used at RRD and people know the software so it seemed the most logical choice since it also fitted the task.

### **3.2.2. Conclusion**

The results to all questions are useful to understand the applied project management approach better. Working with Gephi 0.9.2 it became clear that "project mapping" could be of added value for project management because it shows an overview of the whole project and all its relations. However not all preferred information can be included in Gephi 0.9.2. For example, some handy graphical effects such as clicking on an element and showing its relations and slowly elaborate this network from that specific element, or adding the progress status of a FD development part, or more information about the stakeholders, Gephi 0.9.2 is therefore insufficient. Only by clicking on the element in Gephi 0.9.2, and then clicking on extra information, a new text box will appear (over the graph) with the extra information. This should be easier in the new tool to improve usability.

### **3.3. Feedback and Insights from the Project Manager**

Feedback and insights from the project manager of COUCH are important because he would be the primary user of the designed tools. Moreover, he is responsible for a well-executed COUCH project with a useful outcome. His feedback and insights are related to the project management of the case project (COUCH / FD) and an example of the RRD's research project management. So, it provides relevant insights to keep in mind during the development of both tools.

It is mentioned by the project manager that the management of a European research project is much more complex than the management of a small project; like the development of the COUCH prototype. A large, multidisciplinary project includes a lot of different interests from every partner. Participating in an European research project they all want to include elements of their individual research agendas; per partner and even per partner's internal stakeholders. As a result, many discussions are held and finding an agreement takes more time and is more difficult. This has a great impact on the project management; e.g. project planning, project communication and project documentation. The more parties involved, the more complex project management becomes. With the partner institutes or companies located throughout Europe, almost all communication has to happen online. Online communication is experienced to be more complex (threshold, not quick, planned and lost of non-verbal communication etc.). Another disadvantage of these multidisciplinary research projects is that stakeholders might not be involved during the whole project. It could be that an expert is only joining to perform a certain task. All tasks are connected and therefore taking over a certain task becomes crucial. Communication is of great importance in order to transfer both, tasks and information smooth and clear.

The project manager (and later also another internal stakeholder) pointed out that the requirements, which were set at the beginning of a project are often forgotten or neglected during the development. Only at the end of the project the requirements it will be checked if they are achieved. As a result, requirements might be forgotten or not relevant anymore and are therefore not achieved. This might result in loss of possible great ideas. There is also a lack of documenting all relevant meta data of a requirements, including underlying decisions.

Furthermore, the project manager pointed out that providing a project overview, like made in Gephi 0.9.2, offers potential, showing a clear overview of the project. Nonetheless, he concludes that the main problem lies in grounded decision-making. The project manager visualises the project picture; all internal stakeholders are also involved in other projects. RRD's internal stakeholders are busy with multiple projects, they are not always involved in the whole project, are not able to attend all meetings, and are generally very busy. The internal stakeholders have to divide their time and attention between all projects and anticipate on unforeseen events and uncertainties. They all try to structure this rather complex involvement in all projects, however this is hard, being busy with multiple activities at the same time. This often results in ad hoc decision-making. Ad hoc decisions are decisions made by only one or maybe a few persons, without overthinking the (long-term or broad) impact of that decision. Consequently, this could result in unintended or unwanted project outcomes, that might need fixing before continuation of the project. These decisions are based on their own experience or on what they assume as logical. Often ad hoc decisions are made due to time pressure, or non-optimal communication between stakeholders. It could even be that stakeholders are not aware of making ad hoc decisions. Mostly internal (real life) conversations are easy, quickly asking someone's opinion at the coffee corner and making a decision based on that information, happens a lot. On top of that, these decisions are often not documented. So, if decisions are reconsidered, it might not be clear why this decision was made. It is important to document decisions and the reasons behind a decision. The impact of ad hoc decisions is not determined; it is unclear if the final product or service will be positively affected by this decision. Finally, the project manager mentions that an overall overview of all projects RRD is working on is not available, while this could be of added value to see relations between projects and stakeholders. This comment is noted for the design of the final tool (PMST).

#### **3.4.1. Cause and effect analysis on ad hoc decision-making**

A cause and effect analysis of ad hoc decision-making is done to get a better understanding of pitfalls and how to prevent ad hoc decision-making. The causes named here, are general which means they might not be derived from the COUCH project. They are based on input from the interviews, observations, personal experience and common knowledge. Possible causes of ad hoc decision-making:

- Time pressure can lead to quickly decision-making, because discussing is time consuming.
- Lack of cooperation, stakeholders only focus on their own tasks.
- Lack of communication, not discussing (all) decisions.
- Project method, e.g. not documenting decisions, so no one else can check it and the decision maker will not give it a second thought.
- Reuse of available resources, often knowledge, people know something and base their decisions only on this knowledge.
- Lack of team spirit, preferring to work alone and thus make decisions alone.
- Lack of easy documenting decisions, if it can not be done quick and easily motivation to document decisions is gone, and it probably will not be done at all.

### 3.4. Stakeholder Analysis of Research Projects Tool

This second stakeholder analysis focusses on the possible users of the project management tools. The users of the tools, can be divided in primary users, secondary users and tertiary users. They are the stakeholders who will actually use the tool when it is available. The tool should help them doing their job; from being responsible for a project to managing it or using the tool to document decisions, etcetera. Below the stakeholders are categorised in the user categories, for both the CMST and PMST. These users are quite similar because the CMST is the case study for the PMST. The main difference in users is that the users of the PMST are a multiplied number of the CMST users due to the involvement of multiple projects thus, multiple user groups.

#### ***Users of the project management tool developed for COUCH's development of the FD (CMST)***

##### **Primary user**

There is only one project manager and he is the primary user of the tool. He is responsible for user access, information availability, etcetera.

##### **Secondary users**

These are the internal stakeholders of RRD who are developing the FD of COUCH. They have an executive role within the project. Therefore, they have to enter data into the tool in order for the tool to work, so they can also benefit from the advantages of the tool. Internal stakeholders of the FD are: evaluation designers, dialogue developers, usability study designers, content developer, software developers, character designer and UI designer.

##### **Tertiary users\***

Tertiary users are stakeholders who do not necessarily need to use the CMST. However, there is a group of stakeholders who could profit from gathering project information from the tool. These stakeholder are: the RRD eHealth coordinator, so he can use the tool to keep an eye on the project (progress and outcomes) and also to see if there are maybe some useful insights that could be used in other (new) projects. Project managers of other RRD eHealth projects could benefit, for example, by looking up similarities between the FD project and their project. Moreover, the RRD eHealth director could always use the tool to check for project information or updates. Finally, as the FD is a sub part of the COUCH project, the other stakeholders of COUCH could profit from the information that is available in the tool about the FD (progress, deliverables, etc.).

#### ***Users of the project management tool developed for RRD's European eHealth research projects (PMST)***

##### **Primary users**

All internal project management teams (PMT) are the primary users of tool. Each PMT for it's own project that is included in the PMST. The PMT usually is one coordinator, but it could also be two or three. Coordinators are responsible for user access, information availability, etcetera.

##### **Secondary users**

The internal stakeholders include all the involved researchers of RRD who are involved in a European eHealth research project. They are classified per project, and only have access to that project in the PMST. So, the PMST is available for multiple projects, thus including multiple groups of secondary users.

##### **Tertiary users**

Stakeholders, interested in the information that will be provided by the tool, are; directors and coordinators of RRD, so they can keep an eye on the project. Interested in more details (e.g. results) about the project, might be other project managers of RRD who might be interested in collaboration or re-use of resources.

\* The functions and features the tertiary users would need, will probably already be included for the primary and secondary users. Therefore, the development of this tool will not focus on the tertiary users.



### 3.5. Conclusion

To conclude Chapter 3, an actor network turned out to be an efficient and effective way to show all stakeholders, project aspects and all their relations in one network. However, Gephi 0.9.2 did not appear to be the most ideal IT solution to create this network with. So the tools should therefore be an improved IT solution of which the actor network is one of the methods to present project information.

The information retrieved from the project background research and the stakeholder interviews is divided in strengths, weaknesses, opportunities and threats of the project. This provides a SWOT analysis about the project management of: 1) the COUCH at RRD and 2) the COUCH project in general (an example of a European eHealth research project of RRD). The SWOT analysis is included in Appendix B.

It became clear that there is no urgent necessity for a project management support tool, the focus of this research therefore lies on the potential value of such a tool. To conclude the project analysis, a problem definition for both analysed project managements is given here, summarising disadvantages and weaknesses: 1) for the project management of COUCH Functional Demonstrator and 2) for the project management of RRD's European eHealth research project.

#### ***Problem definition of COUCH (FD) project management***

- Internal stakeholders make many ad-hoc decisions
- Internal stakeholders disregard the requirement list
- Internal stakeholders be only partly involved
- Internal stakeholders have different personal interests
- Internal stakeholders' commitment is limited due to busy schedules

#### ***Problem definition of RRD's European research projects project management***

- Internal stakeholders make many ad-hoc decisions
- Internal stakeholders disregard of the requirement list
- Internal stakeholders be only partly involved
- Internal stakeholders have different personal interests
- Internal stakeholders' commitment is limited due to busy schedules
- Partners have different interests
- Mainly online communication with partners

The findings from the project analysis together with the problem definitions are summarised into a list of project management requirements. These requirements are input for the design of the tools, the complete list can be found in Appendix C. Here a few important requirements are stated.

#### ***Requirements for the project management of RRD's research projects***

- Project management should support decision-making
- Project management should support all decision's documentation
- Project management should support dynamic requirement engineering
- Project management should support the re-use of resources
- Project management should be able to deal with ad-hoc decision making
- Project management should minimise working at cross purposes
- Project management should support stakeholders staying involved and up-to-date
- Project management should handle partly involvement of stakeholders and partners







# CHAPTER

## Background Theories

# 4

## 4. Background Theories

Background research is done to get more knowledge on the topic “project management” in general and to gain insights in possible solutions. Synthetic Environments, Decision Support Systems and Requirement Engineering research showed great potential background knowledge to start designing a project management support tool. Next to that, a market research is done to get an idea of what tools there are already on the market that support project management. Looking into the features of current available tools to see what might be interesting to incorporate.

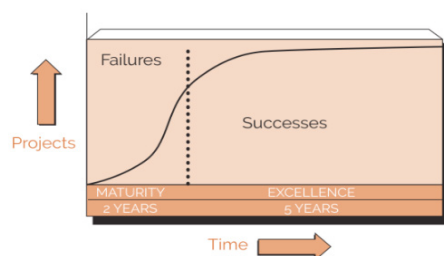
### 4.1. Project Management

Project management is the main topic of this research. It is a broad topic, that is already researched by many. Despite that, the focus of these researches often differs because they all define “project management” slightly different and might focus on various influences it might have on projects. The following definition of project management is used in this research:

*“Project management is the application of knowledge, skills, tools, and techniques to project activities to achieve project requirements. Project management is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing.” – PMBOK Guide<sup>12</sup>*

To determine whether a certain project management plan, strategy, framework, tool, or a combination, is beneficial, it should at least result to a successful project management. A successful project management, will be defined in this research as: continuously achieving project objectives within a certain time span, within budget, reaching desired performance and user satisfaction while effectively and efficiently using the appointed resources (Facer & Pahl, 2017). The project is a success if the project has met all the success criteria, the project added value and all constraints were taken into account (Kerzner, 2017). It would be even better when the project management has been successful as well, and if the discovered knowledge has led to interesting changes (Facer & Pahl, 2017).

Two definitions related to project management success are maturity and excellence. Maturity in the context of project management means that repeated successes are expected due to the use of a standard methodology. This implies a proper foundations of tools, techniques, processes and an existing project culture. It is important to review the project methodology at the end of each project, discussing what worked out well, and what are recommended points of approval. Project management excellence grows when companies have developed an environment in which all projects are continuously successful. It takes time to develop a great maturity, and only when a great maturity is reached excellence can be achieved (Kerzner, 2017), this is illustrated in Figure 10. The opposite of success is failure. Perceived failure can be defined as the net sum of actual failure (perfection is not reached) and planning failure (the actual time span differs from the planning) (Kerzner, 2017).



**Figure 10.** The growth of excellence (Kerzner, 2017)

In order to support the project management team with creating maturity (and excellence), methodologies should be integrated in the project management. However, the project managers self are still the ones who manage the project, also, they should show their faith in the methodology they have chosen (Kerzner, 2017). It is the role of the project manager(s) to help the team, run interference and support them in getting their work done on all different levels (Heagney, 2016). They have to fulfil all the roles to create and maintain an effective team (Pinto & Kharbanda, 1995). When project management is applied successfully by both the project management team and the involved stakeholders, it is expected to lead to the following benefits (Kerzner, 2017):

- Shorter “time to market”
- Lower project risk
- Improved decision-making processes
- Higher customer satisfaction
- Less time spend on internal politics
- More time for value-adding efforts

There are two ways of project management, one is the rigid approach and the other is the agile approach. When following the rigid approach, requirements form the basis of that project, the requirements are set at the beginning of the project and everything else is based on these requirements. Agile project management on the other hand, uses a flexible approach; using frameworks including: forms, check lists, guidelines and templates to manage the project. Depending on the project, the project management team should define where to place the project on a scale from rigid to flexible in order to apply the right approach. When the approach is clear, a matching methodology/framework can be chosen. This framework becomes the common thread of the project’s support structure (Kerzner, 2017).

Designing a methodology, it is important to keep in mind that the stakeholders should understand the methodology, thus it should not be too abstract or complex. The methodology should cover all crucial areas and has to be integrated in the company’s work flow. It should use standard terminology and has to be efficient, it should definitely not cost the stakeholder lots of administration work. Next to that, the methodology should be robust and flexible so it can handle changes or out-of-the-box thinking. And, it should fit the type of project (Kerzner, 2017).

Nonetheless, the project management team can come up with the best methodology that they trust and are enthusiastic about, it still needs cooperation from the stakeholders. Unfortunately, stakeholders always tend to be negative about changes in working habits (Kerzner, 2017). Therefore the project management team should already upfront take that resistance into account and handle implementation with care and in cooperation with the stakeholders.

IT-support proves advantages to support knowledge management of a project. It is proposed to have a positive influence on the performance of an organisation as well as on the (individual) knowledge creation process (Abubakar et al., 2019). Girard and Girard define knowledge creation as the process of achieving the best organisational objectives through knowledge creation, sharing, usage and management (Girard & Girard, 2015). The advantage of IT support in knowledge management lies in the effectively and efficiency collecting, exchanging and storing knowledge. As a result, it will improve in-organisational communication (Abubakar et al., 2019). Moreover it facilitates in absorbing knowledge and exchanging ideas (Cohen & Levinthal, 1990). Finally knowledge management allows for reuse of valuable knowledge and so increases the work efficiency (Wang et al., 2015).

## 4.2. Synthetic Environments

A Synthetic Environment (SE) is a combination of virtual and real elements describing an alternative setting of a real life situation. It is not defined what the distribution between the elements has to be, it might only include a small virtual aspect or just a small real element. The virtual elements are added to describe possible project scenarios. This offers insights to make proper predictions about the effectivity of (new) SE in specific development phases. It shows strengths and weaknesses, potential risks and suggests improvements. Since the real life scenario is made virtual, it can be easily tested without taking up a lot of time or being expensive. The project can be analysed from different stakeholder perspectives to find the best fitting solution per stakeholder. A SE can be personalised per stakeholder, or a combined SE can be developed, which represents the preferences from all stakeholders. Generating a general SE for a certain project will increase communication and collaboration in multidisciplinary development projects (Damgrave, 2017).

Designing a Synthetic Environment can be done in several ways. How a SE should be developed and what is required depends on the project. Damgrave describes a possible design approach in his dissertation (Damgrave, 2017). His approach is explained below and will be considered as a method to develop the project management support tools.

Starting with the development of a SE, it is important to first gather all available and relevant information about the project. It is important to get a good grip on the stakeholders and their relations, the requirements and most important the underlying thoughts of decisions. It is important to develop a flexible and user-friendly SE, because the greater the flexibility, the easier adaptations can be made. Either for re-use in a different environment, or when adaptations in the SE are necessary for optimisation. Designing a SE brings a lot of uncertainties with it. It is important to react open to these uncertainties and deal with them as characteristics of the SE. It is important to be open, and not fixate certain aspects at the beginning. That will limit the process of finding the most suitable solution. Designing a SE is an ongoing process, new elements will be added, which will influence the design of the SE. Later in the process, when it becomes clear that certain aspects are of no added value, or should be used in a specific way, decisions can be made final.

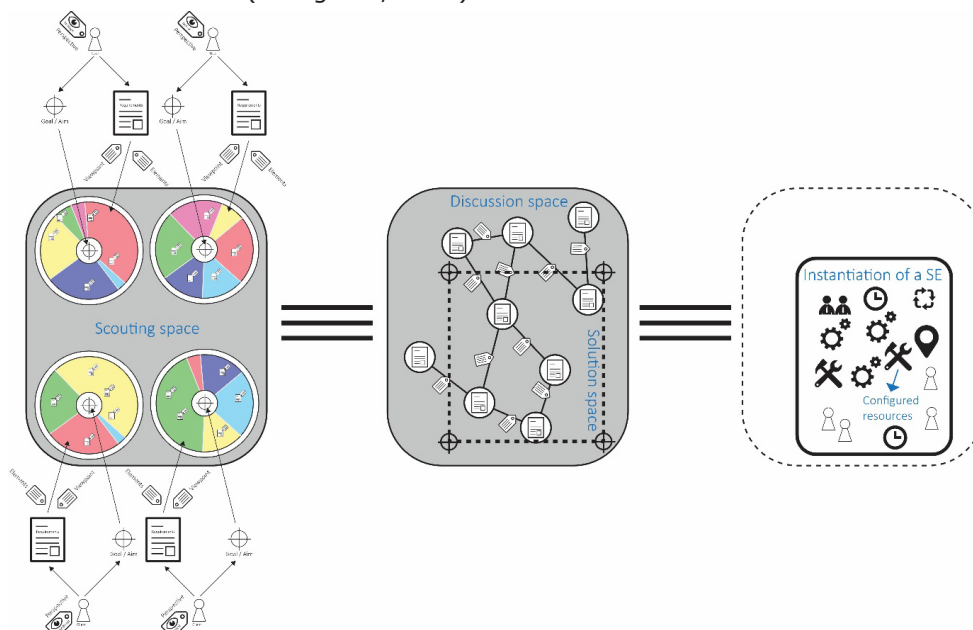
As said, a SE is an instantiation of multiple elements. These elements can be real or virtual elements. The elements can be combined using several tools, these tools should be well-chosen in order to develop the best SE. Combining the right tools asks for high-level configurations. The development of the SE itself ask for a well-considered design process. To develop the "best working" SE, analyses have to be done, these provide insight in the requirement specifications of these tools. It should be incorporated what techniques, tools and solutions are already available. However, it should not limit the suggestions of new ideas (Damgrave, 2017).

To map all the involved elements, project stages and stakeholders, a supportive method would be useful. The actor network introduced in section 3.1 could be a way to map all project elements. Damgrave also provides a method to map all project elements by introducing three different perspectives to divide the stakeholders. The strategic perspective, the tactical perspective and the operational perspective. With the strategic perspective the perspective of the company is meant. The tactical perspective covers the operator perspective and lastly, the operational perspective includes the user perspective. The different perspectives result in different viewpoints on the same topic. Each viewpoint presents a different way to look at a certain topic. This makes it easier to cluster, tag or filter the information. Now the differences and similarities between stakeholders become clear. These differences might lead to discussions, and the similarities form a starting point to build the SE on (Damgrave, 2017).

When the perspectives of the stakeholders are determined, the blueprints can be designed. A blueprint is a certain template which is introduced to label all the needs and wants (requirements) of a stakeholder. Each stakeholder designs its own blueprint. The main purpose according to the stakeholder's perspective is written in the middle. There are nine elements that are minimally necessary to develop the SE. These elements are: hardware, software, user, environment, information, knowledge, methodology, resources and working methods (Damgrave et al., 2013). The requirements should be divided per element, per stakeholder. Not all requirements are evenly important to each stakeholder. This difference will be outed visually in the blueprints. The blueprints are individual parts of the SE. They are not integrated, therefore a framework should be designed in order to realise the SE. Blueprints can be matched and structured, this will be the base layer of the SE. The blueprints are used to start discussions between stakeholders. They represent the stakeholder's opinions and will trigger discussions about each other's way of working. It is an open space without limitations; nothing is wrong about the idea someone could have.

From the discussions space the stakeholders should proceed to a solution space. Therefore, information should be filtered, no duplicate information. This will create a tighter information area, and it is the task of the project management team to minimize this area to what is called the solution space. The solution space contains all the aspects that together define the final SE. The final SE is the fundament for project design, it is crucial that it is flexible. It should be able to create freely ideas, and issues can be easily handled. All information is categorised and structured in the SE, and can be easily searched for and also be adapted. Requirements are related to stakeholders, who are all analysing within the SE from a different perspective. They have their own personal goal but share the same goal on a higher level, to lift the SE to the most appropriate solution.

Different viewpoints can be taken to analyse the problem and to come up with new solutions, or to find the best solution. This way of analysing is called the "scouting space". Combining all the information from the blueprints, the solution space and the scouting space will form the SE profile, illustrated in Figure 11. The SE profile always includes the outcomes of the solution space and zooms in on a certain solution for which scenarios can be written to deepen this solution to a final concept. In the end the most fitting SE should be chosen from this SE profile to be the final Synthetic Environment (Damgrave, 2017).



**Figure 11.** The architecture, with the three stadia of evolution of a Synthetic Environment (Damgrave, 2017)

### 4.3. Decision-making Support Frameworks

The theory about Synthetic Environments focusses mainly on stakeholders, requirements, and project relations and the underlying thoughts behind them. However, the “ad hoc decision-making problem”, pointed out by the project manager (section 4.2) is a rather specific problems that might require a more specific approach. Decision Support Systems (DSS) as the name implies, focus on supporting decision-making, a feature that might be interesting to include in the tools in order to reduce ad hoc decision-making.

A product development process includes many decisions that have to be made. These decisions can be conscious and unconscious, and have influence/impact both expected and unexpected, anywhere in the project life cycle (Lange et al., 2016). Therefore, it is important to take the consequences of these decisions into consideration, to make sure the impact of a decision is preferred (De Lange et al., 2014). It is important that designers are aware of the elusiveness of decision-making and should manifest means to incorporate elusiveness into decision-making. Uncertainties should be a mean instead of a barrier. Despite that, there is a lot information related to a project life cycle, which is probably complex or might include irrelevant parts. Decision-making only adds up to this pile of information, therefore decision-making should be an activity that adds value. Where the designers come up with new ideas, create back-up for an idea and assess a certain idea. Implementing the decision-making process in the project life cycle, all information related to the decision-making (context, rationale, etc.) becomes useful. As a result, when an idea is rejected, there is still useful information available that can be re-used for making other decisions (Lange et al., 2016).

Management Study Guide<sup>13</sup> provides management and skill based education. Their study guide is ISO certificated (ISO 9001:2015 Certified Education Provider) and one of the topics is about Decision Support Systems. They provide some background information about decision-making and some methods to analyse decision-making processes in a company. Because each decision should (indirectly) create value for the organisation, supporting the decision-making process of organisations will help them to become more agile and will reduce the decision-making time.

As it is implied in the title, a decision support system’s goal is to facilitate optimal decision-making. This can be done by a computer-based application that collects, combines and analyses data. The data includes among others documents, fundamentals of science and personal knowledge, this could include previously made decisions with the decisions rationale. Analysing this data will make it possible to identify problems and determine their solutions. Which will result in optimal decision-making. A decision-making process consist four actions, namely; exploitation of resources, determining the impact of actions, examine previous actions and predict future trends. Investing in a successful decision-making process results in good decisions. Good decisions are characterised by: a greater usefulness, take internal and external factors into account, have no conflicts of interests, and eventually provide the decision maker with useful information<sup>13</sup>.

Possible decision-making strategies to include in a project management support tool are:

- A file drawer system that provides useful information to make a specific decision.
- The representation model, which focusses on specific problems and looks into different decision paths by stimulating the decision maker to conduct ‘what if’ analysis (D. Lutters et al., 2004).
- A suggestion system that assists in collecting and structuring data in order to suggest an optimal decision for a specific case.
- A framework for strategic decision-making that is based on the elusiveness of decision-making, referring to volatility, uncertainty, complexity and ambiguity (Lange et al., 2016).

13 <https://www.managementstudyguide.com/decision-support-systems.htm>

Decision Support Systems can be split in two categories when looking at the type and frequency of decision-making: programmed decision-making support and ad hoc decision-making support. Ad hoc decisions are described as decisions made in an unanticipated situation, which matches with the problem pointed out by the project manager of COUCH. Ad hoc decisions are often based on implicit information, information that influenced by the involved actor(s), knowingly or unknowingly (Lange et al., 2016).

The designer should keep the following in mind when designing a decision support system: the data management functions, the available hardware platforms, the user interface, the compatibility with other applications, and costs. Suggestions of certain frameworks are mentioned below.

#### 4.3.1 Decision Support Systems

A suggestion of a certain documentation framework with promising results is summarised here, and is used as input for the development of a project management support tool. The proposed framework consist of four viewpoints, based on typical stakeholders. The viewpoints cover all stakeholder's concerns related to the decision-making process. Viewpoint one: Decision Detail, focussing on the rationale of decisions. Viewpoint two: Decision Relationship, referring to the relations between decisions. Viewpoint three: the Decision Stakeholder Involvement, illustrating the relations between decisions and stakeholders. Lastly, viewpoint four: Decision Chronological, taking changes, updates and reuse of certain decisions into account (Van Heesch et al., 2012).

Another suggestion is a tool that will support the improvement of software architecture's quality via decisions visualisation. This tool focusses on decision browsing and detailed decision analysis by storing design decisions on a database for later retrieval. As a result, decisions can be easily saved and distributed using the import and export features. It is also possible for the user to create, modify, or delete a decision or are decision relation. The decisions and their relations are visualised in several ways in the tool to support the user by reading and analysing the decisions (Lee & Kruchten, 2008).

The Prefuse visualisation framework (Heer et al., 2005) is used to visualise the decisions. The tool illustrates the decisions and their relations in four different ways. The first one is a list, in which the decisions and their relation (type) and other attributes are listed, this is the only non-visual illustration. The second one shows decision-graphs, were all decisions are the nodes and their relations are the edges. It allows the users to quickly observe the decisions and their relations in comparison to the list. In this graph graphical design elements can be included to visualise certain decision characteristics and information. The third way visualises the decisions in chronological order, showing the evolution of the decisions; easily noticing changes. The last way pictures the decisions from an impact perspective, showing all relations a certain decisions has. This will help determining the impact of a change for example (Lee & Kruchten, 2008).

An actor network, as presented in section 3.1 is a great support to decision-making, decision management and requirement management. An actor is a intermediary between specific parts of the product definition and specific requirements (or decisions). The actor network allows for tracking requirements and decisions in a few steps. It provides the relations to stakeholders, who made a certain decision or requirement or the project aspects that are influenced by a certain requirement or decision. The actor network allows for a flexible requirement specification that is preferred in design processes (an evolving requirement list) (E. Lutters et al., 2014).



#### 4.4. Requirement Engineering

Requirement engineering is the term used for all activities that are related to the requirements of a system, e.g. designing, analysing, documenting, validating and maintaining (Pohl, 1994). For all these activities there are multiple approaches possible, it depends on the type of project which approach would be most beneficial. Essentially these activities can be grouped as two main activities, namely the requirement development and the requirement management. Developing a requirement includes all the activities like designing, analysing, documenting and even validating, while requirement management refers to maintaining the requirements, for example making sure the requirements are traceable (Pandey et al., 2010). The latter, requirement management, is the most difficult. Figure 12 mentions the types of requirements and the process of development and management they go through.

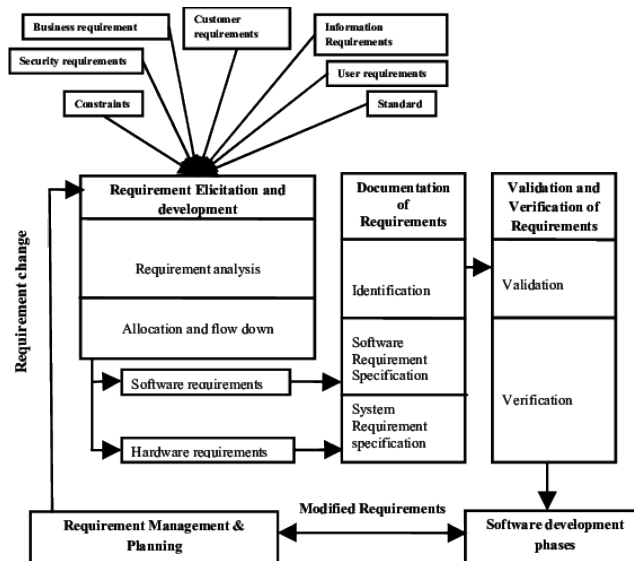


Figure 12. Requirement Engineering Process Model (Pandey et al., 2010)

##### 4.4.1 Requirement documentation

A common assumption is that requirements have to be specified at the beginning of a project and have to be followed for the rest of the project. E. Lutters et al. (2014) argue that this is untrue; setting requirements at the beginning of a project and allowing modifications due to new insights is a strength. As a result requirements will not bias the decision-making process or fix a certain design direction, they evolve over time. Of course a flexible requirement specification carries uncertainties and ambiguities, but these should be integrated in the design process and require re-evaluation of requirements which will lead eventually to substantiated choices (E. Lutters et al., 2014). It is important to document the requirements in a way that they are easily found and read back. Requirement identification is one of characteristics that will help to make this possible. Requirement ID's should be informative to the user. Requirement classification can help define this ID. Requirement classification is commonly done by dividing the requirements in functional and non-functional (technical) requirements. The functional requirements describe an action the designed system will perform. The non-functional requirements include overall characteristics; the system's properties (Pandey et al., 2010).

Another classification method is the FICS classification, where the requirements are divided according to the domain in which the product will operate. These domains are divided based on certain characteristics referred to as: functions and events (F), interaction and usability (I), content and structure (C) and lastly, style and aesthetics (S) (Benyon & Macaulay, 2002).



Requirements could also be identified with a priority label. Prioritization methods are important in a project because they can help preventing failure, unnecessary costs, lost of resources and support the designer- and user communications about the main project outcomes. Prioritising can be done using the MoSCoW method. With this method, requirements can be classified as: must-haves (M), should-haves (S), could-haves (C) and wishes (W) (Hatton, 2008). Supporting the background identity of a requirement, it might be interesting to include the source of a requirement. Moreover, an explanation about the requirement design: "the rationale", also adds useful information. (Van Velsen et al., 2013). The requirement management depends among others on the requirement documentation. Identifying the requirements in a understandable and traceable way will help the requirement management. On top of that a requirement history section (Van Velsen et al., 2013) should be added to the requirement information. This section will provide the reader with information about the author, editor and the time and date of the latest creation or edit.

Over the last years there is a change in Requirement Engineering in software development, from a traditional approach to a more agile approach. The characteristics of the traditional approach are that Requirement Engineering is done at the start of a project and only then input from product users is incorporated. This approach is rather rigid, focussing on documentation, and not being flexible with new insights during the development. Agile Requirement Engineering focusses on more face to face communication and customers can provide input during the whole development life cycle. In agile Requirement Engineering the focus is distracted from requirement documentation to being open for new ideas and updates, having no complex documentation process (Batool et al., 2013). But still Requirement Engineering is the most important phase in agile software development projects. Proposed Requirement Engineering methods in research are the ARAM (Agile Requirement Abstraction Model) (Svensson et al., 2008), agile requirement elicitation (Mahmud & Veneziano, 2011), SnapMind (Wanderley et al., 2014) or JAD (Kumar et al., 2014). These methods highly focus on the input from users or customers, they use different techniques to acquire this information. From highly customer involvement, to mind mapping, scenario writing to stakeholder workshops. All these techniques are promising in handling issues that rise with agile Requirement Engineering, so as a result traditional Requirement Engineering can with these approaches be handles in a agile environment (Mateen et al., 2018).

Incorporating the requirements in the actor network would be beneficial for the requirement management. It allows for easy tracking of the requirements; who is responsible for the requirements, what project aspects are affected by that requirement. When changes or updates are required the impact it would have on the project can be outlined, this allows for considerations on that matter (E. Lutters et al., 2014).

#### 4.5. Market Research of Project Management Tools

This market research about project management tools is an exploration, to get some background knowledge about the services that are already available to support project management. This market research looks broadly into the state-of-the-art of project management tools: what are the functions and features of these services and what is their purpose?

On the next page some features are included that were frequently found in the market research and seem interesting for the potential users of the project management support tools. The list is a result of the tools that were graded with a 4.5 or higher by reviewers of GetApp<sup>14</sup> on December 1st, 2019. Most of the tools are designed to support organisational parts of a project. They focus on project planning, task division, stakeholder collaboration, and more. There are also tools that focus

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14 <https://www.getapp.com/p/sem/project-management-software>

on providing external stakeholders insights in their project or budget control or activity tracking or Lean methods, however these features seem not directly useful to incorporate in the project management support tools based on the project analysis of Chapter 3.

### Interesting features found in market research

- Admin controls
- Mobile phone application
- Task conversations
- Due date tracking
- List and prioritise tasks
- Templates for use cases
- File sharing
- Project planning
- Database of Wiki's
- Connect goals and strategic initiatives
- Define and manage actions
- Calendar Sync with Outlook, Google etc.
- Prioritisation methods
- Adding skills to persons
- Staff time off tracker
- Clever calendar
- Personal dashboard
- Resource pool
- Automated alerts
- Prioritize features that align with strategy

Next to this general market research, research is done about available tools that support requirement and decision documentation and communication. This is researched separately because current requirement and decision; documentation and communication appeared to have an opportunity space (Chapter 3. Project Analysis). The two most promising tools are mentioned here because they seem to support the users with requirement engineering and decision management in multiple ways.

SpiraTest15, a requirement management tool including requirement testing and providing requirement traceability. The tool includes both, functional and technical requirements. The features of this tool are:

- Requirements capture according to a certain template (illustrated in Figure 13)
- Requirements management; organising (e.g. prioritise), filter, move or copy requirements
- Support use case documentation and relate them to the related requirements
- Customise requirement properties, e.g. including business specific frameworks or templates
- Add requirement specific workflows
- Manage requirements tests to validate its functionality
- Requirement traceability via requirement relations (with each other and other aspects)
- Cross-project traceability to share and reuse features and tests from other projects
- Requirement history information
- Add attachments to the requirements

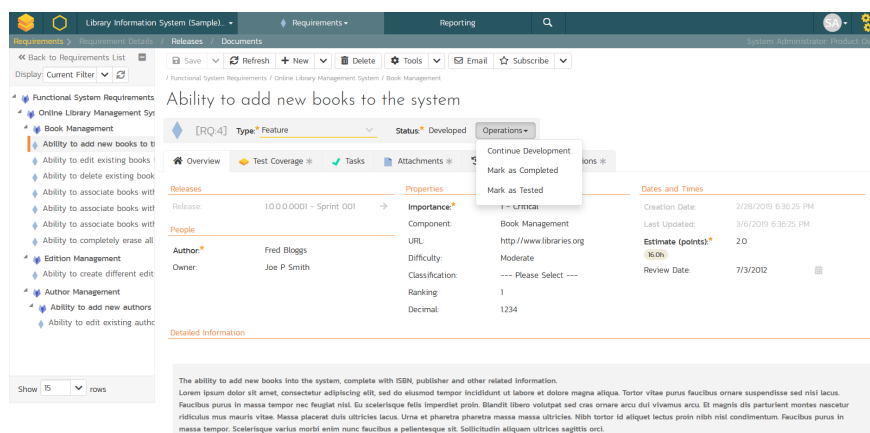


Figure 13. SpiraTest<sup>15</sup>: a screenshot of a requirement information screen

ReqSuite® RM<sup>16</sup>, is a requirement management tool for organisations to help them with analysing and managing requirements in development or procurement projects. Promoting a 40% reduction of costly project work and simplifying the analysis, planning, and design. Features:

- AI supported assistance
- A process assistant
- Pre-filled templates, including personally designed templates
- Scalable requirements analysis and functionality reuse
- Analysing requirement content, description quality, dependencies or impacts
- Add attachments to the requirements
- Automatically saves changes and shows the different versions (ability to compare and restore)
- Linking requirements to each other
- Possibility to reuse certain requirements
- Showing (and so controlling) status workflows and progress
- Features for collaboration on certain actions

#### 4.6. Conclusion

This thesis aims to develop a project management support tool for RRD's European eHealth research projects (PMST). The approach is first to develop a project management support tool for the Council of Coaches project (CMST), and use this case study to develop the final tool. This background research has pointed out some interesting theories, frameworks, methods and general information related to project management. It became clear that RRD should strive for maturity (short term goal) and excellence (long term goal). IT supported methods could be a solution, so the development of a certain tool that is IT supported, could be promising to reach these goals. This new tool should support agile project management because agile project management allows flexibility regarding project choices. The implementation strategy of a new of project management approach (including a tool) is important. However, this research focusses on the functionalities of the tool, implementation is of the designed tool is out of scope.

But, how to design such a tool, that will be robust and flexible and solves the problems that are summarised in section 3.5? A Synthetic Environment could be developed to predict the consequences of a project update by visualising the changes in relations between project elements. The user can analyse these changes and decide whether or not to go through with the update. The SE should be developed with a focus on decision-making, resulting in a PMST that also tackles ad hoc decision-making. A SE creates a virtual overview of the project to support the project management. Next to that, building a SE focusses on involving all stakeholders, including their opinions and documenting their requirements and decisions. Therefore, the PMST should be a SE, and therefore it will be designed according to the framework of R. Damgrave, but redesigned for and with the project management of RRD's European eHealth research projects. This redesign will include the methods to support decision documentation and requirement documentation (RE).

Finally, market research has shown that there a lot of project management tools available. However, these mainly focus on time and cost management, which is not encountered as a problem of the project management of the development projects. Next to that, none of the tools provide certain decision impact models, which would probably be a supportive feature for the project management. The interesting features will be considered during the designing of the tools. The requirement engineering support tools point out some interesting features: e.g. versioning, requirement relations, requirement importance, requirement status. These features are suggested to include in the design of the project management support tools.

<sup>16</sup> <https://www.osseno.com/en/requirements-management-tool/>






# CHAPTER

## Design Requirements

# 5



## 5. Design Requirements

In the next chapters, the development of the CMST's design is documented from first concept to final design. The previous chapters are input for the design of the CMST. The functionalities are based on the shortcomings of the current way of project organisation, management, communication and documentation that were found in the background research. The findings from the project analysis (Chapter 3) and the background theories (Chapter 4) are input for the ideation of the CMST. The background information about COUCH is kept in mind so the design of the CMST will match with the project specifics. The development of the CMST is a case study, that will eventually make it possible to design a management supportive tool for development projects within eHealth research projects (PMST) in general, and in specific for RRD. The case study project is seen as an individual project. For the final tool, the PMST, the part of the European research project that is executed by RRD is seen as an individual project, which of course has relations to the other parts of the associated research (as illustrated in Figure 2). Both tools are developed from a designers perspective; focussing on the functions and features rather than for example the graphical design, development costs or a psychological analysis on whether stakeholders will eventually use these tool. The focus is on the functional requirements, rather than the technical requirements. In the end, the tools fulfil a function rather than a goal, so support project management instead of improving project management. Identifying dependencies and interpreting the information provided by the tool is always the responsibility of the user.

### **Goal of the CMST**

"Support the COUCH Functional Demonstrator project management throughout the whole project life cycle".

### **Design assignment CMST**

"Develop a project management tool that supports the stakeholders who are involved in the development of the COUCH Functional Demonstrator so the project (outcome) will be lifted to a higher level compared current situation."

### **Goal of the PMST**

"Support project management of the development project that is included any (new) European eHealth research project (of RRD) throughout the whole project life cycle."

### **Design assignment PMST**

"Develop a project management tool that supports the internal stakeholders who are involved in the development part of an European eHealth research project so the project (outcome) will be lifted to a higher level compared current situation."

### **Approach to design the PMST**

"Redesign the CMST, that was designed for a part of a specific development project within a research project (COUCH), into a general project management tool that supports the development part of multiple European eHealth research projects (of RRD)."

**Sub goals**

- The sub goals of the PMST and the case study (CMST) are the same, since both are based on the outcomes of the project analysis.
- Support the project management team (primary user)
- Improve project documentation for the primary and secondary users
- Stimulate stakeholder collaboration and communication (primary and secondary users)
- Support (ad hoc) decision-making of the primary and secondary users and handling emerging new requirements
- Support effective and efficient knowledge sharing among all users

Except from the first sub goal, both the primary and secondary users are involved. Only when the primary and secondary cooperate and use the CMST/PMST, the CMST/PMST can prove its benefits. This note should be kept in mind when designing the CMST/PMST.

**5.1. Opportunity space**

The implementation of Synthetic Environment characteristics in the tools for better support is promising. There are similarities between SEs and the project management of research projects.

The levels of aggregation consist of three different viewpoints and can be related to project management in the following ways.

**Strategic level** – the company perspective – contains the perspective of the RRD eHealth department: realising a lean tool that can be used in multiple projects. From this perspective the main requirements are that the tools investments (costs, time) pay back over time and support a long-term vision (maturity and then excellence).

**Tactical level** – the operator perspective – the managers of the research projects are operators that will use the tool for a specific project. Their requirements are easy maintainability and adjustability of the tool and simultaneously provide robustness.

**Operational level** – the user perspective – the users of the tool are all involved internal stakeholders of a certain project. From the user perspective it is required that the tool includes the right functionalities and can be adopted in current workflows.

The tool should create an environment for the project that has SE characteristics. In order for this to be possible, all project elements should be represented in the tool. This is a representation of the current setting of the project. The project information that has been included in the network made with Gephi 0.9.2 (section 3.2) is an abstract representation of the COUCH FD development. The information included in this overview plus the additional information that was gathered from the project analysis yet not represented in the overview, is analysed because these are the elements that represent that current setting of a project. This is an example that can be used to evaluate the required project elements.

The project elements and their relations have to be visible in the tool. If there are updates on the project considered, the SE shows what the impact of such update would be. This means that when all the relations of this new update are added, it becomes clear what the influence of this update would be on other project elements (project aspects, stakeholders, requirements and decisions). A SE of this project shows the influence of the update, the user can now evaluate this change and decide whether to implement the update or not. This feature should be included in the PMST design.

All the stakeholders (actors) of a project have different perspectives on the project. They have their own goals within the project, these goals should be aligned. Next to that, the stakeholders' different opinions about a certain decision or requirement which should be included in the tool. The actor network (section 3.1) proved to be promising with the right IT support, a SE provides viewpoints to show these different opinions on a certain topic. It allows for clustering, classification, tagging and filtering of information, which seems to be a useful function/characteristic to incorporate the tool. Emerging differences can lead to discussions, and similarities form a starting point to build the project (with SE characteristics) on. An overview that provides all project information in a clear and visual way (called the project overview) should be based on the actor network. The filtering of information in the actor network could be incorporated in the tool by making use of filters which allow the user to include certain aspects (or not).

Decisions, including their rationale, should be documented in such a way that the information becomes valuable (section 4.3). Documenting decisions can be done by a computer-based application that collects, combines and analyses data, the CMST/PMST should be such application. The viewpoints introduced by Van Heersch et al. (2012) could be a valuable addition to the tool's decision documentation support. Including the decisions' rationale; relations between decisions other aspects and stakeholders; and creating a decision "timeline", including the date and time of a decision (moment of introducing or updating). Lee and Kruchten (2008) suggest decision visualisation, the visualisation could be incorporated in a decision list and in the suggested project overview. The decision list captures all decisions and allows updates and additions. Moreover, the decision list can be filtered (to display different information, and different viewpoints) and can be exported. Including the decisions in the project overview to illustrate their relation and have all information in one place is a great design opportunity, especially when the requirements are also included in this overview, which would support requirement management. The users should be able to document the requirements in an effective and efficient way, including informative information about the requirement (e.g. author, rationale, classification, prioritisation and impact). In addition, the requirements should be modifiable through the project life cycle. The tool should therefore include a standard way of documentation and presentation which allows for updates and that documents the requirement history (author, date, time).

## 5.2. Approach

The requirements from section 3.5 that were based on the project analysis, should be kept in mind when designing. The insights from the background theories (see section 4.6) provides design solutions for the tools. This chapter states the goals and design brief of the requirements based on the previous findings. These should lead the design process. The opportunity space that is described in section 5.1 explains certain design directions. A brainstorm about the requirements will be done that should result in implementation and extension of the functions and features. This will result into a list that will state the functions and features of the CMST concept (section 6.2). From the first concept of the CMST, a mock-up will be developed to demonstrate a possible solution of how the CMST could look, including the main characteristics. This mock-up will be used to evaluate the CMST with the potential users. The results from the evaluation will be taken into account when the final design is developed. The final design of the CMST is presented in Chapter 8, including updated mock-up illustrations. The CMST is designed only for the Council of Coaches project, so now the CMST should be redesigned into a tool that will support the project management of all European eHealth researches of RRD. This tool is called the PMST and the required transition and extensions will be based on section 2.1, that describes the background information about these research projects and the CMST design. The final design is presented in Chapter 9.







# CASE STUDY

## *Designing a Management Support Tool for the Council of Coaches project*

The case study has been introduced to get grip on how RRD's project management of European eHealth research projects is handled, by analysing one of their current research projects; Council of Coaches. The tool that is designed for the case study, the CMST, is an example of how the PMST concept should look like.

The concept of the CMST is introduced in Chapter 6 and evaluated in Chapter 7. The final design of the CMST is presented in Chapter 8.



# CHAPTER

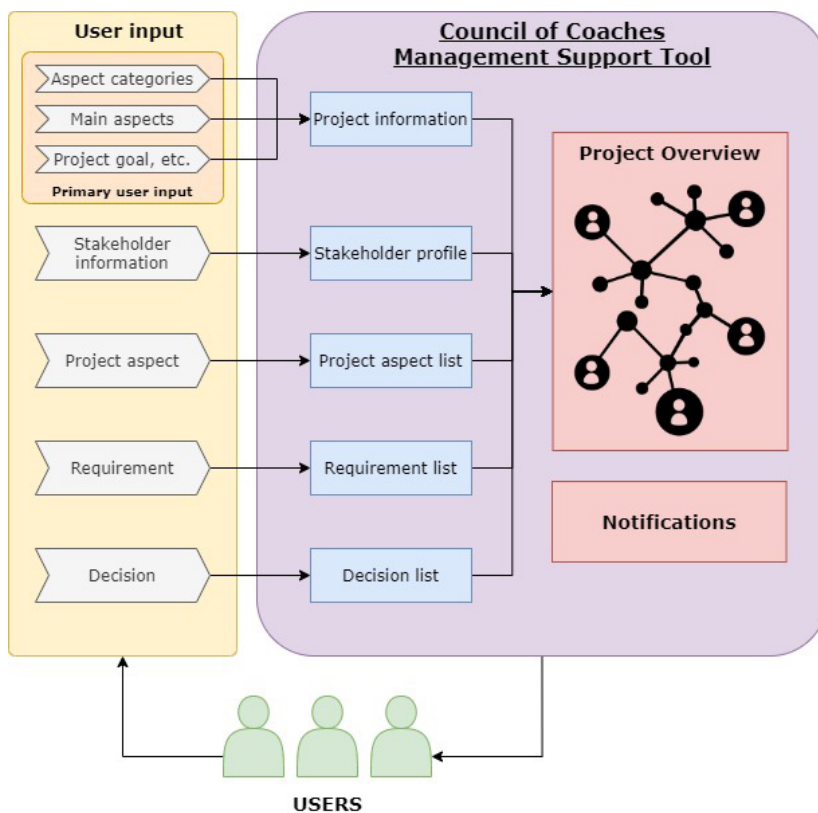
Concept of the CMST

# 6

## 6. Concept of the Council of Coaches Management Support Tool

This chapter presents the proposed concept of the Council of Coaches Management Support Tool (CMST). The CMST is the result of the design suggestions that were presented in Chapter 5. The CMST's output is based on the project information that emerged as important in the project analysis (Chapter 3). Project information can be classified in project elements: stakeholders, project aspects, requirements and decisions. Project aspects can be related to the following: hardware, software, information, knowledge, environment, workflow, working methods, ethical aspects, legal aspects, profit, society, design stages, development stages, exploitation stages, resources, management aspects, project goals, project milestones and project planning. This list of topics is based on the elements necessary to propose a SE according to R. Damgrave (2017).

Figure 14 shows the information flow of the CMST to provide a general understanding of the CMST upfront. The functions of the CMST have to support the primary and secondary users. However, to profit from functions, the CMST always needs input (information) from the users. The general project information should be added by the project management team (primary user) at the start of the project, see the orange "block" in Figure 14. Afterwards the project management team invites the internal stakeholders. All internal stakeholders should add information about themselves to their profile. Moreover, they add project elements to their project role/tasks like related project aspects, related requirements, decisions they made and the stakeholders they work with. An element contains detailed information about that element, for example the author, rationale and other relations these elements have with other elements. The output of the CMST includes the same information as the input but is structured, combined, listed or filtered. This leads to a clear project overview and provides the user with insights about the project (complexity).



**Figure 14.** Representation of the information flow of the CMST and the information that is presented and provided by the CMST

### 6.1. Scenarios

The user interaction and user experience are important to stimulate the use of the CMST. Scenarios are introduced to gain insights in the interaction and user experience. These scenarios will help to understand the added value of the CMST. Functions and features of the CMST are illustrated in the scenarios in combination with the user(s) who wants to accomplish a certain task using this specific design. The scenarios always include at least one goal and one person who is involved with the design. These scenarios tell a certain story in which a user of the CMST executes certain actions or has to deal with certain events. How they react or deal with the situation is related to the design (Carroll, 1999). The background stories mentioned in these scenarios are based on the development project of the COUCH Functional Demonstrator. Nevertheless, these stories and names are made up and do not represent real information. A few of the scenarios that were made can be found in Appendix D.

### 6.2. Requirements

The requirement list includes all functional requirements for the Functional Demonstrator tool and some non-functional requirements. The requirement list is included in Appendix E. The requirements have been drawn up on the basis of previously found information. The list includes requirements about input and output of the tool, referred to as functions and events (F) (FICS classification). Other classifications are interaction and usability (I), content and structure (C) and lastly, style and aesthetics (S) (Benyon & Macaulay, 2002). Next to the domain label (FICS), each requirement also receives a priority label. The prioritising is done using the MoSCoW method (Hatton, 2008). With this method, requirements can be classified as: must-haves, should-haves, could-haves and wishes (will not have). In order to make the information about each requirement complete, the source and rationale of the requirement are added, and are shown in an overview (Van Velsen, Wentzel, & Van Gemert-Pijnen, 2013).

#### *Interpretation of the FICS classification*

- F – Function and event: requirements that describe what the CMST can do.
- I – Interaction and usability: requirements that describe the relation the users have with the CMST. Describe a function that helps the user using the tool.
- C – Content and structure: requirements that describe what the CMST does.
- S – Style and aesthetics: requirements about the graphic design of the CMST.

Each requirement has an ID, based on the FICS classification plus a number. Per requirement is mentioned what the priority is and is elaborated on the rationale behind the requirement and what the source of the requirement is.

### 6.3. Functions and Features

The section elaborates on the proposed design of Chapter 5 and the requirement list that is included in the previous section. The functions and features of the CMST concept are briefly mentioned to prevent repetition in Chapter 8.2 where the functions and features of the final design are explained. To support the visualisation of the idea, screenshots of the developed mock-up are already included in the functions and features list to visualise some of them. The mock-up development is explained in section 6.4 and is based on the functions and features represented here.

It is proposed that the CMST should include a project overview, that shows all project information in one place and allows the users to create a Synthetic Environment. The project overview structure is based on Actor networks (section 3.1) and the content is based on the acquired information from the project analysis (Chapter 3). The CMST should include functions and features that support requirement management and decision-making and documentation.

### 6.3.1. Functions and features list

- The CMST presents information to the user, this information includes:
  - Project information (general information about the project, e.g. the goal)
  - Stakeholder information (e.g. background of the internal stakeholders)
  - Requirements (the requirement itself plus additional information)
  - Decisions (the decision itself plus additional information)
  - All project element relations (project elements are: project aspects, stakeholders, requirement and decisions)
- The CMST allows users to add, edit, delete information (input)
- The CMST creates a project overview that presents all project elements and the relations between these project elements, an example is shown in Figure 15. The CMST needs input from the user to create this overview, therefore the CMST allows users to insert project information and project aspects. The project aspects acquire specific information that is necessary to create the project overview.
  - The CMST presents all inserted project aspects in a list including: aspect, category, project aspect description, parent node(s), child node(s), related requirements, related decisions, related stakeholders, author(s), updating privileges, and history information
  - The CMST allows project aspect adding, editing, deletion and information request

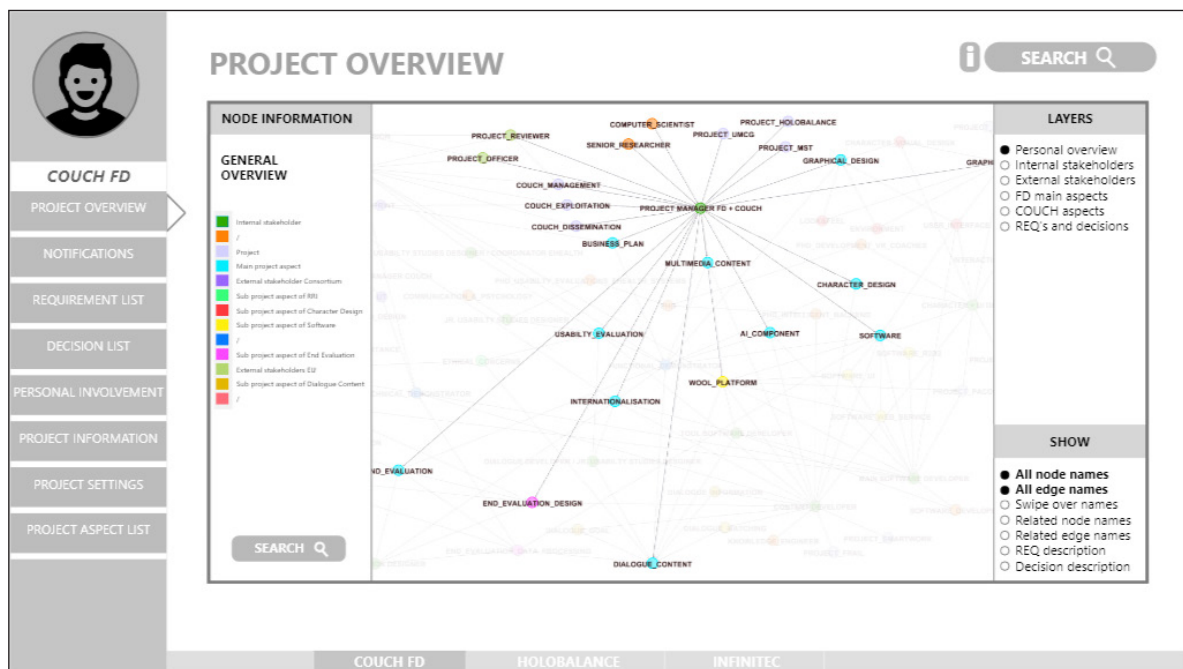
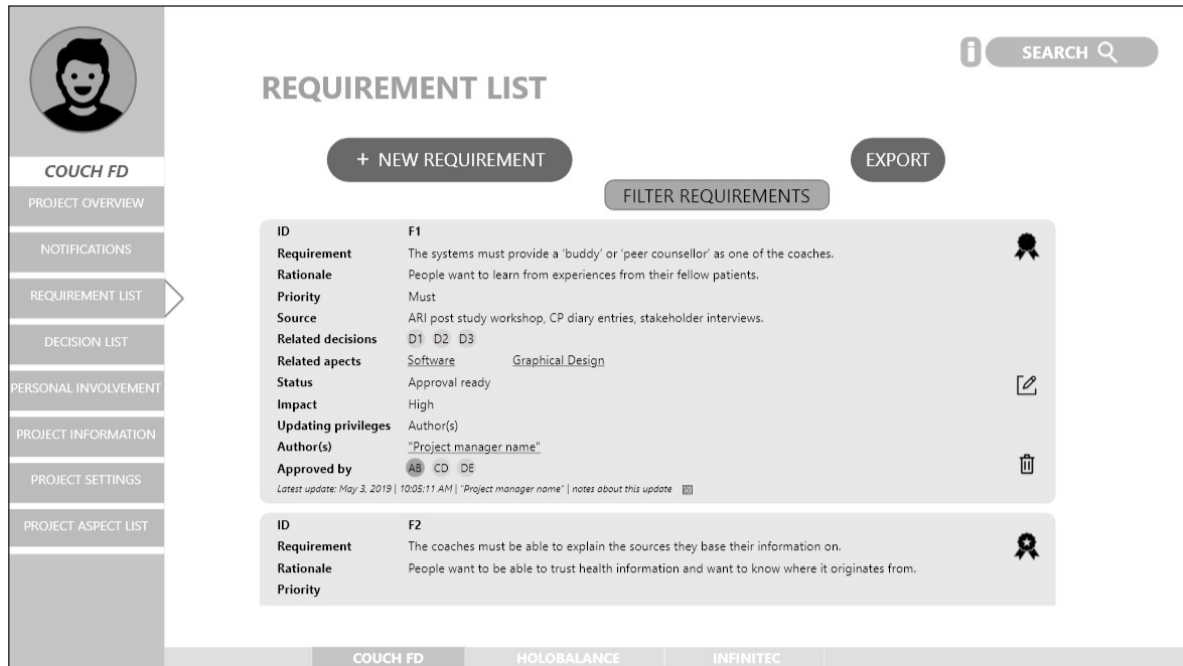


Figure 15. Example design of the CMST's project overview

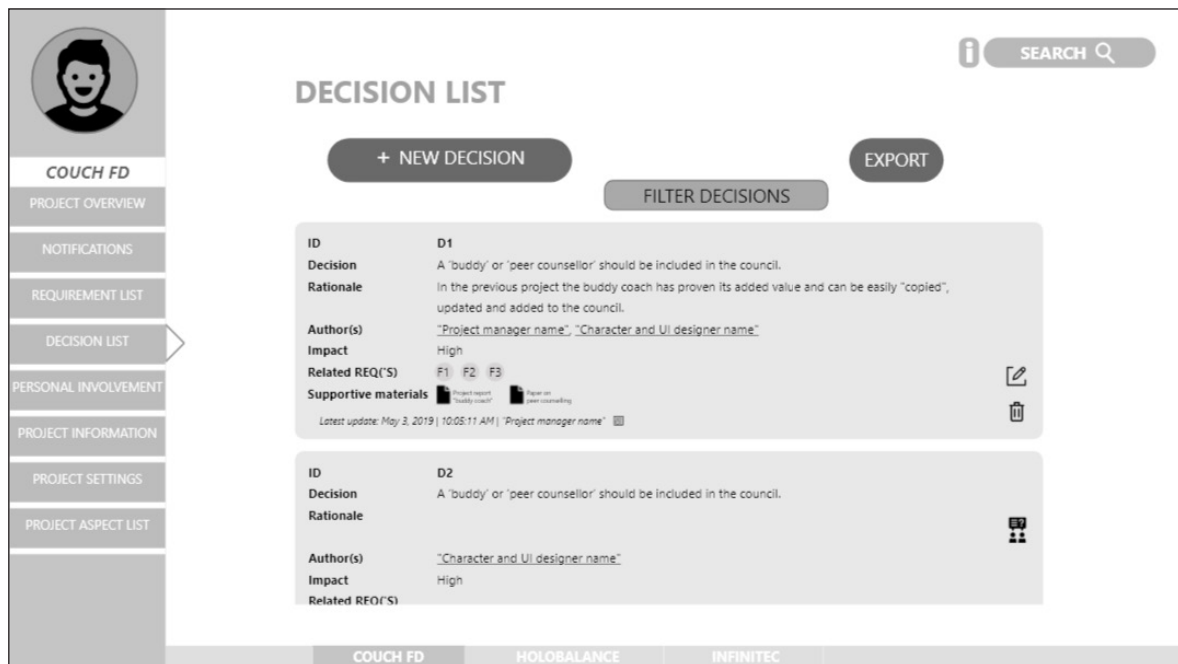


- The CMST supports requirement management. This includes:
  - Presenting the requirements in a list, including: requirement, ID plus classification, and available data on: priority, source, related decisions, related aspects, status, impact, author(s), updating privileges, approvals and history information, see Figure 16.
  - Allowing requirement adding, editing, deletion, approval, information request and status updates.



**Figure 16.** Example design of the CMST's requirement documentation

- The CMST supports decision documentation (see an illustration in Figure 17). This includes the following:
  - Presenting decisions in a list, including: decisions, ID, and available data on: rational, author(s), impact, related requirements, supportive materials and history information
  - Allowing decision adding, editing, deletion and information request



**Figure 17.** Example design of the CMST's decision documentation

- The CMST sends users specific notifications and reminders about actions of the (other) users
- The CMST creates a SE to analyse project updates before applying
- The CMST navigates the user through the project information
  - Directing the user to a stakeholder or aspect when clicking on the name or title
  - Directing the user to the project overview via a "go to overview button"
- The CMST searches information requests of the users
- The CMST suggests words to the user while typing to support consistency of used terms
- The CMST explains required actions from the user to the user

#### 6.4. Mock-up Development

Implementing the functions and features into a workable CMST is done by designing wire-frames. These are first drawn on paper and later in Adobe XD. One of the possible CMST wire-frames becomes the CMST mock-up.

The mock-up is a demonstration of how the CMST could work, a proof of concept of some functions. It involves no programming because it only includes wireframes that are linked to each other and make the mock-up interactive. The previous section already includes some screenshots of the mock-up to help understand the functions and features. The mock-up is designed in Adobe XD because it does not require programming skills. Adobe is chosen for its possibilities, it is easy to design a wireframe, to make iterations and linking all the boards (screens) is possible within a few clicks. A preview screen lets the user experience the designed framework.

A mock-up is designed as an example of the CMST, to illustrate how the CMST design could look like and to demonstrate how it could operate. The main features and functions are designed to get a better idea of how the CMST could work and what the advantages would be. The functions and

requirements drafted in the previous sections are used as input for the design. While designing, it became more clear what the added value of the functions could be and what requirements were not defined yet. Due to the limited time, not everything is designed and there was no focus on the graphical design.

It should be noted that because of privacy reasons, the names of the stakeholders are not included but are referred to with their project job or in general called "stakeholder 1", for example. Text included in the mock-up is often copied from COUCH documents, but also some text is made up, so do not count on the content. Some of the information is copied for reuse. Of course, in general the information is based on the real information of the FD development project.

Users can switch between the projects that are included in the tool, see the yellow marked areas in Figure 18. This is not relevant for the development of the development of the COUCH Functional Demonstrator, since this only includes one project, but it is relevant to illustrate the greater picture of adapting the tool at a company, and therefore included in the mock-up.

The mock-up shows a user interface for a project management tool. On the left is a sidebar with a user profile icon. The main content area is titled "Project manager 'name'" and contains a form with the following fields:

- User type:** Primary user (project manager), Secondary user (internal stakeholder)
- Background:** Technical computer science (BSc) and human media interaction (MSc)
- Job title:** Computer scientist / Senior researcher
- Skills:** Microsoft office, Adobe illustrator, WOOL editor
- Current projects:** COUCH FD, HOLOBALANCE, INFINITEC
- Finished projects:** PROJECT A, PROJECT B, PROJECT C, PROJECT D, PROJECT E, PROJECT F, PROJECT G, PROJECT H, PROJECT I

At the bottom, there is a navigation bar with tabs for COUCH FD, HOLOBALANCE, and INFINITEC. A search bar is located in the top right corner.

**Figure 18.** An example of how the user could be led to the right project

## 6.5. Conclusions

This section concludes the concept design of the CMST. The scenarios referred to in section 6.1 were of added value to visualise and evaluate the functions and features that assumed to be potential. The scenarios included in this thesis report are mainly included to help the user understand the proposed functions and features. The functions and features presented in section 6.2 are promising because they are based on proposed theories, methodologies and approaches that were found to be a possible design direction for the CMST (and PSMT) in the background theories research. The mock-up is designed to demonstrate the main functions and features of the CMST and to give a general idea of how the CMST could be designed. The mock-up will be used to demonstrate the functions and features of the CMST to three potential users, to get their opinion about the CMST. The next chapter explains the approach and results of this evaluation.



# CHAPTER

## Evaluation of the CMST

# 7

## **7. Evaluation of the Council of Coaches Management Support Tool**

The goal of evaluating the CMST mock-up is to receive some useful feedback on the functions and features of the designed FD Tool. With the mock-up, the main functions and features can be demonstrated to the potential users. The evaluations resulted in feedback on the added value and usability. And on top of that, which functions and requirements were of added value, which were not and what should be added to design a better version.

The project manager and two highly involved internal stakeholders of COUCH (potential users of the CMST). They were asked to give feedback on the content of the mock-up. Their feedback has been used to update both the mock-up and the final CMST design, whereas the final CMST design is written in this report and is more important than the mock-up, since the mock-up is only an example of how the CMST could be designed. The final version of the CMST will be described in the next Chapter 8.

### **7.1. Approach**

Three evaluations were done, with focus on the content of the tool; the (graphical) design of the interface was left out in the designing process and therefore not evaluated. The evaluations were held in an informal feedback session, one person per session. The stakeholders first got a short explanation of the goal of the CMST and where told what was expected from them during this evaluation. The CMST's functions and features were demonstrated and explained.

The stakeholders were asked to point out their thoughts and opinion about the project overview, the requirement management, the decision-making and the decision documentation and the possible notifications. They were asked about the amount of information they have to fill in, is it complete, not too detailed, and would it not be expected to be too time consuming? Additionally, if they understand the functions and features and if they foresee added value of the use of the CMST. Naming any advantages or disadvantages of these functions and features. Next to that, their opinion about including progress of certain project aspects, and the impact of requirements and decisions is asked for specifically, due to the uncertainties of the design process.

The stakeholders were asked to mention any feedback and ask any question directly. However, it was not possible for them to imagine if they would really use it eventually, because it is still too abstract and can only be experienced by using the tool in practice. The stakeholders were able to reflect on the potential value. Findings and feedback are shortly mentioned below and were included in the final design.

### **7.2. The stakeholder's perceived potential**

Overall the design of the CMST was evaluated positively. The stakeholders all saw potential in the CMST. The functions and features related to the project overview, the requirement management, the decision-making and the decision documentation and the possible notifications were received well. Most of their comments were in the details. During the evaluation the stakeholders pointed out some advantages they foresee with the use of the CMST. The advantages are listed below.

- The tool could help all stakeholders to stay involved in the decision-making process and the process of drawing up requirements, since this is an easy way to get insight in these processes (accessible and clear).
- The decision overview could help with project reporting.
- Documenting the requirements is easy, and in combination with the export feature very useful. Including the last version of the requirement list in project deliverables or reports will be done with a few clicks. With the requirements easy accessible and in a clear overview, the stakeholders will stay more aware of the requirements and keep the list up-to-date during the whole project life cycle.

- The advantage of relating requirements to project aspects, and project aspects to stakeholders is that, as stakeholder you can see which requirements are your “responsibility” in the project overview.
- Always staying up to date, no working at cross purposes and improved stakeholder communication.
- The notifications are very important and useful, however it should be thought out well which notifications a user can and will receive.
- The information layers are perceived useful, to elaborate on functions, features and questions. Some general filled in examples are suggested to be useful when using the CMST for the first time. The stakeholders think this gives the user a better idea of what would be the utility of adding information.

### 7.3. User evaluation of functionalities

This section summarises the results of the evaluation on specific aspects of the CMST design. Appendix F provides a list of the results in detail, including the related requirement.

#### ***Project overview***

As user, when going to the project overview (see the example in Figure 15) via the menu, it should show that user’s perspective. So the user is visualised in the middle and all it’s relations are visualised around the user. As a result, the user will always see the latest information that is related to him or her.

#### ***Requirement and decision management***

The export feature is a very important feature because if this feature works well, the requirement list that can be created with the CMST would be a feature with great added value. User can easily create a copy of (a part of) the requirement list, to send to someone or add to the project documentation.

The request button in the requirement, decisions and project aspect lists should not only allow the user to send a request to the author asking for completing the information, but also allow for a specific question, suggestion or note on that requirement, decision or aspect.

Determining the impact of a requirement is found a useful question by the interviewees. It ensures a second thought about that requirement. But they also point out that the CMST itself might ensure this because the requirement has to be “officially” filled in.

The stakeholders had different opinions about adding a progress label to the project aspects. One stakeholder thought it would be of added value, another stakeholder doubted the advantages and usability and the project manager does not think internal stakeholders would fill in the status, because it is hard to say when something is ready.

The approval feature is only be thought useful regarding the requirements. It shows how important a requirement is, the more stakeholders approve, the more important. The project aspects should be right and preferably defined by all the stakeholders that are responsible for that aspect, so no approval needed. There are a lot of decisions, if they all have the option to be approved it costs a lot more time.

Since decisions are often not documented at all, because of the time pressure, negligence or motivation, it is decided that decisions cannot be approved. When a requirement is “approval ready” is debatable, also not all stakeholders should be allowed to approve any requirement.

The function to mark a requirement with the label “achieved” is positively received, especially by the project manager. It was not included in the mock-up yet, however since it was pointed out to be very useful it was included in the final version of the mock-up and of course kept as a requirement.

### ***Notifications***

It became clear that the type and amount of notifications depends on the stakeholder’s preferences. Therefore it is of added value that the user can change the settings of (some) notifications him or herself. It was mentioned that the notifications could be an update on a meeting at which the user was not present.

## **7.4. Conclusions**

The evaluations were done to check if the CMST design matches with the expectations of the potential users (COUCH internal stakeholders). Developing the mock-up made it possible to ask the stakeholder’s opinion, to confirm on the design and to help with some debatable functions e.g. a progress feature and defining the impact of a requirement or decision. The stakeholder’s perceived advantages (section 7.2) show the added value of the CMST, meaning it would be of added value to develop such a tool for the COUCH project and proves potential to design such tool for all European eHealth research projects of RRD. The results in section 7.3 zoom in on a detailed level, all the feedback is taken into account and the requirement list and the mock-up are updated. A final design of the CMST, including the requirement list and an explanation of the (updated) functions and features, is described in Chapter 8. Additionally, the final design of the CMST is discussed and some recommendations are written.







# CHAPTER

Final Design of the CMST

# 8

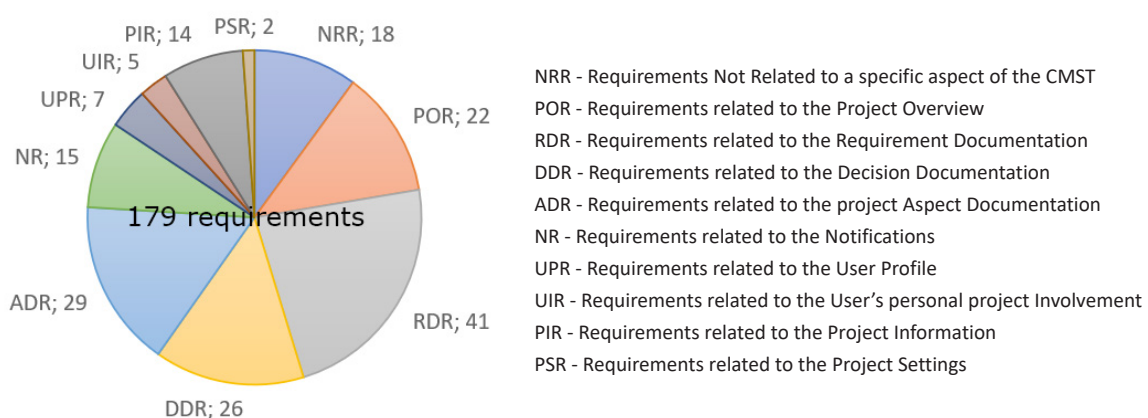
## 8. Final Design of the Council of Coaches Management Support Tool

The designed tool for the Council of Coaches' Functional Demonstrator development was used to 1) optimise the COUCH's FD project management and 2) as a case to set up a tool to that supports the project management of multiple European eHealth research projects of RRD. The final design which results from an updated concept version of the CMST, is explained here. The design, including the functions and features, the advantages and the added value are presented.

### 8.1. Requirements

The first version of the requirement list of the CMST is presented in section 6.3, the actual list can be found in Appendix E. This list describes the initial design of the CMST. After the development of the mock-up and the CMST evaluations, the design of the CMST requires some updates. The final design of the CMST is presented in a new requirement list, this is done to show the progress. The information per requirement is adapted to provided more relevant information. The requirements (in Appendix G) are listed per topic (as mentioned in Figure 19) and the requirement ID's are abbreviations of the topic plus a number. The topics refer to the functions included in the CMST. Further information per requirement in the requirement list includes: if it is a functional (FR) or technical requirement (TR). A functional requirement indicates an action that is performed by the CMST. A technical requirement refers to a specific system property (Pandey et al., 2010). Next to that, it is stated if the requirement is demonstrated in the mock-up. What the source of the requirement is, referring to the phase of the research in which it became clear that the CMST should incorporate it or where it was proved to be of added value. And lastly, to which user group the requirement is most useful; primary user (PU), secondary user (SU) or tertiary user (TU). Screenshots of the developed mock-up (section 6.4) are added to the final requirements list to support the visualisation of the requirements and to understand the final design of the CMST better.

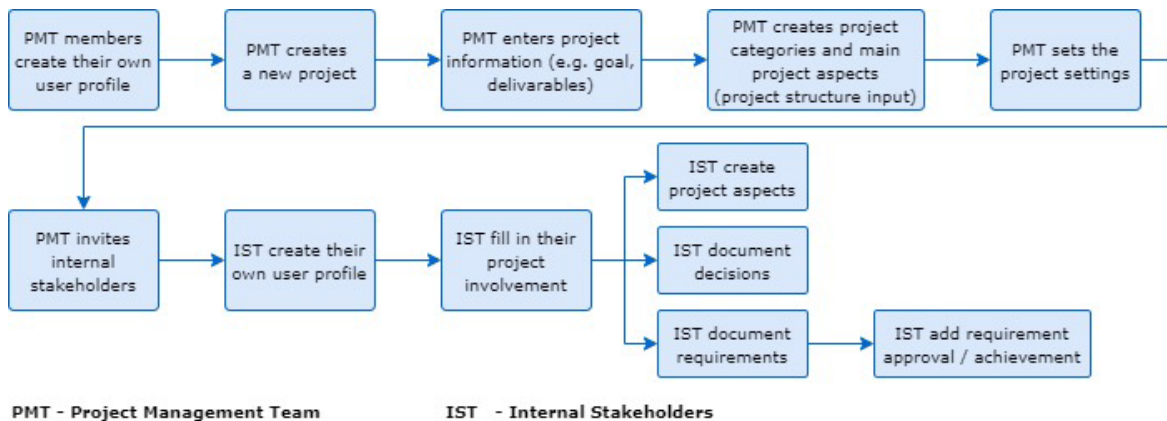
In this final list there is no priority assigned to the requirements because it is the final list that includes all necessary requirements for the best version of the CMST. Additionally, the rationale behind a requirement is left out to shorten this list, to get a better understanding of all the requirements combined. And finally the FICS classifications is not used to define the requirements because almost all are "functions and events" (F) or "content and structure" (C) and this could be better pointed out by the labelling functional and non-functional.



**Figure 19.** Overview of the CMST requirement topics

## 8.2. Functions and features

This section elaborates on the functions and features that were presented in the CMST's concept (section 6.2). The findings from the evaluation (section 7.2) are taken into account in the final design that is presented here. An abstract overview of the preferred order of actions at the start of the project using the CMST is presented in Figure 20. Including what actions have to be taken and by who. Updates and additions are left out of this illustration.



**Figure 20.** Actions taken by the project management team and internal stakeholder when starting a new project in the CMST

The CMST is developed in such a way, that both entering and retrieving information can be done effectively and efficiently. The usability of the CMST is an important aspect, however, the development of the CMST focusses mainly on the functions instead of the graphical and user interface design. The CMST only supports the project management when all internal stakeholders actively use the CMST properly. While designing it is assumed that this would be the case, and the CMST will be used as intended.

This section explains the functions and features of the CMST. Images are used to help understand what is explained. Most of these figures are also a video that can be played with Adobe Flash Player. If the figure is a video as well, the outline of the figure is blue. Clicking on the figure will start the video.

### Project information

The project information includes general information about the project, e.g. a description, the goal, duration, project management team members, deliverables, milestones and internal stakeholders. Figure 21 shows how the project information can be designed in the CMST. The project information is written by the project management team at the start of a project, but can be updated during the project if required. Next to this general information, the project management team has to create the project structure. The project structure is designed so the users can add information in the right place. It is important that the same names are used for certain aspects. The project structure provides a general framework with names and titles that should be used by the users. The project structure will be created when the project management team fills in the templates for project categories and main project aspects. The project structure appears in the project overview. The structure can be adapted during the project life cycle if updates are required.

Figure 21. An example of how the project information could be presented in the CMST

The main project aspects can be related to: hardware, software, information, knowledge, environment, workflow, working methods, ethical aspects, legal aspects, profit or society. These aspects are based on the elements that are required to build a SE according to R. Damgrave (2017) and on the project analysis, to adapt these elements to the case. The Council of Coaches main aspects are mainly divided by the design process aspects (e.g. graphical design, software, end evaluations, as illustrated in Gephi 0.9.2, Figure 9). A possibility of how editing a main project aspect could be done, is illustrated in Figure 22.

Figure 22. An example of how the main project aspects could be edited in the CMST

The categories make sure the user classifies aspects or stakeholders the same (e.g. project, internal stakeholder, external stakeholder), and mean the same with a certain category. Therefore the project management team has to name the category and fill in a description. "Main project aspect" is a standard category of which the description is defined by the project management team, so it will be project specific. The relations pointed out between the main project aspects form the basis for the project overview (project structure). The users can create "sub" project aspects and project relations with these main project aspects, the project overview (network) will expand and become more complete. The parent node can describe a main project aspect or another aspect that is doming other aspects. The aspects that are domed are referred to as child nodes.

### User profile

Each user has it own profile that includes information about the user: name, user type, job title, background, skills, finished projects, current projects and if preferred some extra information, as illustrated in Figure 23. Some of this information is presented as "stakeholder information" in the project overview (e.g. user type, job title and projects the user is involved in). When other stakeholders/users would like to read more about a stakeholder's background, they can read it on that stakeholder's profile. The stakeholder's/user's personal profile is the start screen when opening the CMST. Here the user can choose to open the project he or she is working on (as illustrated in Figure 18), or open a project he or she previously worked. The latter function is not relevant for a single project (such as COUCH), but it is relevant for the final tool (PMST). The user has one profile for all projects the user is involved in, users can only edit their own profile.

**Project manager "name"**

<b>User type</b>	Primary user (project manager) Secondary user (internal stakeholder)
<b>Background</b>	Technical computer science (BSc) and human media interaction (MSc)
<b>Job title</b>	Computer scientist / Senior researcher
<b>Skills</b>	Microsoft office Adobe illustrator WOOL editor
<b>Current projects</b>	COUCH FD HOLOBALANCE INFINITEC
<b>Finished projects</b>	PROJECT A PROJECT B PROJECT C PROJECT D PROJECT E PROJECT F PROJECT G PROJECT H PROJECT I

**Figure 23.** An example of how the user profile could look in the CMST

### User's project involvement

The user's project involvement is kind of a project specific elaboration on the user's profile. The user's project involvement should be filled in at the start of a project, describing the project role, the main project aspects the user works on, and the stakeholders he or she is directly related to (not via a project aspect). The project involvement will probably evolve during the project, the user can edit his or her own project involvement, this is illustrated in Figure 24.

Figure 24. Example of how the edit page of the user's project involvement could look like

### Project overview

The main function of the project overview is to present the whole project, all the involved stakeholders, project aspects, requirements, decisions and how they are related to each other in a clear and understandable way. The project overview is a graphical illustration of the project, presenting combined and relevant information of the project to the user, as shown in Figure 25.

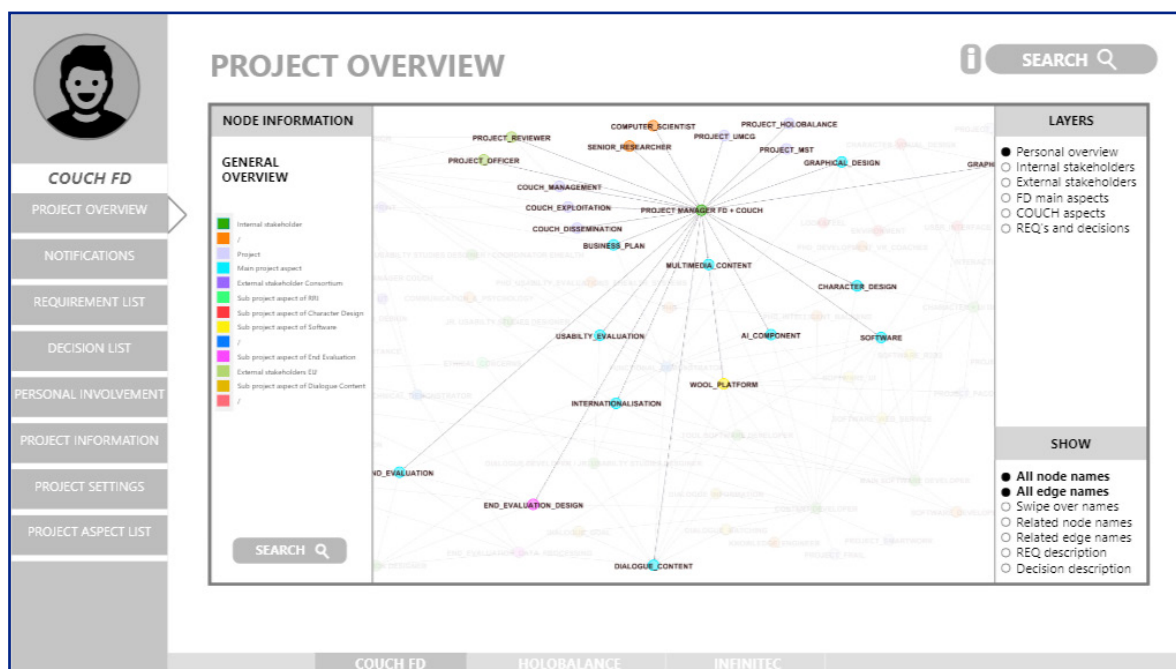


Figure 25. An example of how the project overview could look in the CMST



The CMST retrieves information from the user input, e.g. the project settings, project information, user profile, user's project involvement, project aspect information, requirement information, decision information and combines all this information in the project overview. The overview is a graph in which each node represents a project element (stakeholders, project aspect, requirements and decisions). All these nodes are connected the way they are related to each other in the project.

The main aspects are created and explained by the project management team, so there will be a (non-debatable) starting point. The overview shows the user quickly and in an understandable way who is working on what; what requirements and decisions are related to a certain aspect or stakeholder; and how all elements together lead to the project goal.

The user can choose which information is shown (made visible) in the project overview, e.g. only the node names. Next to that, the user can filter certain information, by showing a specific group of information, e.g. only internal stakeholders. Filtering allows the user to see only (relevant) information. Both functions (illustrated in Figure 25 right side bars) should support the user to navigate through the overview. Additional information is presented in a side tab when a certain node is selected; it tells which node is selected; to which category this node belongs; a short explanation of what this node includes; and which requirements and decisions are related to it, see the "node information" in Figure 25. Users can search for a node in the overview and choose which related elements should be visible and what node information should be shown. When searching or clicking on a certain node this node will be highlighted and centralised, together with its first-degree relations. Or when preferred, also its second-degree relations (or even more). When selecting a node, the user can choose to be directed to that node in the corresponding list. These functions should help the user to navigate through the overview and CMST in general.

### ***Project aspect management***

There are main project aspects, defined by the project management team, and (sub) project aspects. Project aspect can be defined by the internal stakeholders (secondary users). The (sub) project aspects can be created by the users via a certain template where the users has to fill in certain information about the aspect, e.g. name, category, description, parent node, child node, related requirements, related decisions, and related stakeholders. Next to that, the author and updating privileges have to be defined. The project aspects are summarised in a list (project aspects list, see Figure 26), via the lists the project aspects can be edited or deleted by the author of that specific aspect. Or can be commented by another user, asking for clarification or giving feedback for example. Project aspects are important input for the project overview.

### ***Requirement management***

Requirement management mainly focusses on requirement analysing, documenting, validating and maintaining (tracing). The user can add a new requirement to the CMST via a certain template (illustrated in Figure 27) where the user has to fill in the requirement and classification (required to create an ID), and additionally fills in the rationale, priority, source, related decisions, aspects, approval status, impact, updating privileges and author(s). Requirement history (information on the latest update) is automatically updated by the CMST. The edits of a requirement are kept in the requirement history list, a list per requirement that shows all edits. Deleted requirements and requirement history are kept in the requirement history list.

ADD || PROJECT ASPECT

Aspect (node)  
Category  
Description

Type here the name of the project aspect

Choose the type of aspect

Please fill in the project aspect description

Parent node(s) is / are  
Child node(s) is / are

Add project aspect

Add sub project aspect

Add project aspect

Add sub project aspect

Related requirement(s)  
Related decision(s)  
Related stakeholder(s)

Add related requirement

Add related decision

Add related stakeholder

NONE

NONE

NONE

Author(s)  
Updating privilege(s)

Fill in the stakeholder's name

Fill in the stakeholder's name

PROJECT MANAGEMENT

ONLY AUTHOR(S)

EVERYBODY

Fill in the stakeholder's name

Ask a proofread and confirmation from:

Fill in the stakeholder's name

Back to the project aspect list

Figure 26. An example of how the project aspect documentation could be done in the CMST

ADD || REQUIREMENT

ID  
Requirement  
Rationale  
Priority  
Source  
Related decision(s)  
Related aspect(s)  
Status  
Impact  
Author(s)  
Updating privileges

FUNCTIONS & EVENTS  
INTERACTION & USABILITY  
CONTENT & STRUCTURE  
STYLE & AESTHETICS

Type here the requirement in one sentence

Please fill in the rationale behind this requirement

MUST  
SHOULD  
COULD  
WON'T

Please fill in the source related to this requirement

Add related decisions

Add related decisions

NONE

Add related aspect

Add related aspect

APPROVAL READY  
DRAFT

HIGH  
MEDIUM  
LOW  
AUTOMATIC

Fill in the stakeholder's name

Fill in the stakeholder's name

ONLY AUTHOR(S)  
EVERYBODY

Fill in the stakeholder's name

Ask a proofread and confirmation from:

Fill in the stakeholder's name

Back to the requirement list

This project uses the MOSCOW prioritisation, click on the right priority for this requirement.

Choose the matching classification, automatically the follow up number for a new REQ will be added as ID.

When you click on the search icon, a list with all previous inserted decisions will appear to choose from, you can also quickly add a new decision.

Click here if you want to add more authors.

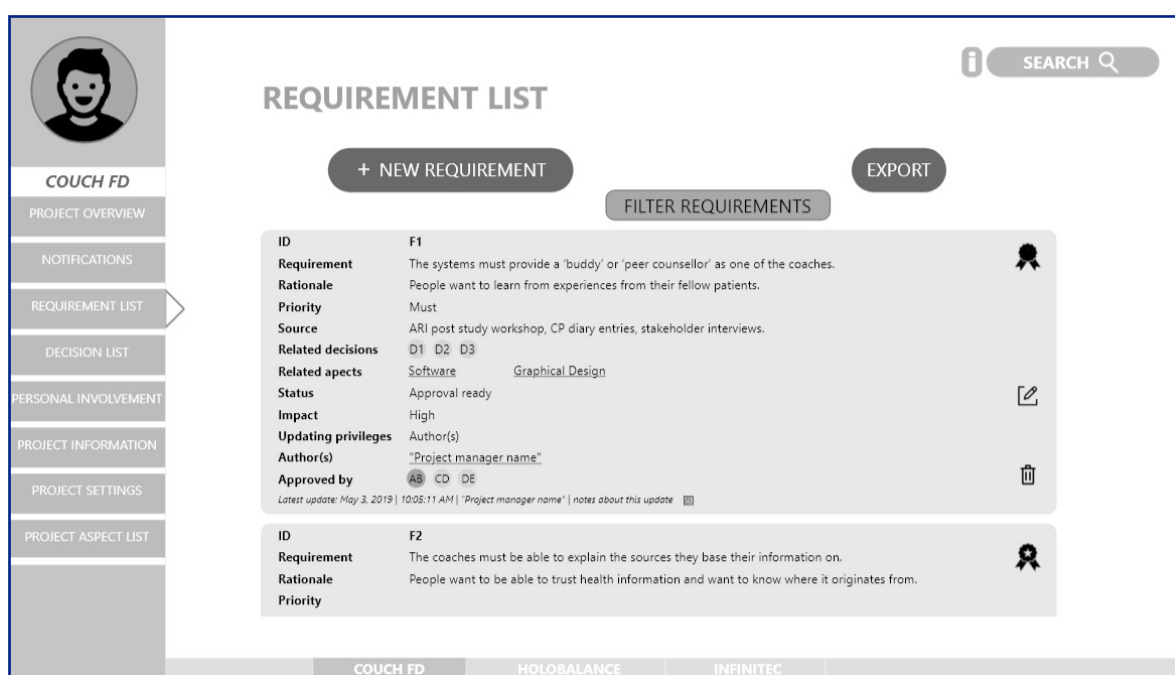
When saving, an automatic notification will be sent to the author(s) of the requirement.

The latest update date will be automatically set on the day and time of saving your edit. Plus the author(s) name will be added.

Ask another internal stakeholder to check this requirement information

Figure 27. An example of how the requirement documentation could be done in the CMST – Add requirement

All requirements are summarised in the requirement list, demonstrated in Figure 28. Users can filter the list, showing specific information or classify the requirements. The export feature allows the user to export (a part of) the list, so it can be included in project documentation or send to external stakeholders, for example. Author(s) can edit or delete requirements via the requirement list and can mark requirements that are already achieved. The user is asked to fill in the requirement rationale, priority, classification, source, related aspects, impact as support to analyse the requirement and its influence on the project. Other stakeholders that are related to one of the requirement aspects are allowed to approve that requirement. When a user approves a requirement, his or her name will be included in the requirement information approval section. When that requirement is edited afterwards the user's approval will be marked till the user approves that requirement again. Users can ask other users to update on a certain requirement or ask a question about it via the "request" feature.

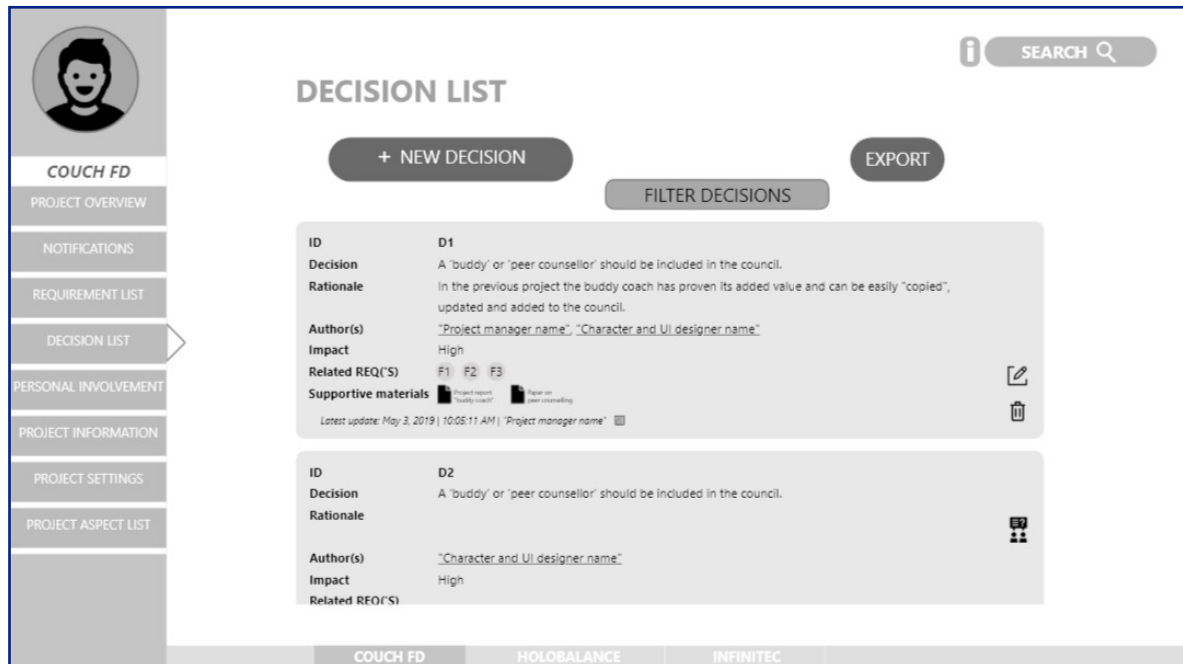


**Figure 28.** An example of how the requirement documentation could be done in the CMST – Requirement list

In the project overview, all related requirements of an element are shown in the additional information tab. For project aspects, the related requirements are shown. For stakeholders the requirements of which the stakeholder is author of are shown, as illustrated in Figure 25. It is also possible to filter the requirements, for example in combination with the main project aspects, then the requirements are also visible in the overview.

### Decision documentation

The way decisions are documented is quite similar to the requirement engineering functions and features. Users can document decision in the CMST via a certain template where the user has to fill in the decision (required, an ID is automatically created) and the user additionally fills in the rationale, impact, related requirements, author(s) and can add supportive materials. This additional information should support stakeholders to make the right decision by thinking ahead of the influence it has on the whole project. All decisions are kept in the decision list (illustrated in Figure 29) and users can filter and export the decision list. Only author(s) can edit or delete a decision, the decision history is automatically updated by the CMST. Users can request an update from the author(s) or ask them a question. The presentation of decisions in the project overview is similar to the requirement presentation.



**Figure 29.** An example of how the decision documentation could be done in the CMST

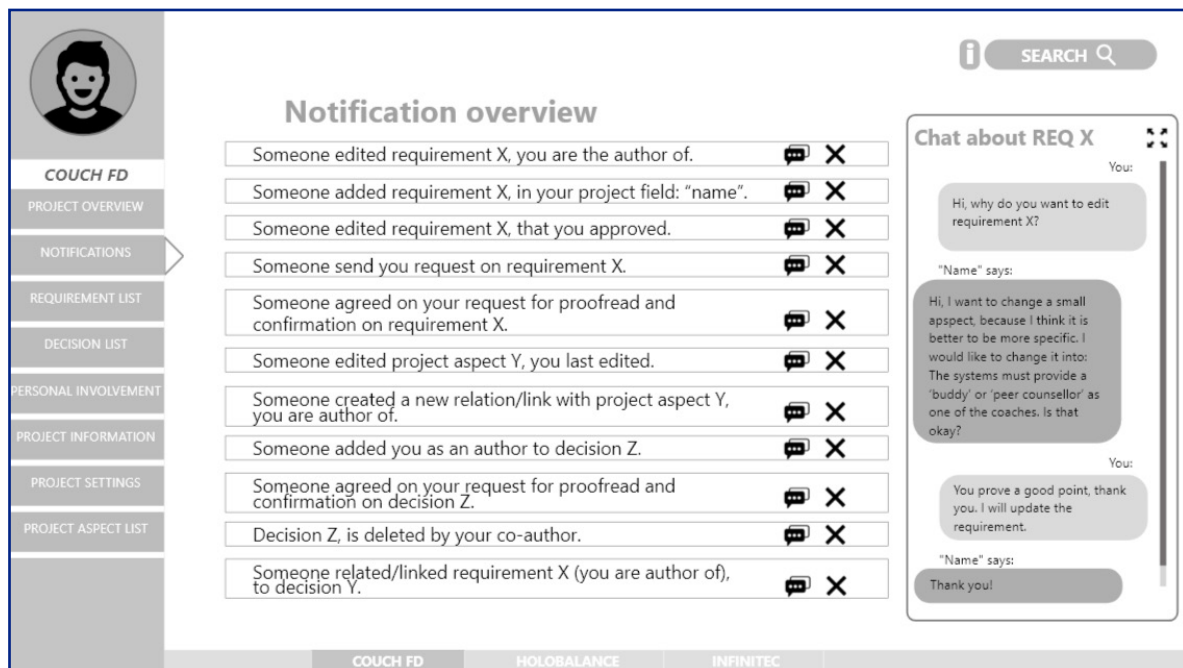
### Notifications and chats

Notifications and chats mainly support usability and project communication. The user receives notifications about actions he or she has to perform or actions that are performed by other users (stakeholders) that have an impact on the user (because he or she is related to a certain aspect for example). The project management team can oblige certain types of notifications to all users. Other notification settings can be set by the user, based on personal preferences. The user can choose the notifications and reminders he or she wants to receive, including how often they should pop-up. The notifications address the user with “you”.

Reminders remind the user to fill in information (project aspect/requirement/decision) that was not yet filled in completely. Examples of notification are listed here.

- Someone edited a project aspect/requirement/decision you are the author of/you last edited/in your project field.
- Someone added you as an author to a project aspect/requirement/decision.
- Someone agreed on your request for proofread and confirmation on a project aspect/ requirement/decision.
- Someone send you a request on a project aspect/requirement/decision, please check out the request.
- Someone created a new relation with a project aspect/requirement/decision you are author of.

From a certain notification, the user can directly go to the subject that is mentioned in the notification. The user can also dismiss a notification or mark it as important. The user can start a chat about the topic that is mentioned in the notification. Each topic has its own chat (this is illustrated in Figure 30) and the chat history is kept by the CMST.



**Figure 30.** An example of how chatting via the notification overview could be done in the CMST

### Project settings

The project settings have to be set by the project management team at the start of the project. The settings are about the notifications that the project management team requires for all users and about requirement documentation (classification and prioritisation methods). Project settings also includes the user access and privileges. Depending on user's CMST access, users can read and add/edit specific information. The project management team has access to all information and can also edit all information. They are also responsible for the secondary and tertiary user access. The project management team specifies the tertiary user access. Moreover, the information the project management team enters (as team) into the CMST, can only be edited or deleted by the project management team.

### Remaining functions and features

#### Analysing project updates upfront

A Synthetic Environment can be created from the project. This SE allows users to see the influence/impact of a change. Project updates (additions, changes or deletions) that the user is not sure about can be runned in a "trial". The CMST creates a "copy" of the project which allows the user to analyse the change upfront. The CMST will show the update similar to a real change but does not save it. The user can analyse the impact and influences the update has on the project. When satisfied with the results the user can apply the update and the CMST will update the project in the CMST. In case the user is not satisfied he or she can disregard the update and nothing will be changed.

#### Proofread and confirmation

When creating or editing a project aspect, requirement or decision, the author has the option to ask for a proofread and confirmation from another stakeholder (as mentioned in Figure 27). That stakeholder will receive a notification and can comment on the information. A proofread and confirmation can also be asked for a SE that is created for a certain project update.

### Everything works two ways

An important function of the CMST is that it relates everything to each other. Not only are these relations visible in the project overview, but it also means that when creating a new element (illustrated in Figure 27; adding a requirement) and mentioning a relation with another element, that element will be updated with that information and now also includes this new relation. All elements are “clickable” and will bring the user to the element in the project overview or if the user is already in the overview, the user will be directed to the element in the list (e.g. requirement list) or for stakeholders to that stakeholder’s user profile.

### Functions to support usability

- Information layers that explain the functions and features are included to help the user understand the functionalities and elaborate on information that has to be completed, an example is given in Figure 31.
- Name/title suggestion is included, so when typing the user can see and choose from the names/titles that are already in the database (e.g. people, aspects, etcetera).
- A search option per input field is included, so the user is able to choose from a list that includes all previously added elements, showing only the relevant elements to that question.

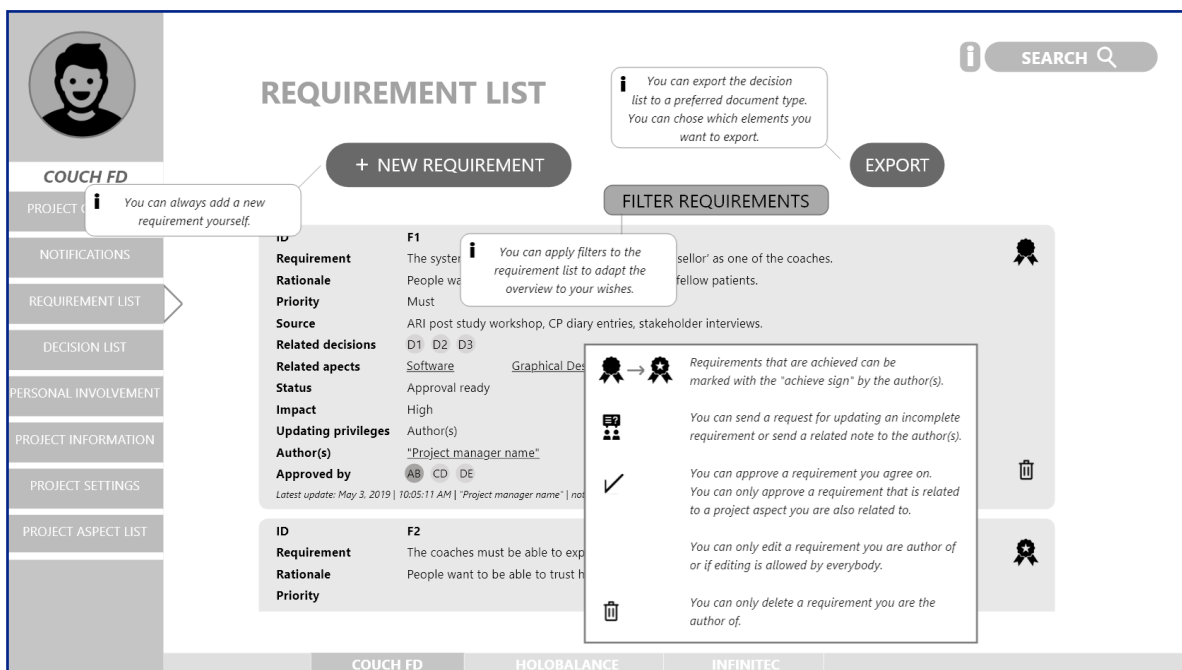


Figure 31. An example of the requirement list information layer in the CMST

### 8.3. Conclusions

The goal of the CMST is to support the COUCH Functional Demonstrator project management in such a way that the result of the project (the Functional Demonstrator) will be the best and most appropriate solution.

Integrating characteristics of Synthetic Environments (SEs) into the designed CMST has proved to be possible. In SEs, blueprints are the backbone, they support stakeholders with categorising their information. This is integrated in the CMST by introducing project categories and main project aspects. The categories help classifying the information that added into the CMST by the user. The main project aspects are determined by the project management team and support the user with defining (sub) project aspects. The main project aspect topics are based on the elements that are suggested by R. Damgrave (2017) that form together the blueprint of a SE.

All stakeholders, project aspects, requirements, decisions plus their explaining information are brought together in an architecture. This architecture is based on actor networks and includes all elements (stakeholders, project aspects, requirements and decisions) mentioned. Filters and graphical elements support the visualisation and present information in a different structure. This allows the user to analyse information from different viewpoints (perspectives). The disagreements between stakeholders or stakeholder groups should be discussed and the agreements represent a Synthetic Environment of Council of Coaches that can be developed in the CMST.

All decisions and requirements can be effectively and efficiently documented and managed in the CMST. This allows for easy adding and updating of certain decisions or requirements. A template is presented that asks the user to fill in certain aspects about a requirement and decisions. This information is documented and contains the knowledge that is saved by the CMST. Adding more information to the CMST reinforces the CMST over time.

All project elements can now be visualised in the CMST in a clear and understandable way. Adaptations can be made within only few steps, which allows the user to analyse the impact/influence of a project update.

The potential users who evaluated the CMST were positive about its functions and features, and stated improvements that are related to the (sub) goal(s). As a result, it is expected that the CMST would reach its goal and sub goals when designed and implemented.

The CMST is input for the development of the Project Management Support Tool for European eHealth research projects (PMST). Because the CMST design supports the project management of COUCH, only iterations of the CMST design are required to design the PMST. Decisions made for the CMST have to be reconsidered, but most will be applicable for the management support of multiple research projects as well, only a few abstractions and some extensions are necessary for the PMST design. The final design of the PMST is presented in Chapter 9.



### 8.4. Discussion on the Council of Coaches Management Support Tool design

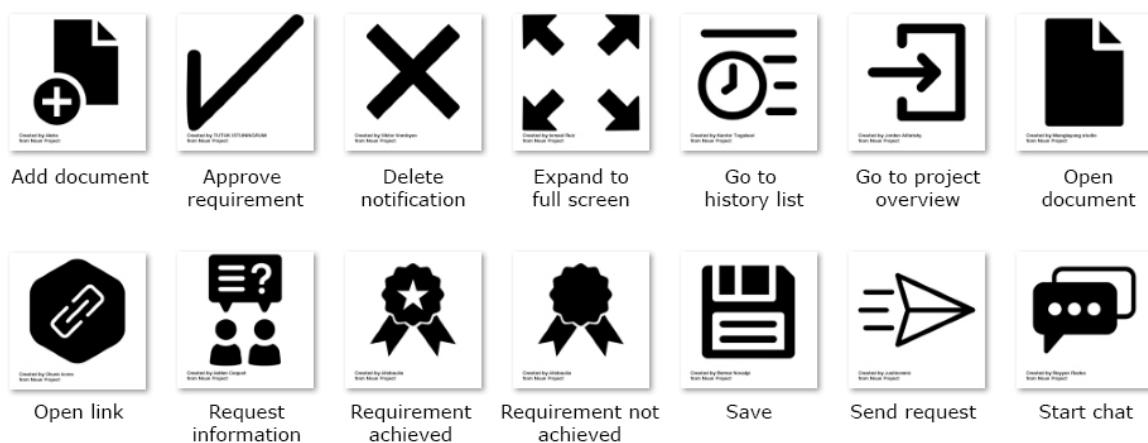
This section discusses mainly the mock-up design because the CMST is no real final proposed design that will be developed. The CMST design becomes the concept design of the PMST. Therefore, there are no discussions or recommendations related to the implementation or further design of the CMST. However, designing and the design of the CMST can be learned from and are used as input for the design of the PMST.

Project planning and “project issue” related requirements were not included in the CMST design since these features are already available in other project management tools so these functions are imaginable. For the FD project, other tools are used to keep track of the planning and issues. It might be that in the end ideally those functions are included in the PMST, so only one tool can be used to manage the project. However, for this research it is decided to not focus on these aspects and leave them out of the final design.

The suggested CMST design is positively evaluated, however it is not imaginable what exact functions and features would support the users, without trying it out first. Therefore, the proposed design is only proposed as a possible solution (for the PMST), the CMST design makes sense based on literature research and potential user’s feedback.

#### 8.4.1. Notes on the mock-up development

The elements that are designed, sometimes do not functions completely as desired. Next to that, the mock-up includes details that were not researched or thought out completely. There were just included to support the main idea. Elements that differ (slightly) from the concept CMST are listed here.



**Figure 32.** Symbols used in the mock-up design of the CMST

- The requirement, decision and project aspect information are thought out and evaluated. The questions asked to fill in when adding a new element are the questions that should be included in the final CMST. However the order of the questions might not be completely logic and is not researched because the type of questions changed during the development and so unintentionally did the order. This is recommended to research in future usability studies.
- The symbols (illustrated in Figure 32) that are used in the mock-up generally match with their function, however, they are quickly chosen and not evaluated. This is recommended to research in future usability studies.



- How to create a SE is not included in the mock-up because it is assumed that it should look and work similarly to “normal” updates.
- The mentioned notifications are suggestions of what could be notifications in the final design, however they are generalised and do not point out specific elements.
- The project overview includes screenshots of Gephi 0.9.2 that were developed to analyse the FD project. Sometimes the screenshots are modified to demonstrate a feature.
- Switching from the decision in the decision list to the decision in the project overview is demonstrated, however D1 does not become the central node as it should be.
- When approving a requirement, the name of the user does not perfectly fit the row of the other stakeholders who approved the requirement before.
- The project overview allows users to filter the information that is presented, in the mock-up this function is called “layers” instead of filters, it should be called “filters”.



# FINAL TOOL

## *Design of the Project Management Support Tool*

The design of the Project Management Support Tool for RRD's European eHealth research projects (PMST) is based on the design of the CMST. The PMST is the final deliverable of this thesis. Chapter 9 presents the transition from CMST to PMST and the final design of the PMST.



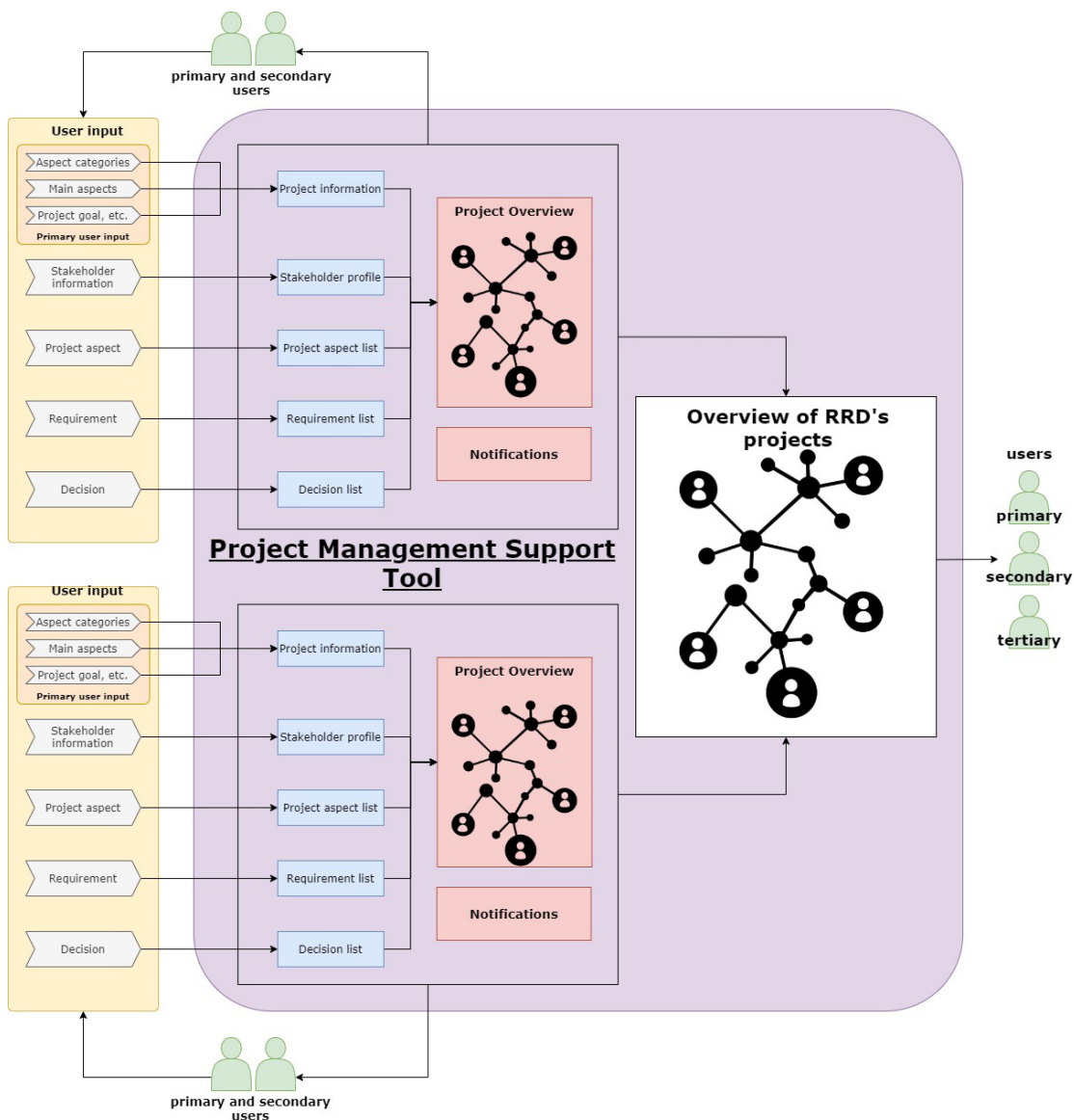
# CHAPTER

## Final Design of the PMST

# 9

## 9. Final Design of the Project Management Support Tool

The Project Management Support Tool (PMST) is the final deliverable of this master thesis. The PMST design is based on the designed Council of Coaches Management Support Tool (CMST), that is the case study of this research. The final design of the CMST is presented in Chapter 8. The PMST includes abstractions and extensions compared to the CMST, these changes are relatively small, therefore a presentation of the final design of the PMST would be repetitive to Chapter 8. Therefore, it is chosen to only present the abstractions and extensions in detail. Accordingly, it is recommended to read Chapter 8, prior to this chapter to get a better understanding of the final design of the Project Management Support Tool. This chapter refers to the final requirement list of the PMST. The final design of the PMST is a suggestion to support the management of development processes that are part of European eHealth research projects in the future. The PMST is a suggestion for RRD's project management which requires a new "way of working". By adding more information into the PMST, the added value of the PMST reinforces over time. An illustration of how information will flow in the PMST is shown in Figure 33.



**Figure 33.** Representation of the information flow of the PMST and the information that is presented and provided by the PMST

## RECAP

### **Goal of the PMST**

“Support project management of the development that is included any (new) European eHealth research project (of RRD) throughout the whole project life cycle.”

#### **Primary users**

The members of the project management team/coordinator(s) of RRD’s European eHealth research projects.

#### **Secondary users**

All the involved researchers of RRD who are involved in a European eHealth research project.

#### **Tertiary users**

Directors and eHealth department coordinator of RRD.

## 9.1. Transition from CMST to PMST

The design of the CMST can be tailored so the eventual tool, the PMST, supports multiple research projects. The design of the PMST is based on the background information about RRD’s research projects and on the findings of the project analysis of a certain research project of RRD: “COUCH”, see Chapter 3. The strengths, weaknesses, threats and opportunities of RRD’s European eHealth research projects were analysed in Chapter 4 and show the improvements that have to be tackled in this new design. The project management team can choose from various strategies, working methods or frameworks, based on the information provided by the PMST (based on previous project data). This is different from the case study, where all the methods were already defined. Therefore, the PMST is more robust and flexible. Robust and flexible are characteristics of also Synthetic Environment (SE, Chapter 5.2), the design methodology of developing a SE will be even more incorporated in the PMST. Strategies and suggestions from the SE research will be included in the final design. The same applies for useful methods proposed in the Project Management research (Chapter 5.1), Decision Support System (Chapter 5.3) and Requirement Engineering (Chapter 5.4) research. Interesting features from the market research (Chapter 5.5.) that were not included in the design of the CMST are now re-evaluated on added value for the PMST. For the abstractions and extensions below it is important to keep in mind that the (previously) designed mock-up is only an example and the abstractions and extensions are based on the final explanations of features and the requirement list of the CMST.

### 9.1.1. Abstractions

The abstractions that have to be made are due to the fact that for the Council of Coaches already some methods were chosen and these had to be followed up. The abstractions that are necessary to develop the PSMT are all related to the requirement documentation. For COUCH the requirement classification and prioritisation were already defined and these methods were adopted in the CSMT. It is very useful to include certain methods in the tool because it would support requirement engineering. However, there are multiple requirement identification methods and it should be decided per project which method would be the most suitable. As a result, requirements RDR28, RDR29, RDR31 and RDR33 (Appendix C) require an update. The new requirements do not refer to the FICS classification or MoSCoW prioritisation anymore. In the PMST, the project management team chooses the classification and prioritisation method at the beginning of the project. When the methods are chosen, the PMST updates the requirement documentation features, so the right questions are asked and optionally the corresponding answers are proposed.

### 9.1.2. Extensions

The main difference between the case study (COUCH project) and potential research projects is that the case study project is one project that already had its methods, its plan, its communication ways. Based on these findings the CMST was developed. However, when a new research project is started, the project management team still has to define a project management method, planning, communication platforms, etcetera. This creates an opportunity for extra tool functions and reuse of resources that would support this first management related phase of the project. Moreover, the users will be new to the PMST, there are already information layers included in the PMST, nonetheless, some extra support including; instructions, tips, examples, suggestions could help the user understand the PMST and support managing a project with the PMST. Finally, support with defining project (management) goals at the beginning of the project and evaluating the project (management) at the end could be valuable. The extensions are elaborated per feature.

#### ***The reuse of resources***

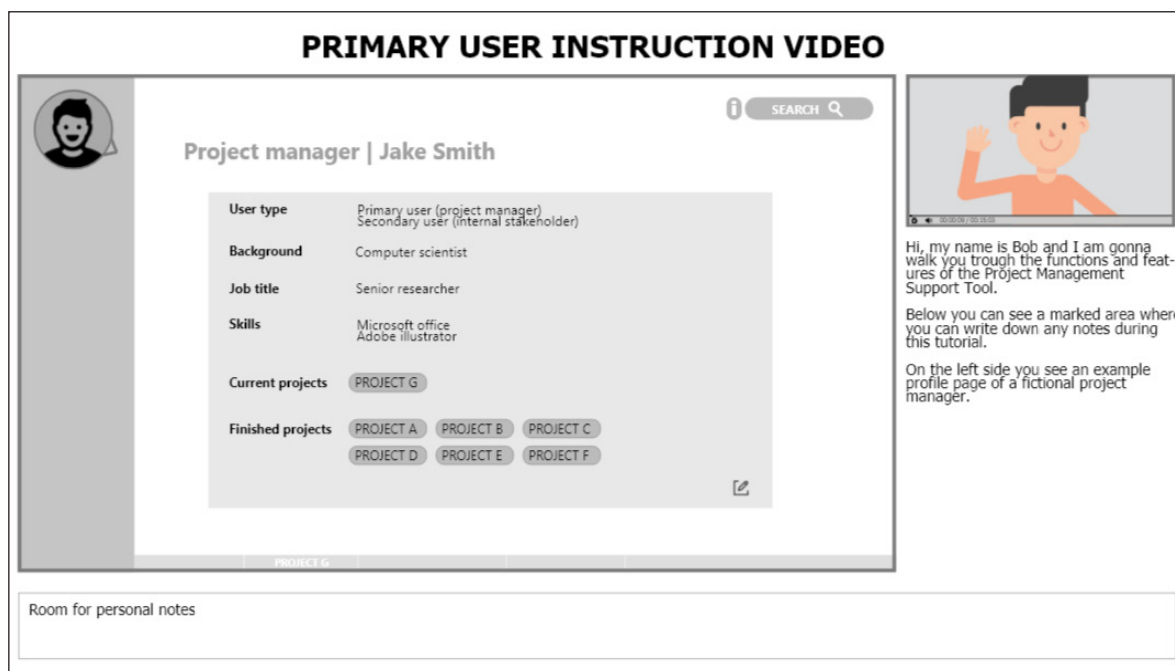
The PMST supports many projects. Users can only access the project they are involved in, which could be multiple. The users have one profile and can switch between their projects. Data from all the projects is saved in the PMST. The PMST's database captures both current and previous projects. As a result, users can ask the project management team of another project to grant them tertiary user access. This allows the user to read all the (tertiary user available) project information from that project. So users could gather knowledge about previous projects, project methods, project management, stakeholders, all to support their own project (management). As a result, the user can profit from already available resources.

#### ***Extending support in the form of "advice"***

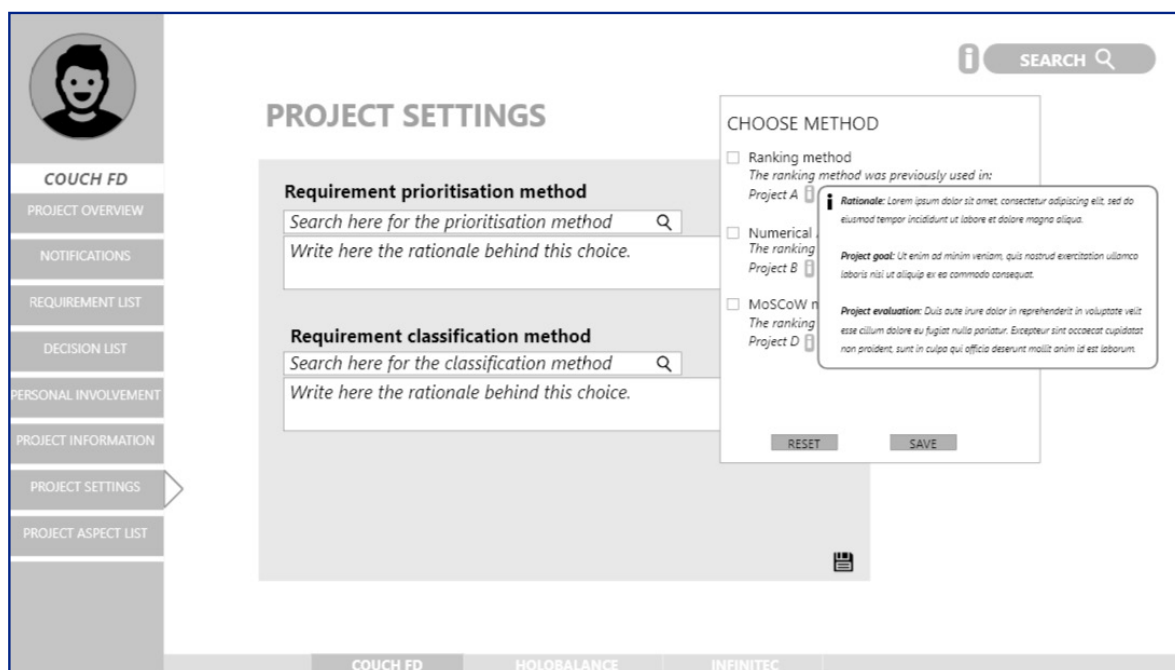
The PMST should include a feature that helps the user understand the work flow and the added value of the PMST. The potential users of the CMST/PMST pointed out that such feature would be useful (section 7.2). It should include an informative video (tutorial) that leads the user through the functions and features of the PMST, see Figure 34. The informative video should be specific for the type of user, so one for the primary users, one for the secondary users and one for the tertiary users. When the user is invited for the PMST, he or she should receive the option to watch the informative video and/or have instructions presented related to the users actions or presence in the PMST. It should highlight how the PMST built the project overview and how everything is related to each other and pointing out the consequences of adding a relation. The information button will still exist in the PMST, this information can be requested when previous features are not used but instructions are required.

As explained for the CMST, the PMST provides suggestions when for example choosing a related stakeholder, it will then present all stakeholders that are already mentioned in the PMST. This feature works on project level, meaning it only shows the stakeholder of that specific project. For the settings, methods, project categories and main project aspects, that have to be chosen at the start of a project by the project management team, applies something similar. The PMST saves all previous answers to these questions of all projects that were managed with the use of the PMST. Thus, the PMST build a database of which it extracts information, to present to the primary user (the project management team). It will also include a link to that project's evaluation, to provide more information on the project's success with that method. See Figure 35 for a demonstration of an example of how this feature could look like. It should be noted that this feature is not of great added value at the start of the implementation of the PMST because the database does not already include related data. The added value of the PSMT becomes greater over time, the more it is used, the more data it has collected and the more information it can present.





**Figure 34.** A screenshot as an example of how the primary user instruction video screen could look like



**Figure 35.** A demonstration of how the PMST could support the project management team with choosing the project settings and creating main project aspects, based on available data

### Support defining the project management goals

The goal of a project is included in the PMST under “project information”, these goals are set when the proposal, to apply for a European funding, is written. These goals are necessary to work towards an optimal and satisfying solution. It has been pointed out that, successful project management leads to better project outcomes (Kerzner, 2017). What could help establishing a successful project management, is setting project management goals at the start of a project. Currently RRD does not set specific project management goals at the start of a project. Setting project management goals is especially useful when the PMST is new to the project management team and to the users it is important to keep in mind that the tool becomes part of the project management and that it might take some extra time to adapt to this new strategy. But over time the users get familiar with the PMST, and the tool will gain its true added value. The project management team is responsible for the PMST settings, which have an influence on the project’s workflow. Starting a project with a clear goal for project management will support the chosen methods and help reaching both goals; the project goal (measured through user satisfaction) and the project management goal (based on how the internal stakeholders experienced working on this project) (Kerzner, 2017). Figure 35 illustrates how defining project management goals could be done in the PMST.

**PROJECT MANAGEMENT INFORMATION**

Project management goal: Write here the project management goal down

Collaboration: Write here a plan about how to support internal stakeholder collaboration

Communication: Write here a plan about how to communicate within the project

Documentation: Write here a plan about in

**Information:** The project management goal will be reached when all internal stakeholders have, in the end, positively experienced working on this project.

Their work experience will be based on several aspects, among others:

- If they were enthusiastic about the research topic
- If they were satisfied with their role within the project
- If they felt they could effectively do their job (while using the PMST)
- If they felt part of the team, and acted as a team
- If they are positive about how project communication was done (easy, efficient, effective)
- If they are positive about how project documentation was done (easy, efficient, effective)
- If they are positive about how knowledge sharing among (internal) stakeholders was done (efficient, effective)
- If there were no other problems encountered

**Figure 35.** An example of how project management goals could be set in the PMST

### Support evaluating the project (management)

The success of a project and of the project management can not only be concluded by the project management team, it is dependent of the opinions of all internal stakeholders. Nevertheless, the success rate will vary depending on who you ask. It is very useful to evaluate a project, it will lead to new insights, and a list with do’s and don’ts. The feedback can be used as input for setting new project (management) goals, new project methods, etcetera. RRD has not incorporate a standard evaluation at the end of each project. Though, project managers can ask each other about certain project plans.

A feature of the PMST is “project evaluations”, an example is shown in Figure 36. A standard evaluation protocol or the option for the project management team to design their own evaluation. Because the success of a project depends on who you ask (Kerzner, 2017), preferably all internal stakeholder should do the evaluation. This evaluation should evaluate both, the project itself (e.g. outcome) and the applied project management (how the project went (Facer & Pahl, 2017)). Therefore, the PMST includes the feature that makes it possible for the project management team to set up an evaluation and send this to the internal stakeholders via the PMST. The PMST will gather the feedback and present it in a clear overview to the project management team. The project management team can now conclude the success of the project and the success of the project management. Their findings: interesting knowledge, methods, etcetera can be shared via the PMST. (A summary of) the conclusions will be available to all users of the PMST. Sharing these findings will lead to new learning perspectives that can increase the quality of future projects (Facer & Pahl, 2017). As a result the maturity and excellence (Kerzner, 2017) will grow.

**PROJECT MANAGEMENT EVALUATION**

**Project management goal** *Is the project management goal reached? Please elaborate.*

**Collaboration** *How is the project collaboration perceived by the internal stakeholders? Please elaborate.*

**Communication** *How is the project communication perceived by the internal stakeholders? Please elaborate.*

**Documentation** *How is the project documentation method perceived by the internal stakeholders? Please elaborate.*

Create an evaluation survey for all internal stakeholders

Send evaluation survey to all internal stakeholders

Send this information to all internal stakeholders

PROJECT A PROJECT B PROJECT C

**Figure 36.** An example of how project management could be evaluated in the PMST

### **The RRD research project overview**

The PMST supports multiple European eHealth research projects (of RRD). Providing an overview of all these projects plus their internal stakeholders will help with finding resources for reuse, or getting insights in the involvement of internal stakeholders or the company in general. The overview is accessible to all users of the PMST. This overview would be extra useful for the tertiary users, like the eHealth department coordinator, to keep track of all projects.

The research project overview looks like the project overview (it is a actor network) but includes only projects, project information (including project (management) goals and evaluations, project status, involved internal stakeholders per project, reused components, common resources, shared resources, and present meta data of these related research project aspects. This information is assumed to be the most relevant for all users to have always access to. The search and layer option allows the users to filter the overview, e.g. for a specific stakeholder, or project. As a result, the interrelations between the project life cycles become visible (E. Lutters et al., 2014). In Figure 37 is an example given of how the projects overview could look like in the PMST.

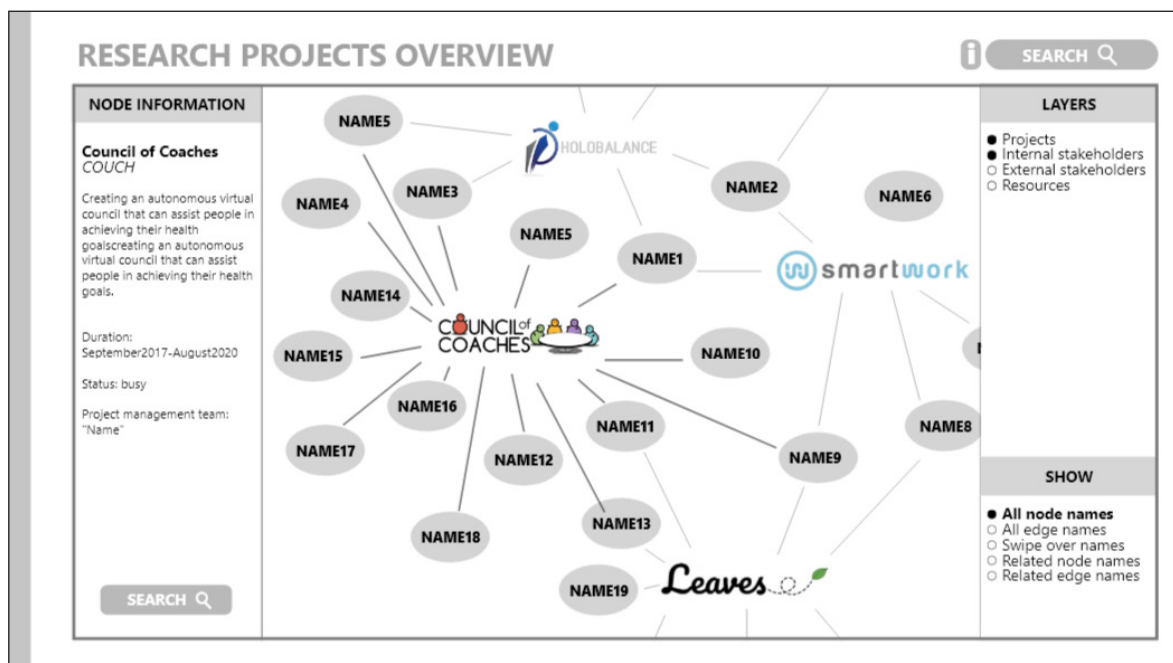


Figure 37. An example of how the projects overview could look like in the PMST

## 9.2. Requirements

The requirement list for the final design of the PMST is included in the requirement list of the CMST, see Appendix E, to avoid repetition, due to minor changes and only a few additions. The requirements that include changes and additions include the tool name in the requirement ID. If one requirement was distinguished in two new requirements (an abstract), an addition -1 and -2 is added to the ID. The new requirement descriptions include bold text to emphasise the change. The extensions are all requirements “not related to a specific aspect of the PMST”, see requirements NRR19 – NRR21, PIR15 – PIR24 and PSR3 in Appendix G.

## 9.3. Conclusion

The implementation of Synthetic Environment characteristics in the design of the CMST has been successful (see section 8.4). The same can be concluded for the PMST because there are no abstractions or extensions of the CMST that change that character of the PMST.

The Project Management Support Tool (PMST) is a tool that can support multiple projects with their project management at the same time. It is possible for the users to use the PMST for multiple projects simultaneously. All the data is saved, the PMST builds up a knowledge database from which its users can profit. It will show them possibilities and provide the users with information so they can analyse how certain decisions influenced the project. This is possible due to the improved project goal setting, for both the project outcome as well as the project management. Moreover, a feature to evaluate the project (management) is included, which will provide very useful insights to the internal stakeholders that they can use in their next projects. As a result, RRD’s European eHealth research projects will reach maturity and over time grow in excellence.

#### 9.4. Discussion and Recommendations

The PMST is an IT supported project management tool that is proposed to be included in the project management process for RRD's European eHealth research projects. Including the PMST in RRD's working methods asks for a new project management approach and adapted working methods of all internal stakeholders. The PMST helps stakeholders to get grip on the greater picture of all projects, and supports each project management individually. Especially the project (management) goal setting and project (management) evaluation, are completely new methods for RRD. While these are affirmed by research, the success of such methods always is company/stakeholder dependent and should be implemented at RRD to understand its the real value. The PMST provides the users with helpful overviews, lists, information (section 8.2), but it is up to the users to interpret and use this information in order for the PMST to be of added value.

The extensions were commented by the project manager, who was a bit sceptical about the new project management approach regarding the project (management) goal setting and evaluations. Due to doubts about the new approach matching with RRD's current working methods. However, this new approach is meant to give the current project management a new lead for improvement. The projects overview is received positive, it will especially support the primary and tertiary users. The transition from a project specific project management tool (the CMST) to the project management tool that will support multiple research projects (PMST), was expected to be larger than it appeared. Redesign was not a big step on the front-end, the main complexity of this transition lies in the back-end, which was out of scope for this research, and assumed to be working. The back-end is an important part of a functional PMST and should be developed according to the proposed design. An additional design process should be done for the back-end development.

It is hard to really tell how the PMST will exactly look on a detailed level. The requirements are specific, yet only describe a function that could be interpreted in multiple ways. The context that is illustrated only stirs into a certain direction resulting in development outcomes that are specified by the developer. In addition, the details of the PMST design are in the hands of the developer. The mock-up demonstrates how the PMST could look like but is still a generic example, since the graphic design, user experience, designing all functions and include all information provided by the PMST lies out of scope. When developing a functional PMST, it probably becomes clear which design elements are not detailed enough. There are multiple possibilities to interpret and then develop a certain requirement, these possibilities should be explored as well. It is assumed that the PMST will be used commonly by all the internal stakeholders, because that is how the PMST collects data and becomes more useful, which will improve project management.

The background theories mentioned several strategies to support the decision-making process. These strategies were eventually not further researched and not implemented in the CMST. Researching the following topics are recommended because these topics seem to be a great input for extra features on decision-making and requirement engineering, namely:

- The file drawer system that provides useful information to make a specific decision
- The representation model (conducting 'what if' analysis) (D. Lutters et al., 2004)
- A strategic decision-making framework based on the elusiveness of decision-making (Lange et al., 2016).
- Requirement classification methods (including these methods as examples in PMST)
- Requirements prioritisation methods (including these methods as examples in PMST)

Currently available project management tools often focus on planning and issue tracking, when the PMST has been successfully implemented and is extensively used, it might be interesting to look into extensions that could support project planning and issue tracking or by allow synchronizing with already existing tools. Having information at one place (no need for multiple tools), project management will be easier for all stakeholders. Thus, it is recommended to look into a broader kind of project management support when the PMST is successful.

Still all these recommendations can be done and a perfect PMST might be designed, it really depends on whether all users are convinced to use the PMST and continue to use the PMST. It was assumed that all users will use the PMST as intended, however, this is a rather optimistic assumption. Implementing the PMST in the project management requires changes that the users have to adapt. For example the PMST requires a lot of documentation which might not seem of added value and can be seen as only time consuming. It should also be noted that the adaptation of the PMST will cost time and effort.

Since the PMST only works and becomes of added value when adopted by all users a lot depends on the true added value, usability and implementation. It should be researched how the PMST could be best promoted and implemented. Additionally it should be researched what would happen and how it could be prevented if users only partly fill in information or stop using the PMST at all. The "request feature" is included in the PMST so users can ask each other to update certain information. This might stimulate the group accountability, but this could also result in frustrations to users who always have to ask for updates, or if requests are neglected. The company that wants to adapt the PMST can oblige the project management team and internal stakeholders to use the PMST, this is not desirable. The user will probably resist the change in working methods and can only be really convinced of the added value of the PMST when used in practice. All these aspects should be researched so implementation can be done smoothly and the PMST will be used as intended.

#### **9.4.1. Recommendations on the PMST**

It is recommended that the implementation of the PMST into the current working methods of RRD should be done on all aggregation levels (strategic level, tactical level and operational level) to really let the PMST become part of RRD's workflow. But before the PMST can be implemented some further research, development and evaluations are required:

- Research the notifications that will be send by the PMST
- Designing the user interface (including the graphical design), this is very important for the usability and the intuitive use of the PMST
- Developing a prototype including all proposed requirements, functions and features
- Testing the prototype with potential users (maybe using an example project)
- Evaluating the user experience and functions and features during the prototype test
- If required, redesign of the PMST based on the test/evaluation results
- Developing of the PMST
- Implementation methods of the PMST (e.g. making sure the user is aware of the PMST's reinforcement over time)



When used excessively the PMST could be redesigned and include more features to add extra meta data to label actions, decisions, stakeholders, and other aspects so the information will reach a higher level of detail. This should not always be visible, to keep the usability but it would be great to include it all, so the user is able to request the information when necessary or it is presented to the user at the right moment. The design of the PMST should be evaluated and a new version should be developed. Ideally the PMST should always be in development, to be as supportive as possible.

#### 9.4.2. Promotion

This paragraph summarises the added value of the PMST by pointing out the main advantages. Next to that, an overview is created that summarises these advantages per user group together with the information flow diagram, this is illustrated in Figure 38. This overview could be used for promoting the PMST to potential users.

### Project Management Support Tool

*Stay involved, always up-to-date!*

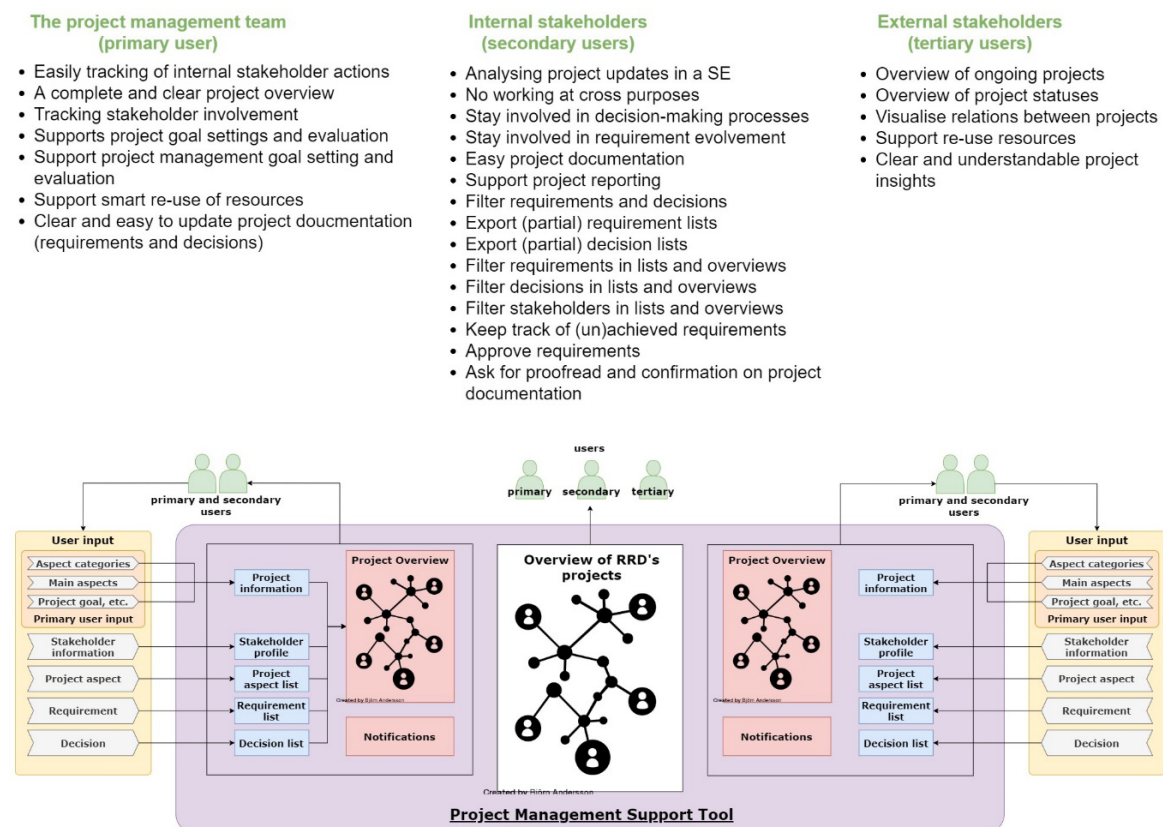


Figure 38. Promotion overview of the PMST

The main advantages of the PMST could be used to promote the PMST to potential users. One of the main advantages of the PMST is that the PMST combines several types of project information in one project overview. The project overview presents all elements: stakeholders, project aspects, requirements and decisions to the users in a clear and understandable way. The user can adapt the information that is presented via filters and settings. The project elements are also presented in lists per topic. The PMST includes a requirement and decision list, which are especially useful to the secondary users. They can add or change these requirements and decisions. These lists can be filtered and exported. For example, it can be filtered which requirements the a certain project team (e.g. software developers) have to achieve.

The different stakeholder's viewpoints can be analysed because the relations between elements are visible. For example, the software team can have a different opinion on the user interface than the graphical design team. The user can look into the decisions made by both groups and analyse both their viewpoints on the user interface.

If the users is not sure about a certain project update, the update can be made in a Synthetic Environment (SE). The SE allows the user to see the effects of a certain update, the user can analyse the impact/influence it will have on the project.

The notifications help the user staying up to date about changes in the project, for example a notification is send when a new requirement set. Notifications are user specific, meaning the user is only notified of relevant information. The user receives reminders of unfinished project information, e.g. the details of a requirements.

Next to the advantages on project level, one of the strengths of the PMST is that it can support multiple projects at the same time. Users can use the PMST for multiple projects. In addition the PMST provides an overview of all the projects that are supported by the PMST and relations can be made and illustrated via the PMST. This overview is especially useful for the coordinator of all projects (tertiary user) because it shows which (internal) stakeholders are involved in which projects. The overview can also become handy when looking into reusing possibilities, determining if a certain project aspect can be reused in another project.

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# CHAPTER 10

General Conclusion  
and Discussion



## **10. General Discussion and Conclusion**

The design of the CMST and PMST are already discussed and recommendations are given in sections 8.4 and 9.4. Thus, this general discussion and recommendations focus on the research approach and design process.

A heuristic research approach was chosen for the development of the PMST. The heuristic research approach introduced a case study in order to design a project management tool based on one of RRD's current research projects, so the design could be based on that project's analysis. This turned out to be a successful approach; observing the project management, reading project documents and analysing the stakeholders gave great insights in the project and project management. Together with the background research based on project management and some the crucial aspects of RRD's research projects (requirement and decision management), an idea of how the tool could like was born. It was assumed, (and turned out) that continuously exploring of the project and possible methods was required, hence the heuristic approach. This appeared to be the case, because while time passed, more knowledge has been gained and new ideas were born. These insights were included in the final design of the PMST. The final PMST design is a proposed design, there is no influence on how these functionalities will be developed exactly or will be interpreted by the users because this is part of a later development phase.

If this research is used to design a tool for a comparable project, the heuristic approach is recommended. Moreover, it is recommended to choose a case study project, or maybe two, and have lots of discussions with the project management team(s), especially at the start of the research to get more insights.

### **10.1 Final Conclusion**

The objective of this thesis is "to design a Project Management Tool that Supports the development project that is part of an European eHealth research projects". The Project Management Support Tool (PMST) supports the project management because it includes a project overview that evolves over time and provides insights in a certain project. The PMST facilitates an approach to document project information (e.g. goals, approaches, stakeholders, requirements, decisions and rationales). It supports the decision-making process and gently forces the user to think of the impact of a certain decision. It handles emerging new requirements and requirement updates to allow requirement evolvement over time. By providing all information at one place (in the PMST) and sending notifications about actions, the PMST supports effective and efficient knowledge sharing.



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## Appendix A - Internal Stakeholder Overview

The interview starts with an introduction about the interviewer, her background and master thesis subject and the reason why the interview is held. This introduction should make the interviewee feel comfortable and point out the added value of his or her time that is spent on this interview. The structure of the interview is mentioned and a side note is given that there are no wrong answers.

1. Name, company / institutions and function.

It could be that external stakeholders are involved in the project. Therefore, it is asked for which company or institution the interviewee works. The function description is asked because it could be of added value to know someone expertise. It can help to assign certain tasks to the right people.

2. Do you have a personal goal / interest in the research (or work) you do?

It is important that personal goals or interest match with the goal or concern of the project. If there is a match, research is often more extensively executed, it could give some new input to other projects with a similar goal. Next to that, there will probably be worked on with more enthusiasm. Nonetheless, on the other hand, someone could be extremely involved and create emotional values to the project. As a result, decisions might not only be made rationally.

3. Do you have a personal goal / interest in the development of the COUCH FD?

Asking about the interest in the development of the COUCH FD will show what kind of relation the stakeholder has with the project. The influences someone has on the project, as explained above, could give project management some useful insights.

4. During the project span of COUCH, did or do you work on other projects that are related to COUCH FD or could provide some useful input or profit from COUCH FD output?

*Think of project with similar subjects or the result of one project can be used as an input for COUCH FD, or the other way around. Moreover, participation in the COUCH project should be taken into account. Please name the project and shortly describe the relation.*

Often research projects point out some overlap with each other. Methods or results for example could be exchanged and reused. It could result in some requirements or explanations for certain choices.

5. How important is the COUCH project and the associated development of the FD for you?

*This is not related to the time you spent on the project, or the importance of the project in general. Please rate the importance with a rounded number from 1 to 10. Keep in mind there is no wrong answer.*

The involvement in the project often depends on other parallel projects that requires time. It is person specific which project is aimed most important. It shows the attachment of a stakeholder to the project.

*From now on, the questions will only be about the FD.*



6. In which development parts of the FD are you involved? What is your role / task in this part?

The final tool that will be developed will contain an overview of all parts of the FD and all stakeholders that are involved. It will show how the FD is built, who worked on what part, reasoning behind decisions etcetera. If new decisions have to be made or adaptations to the product, this network can be used to get faster and more insights and see what should be changed. Asking about role and tasks can point out responsibilities.

7. Who else is involved in the same developments parts? Do you receive requirements from them, do you impose requirements or do you work (closely) together?

It is interesting to know why decisions are made and who made them. This will show who are the key players in development and it can be checked if they are the right person for the that kind of decisions, do they for example have all the information? Moreover, often ad hoc decisions are made, or there was chosen for the easiest solution. Getting insights in the requirements and reasoning will make stakeholders aware of their reasoning and will help them to choose the most appropriate solution.

*If necessary: Do you have an action plan for fulfilling your role / task? How do you make decisions?*

In case question 7 is only shortly answered this question can be asked to get some more insight on how decisions are made.

8. What resources (products / programs / etc.) do you need to execute your tasks? And why did you choose these specifically?

Do you use these resources because they are the best option or because they were just available? For the best result you should use the best resources, however this is not always possible due to the available money, time or expertise. It should always be a well-considered decision.

9. Responsible Research and Innovation

The European Commission obliges the COUCH consortium to included these topics in their research. This question asks the stakeholders if they are influenced by this requirement.

- Do you have anything to do with rules and regulations?
- Do you have anything to do with ethical concerns?
- Do you have anything to do with the importance of user-centered design?
- Do you have anything to do with social importance?

10. Are you involved in the interest of gaining profit?

If gaining profit is something that is strived for, it probably alters decision-making. For example, aspects like user-friendliness could be neglected when it means the product will be more expensive.

## Appendix B - SWOT analysis

### **SWOT analysis of the project management tool COUCH's development of the FD**

#### **Strengths**

- The COUCH Functional Demonstrator is mainly developed at RRD → Real life communication, easy walk by someone else's office.
- Skype meetings with external partners
- Monthly real life meetings with the University of Twente (CMC)
- A committed project manager
- Good cooperation within the team
- Internal stakeholders are working on the same page
- Motivated team
- Flexible and open project manager
- Use of Gantt charts, issue tracker and an internal wiki page
- Internal stakeholder grade the project importance with an 8 on average.

#### **Opportunities**

- Abstract goal: "Demonstrate and test the principle" → big opportunity space
- (Re)use of already available resources
- Room for initiatives related to the project management (e.g. this master thesis)

#### **Weaknesses**

- Internal stakeholder who are only partly involved in the project
- Both internal and external stakeholders have their own goal(s) within the project
- Ad hoc decision-making
- Lack of decision documentation
- No dynamic requirement list that is used in all project phases
- Project manager is too attached
- No internal COUCH meetings with all internal stakeholders at RRD
- Limited commitment due to busy schedules
- Only online communication with consortium (except from real life meetings)
- Uncommitted partners can have negatively influence on the whole European project
- Not a real individual project, collaboration with consortium required

#### **Threats**

- Other partners encounter COUCH related project problems
- Stakeholders who get fired
- Stakeholders who quit

### **SWOT analysis of the project management of RRD's European eHealth research projects**

#### **Strengths**

- Large project teams → Many resources
- Multidisciplinary project teams → wide range of expertise
- Has a project management team
- European funding
- European Commission control
- General project structure from the EU commission → obliged to define clear goals / WP's / deliverables / milestones
- Skype meetings, some real life meetings
- Common project document sharing platform

#### **Opportunities**

- (Re)use of partners resources
- Writing own project proposal, including space for new initiatives
- New (state of the art) research

#### **Weaknesses**

- Large project teams → difficult communication
- Uncommitted partners
- Different interests per partner
- Partly involved stakeholders
- Different interests per stakeholder
- Limited commitment due to busy schedules
- Mainly online communication
- Ad hoc decision-making

#### **Threats**

- Partner bankruptcy
- Lack of cooperation of a partner

***Strengths to counteract the weaknesses mentioned in both SWOT analysis***

**Strengths to counteract the weaknesses**

- Stakeholders keep ledger and log with their roles and corresponding tasks and working methods
- Defining a plan to incorporate all stakeholder's goals
- Effective and efficient task execution
- Stakeholders document their decisions including its impact at an open platform
- Decision documentation
- IT support to document decisions and allows updates
- IT support to manage requirements
- Keeping each other (all internal stakeholders) up-to-date via meetings or communication platforms

**Weaknesses**

- Internal stakeholder who are only partly involved in the project
- Both internal and external stakeholders (partners) have their own goal(s)/interests within the project
- Limited partner or internal stakeholders' commitment due to busy schedules
- Large project teams → difficult communication
- Mainly online communication
- Ad hoc decision-making
- Lack of decision documentation
- No dynamic requirement list that is used in all project phases
- No internal COUCH meetings with all internal stakeholders at RRD

## **Appendix C - Project Management Requirements**

### ***Project management requirements (input for the design of the project management support tools)***

- Project management should support decision-making
- Project management should support all decision's documentation
- Project management should support dynamic requirement engineering
- Project management should support the re-use of resources
- Project management should be able to deal with ad-hoc decision making
- Project management should minimise working at cross purposes
- Project management should support stakeholders staying involved and up-to-date
- Project management should handle partly involvement of stakeholders and partners
- Project management should support real life communication that happens spontaneously
- Project management should support real life meetings
- Project management should support online communication with partners
- Project management should support documentation of communicated decisions made in real life and online
- Project management should support project management commitment
- Project management should support cooperation within the team
- Project management should motivate the team
- Project management should be robust and flexible
- Project management should use project management support tools (e.g. Gantt charts, issue tracker or an internal wiki page)
- Project management should handle temporarily involvement of stakeholders
- Project management should be able to deal with ad-hoc decision making
- Project management should support stakeholder having objective opinions
- Project management should incorporate the limited commitment of stakeholders (due to busy schedules)
- Project management should support collaboration and communication with external stakeholders (e.g. consortium)
- Project management should support project opportunities
- Project management should be able to handle unforeseen events (e.g. stakeholders who get fired or quit)
- Project management should support personal project goals of stakeholders (and partners)
- Project management should be able to handle limited partner commitment

## Appendix D - Scenarios

### *Persona – Jake*

Jake is senior researcher at Roessingh Research and Development. He became project manager of the project: the development of the Functional Demonstrator (of Council of Coaches). It is his first time leading a project. He wants to get the most out the project. He strives for good project communication and an end product that is of true value for the user.

### **Scenario 1 – Starting a new project**

Jake recruited colleagues, who are enthusiastic and interested in the project. From another project manager he got the advice to use the tool, this tool will help him to manage the project. He opens the tool and creates a “new project”. The tool provides him with information about the steps he has to take. He starts creating his own profile. After that, he fills in all the general aspects of the project. For this he can use the project proposal he wrote. Filling in the goal, deliverables and main characteristics of the project. The next step is dividing the project into main aspects, that together will lead a fine developed Functional Demonstrator. Jake adds several main aspects (including a description) like software development, graphical design, content development and business plan. He fills in the related stakeholders, requirements and decisions that he already knows. After filling in all the general project information, he sends invites to the stakeholders he recruited.

### **Scenario 2 – New internal stakeholder**

Eva is a colleague of Jake and was asked by Jake to participate in the project that he will be leading, she was enthusiastic and said yes. He told her to install the tool, she used the credentials Jake gave her to log in. She got an invite to participate in the Functional Demonstrator project. She accepts the invite, a few seconds later she gets a notification from the tool that there are some questions waiting for her to be filled in. She clicks on the notification and her profile appears. An overview with questions is presented, she answers all the questions. Afterwards she receives another notification that tells her to fill in the personal project involvement. She opens the project involvement information and fills in her role and the project aspects she will be working on. Jake now receives a notification that Eva update her profile and project involvement.

### **Scenario 3 – Updating a requirement**

Yesterday, the first part of the results of the evaluations came in. Jake notices that one of the main complaints from the end users were about a specific part of the user interface. Therefore, he wants to know why the user interface was designed like this. He opens the tool. He goes to the decision overview; he searches for the user interface part. He clicks on the part and a list with all documented requirements opens. He opens the matching requirement and sees that there was no rationale filled in. It could be that the requirement was made ad hoc, to quickly continue with the development. Since there is no rationale, Jake clicks on the request button of the requirement and asks the authors to complete the requirement information, also he points out that the user evaluation results are in contradiction with this requirement. The authors receive a notification that Jake send them a request. The authors agree with Jake and update the requirement with the new information. Jake receives a notification that the requirement was updated, he checks the result and agrees on the new requirement so he clicks on the “approve” button. Now his name is added to the list of stakeholders who agreed on that requirement. The authors receive a notification of Jake’s approval and are happy.

***Scenario 4 – Resources re-use***

Jake got the idea of adding a recipe book to the Functional Demonstrator. He got the idea from a colleague who talked about the recipe book they included in another project. He opens the tool and goes to the project overview. He searches for the project of his colleague. Fortunately, Eva, who is an internal stakeholder, also worked on that other project. He plans a meeting with her to discuss the idea to incorporate a recipe book into Functional Demonstrator. Eva is enthusiastic because the recipe book was successful and can be easily copied, fine-tuned and added to the Functional Demonstrator. Jake assigns this job to her. In the tool he adds a new sub aspect to the main aspect “content development” and connects it to Eva. The related stakeholders of the main aspect “content development” all receive a notification of this update.

***Scenario 5 – Future profit; from research to market***

The COUCH research project has come to an end. Jake is very enthusiastic about the demonstrator they developed. He talks to the director and discusses the possibilities of bringing the product on the market. From the final evaluation they got some really positive reactions, this supports Jake’s enthusiasm. The director gives a “go” and Jake starts taking action. He opens the tool and looks at the results from the final evaluation. He starts working out the positive feedback into a business model and the negative feedback into new requirements. With the new requirement list he checks which parts should be adapted. He checks the project overview to see who are the most qualified people to ask to work this out. He asks them to participate in this COUCH 2.0 project. In the tool he starts a new project and uses the old project information to create this new project. The data gathered of the first project could be used as background information. Some parts might only need some slight adaptations.

## Appendix E - Requirements of the CMST (concept)

<b>ID</b>	<b>F1</b>
<b>Requirement</b>	The project management team should be automatically notified by the CMST when a requirement is marked as uncertain or issue.
<b>Source</b>	Project management interview
<b>Rationale</b>	In order to manage in a good way, it is important to stay up-to-date about what is going on within the project. If everything goes according to plan, the project can keep going. However, when uncertainties arise or issues pop-up, it is important to check them. What will be the consequences of these uncertainties or issues, it might change the project plan or even the project outcome. Therefore, project management has to be notified as soon as possible.
<b>Priority</b>	Should

<b>ID</b>	<b>F2</b>
<b>Requirement</b>	When a requirement is met, the responsible user should be able to tick it off with a check mark in the CMST.
<b>Source</b>	Decision-making process
<b>Rationale</b>	During the project, and especially at the end, it is important to know if the developed project will meet all your defined requirements. Meeting them all is important to reach the best solution. By ticking of requirements during the development you will be sure they are all met in the end.
<b>Priority</b>	Should

<b>ID</b>	<b>F3</b>
<b>Requirement</b>	When there are some troubles meeting a certain requirement, the responsible user could be able to mark the requirement with an issue sign in the CMST.
<b>Source</b>	Project management interview and software engineer interview
<b>Rationale</b>	It is important to meet all requirements in order to reach the best solution. However, it might be that some requirements are hard to meet, due to internal or external project changes. When marking the requirement with an issue sign other internal stakeholders will notify and might be able to help think of a solution and can (if necessary) adapt their approach.
<b>Priority</b>	Could

<b>ID</b>	<b>F4</b>
<b>Requirement</b>	If a requirement adaptation is made, the responsible user of that requirement could be notified by the CMST and be able to see the amendment.
<b>Source</b>	Decision-making process
<b>Rationale</b>	The requirement list will be updated during the project, it is a “living document”, this also might include changing a certain requirement. If someone, other than the person who first added the requirement changes it, the responsible person will be notified so he can see if he agrees with the change. Seeing the amendment is a reminder to fasten the agreement.
<b>Priority</b>	Could

<b>ID</b>	<b>F5</b>
<b>Requirement</b>	Primary or secondary users could add their names to a requirement in the CMST and mark it with a new level of certainty.
<b>Source</b>	Decision-making process
<b>Rationale</b>	Setting a requirement with more people, means that more people agree with it and thought it through. So, for example, discussing with three internal stakeholders about a certain requirement represents a certain level of certainty of that requirement. If other internal stakeholders read the requirement in the CMST, and agree with it, they can add their names to increase the level of certainty.
<b>Priority</b>	Could

<b>ID</b>	<b>F6</b>
<b>Requirement</b>	The CMST must show related project aspects of a certain project aspect when asked for by the user.
<b>Source</b>	Analysing COUCH (FD)
<b>Rationale</b>	Seeing what aspects are related to the aspect the user is “busy” with, it could answer some questions of the user and might help understand actions and support developing the most suitable solution.
<b>Priority</b>	Must

<b>ID</b>	<b>F7</b>
<b>Requirement</b>	The CMST must include an overview that includes all project aspects and project aspect relations and shows a specific sub overview to the user, based on the users’ data input.
<b>Source</b>	Project management interview
<b>Rationale</b>	The project overview will be the main communication overview which allows the user to look to the project from different perspectives. The overview can inform, give more insight in the project and focusses on showing relationships on different levels.
<b>Priority</b>	Must

<b>ID</b>	<b>F8</b>
<b>Requirement</b>	Using layers, the CMST must be able to create sub project overviews. The layers are: external stakeholders, internal stakeholders, stakeholder information, FD parts, COUCH parts, progress, status, resources, management aspects, requirements, decisions, 1 project aspect element + 1 <sup>st</sup> degree relations, 1 project aspect element + 2 <sup>nd</sup> degree relations, 1 project aspect group + 1 <sup>st</sup> degree relations, 1 project aspect group + 2 <sup>nd</sup> degree relations,
<b>Source</b>	Project management interview, SE, COUCH
<b>Rationale</b>	The project overview will be the main communication overview which allows the user to look to the project from different perspectives. The overview can inform, give more insight in the project and focusses on showing relationships on different levels.
<b>Priority</b>	Must

<b>ID</b>	<b>F9</b>
<b>Requirement</b>	The CMST must recognise the following as project elements: project aspects external stakeholders, internal stakeholders, FD parts, COUCH parts, resources, management aspects, requirements, decisions, all types of explanations / reasoning, project goal, project milestones, project deliverables, project planning.
<b>Source</b>	SE, COUCH research
<b>Rationale</b>	The CMST should recognise project elements in order to incorporate the elements in the functions of the CMST.
<b>Priority</b>	Must

<b>ID</b>	<b>F10</b>
<b>Requirement</b>	Primary and secondary users of the CMST must be able enter decisions into the CMST.
<b>Source</b>	Interviews
<b>Rationale</b>	Decision documentation is one of the functionalities that followed from the interviews. Primary and secondary users are the leading people of the project, the once who make the decisions and therefore they must be able to add decisions to the CMST. As a result the primary and secondary users can see what decisions other user made and think of the effect it will have on the final product.
<b>Priority</b>	Must



<b>ID</b>	<b>F11</b>
<b>Requirement</b>	Primary or secondary users could add their names to a decision in the CMST and mark it with a new level of certainty.
<b>Source</b>	Decision-making process
<b>Rationale</b>	Making a decision with more people, means that more people agree with it and thought it through. So, for example, discussing with three internal stakeholders about a certain decision represents a certain level of certainty of that decision. If other internal stakeholders read the decision in the CMST, and agree with it, they can add their names to increase the level of certainty.
<b>Priority</b>	Could

<b>ID</b>	<b>F12</b>
<b>Requirement</b>	Users are obliged to fill in the rationale behind a decision.
<b>Source</b>	Project management interview
<b>Rationale</b>	The CMST must help / motivate for predicting the result of (ad hoc) decisions. Forcing the user to fill in the rationale they have to give the decision a second thought (in case they did not), so it is not make ad hoc.
<b>Priority</b>	Should

<b>ID</b>	<b>F13</b>
<b>Requirement</b>	The CMST should allow project management to indicate what read-only information the tertiary users have access to.
<b>Source</b>	User analysis
<b>Rationale</b>	For the tertiary users the CMST must be an information point. Since it will only be confusing to read unfinished project information, the project management team should be able to provide only access to the tertiary users of (almost) complete and relevant information.
<b>Priority</b>	Should

<b>ID</b>	<b>F14</b>
<b>Requirement</b>	The CMST must share information given by the project management team about the project among the users.
<b>Source</b>	COUCH (FD) research
<b>Rationale</b>	Including main project information, written by project management in the CMST would be useful because then all information is provide in one place and internal stakeholders can look it up for refreshment of for example the main goal and deliverables of the project.
<b>Priority</b>	Must

<b>ID</b>	<b>F15</b>
<b>Requirement</b>	Project management must be able to mention the main project elements and their relations with each other and other project elements in the CMST.
<b>Source</b>	COUCH (FD) research and stakeholder interview with the project manager
<b>Rationale</b>	For the CMST to create an overview that relates all project elements to each other, input is necessary. The project management team has a hold on the bigger picture of the project and is therefore the right person to divide the project in logical sub parts and to mention the relations the parts have with each other and other aspects. If according to an internal stakeholder the information might not be completely right, of course he can mention it to project management.
<b>Priority</b>	Must

<b>ID</b>	<b>F16</b>
<b>Requirement</b>	The user's accessibility to the CMST must be authorised and coordinated by project management.
<b>Source</b>	User analysis
<b>Rationale</b>	The CMST is not an open source; access must be given by the project management team. Only involved internal stakeholders will receive access.
<b>Priority</b>	Must

<b>ID</b>	<b>F17</b>
<b>Requirement</b>	The CMST could include and show a project planning made by project management.
<b>Source</b>	COUCH (FD) research
<b>Rationale</b>	Including the project planning has two advantages: 1) presenting all information in one place makes it easy to find. 2) relations between planning and project elements can be made. Showing the planning is necessary to reach the two advantages.
<b>Priority</b>	Could

<b>ID</b>	<b>F18</b>
<b>Requirement</b>	The CMST must include a personal account (log in and password) for every user.
<b>Source</b>	Market research   Management Tools
<b>Rationale</b>	In order for the users to use the CMST, project management needs to provide them with a personal account so they can get access to the CMST.
<b>Priority</b>	Must

<b>ID</b>	<b>F19</b>
<b>Requirement</b>	The CMST should include a user profile with tailored information for every primary and secondary user.
<b>Source</b>	Market research   Management Tools
<b>Rationale</b>	For the CMST to be of added value for the secondary users, a user profile with tailored information would be necessary. Showing tailored information to the user increases the personal usefulness of the CMST.
<b>Priority</b>	Should

<b>ID</b>	<b>F20</b>
<b>Requirement</b>	Notifications could be found in the user's personal notification overview and could pop-up when using the CMST.
<b>Source</b>	Market research
<b>Rationale</b>	The user will be notified when adaptations are made on requirements or decisions he is related to. This can result in a lot of notifications and therefore there is a special overview for these on the user's profile. When the user has the CMST open, the notification will also be shown directly in a pop-up screen. This way the user will be up-to-date about adaptations and can directly act upon them.
<b>Priority</b>	Could

<b>ID</b>	<b>F21</b>
<b>Requirement</b>	The CMST must give word suggestions, based on previous filled in project elements.
<b>Source</b>	Market research   Management tools
<b>Rationale</b>	To increase usability, the CMST will give suggestions while typing. While typing matches will be searched with previous entered words.
<b>Priority</b>	Must

<b>ID</b>	<b>F22</b>
<b>Requirement</b>	All users with access to the project could be able to communicate with each other through the CMST about the project by commenting on a project aspect.
<b>Source</b>	Market research   Management tools
<b>Rationale</b>	A solution when it is not possible to discuss it. It can be discussed in the tool so the topic is clear and the information is in one place.
<b>Priority</b>	Could

<b>ID</b>	<b>F23</b>
<b>Requirement</b>	The CMST must give suggestions for links between project elements by showing previously inserted project elements.
<b>Source</b>	SE research
<b>Rationale</b>	When creating a relation, the CMST shows all previously mentioned project elements so the user can choose from them easily, this will reduce the risk of forgetting a relation.
<b>Priority</b>	Must

<b>ID</b>	<b>F24</b>
<b>Requirement</b>	Primary and secondary users must be able to add project elements and relations into the CMST.
<b>Source</b>	Actor network   Project analysis
<b>Rationale</b>	The users must be able to add project elements and relations freely. It could be the case that an aspect not included yet (by the project management team or via inserting requirements and decisions) but still important.
<b>Priority</b>	Must

<b>ID</b>	<b>F25</b>
<b>Requirement</b>	The CMST should allow users to mark issues and show the status of an issue (not solved, in progress, solved, issue).
<b>Source</b>	Project analysis (issue tracker)
<b>Rationale</b>	Keeping all internal stakeholders up-to-date is important since all aspects are related to each other and internal stakeholders might depend on each other.
<b>Priority</b>	Should

<b>ID</b>	<b>F26</b>
<b>Requirement</b>	The CMST should provide an up-to-date list of aspects that are marked by the primary and secondary users as issue.
<b>Source</b>	Project analysis (issue tracker)
<b>Rationale</b>	Including an issue list will be useful for (mainly) the project management team to have a clear and complete overview of all issue.
<b>Priority</b>	Should

<b>ID</b>	<b>F27</b>
<b>Requirement</b>	The CMST should allow the project management team to add the status of the milestones (not started, in progress, finished, issue, overdue) and show it in an overview.
<b>Source</b>	Project analysis (project planning)
<b>Rationale</b>	Keeping track of the progress that is made is important to see if the project is still on track and if not what the reason is. Milestones are a great way of planning projects and give a clear representation of smaller goals to work on.
<b>Priority</b>	Should

<b>ID</b>	<b>F28</b>
<b>Requirement</b>	The CMST should allow users to add the status of the deadlines (not started, in progress, finished, issue, overdue) and show it in an overview.
<b>Source</b>	Project analysis (project planning)
<b>Rationale</b>	Keeping track of the progress that is made is important to see if the project is still on track and if not what the reason is. Setting deadlines reminds and maybe pushes users to keep on track to make sure the final deadline will be reached.
<b>Priority</b>	Should

**Requirement F29, F30, F31 and F32 are added after a requirement feedback session with the project manager and the SE expert.**

<b>ID</b>	<b>F29</b>
<b>Requirement</b>	Users could send each other requests to fill in additional information of a certain aspect.
<b>Source</b>	Feedback session project manager and SE expert / project analysis
<b>Rationale</b>	If a user needs additional information about a requirement that was not completely filled in by the author, it would be useful if that user could request repletion of that requirement.
<b>Priority</b>	Could

<b>ID</b>	<b>F30</b>
<b>Requirement</b>	Users could ask the opinion of other users about requirements and decisions via the CMST
<b>Source</b>	Feedback session project manager and SE expert / project analysis
<b>Rationale</b>	It would be of added value is users could not only request the author to replete the requirement or decision information, but also could give feedback or ask a questions about a certain requirement or decision.
<b>Priority</b>	Could

<b>ID</b>	<b>F31</b>
<b>Requirement</b>	Users could agree on (approve) a requirement of a first degree related stakeholder via a certain feature.
<b>Source</b>	Feedback session project manager and SE expert / project analysis
<b>Rationale</b>	An agreement would only be of true value if the user is related to the topic and has knowledge of it.
<b>Priority</b>	Could

<b>ID</b>	<b>F32</b>
<b>Requirement</b>	Users can create a SE of the project.
<b>Source</b>	Project analysis / SE research
<b>Rationale</b>	Users can create a alternative project setting to analyse the influence/impact of a certain change they want to make but are not sure about.
<b>Priority</b>	Must

<b>ID</b>	<b>F33</b>
<b>Requirement</b>	Users must be able to export the requirement list.
<b>Source</b>	Feedback session project manager and SE expert / project analysis
<b>Rationale</b>	Because project documentation will be written in other programs, it would be of added value if the requirement list can be downloaded in a preferred format, so it can be included in the project documentation.
<b>Priority</b>	Must

<b>ID</b>	<b>I1</b>
<b>Requirement</b>	Primary and secondary users of the CMST must be able enter requirements into the CMST.
<b>Source</b>	Project analysis (requirement documentation)
<b>Rationale</b>	In order to improve documentation, decision-making and communication a requirement list would be a great addition to the CMST. This way all user can see what requirements are set to strive for the most suitable solution.
<b>Priority</b>	Must

<b>ID</b>	<b>I2</b>
<b>Requirement</b>	Primary and secondary users must be compelled by the CMST to fill in who is / are responsible for a certain requirement.
<b>Source</b>	Project analysis (requirement documentation)
<b>Rationale</b>	Compelling user to include more information about requirements will strengthen the requirement and inform other users with more detailed information about who is responsible and who you can contact for questions are to discuss about the requirement.
<b>Priority</b>	Must

<b>ID</b>	<b>I3</b>
<b>Requirement</b>	When entering a requirement, the CMST should ask the user to mark the requirement with a priority according to MoSCoW.
<b>Source</b>	Project analysis (requirement documentation)
<b>Rationale</b>	COUCH chose to give all requirement a certain priority according to MoSCoW. Therefore, the CMST will ask about the kind of priority when entering a new requirement, this increases usability.
<b>Priority</b>	Should

<b>ID</b>	<b>I4</b>
<b>Requirement</b>	When entering a requirement, the CMST should ask the user to mark the requirement according to the FICS classification.
<b>Source</b>	Project analysis (requirement documentation)
<b>Rationale</b>	COUCH chose to classify all requirements according to the FICS classification. Therefore, the CMST will ask about the classification when entering a new requirement, this increases usability.
<b>Priority</b>	Should

<b>ID</b>	<b>I5</b>
<b>Requirement</b>	The primary or secondary user who fills in the requirement must be compelled by the CMST to fill in the level of certainty; indicating how certain he (and any peers) is about the requirement.
<b>Source</b>	Project analysis (requirement documentation idea)
<b>Rationale</b>	Indicating how certain you are about the requirement you add gives other users a better insight about the requirement. For example, if you add a requirement that is based on information on a test, you are quite certain, but if you found something in research and it is not your field of expertise you might not feel completely certain about this requirement. But you can mention that and maybe another user confirm it for you.
<b>Priority</b>	Must

<b>ID</b>	<b>I6</b>
<b>Requirement</b>	Primary and secondary users must be compelled by the CMST to fill in who is / are responsible for a certain decision.
<b>Source</b>	Project analysis (prevent ad hoc decision-making)
<b>Rationale</b>	Compelling user to include more information about a decision will strengthen the decision and inform other users with more detailed information about who is responsible and who you can contact for questions are to discuss about the decision.
<b>Priority</b>	Must

<b>ID</b>	<b>I7</b>
<b>Requirement</b>	Primary and secondary users should receive a notification from the CMST each time someone else entered a requirement or decision mentioning he is (co-) responsible for.
<b>Source</b>	Project analysis
<b>Rationale</b>	To make sure you agree on requirements and decisions inserted by someone else, representing your name, users will receive notifications of it so they can check whether this is indeed the statement they agreed on.
<b>Priority</b>	Should

<b>ID</b>	<b>I8</b>
<b>Requirement</b>	The primary or secondary user who fills in the decision must be compelled by the CMST to fill in the level of certainty; indicating how certain he (and any peers) is about the decision.
<b>Source</b>	Project analysis (prevent ad hoc decision-making)
<b>Rationale</b>	Indicating how certain you are about the decision you add gives other users a better insight about the decision. For example, if you add a decision that is based on information on a test, you are quite certain, but if you found something in research and it is not your field of expertise you might not feel completely certain about this requirement. But you can mention that and maybe another user confirms it for you.
<b>Priority</b>	Must

<b>ID</b>	<b>I9</b>
<b>Requirement</b>	Project management should be automatically notified by the CMST when a decision is marked as uncertain or issue.
<b>Source</b>	Project analysis
<b>Rationale</b>	Project management team has to act upon uncertainties and issues since these can impact the whole project. When notified, project management can directly start evaluating the consequences and take action if needed.
<b>Priority</b>	Should

<b>ID</b>	<b>I10</b>
<b>Requirement</b>	The CMST must ask users about to mention the impact of a (ad hoc) decision (minor, medium, major) on the project outcome when entering a new (ad hoc) decision.
<b>Source</b>	Project analysis (prevent ad hoc decision-making)
<b>Rationale</b>	Asking the user about the impact of a (ad hoc) decision will trigger the user to carefully (re)consider about the decision to make sure the right one is made.
<b>Priority</b>	Must

<b>ID</b>	<b>I11</b>
<b>Requirement</b>	Secondary users must have access to everything but cannot change input inserted by the project management team.
<b>Source</b>	Project analysis
<b>Rationale</b>	In order for the CMST to work, input is needed from both primary and secondary users. And for the CMST to be also useful to the secondary users, they should have access to all information that results from it. The main project aspects are given by project management and are fixed (goal, final deadline, etcetera) this should not be changed by some random action of a secondary user.
<b>Priority</b>	Must

<b>ID</b>	<b>I12</b>
<b>Requirement</b>	Tertiary users must have read-only access to the CMST.
<b>Source</b>	Project analysis
<b>Rationale</b>	Tertiary users are no specialist of the project and therefore should not be able to insert data into the CMST. Since they will be mostly interest in a quick update or some insights, the read-only access will be sufficient.
<b>Priority</b>	Must

<b>ID</b>	<b>I13</b>
<b>Requirement</b>	Project management could receive a reminder once a month within the CMST to check the completeness of the requirement list and status of the requirements.
<b>Source</b>	Project analysis (project management)
<b>Rationale</b>	To support the project management team, the CMST will automatically send reminders to the project management team in order to update them on the requirement progress.
<b>Priority</b>	Could

<b>ID</b>	<b>I14</b>
<b>Requirement</b>	Users must be able to mention who is working on what part of the project in the CMST.
<b>Source</b>	Project analysis
<b>Rationale</b>	To complete the project overview relations between stakeholders and certain project aspects are important. This will show who is working on what and who if tasks are logically divided.
<b>Priority</b>	Must

<b>ID</b>	<b>I15</b>
<b>Requirement</b>	Primary and secondary users must be able to add explanations, documents, research papers, graphs, etcetera to strengthen and explain their reasoning behind a requirement or decision.
<b>Source</b>	Project analysis
<b>Rationale</b>	In order to improve decision-making and communication it could help to support their decisions and requirements with extra information elaborating or proving a certain point.
<b>Priority</b>	Must

<b>ID</b>	<b>I16</b>
<b>Requirement</b>	The CMST should include instructions for the users about functions and features of the CMST.
<b>Source</b>	Market research
<b>Rationale</b>	To make the CMST as user friendly as possible it should be self-explainable which could mean including instructions intertwined in the CMST.
<b>Priority</b>	Should

<b>ID</b>	<b>I17</b>
<b>Requirement</b>	The CMST should ask users about the status of the uploaded project deliverable documentation (concept version, needs feedback, final version) when uploading.
<b>Source</b>	Project analysis
<b>Rationale</b>	Project deliverables are written with involved stakeholders and reviewed by a stakeholder who was not involved, after the feedback is processed the deliverable is finished and will be published. This option will support getting a hold of the progress. When reading users will know if this is a concept or already the final.
<b>Priority</b>	Should



<b>ID</b>	<b>I18</b>
<b>Requirement</b>	The CMST should allow project management to update or change the project planning, milestones and deadlines.
<b>Source</b>	Project analysis
<b>Rationale</b>	The project management team is responsible for the project planning, milestones and deadlines and since these aspect could change during the project, management should be able to update them.
<b>Priority</b>	Should

<b>ID</b>	<b>I19</b>
<b>Requirement</b>	The CMST wishes to include a web application (mobile phone).
<b>Source</b>	Project analysis
<b>Rationale</b>	It might be the case that the users have no access to a laptop or computer, therefore, it might be an advantage to have a mobile version available.
<b>Priority</b>	Wishes / Will not

<b>ID</b>	<b>I20</b>
<b>Requirement</b>	The CMST should allow users to mention project related issues and include the features from the issue tracker.
<b>Source</b>	Project analysis (issue tracker)
<b>Rationale</b>	Currently COUCH works with issue tracker, it is perceived useful. Therefore, an issue list is added to the CMST where users can add issue that they encounter. This way other users can see them and might be able to help them or are at least up-to-date about what is going on. It would be most user friendly if all needed functions and features are in one place. Also the issue can now be related to the development parts and other project elements.
<b>Priority</b>	Should

<b>ID</b>	<b>I21</b>
<b>Requirement</b>	Via a certain aspect in the overview the user should be able to ask for redirection to a section with more information.
<b>Source</b>	Actor network
<b>Rationale</b>	Easy clicking through the CMST to the right information will increase usability. Therefore it should be possible to for example, go from the project overview to the requirement list.
<b>Priority</b>	Should

<b>ID</b>	<b>C1</b>
<b>Requirement</b>	Primary users must have access to everything.
<b>Source</b>	Project analysis
<b>Rationale</b>	Project management team are the primary users, they manage not only the project but are also responsible for the CMST since the tool is developed to support them. Management of the CMST requires complete access.
<b>Priority</b>	Must

<b>ID</b>	<b>C2</b>
<b>Requirement</b>	When project management wants to send an invite to a user the CMST should ask to define the type of access.
<b>Source</b>	Designer's idea
<b>Rationale</b>	To standardise procedures, the CMST should ask automatically what type of access is preferred when creating a new account.
<b>Priority</b>	Should

<b>ID</b>	<b>C3</b>
<b>Requirement</b>	The project management team must receive a notification when primary and secondary users add new project elements and relations into the CMST.
<b>Source</b>	Designer's idea
<b>Rationale</b>	Since the project management team is responsible for the project, they must receive a notification of actions that happen and are documented in the CMST to stay up-to-date.
<b>Priority</b>	Must



<b>ID</b>	<b>C4</b>
<b>Requirement</b>	The CMST should base tailored information presented on the personal account in the CMST on the function of the user within the project.
<b>Source</b>	Market research
<b>Rationale</b>	The CMST will be most useful for users if tailored information is presented to them. This information should be based on a characteristic of the user; with the project the best fitting characteristic is probably the users function within the project, relating to the part he is working on or deadlines, meetings, requirements, decisions relevant for his sub team.
<b>Priority</b>	Should

<b>ID</b>	<b>C5</b>
<b>Requirement</b>	Relations between project elements that are (indirectly) given by the primary and secondary users must be automatically included in the CMST output.
<b>Source</b>	Actor network
<b>Rationale</b>	All project relations are valuable input for the CMST in order to create lists and overviews of project data. With the CMST automatically save them the information will quickly grow.
<b>Priority</b>	Must

<b>ID</b>	<b>C6</b>
<b>Requirement</b>	Primary and secondary users must be asked by the CMST to point out all relations between project elements.
<b>Source</b>	Actor network
<b>Rationale</b>	In order for the project overview to be useful input is needed from the users. They have to mention relations between aspects and the CMST will then create an informative overview.
<b>Priority</b>	Must

<b>ID</b>	<b>C7</b>
<b>Requirement</b>	The CMST must include a list with all requirements.
<b>Source</b>	Project analysis
<b>Rationale</b>	An overview of all requirements would be useful when looking for a certain decision or reading upon what is decided recently or in general for example.
<b>Priority</b>	Must

<b>ID</b>	<b>C8</b>
<b>Requirement</b>	The CMST must automatically add inserted requirements to the requirement list.
<b>Source</b>	Requirement engineering
<b>Rationale</b>	For usability it is better if the CMST automatically adds the requirements to the decision list, if not added there.
<b>Priority</b>	Must

<b>ID</b>	<b>C9</b>
<b>Requirement</b>	The CMST must include a list with all decisions.
<b>Source</b>	Project analysis
<b>Rationale</b>	An overview of all decisions would be useful when looking for a certain decision or reading upon what is decided recently or in general for example.
<b>Priority</b>	Must

<b>ID</b>	<b>C10</b>
<b>Requirement</b>	The CMST must automatically add inserted decisions to the decision list.
<b>Source</b>	Decision-making process
<b>Rationale</b>	For usability it is better if the CMST automatically adds the decisions to the decision list, if not added there.
<b>Priority</b>	Must

<b>ID</b>	<b>C11</b>
<b>Requirement</b>	The CMST must be able to present the output: project information and project elements in an understandable way (e.g. list, scheme, illustration, overview) to the users.
<b>Source</b>	Actor network
<b>Rationale</b>	From the user input the CMST should develop useful output for the users in order to use their own combined information in a more efficient way.
<b>Priority</b>	Must

<b>ID</b>	<b>C12</b>
<b>Requirement</b>	The CMST could show who is busy solving a certain issue.
<b>Source</b>	Project analysis (issue tracker)
<b>Rationale</b>	Extra information on the topic
<b>Priority</b>	Could

<b>ID</b>	<b>C13</b>
<b>Requirement</b>	The CMST could show who mentioned a certain issue.
<b>Source</b>	Project analysis (issue tracker)
<b>Rationale</b>	Showing who mentioned the (development) issue is necessary for contacting, helping and solving this issue.
<b>Priority</b>	Could

<b>ID</b>	<b>C14</b>
<b>Requirement</b>	The CMST must allow for adaptations, updates or additions of previous user input.
<b>Source</b>	Decision-making process   Requirement engineering
<b>Rationale</b>	There is no first time right, especially with Synthetic Environment like the CMST it is meant to try certain aspects virtually out. Therefore, updates or additions of previous user input, should be adaptable / updatable.
<b>Priority</b>	Must

<b>ID</b>	<b>C15</b>
<b>Requirement</b>	The CMST must include a search function for words, titles, definitions, abbreviations and names.
<b>Source</b>	Market research
<b>Rationale</b>	To increase usability a search function will be useful to get all related results out a quickly chose the one you are looking for as a user.
<b>Priority</b>	Must

<b>ID</b>	<b>C16</b>
<b>Requirement</b>	The CMST should show the progress status of project development part (not started, in progress, finished, issue) given by the users.
<b>Source</b>	Project analysis (planning)
<b>Rationale</b>	Sharing the project part status keeps others up-to-date so they know what is going on, especially the project management team. Marking issues is important for the advantage of sharing issues in an issue list.
<b>Priority</b>	Should

<b>ID</b>	<b>C17</b>
<b>Requirement</b>	The CMST could show milestones in the project planning.
<b>Source</b>	Project analysis (planning)
<b>Rationale</b>	Showing milestones in the project planning would be a great way for the project management team to share important dates in a place everybody can find them.
<b>Priority</b>	Could

<b>ID</b>	<b>C18</b>
<b>Requirement</b>	The CMST could show deadlines in the project planning.
<b>Source</b>	Project analysis (planning)
<b>Rationale</b>	Showing deadlines in the project planning would be a great way for the project management team to share important dates in a place everybody can find them.
<b>Priority</b>	Could

<b>ID</b>	<b>C19</b>
<b>Requirement</b>	The CMST could show meetings in the project planning.
<b>Source</b>	Project analysis (planning)
<b>Rationale</b>	Showing meetings in the project planning would be a great way for the project management team to share important dates in a place everybody can find them.
<b>Priority</b>	Could

<b>ID</b>	<b>S1</b>
<b>Requirement</b>	The main project overview should be reachable within three handlings.
<b>Source</b>	Other tools   common sense
<b>Rationale</b>	The project overview will be the main key of the CMST. Therefore it should be easy accessible, here defined as: the user only has to make three handlings (e.g. clicks) to reach the overview.
<b>Priority</b>	Should

<b>ID</b>	<b>S2</b>
<b>Requirement</b>	The general search function of the CMST should always be directly accessible.
<b>Source</b>	Other tools   common sense
<b>Rationale</b>	The search function is meant for looking something up when you do not know where to find it. In order to be able to look always anything up the search function should be always directly accessible.
<b>Priority</b>	Should

<b>ID</b>	<b>S3</b>
<b>Requirement</b>	The CMST's UI must be user-friendly, clear and attractive.
<b>Source</b>	Common sense
<b>Rationale</b>	To stimulate use it is necessary to develop a user-friendly CMST that the user easily understand, can use and preferably want to use.
<b>Priority</b>	Must

## ***Appendix F - Requirements of the CMST and PMST (final)***

**Requirement F7** – The CMST must include an overview that includes all project elements and project element relations and shows a specific sub overview to the user, based on the users' data input.

**Related result:** the project overview should not show a general project overview but should show the logged in user and his or her relations in the project network. That way the user always sees the latest information of his or hers relations (involvements). The user can then directly redirect to another aspect or person from his or her own place in the network. This was updated before evaluation two and three and positively received.

**Requirement F29** – Users could send each other requests to fill in additional information of a certain aspect.

**Requirement F30** – Users could ask the opinion of other users about requirements and decisions via the CMST.

**Related result:** the function of the request button should be broadened. It should not only be a request to ask the authors to complete the aspect information, but also be a possibility to add a note, for a specific request update, to ask a question or to suggest an update. This was also updated before evaluation two and three and agreed on.

**Requirement F20** – Notifications could be found in the user's personal notification overview and could pop-up when using the CMST.

**Requirement I7** – Primary and secondary users should receive a notification from the CMST each time someone else entered a requirement or decision mentioning he is (co-)responsible for.

**Related result:** it became clear that the type and amount of notifications depends on the stakeholder's preferences. The project manager pointed out that he expects to receive too many notifications because he is involved in so many aspects. Therefore, he would not like to receive a notification of all user actions. On the other hand, the other stakeholders pointed out to prefer to receive notifications. For example, a receiving a notification when other members of their "sub team" made a decision when they were not present. The notifications are then some kind of summary of that meeting to them.

**Requirement F32** – Users must be able to export the requirement list.

**Related result:** the export feature is not worked out because it is out of scope. It is assumed to be easily developed in a preferred way. However, the internal stakeholders were questioning this feature, they said it is a very important feature because if this feature works well, the requirement list that can be created with the CMST would be a feature with great added value.

**Requirement I10** – The CMST must ask users about to mention the impact of a (ad hoc) decision (minor, medium, major) on the project outcome when entering a new (ad hoc) decision.

**Related result:** referring to adding or editing a requirement, the user is asked about the impact of the requirement. This question can be perceived useful by the stakeholders, they say it is good to give requirements a second thought. However, it might also be that the tool itself (unknowingly) encourages the user to think about the impact. Because the user has to add the requirement to the tool, and is asked to fill in the related aspects and more, he or she is forced to think about the requirement more thoroughly.

**Requirement F8** – Using layers, the CMST must be able to create sub project overviews. The layers are: external stakeholders, internal stakeholders, stakeholder information, FD parts, COUCH parts, progress, status, resources, management aspects, requirements, decisions, 1 project aspect element + 1<sup>st</sup> degree relations, 1 project aspect element + 2<sup>nd</sup> degree relations, 1 project aspect group + 1<sup>st</sup> degree relations, 1 project aspect group + 2<sup>nd</sup> degree relations.

**Requirement I17** – the CMST should ask users about the status of the uploaded project deliverable documentation (concept version, needs feedback, final version) when uploading.

**Related result:** the stakeholders had different opinions about adding a progress label to the project aspects. One stakeholder thought it would be of added value, another stakeholder doubted the advantages and usability and the project manager does not think internal stakeholders would fill in the status, because it is hard to say when something is ready. Since the use is doubtful, as well as the real added value that the progress has to be communicated via the tool, and the information that has to be added should be short, the progress is left out.

**Requirement F31** – Users could agree on (approve) a requirement of a first degree related stakeholder via a certain feature.

**Related result:** the approval feature is only be thought useful regarding the requirements. It shows how important a requirement is, the more stakeholders approve, the more important. The project aspects should be right and preferably defined by all the stakeholders that are responsible for that aspect, so no approval needed. There are a lot of decisions, if they all have the option to be approved it costs a lot more time. Since decisions are often not documented at all, because of the time pressure, negligence or motivation, it is decided that decisions cannot be approved. Related to the requirement approval; one stakeholder pointed out that it would be useful that a requirement only can be approved when the author says so. Because often the first drafts are not feedback ready. Also, when a requirement is changed, the approval should be updated as well. Users should be notified of that. Lastly it was pointed out that only direct related stakeholders should allowed to approve a requirement. The other stakeholder did not mention any feedback on the approve function. The project manager on the other hand, is not convinced people will set a requirement on "approval ready". And in case they do, if users will approve each other's requirements. This is debatable and can only be find out when the CMST is actually used.

**Requirement F2** – When a requirement is met, the responsible user should be able to tick it off with a check mark in the CMST.

**Related result:** including the function to mark a requirement with the label "achieved" is positively received. Especially by the project manager. It was not included in the mock-up yet, however since it was pointed out to be very useful it was included I the final version of the mock-up and of course kept as a requirement.

**Requirement F11** – Primary or secondary users could add their names to a decision in the CMST and mark it with a new level of certainty.

**Requirement F31** – Users could agree on (approve) a requirement of a first degree related stakeholder via a certain feature.

**Related result:** the feedback on the approval function differs per stakeholder. One stakeholder pointed out that it would be useful that a requirement only can be approved when the author says so. Because often the first drafts are not feedback ready. When a requirement is changed, the approval should be updated as well. Users should be notified of that. Lastly it was pointed out that only direct related stakeholders should allowed to approve a requirement. The other stakeholder did not point out any feedback on the approve function. The project manager on the other hand, is not convinced people will set a requirement on "approval ready". And in case they do, if users will approve each other's requirements. This is debatable and can only be find out when the CMST is actually used.

**Requirement F5** – Primary or secondary users could add their names to a requirement in the CMST and mark it with a new level of certainty.

**Requirement F11** – Primary or secondary users could add their names to a decision in the CMST and mark it with a new level of certainty.

**Requirement I5** – The primary or secondary user who fills in the requirement must be compelled by the CMST to fill in the level of certainty; indicating how certain he (and any peers) is about the requirement.

**Requirement I8** – The primary or secondary user who fills in the decision must be compelled by the CMST to fill in the level of certainty; indicating how certain he (and any peers) is about the decision.

**Related result:** the option to fill in how certain a user is about a requirement is unnecessary, according to one of the stakeholders. It was mentioned that adding a certain requirement in the CMST already indicated that the user is certain enough about the requirement. Also, it is important to keep the requirement information short, so the threshold to fill in the information (and read it) would be low.

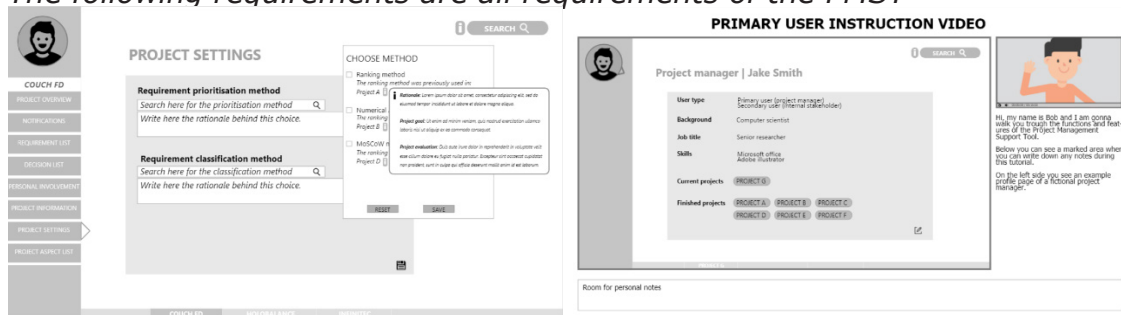
**General results:** the terms used to ask the user to elaborate on a requirement, decision or aspect are also discussed and optimised in order to make them more self-evident. The information layers are still perceived useful, to elaborate on functions, features and questions. Some general filled in examples are suggested to be useful when using the tool for the first time. The stakeholders think this gives the user a better idea of what would be the utility of adding data.

## Appendix G - Requirements of the CMST and PMST

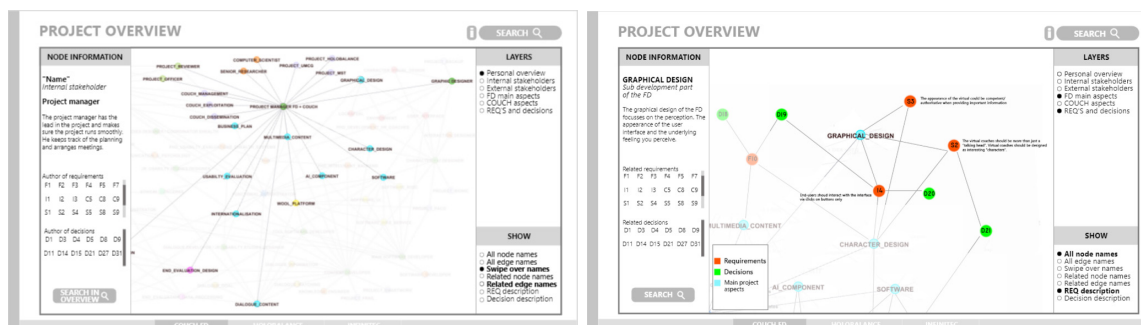
### Requirements Not Related to a specific aspect of the CMST

<b>NRR1</b>	The CMST gives feedback on the actions of the user (e.g. requirement saved, request send, approved, etc.).		
FR	Demonstrated	IDE background	PU / SU
<b>NRR2</b>	When relating a certain element to another, information of both elements will be updated.		
TR	Not demonstrated	Common sense	PU / SU
<b>NRR3</b>	If the user does not fill in who the author of a project aspect, requirement or decision is, it's own name will automatically be filled in, so he or she is the author.		
TR	Not demonstrated	Common sense	PU / SU
<b>NRR4</b>	The CMST automatically saves all information all the time.		
TR	Not demonstrated	Common sense	PU / SU
<b>NRR5</b>	All elements that are mentioned are links to the element information of that specific element.		
TR	Demonstrated	IDE background	PU/SU/TU
<b>NRR6</b>	Clicking on the main element (link) will redirect the user to the element in the project overview.		
FR	Demonstrated	Common sense	PU/SU/TU
<b>NRR7</b>	Clicking on the main element (link) in the project overview, the user will be redirected to the to the element's information section.		
FR	Demonstrated	Common sense	PU/SU/TU
<b>NRR8</b>	Clicking on an element that is mentioned in another element's information, the user will be redirected to the element in the matching list (project aspect list / requirement list / decision list) or in case of an internal stakeholder to the profile of that stakeholder.		
FR	Demonstrated	Common sense	PU/SU/TU
<b>NRR9</b>	Each section has a link to provide additional information about that section.		
FR	Demonstrated	Stakeholder evaluation	PU/SU/TU
<b>NRR10</b>	The information provide per section explains functions, questions asked, and give instructions to the user.		
TR	Demonstrated	Market research	PU/SU/TU
<b>NRR11</b>	The CMST addresses the users with "you".		
TR	Demonstrated	IDE background	PU / SU
<b>NRR12</b>	User have to log in with a user name and password.		
TR	Not demonstrated	Common sense	PU / SU
<b>NRR13</b>	The CMST provides a manual explaining the "first time use".		
FR	Not demonstrated	Common sense	PU / SU
<b>NRR14</b>	The project management team can ask the users specific questions via the CMST (e.g. their personal project goal).		
FR	Not demonstrated	Stakeholder interviews	PU
<b>NRR15</b>	Only primary and secondary users are allowed to make changes.		
TR	Not demonstrated	Stakeholder interviews	PU / SU
<b>NRR16</b>	It is predefined which changes the primary and secondary users are allowed to make.		
TR	Not demonstrated	Stakeholder interviews	PU / SU
<b>NRR17</b>	The project management team defines the specifics of the access that tertiary users have.		
TR	Not demonstrated	Stakeholder interviews	PU / TU
<b>NRR18</b>	The general search options directs the user to the information layer of the search.		
FR	Not demonstrated	Common sense	PU/SU/TU

The following requirements are all requirements of the PMST



<b>NRR19</b>	The PMST includes a database with all the data from all (previous) projects that can be accessed by users with a tertiary user's permission.		
<b>PMST</b>			
TR	Not demonstrated	Background theories	TU
<b>NRR20</b>	The PMST includes a user group specific instruction video that leads the user through all functions and features of the PMST.		
<b>PMST</b>			
TR	Not demonstrated	Market research	PU/SU/TU
<b>NRR21</b>	When the user is invited to use the PMST for a certain project, the user will receive the option to watch the instruction video.		
<b>PMST</b>			
TR	Not demonstrated	Market research	PU/SU/TU
<b>NRR22</b>	When the user is invited to use the PMST for a certain project, the user will receive the option to have instructions presented related to the users actions / presence in the PMST.		
<b>PMST</b>			
TR	Not demonstrated	Market research	PU/SU/TU
<b>NRR23</b>	The PMST creates an overview of all RRD's European eHealth research projects plus the related internal stakeholders, providing information about project (management) goals and evaluations, project status, involved internal stakeholders per project, reused components, common resources, shared resources, and present meta data of these related research project elements.		
<b>PMST</b>			
FR	Not demonstrated	Stakeholder interviews	PU/SU/TU



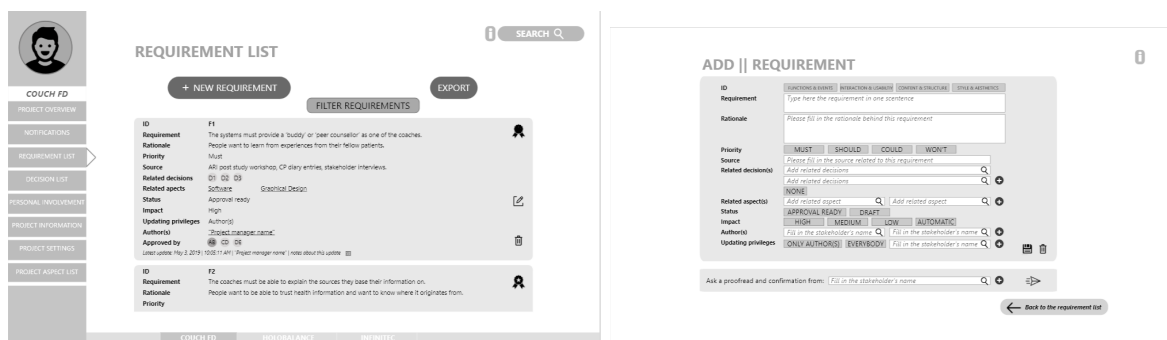
Requirements related to the Project Overview

<b>POR1</b>	The CMST combines all the project elements in an overview (called project overview).		
<b>FR</b>	Demonstrated	SE research   Actor network	PU/SU/TU
<b>POR2</b>	The CMST includes relevant project aspect information and stakeholder information in the project overview.		
<b>TR</b>	Demonstrated	Stakeholder interviews	PU / SU



<b>POR3</b>	The project overview shows the relations between project elements.		
FR	Demonstrated	Background theories	PU/SU/TU
<b>POR4</b>	The project overview shows additional information of the selected aspect or stakeholder.		
FR	Demonstrated	Stakeholder interviews	PU/SU/TU
<b>POR5</b>	The project overview shows the related requirements and decisions of a selected project aspect.		
FR	Demonstrated	Background theories	PU/SU/TU
<b>POR6</b>	The project overview shows the requirements and decisions a selected stakeholder is the author of.		
FR	Demonstrated	Background theories	PU/SU/TU
<b>POR7</b>	The search field included in the project overview allows the user to search for a specific project aspect or stakeholder in the overview. The result will be selected.		
FR	Not demonstrated	Common sense	PU/SU/TU
<b>POR8</b>	The user can choose which information will be shown in the overview, e.g. node names, edge names, related node names, related edge names, and which degree of relations.		
FR	Demonstrated	Stakeholder interviews	PU/SU/TU
<b>POR9</b>	The CMST shows the user (and it's relations) in the overview, when the user goes to the overview via the menu.		
TR	Demonstrated	Stakeholder evaluations	PU / SU
<b>POR10</b>	The project overview allows changing from selected project aspect or stakeholder by selecting another node (element).		
TR	Demonstrated	Background theories	PU/SU/TU
<b>POR11</b>	The project elements mentioned when selecting a node, are links that will redirect the user to the corresponding section that includes more information.		
TR	Demonstrated	Background theories	PU/SU/TU
<b>POR12</b>	The project overview includes the option to choose from a list of layers, that show a specific part of the overview.		
TR	Demonstrated	Stakeholder interviews	PU/SU/TU
<b>POR13</b>	Information in the project overview can only be edited via the information layer of that project aspect or stakeholder.		
TR	Demonstrated	Common sense	PU / SU
<b>POR14</b>	The project overview can be reached from the menu.		
TR	Demonstrated	Common sense	PU/SU/TU
<b>POR15</b>	Users can add meta data to a relation (edge) in the project overview.		
FR	Not demonstrated	Background theories	PU / SU
<b>POR16</b>	Users can only add meta data to a relation (edge) that is connected to a node that they are allowed to edit.		
TR	Not demonstrated	Stakeholder evaluation	PU / SU
<b>POR17</b>	The project management team defines the types of layers in the project overview.		
TR	Not demonstrated	Stakeholder evaluation	PU
<b>POR18</b>	The CMST automatically registers who was responsible for the creation or latest edit of a relation (edge) and when this was done.		
TR	Not demonstrated	Common sense	PU / SU
<b>POR19</b>	The CMST automatically adds the information about the latest creation or edit to the relation (edge) information.		
TR	Not demonstrated	Common sense	PU / SU
<b>POR20</b>	Project relations can be added via element information or via a function in the project overview.		

TR	Not demonstrated	Common sense	PU / SU
<b>POR21</b>	Selecting an element in the project overview, put that aspect in the middle and zoomed in so all primary relations are visible.		
TR	Not demonstrated	Common sense, IDE background	PU/SU/TU
<b>POR22</b>	Users can create a SE of the project.		
FR	Not demonstrated	SE research	SU
<b>POR23</b>	Users can ask other users for proofread and confirmation of the created SE.		
FR	Not demonstrated	SE research	SU
<b>POR24</b>	The <b>PMST</b> gives the project management team suggestions for types of layers to choose from in the project overview.		
FR	Not demonstrated	Common sense	PU



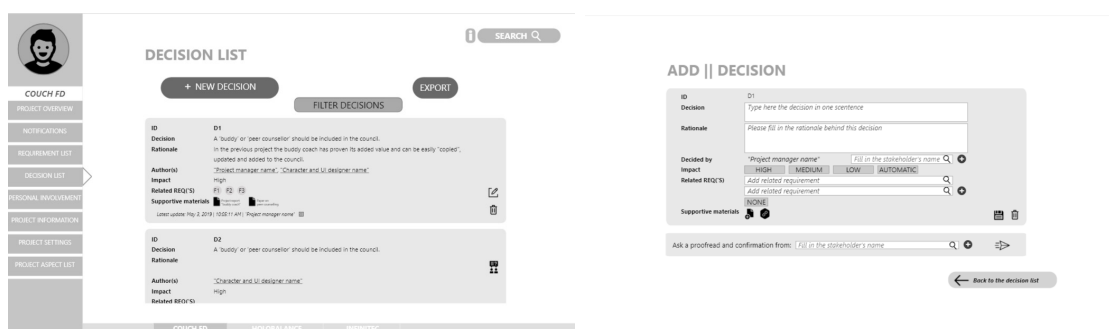
### Requirements related to the Requirement Documentation

<b>RDR1</b>	The CMST combines all requirements in the requirement list.		
FR	Demonstrated	Project analysis	PU/SU/TU
<b>RDR2</b>	Users can add new requirements to the requirement list.		
FR	Demonstrated	Project analysis	PU / SU
<b>RDR3</b>	The CMST gives the mentioned author(s) of a certain requirement the right to update that requirement.		
TR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>RDR4</b>	The user who creates a requirement defines who may update that requirement: author(s), direct aspect related primary and secondary users, specifically chosen stakeholders, or a combination, or all internal stakeholders.		
TR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>RDR5</b>	Only users with updating privileges can edit or delete requirements.		
TR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>RDR6</b>	Only users with updating privileges can add an “achieved label” to a requirement that has been achieved.		
TR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR7</b>	In the requirement list is visible which requirements are already achieved (and which not).		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR8</b>	Users can “approve” a requirement they agree on.		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR9</b>	Approval of the creator or latest editor of a requirement, will automatically be added to the requirement.		
TR	Not demonstrated	Common sense	PU / SU

<b>RDR10</b>	In the requirement list is visible which requirements are already approved and by who.		
TR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR11</b>	When the user approves a requirement, his or hers name is automatically be added to the "list" of people who approved that requirement.		
TR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR12</b>	Users can send a request to the creator or latest editor to ask for a requirement update or send a note with a question or suggestion.		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR13</b>	User can go to the requirement in the project overview via a requirement specific link in the requirement list.		
TR	Not demonstrated	Common sense	PU / SU
<b>RDR14</b>	The CMST automatically registers who was responsible for the creation or latest edit of a requirement and when this was done (called requirement history).		
TR	Not demonstrated	Project analysis	PU / SU
<b>RDR15</b>	The CMST automatically adds the information about the creation or latest edit to the requirement information (called requirement history).		
TR	Not demonstrated	Project analysis	PU / SU
<b>RDR16</b>	The CMST will ask users who created or edited a requirement if they want to add a note when saving the requirement which will be included to the requirement history.		
FR	Demonstrated	Project analysis	PU / SU
<b>RDR17</b>	The CMST creates a requirement history list for each requirement with information about the creation of that requirement and edits that were done.		
FR	Demonstrated	Project analysis	PU / SU
<b>RDR18</b>	Deleted requirements are saved and can be found back in the requirement history list.		
FR	Not demonstrated	Market research	PU / SU
<b>RDR19</b>	Deleted requirements can be restored from the requirement history list.		
FR	Not demonstrated	Market research	PU / SU
<b>RDR20</b>	Users can go to the history list of a requirement via a requirement specific link in the requirement list.		
FR	Demonstrated	Common sense	PU / SU
<b>RDR21</b>	The CMST updates the status of the approval given by other users when a requirement is edited.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>RDR22</b>	Requirement approval can only be given by stakeholders who have the right to update the requirement or are related stakeholders of the related project aspect(s).		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR23</b>	Requirement approval can only be given when the author set the requirement status to "approval ready".		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>RDR24</b>	Users can filter requirements based on their preferences (e.g. only complete, date, related aspects, highest priority, etc.)		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR25</b>	User can export the requirement list to a preferred type of document including the preferred type of information (e.g. only ID and description, etc.).		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>RDR26</b>	When users search for a specific requirement in the general search feature of the CMST, they will be redirected to that requirement in the requirement list.		
FR	Not demonstrated	Common sense	PU / SU

<b>RDR27</b>	The CMST automatically creates an ID for the requirement when a new requirement is created and the type of requirement is chosen (according to the FICS classification).		
<b>CMST</b>			
TR	Not demonstrated	Project analysis	PU / SU
<b>RDR28</b>	The PMST automatically creates an ID for the requirement when a new requirement is created and the type of requirement is chosen (according to the <b>selected</b> classification).		
<b>PMST</b>			
TR	Not demonstrated	Project analysis	PU / SU
<b>RDR29</b>	The requirement classification is based on the FICS classification, labelling a requirement with functions and events, interaction and usability, content and structure or style and aesthetics. This is a multiple choice question for the user.		
<b>CMST</b>			
TR	Demonstrated	Project analysis	PU / SU
<b>RDR29</b>	<b>Only the project management team can define the requirement classification method.</b>		
<b>-1</b>			
<b>PMST</b>			
TR	Demonstrated	Project analysis	PU / SU
<b>RDR29</b>	<b>The PMST incorporates the chosen requirement classification method in the requirement information, and optionally proposes corresponding answers suggestions.</b>		
<b>-2</b>			
<b>PMST</b>			
TR	Demonstrated	Project analysis	PU / SU
<b>RDR30</b>	The CMST has a standard template for creating a new requirement with specific questions that the user is asked to fill in, this includes: ID, requirements, rationale, priority, source, related decision(s), related aspect(s), status, impact, author(s), updating privileges.		
TR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>RDR31</b>	The user has to choose the requirement classification and has to fill in the requirement description in order to be able to create the requirement (boundary conditions).		
<b>CMST</b>			
TR	Not demonstrated	Common sense	PU / SU
<b>RDR31</b>	<b>The project management team can set additional boundary conditions</b> next to filling in the requirement description.		
<b>PMST</b>			
TR	Not demonstrated	Common sense	PU / SU
<b>RDR32</b>	The CMST allows the user to search for a specific requirement answer by showing the related options already available in the CMST. For example, searching for a related stakeholder, the CMST shows all project stakeholders.		
FR	Not demonstrated	Common sense	PU / SU
<b>RDR33</b>	The requirement priority is based on the MoSCoW method, labelling a requirement with must, should, could or won't. This is a multiple choice questions for the user.		
<b>CMST</b>			
TR	Demonstrated	Project analysis	PU / SU
<b>RDR33</b>	<b>Only the project management team can define the requirement priority method.</b>		
<b>-1</b>			
<b>PMST</b>			
TR	Demonstrated	Project analysis	PU / SU
<b>RDR33</b>	<b>The tool incorporates the chosen requirement priority method in the requirement information, and optionally proposes corresponding answers suggestions.</b>		
<b>-2</b>			
<b>PMST</b>			
TR	Demonstrated	Project analysis	PU / SU
<b>RDR34</b>	The requirement impact is a multiple choice question with the options high, medium, low and automatic.		
TR	Demonstrated	Stakeholder evaluations	PU / SU

<b>RDR35</b>	The CMST determines the impact of a requirement when the setting is “automatic”, it depends on the number of related aspects: the more related aspects, the higher the impact.		
TR	Not demonstrated	IDE background, stakeholder evaluations	PU / SU
<b>RDR36</b>	When adding or editing a requirement, users can ask for a proofread and confirmation of a requirement from a chosen stakeholder via the CMST.		
FR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>RDR37</b>	User cannot edit a requirement at the same time.		
TR	Demonstrated	Background theories	PU / SU
<b>RDR38</b>	Requirements cannot have the same ID.		
TR	Not demonstrated	Background theories	PU / SU
<b>RDR39</b>	When a user “approves” a requirement, his or her name will directly be added to the requirement approval section.		
FR	Demonstrated	IDE background	PU / SU
<b>RDR40</b>	Users can create a new decision when relating a decision to a requirement.		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>RDR41</b>	The requirement list can be reached from the menu.		
TR	Demonstrated	Common sense	PU / SU

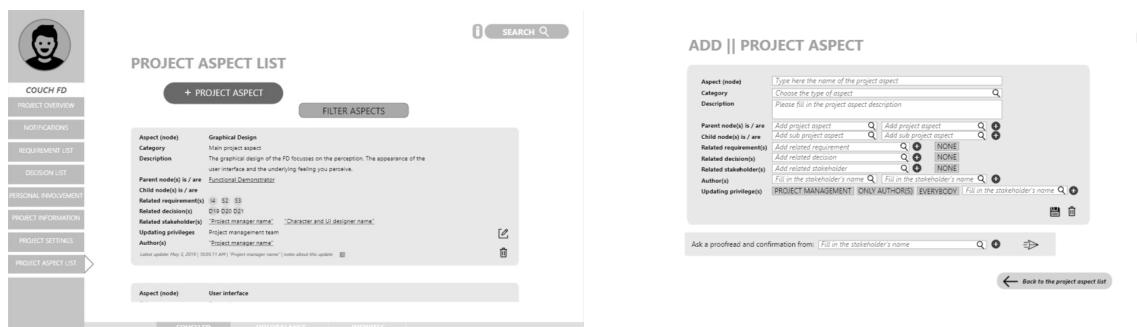


### Requirements related to the Decision Documentation

<b>DDR1</b>	The CMST combines all decision into the decision list.		
FR	Demonstrated	Project analysis	PU / SU
<b>DDR2</b>	Users can add new decisions to the decision list.		
FR	Demonstrated	Project analysis, DSS research	PU / SU
<b>DDR3</b>	The CMST gives the mentioned author(s) of a certain decision the right to update that decision.		
TR	Not demonstrated	Project analysis	PU / SU
<b>DDR4</b>	Only author(s) of a decision can edit or delete that decision.		
TR	Not demonstrated	Common sense	PU / SU
<b>DDR5</b>	The user who creates the decision, is automatically (one of) the author(s).		
TR	Not demonstrated	Common sense	PU / SU
<b>DDR6</b>	Users can send a request to the creator or latest editor to ask for a decision update or send a note with a question or suggestion.		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>DDR7</b>	Users can go to a decision in the project overview, via a decision specific link, in the decision list.		
FR	Demonstrated	Common sense	PU/SU/TU

<b>DDR8</b>	The CMST automatically registers who was responsible for the creation or latest edit of a decision and when this creation or edit was made (called decision history).		
TR	Not demonstrated	Project analysis	PU / SU
<b>DDR9</b>	The CMST automatically adds the information of the creation or latest edit to the decision information (called decision history).		
TR	Not demonstrated	Project analysis	PU / SU
<b>DDR10</b>	Users who create or edit a decision can add a note to the decision which will be included to the decision history.		
TR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>DDR11</b>	The CMST will ask users who created or edited a decision if they want to add a note when saving the decision.		
FR	Demonstrated	Background theories	PU / SU
<b>DDR12</b>	Users can filter decisions based on their preferences (e.g. only complete, date, related requirements, impact, etc.).		
FR	Demonstrated	Stakeholder evaluation	PU / SU
<b>DDR13</b>	User can export the decision list to a preferred type of document including the preferred type of information (e.g. only ID and decision, etc.).		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>DDR14</b>	When users search for a specific decision in the general search feature of the CMST, they will be redirected to that decision in the decision list.		
FR	Not demonstrated	Background theories	PU / SU
<b>DDR15</b>	The CMST automatically creates a new decision ID when a decision is created.		
TR	Not demonstrated	Project analysis	PU / SU
<b>DDR16</b>	The CMST has a standard template for creating a new decision with specific questions that the user is asked to fill in, this includes: ID, decision, rationale, author(s), impact, related requirement(s), supportive materials.		
FR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>DDR17</b>	The user has to fill in the decision, in order to be able to create the decision (boundary conditions).		
TR	Not demonstrated	Background theories	PU / SU
<b>DDR18</b>	The CMST allows the user to search for a specific decision answer by showing the related options already available in the CMST. For example, searching for a author, the CMST shows all project stakeholders.		
FR	Not demonstrated	Background theories	PU / SU
<b>DDR19</b>	The decision impact is a multiple choice question with the options high, medium, low and automatic.		
TR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>DDR20</b>	The CMST determines the impact of a decision when the setting is "automatic", it depends on the number of related requirements: the more related requirements, the higher the impact.		
TR	Not demonstrated	Background theories, stakeholder evaluations	PU / SU
<b>DDR21</b>	When adding or editing a decision, users can ask for a proofread and confirmation of a decision from a chosen stakeholder via the CMST.		
FR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>DDR22</b>	User cannot edit a decision at the same time.		
TR	Demonstrated	Common sense	PU / SU
<b>DDR23</b>	Decisions cannot have the same ID.		
TR	Demonstrated	Common sense	PU / SU

<b>DDR24</b>	Users can upload supportive materials that will be added to their decision.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>DDR25</b>	User can download the supportive materials that are added to a decision.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>DDR26</b>	The decision list can be reached from the menu.		
TR	Demonstrated	Common sense	PU / SU



### Requirements related to the project Aspect Documentation

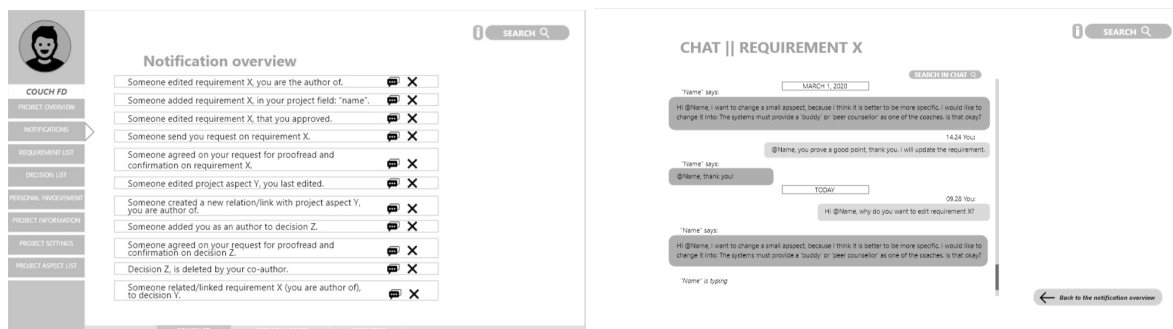
<b>ADR1</b>	The CMST combines all project aspects in the project aspect list.		
FR	Demonstrated	IDE background	PU / SU
<b>ADR2</b>	Users can add new project aspects to the project aspect list.		
FR	Demonstrated	IDE background	PU / SU
<b>ADR3</b>	The CMST gives the mentioned author(s) of a certain project aspect the right to update that project aspect.		
TR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>ADR4</b>	The user who creates a project aspect can define who may update that project aspect: author(s), direct aspect related primary and secondary users of the CMST, specifically chosen stakeholders, or a combination, or all internal stakeholders.		
TR	Not demonstrated	Stakeholder analysis	PU / SU
<b>ADR5</b>	Only users with updating privileges can edit or delete that project aspects.		
TR	Demonstrated	Stakeholder evaluations	PU / SU
<b>ADR6</b>	Users can send a request to the creator or latest editor to ask for a project aspect update or send a note with a question or suggestion.		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>ADR7</b>	User can go to the project aspect in the project overview via a project aspect specific link in the project aspect list.		
TR	Demonstrated	Common sense	PU / SU
<b>ADR8</b>	The CMST automatically registers who was responsible for the creation or latest edit of a project aspect and when this was done (called project aspect history).		
TR	Not demonstrated	Project analysis	PU / SU
<b>ADR9</b>	The CMST automatically adds the information about the creation or latest edit of a project aspect information (called project aspect history).		
TR	Demonstrated	Project analysis	PU / SU
<b>ADR10</b>	Deleted project aspects are saved and can be found back in the project aspect history.		
FR	Not demonstrated	Market research	PU / SU
<b>ADR11</b>	Deleted project aspects can be restored from the project aspect history.		
FR	Not demonstrated	Market research	PU / SU



<b>ADR12</b>	The CMST will ask users who created or edited a project aspect if they want to add a note when saving the project aspect, which will be included to the project aspect history.		
FR	demonstrated	Project analysis	PU / SU
<b>ADR13</b>	The CMST creates a project aspect history list for each project aspect with information about the creation of that project aspect and edits that were done.		
FR	Demonstrated	Project analysis	PU / SU
<b>ADR14</b>	Users can go to the history list of a project aspect via a project aspect specific link in the project aspect list.		
FR	Demonstrated	Common sense	PU / SU
<b>ADR15</b>	Users can filter project aspects based on their preferences (e.g. only complete, date, related stakeholders, etc.).		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>ADR16</b>	When users search for a specific project aspect in the general search feature of the CMST, they will be redirected to that project aspect in the project aspect list.		
FR	Not demonstrated	Common sense	PU / SU
<b>ADR17</b>	The CMST has a standard template for creating a new project aspect with specific questions that the user is asked to fill in, this includes: aspect (node), category, description, parent node(s), child node(s), related requirement(s), related stakeholder(s), author(s) and updating privileges.		
TR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>ADR18</b>	The user has to fill in the aspect name and category in order to be able to create the project aspect (boundary conditions).		
TR	Not demonstrated	Common sense	PU / SU
<b>ADR19</b>	The CMST allows the user to search for a specific project aspect answer, by showing the related options already available in the CMST. For example, searching for a related stakeholder, the CMST shows all project stakeholders.		
FR	Not demonstrated	Common sense	PU / SU
<b>ADR20</b>	When adding or editing a project aspect, users can ask for a proofread and confirmation of a project aspect from a chosen stakeholder via the CMST.		
FR	Demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>ADR21</b>	User cannot edit a project aspect at the same time.		
TR	Not demonstrated	Common sense	PU / SU
<b>ADR22</b>	Project aspects cannot have the same name.		
TR	Not demonstrated	Common sense	PU / SU
<b>ADR23</b>	Users can create a new decision when relating a decision a requirement.		
FR	Demonstrated	Stakeholder evaluations	PU / SU
<b>ADR24</b>	Users can create a new requirement when relating a requirement to a project.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>ADR25</b>	Main project aspects can only be created (and edited) by the project management team.		
TR	Not demonstrated	Project analysis	PU / SU
<b>ADR26</b>	It is possible that a project aspect has no related requirements, decisions or stakeholders (yet), this can be indicated when creating or editing a project aspect.		
TR	Demonstrated	Project evaluations	PU / SU
<b>ADR27</b>	The project aspect list can be reached from the menu.		
TR	Demonstrated	Common sense	PU / SU
<b>ADR28</b>	The related decisions of a requirement are directly filled in by the CMST when adding a related requirement to the main project aspect.		
FR	Not demonstrated	IDE background	PU / SU



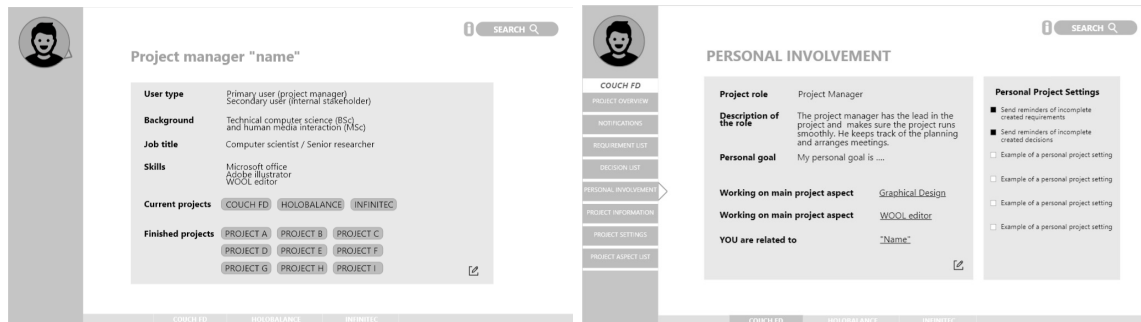
<b>ADR29</b>	The related requirements of a decision are directly filled in by the CMST when adding a related decision to the main project aspect.		
FR	Not demonstrated	IDE background	PU / SU



### Requirements related to the Notifications

<b>NR1</b>	The CMST automatically registers information updates and sends a notification to the related stakeholders.		
FR	demonstrated	Common sense, stakeholder evaluations	PU / SU
<b>NR2</b>	The CMST can send reminders to the author(s) about unfinished project aspect information, requirement information, decisions information, profile information or project information, if this setting is enabled.		
FR	Not demonstrated	Common sense, stakeholder evaluations	PU / SU
<b>NR3</b>	Requests that were send to a user appear as notifications.		
FR	Not demonstrated	Common sense, stakeholder evaluations	PU / SU
<b>NR4</b>	Requirement approvals appear as notifications, if this setting is enabled.		
FR	Not demonstrated	Common sense, stakeholder evaluations	PU / SU
<b>NR5</b>	Requirement changes that need new approval are pointed out to the relevant stakeholders, if this setting is enable.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>NR6</b>	Notifications settings can be managed in the personal settings.		
TR	Demonstrated	Stakeholder evaluations	PU / SU
<b>NR7</b>	The project management team can determine notification settings for the internal stakeholders.		
TR	Not demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>NR8</b>	Users can start a chat about a certain notification topic.		
FR	Demonstrated	Stakeholder analysis	PU / SU
<b>NR9</b>	A chat about a certain topic is saved and can be read back.		
TR	Not demonstrated	Stakeholder analysis	PU / SU
<b>NR10</b>	When a chat is started about a topic that was chatted about before, that chat will reopen.		
FR	Demonstrated	Stakeholder analysis	PU / SU
<b>NR11</b>	Users can organise a notification (label, discard, etc.).		
FR	Not demonstrated	Stakeholder analysis	PU / SU
<b>NR12</b>	Notifications mention the topic, and who did what, or what the user should do.		
TR	Demonstrated	Stakeholder analysis	PU / SU
<b>NR13</b>	Notifications are divided in clear categories.		
TR	Not demonstrated	Stakeholder analysis	PU / SU

<b>NR14</b>	Notification can be filtered, e.g. date, stakeholder, topic, etcetera.		
FR	Not demonstrated	Stakeholder analysis	PU / SU
<b>NR15</b>	The CMST notifies the user about new notifications.		
FR	Not demonstrated	Project analysis, stakeholder analysis	PU / SU



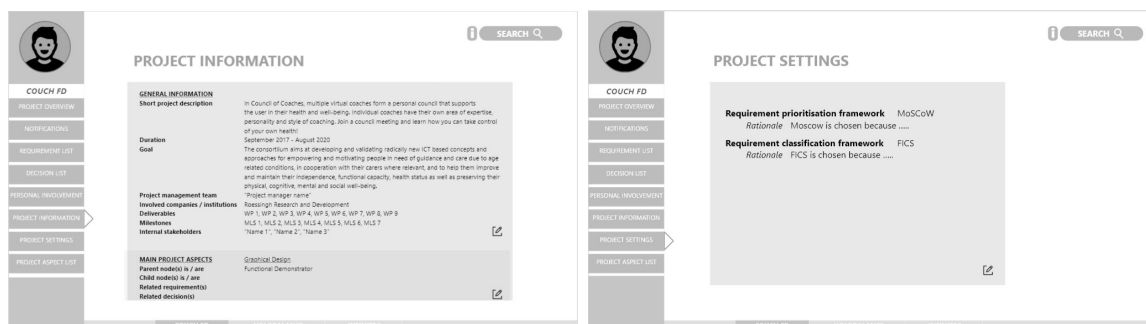
### Requirements related to the User Profile

<b>UPR1</b>	Users can only edit their own profile.		
TR	Not demonstrated	Common sense	PU / SU
<b>UPR2</b>	The user profile includes information about the user that is relevant to being a project stakeholder.		
TR	Demonstrated	Project analysis	PU / SU
<b>UPR3</b>	The project management team defines the “type of user” (and only the project management team can change it).		
TR	Not demonstrated	Common sense, project analysis	PU / SU
<b>UPR4</b>	The “types of users” are primary users (the project management team), secondary users (the internal stakeholders involved in the project), tertiary users (external stakeholders).		
TR	Not demonstrated	Project analysis	PU / SU
<b>UPR5</b>	User can go to their own “node” in the project overview via a specific link in the project on their user profile or click on “project overview” in the menu.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>UPR6</b>	The user profile can be reached from profile picture in the menu.		
TR	Demonstrated	Common sense	PU / SU
<b>UPR7</b>	Users can add direct personal relations with other users, provided that they do not mean a relation via a certain project aspect.		
FR	Not demonstrated	Stakeholder interviews	PU / SU

### Requirements related to the User’s personal project Involvement

<b>UIR1</b>	The personal involvement information includes information about the user’s relation to the project.		
TR	Demonstrated	Project analysis	PU / SU
<b>UIR2</b>	The personal project settings are included (and can be edited) in the personal involvement information.		
TR	Not demonstrated	Stakeholder evaluations	PU / SU
<b>UIR3</b>	Personal project settings improve the user’s preferred usability of the CMST, including preferences about notifications and reminders.		
FR	Not demonstrated	Stakeholder evaluations	PU / SU

<b>UIR4</b>	When the user adds a relation to a new main project aspect he or she is working on, they can choose from the main project aspects already included in the CMST (by the project management team).		
FR	Not demonstrated	Project analysis, stakeholder interviews, stakeholder evaluation	PU / SU
<b>UIR5</b>	The personal involvement information can be reached from the menu.		
FR	Demonstrated	Common sense	PU / SU



### Requirements related to the Project Information

<b>PIR1</b>	Only the project management team can add or edit the project information.		
TR	Not demonstrated	Project analysis	PU
<b>PIR2</b>	The project information can be reached from the menu.		
FR	Demonstrated	Common sense	PU / SU
<b>PIR3</b>	General project information can be added to the project information, e.g. a description, duration, goal, project management team members, involved companies / institutions, deliverables, milestones and internal stakeholders.		
TR	Demonstrated	Project analysis	PU
<b>PIR4</b>	The main project aspects can be created in the project information, but only by the project management team.		
FR	Not demonstrated	Project analysis	PU
<b>PIR5</b>	The main project aspect information includes: parent node(s), child node(s), related requirement(s), related decision(s), related stakeholder(s).		
TR	Demonstrated	Project analysis	PU
<b>PIR6</b>	The related decisions of a requirement are directly filled in by the CMST when adding a related requirement to the main project aspect.		
FR	Not demonstrated	Common sense	PU
<b>PIR7</b>	The related requirements of a decision are directly filled in by the CMST when adding a related decision to the main project aspect.		
FR	Not demonstrated	Common sense	PU
<b>PIR8</b>	The user can choose N/A when a project aspect does not have a parent node, child node, related requirement, related decision or related stakeholder.		
FR	Demonstrated	Project analysis	PU / SU
<b>PIR9</b>	The project categories can be created on the project information, but only by the project management team.		
TR	Demonstrated	Project analysis	PU
<b>PIR10</b>	The project category information includes: category name and a description.		
TR	Demonstrated	Project analysis	PU

<b>PIR11</b>	Only the project management team is allowed to send invitations to stakeholders with CMST access.		
TR	Not demonstrated	Project analysis	PU
<b>PIR12</b>	Only the project management team can define the access for each user category.		
TR	Not demonstrated	Project analysis	PU
<b>PIR13</b>	Only the project management team can define the stakeholder's user category.		
TR	Not demonstrated	Project analysis	PU
<b>PIR14</b>	Information about user access is only available for the project management team.		
TR	Not demonstrated	Project analysis	PU

*The following requirements are all requirements of the PMST*

<b>PIR15 PMST</b>	The PMST saves all methods, project categories and main project aspects of all (previous) projects and presents them to the project management team when a new project is created and the team has to make similar decisions.		
FR	Not demonstrated	Background theories	PU
<b>PIR16 PMST</b>	The PMST provides the option to read the project's evaluation when information from previous projects is requested (see NRR23).		
FR	Not demonstrated	Background theories	PU
<b>PIR17 PMST</b>	The PMST stimulates the project management team to set a goal for the project management strategy.		
FR	Not demonstrated	Background theories	PU
<b>PIR18 PMST</b>	The PMST stimulates the project management team to evaluate the project management strategy at the end of the project.		
FR	Demonstrated	Background theories	SU
<b>PIR19 PMST</b>	The PMST stimulates the project management team to evaluate the project outcomes at the end of the project.		
FR	Not demonstrated	Background theories	PU
<b>PIR20 PMST</b>	The PMST can send the conclusions of the project management evaluation to the internal stakeholders.		
FR	Demonstrated	Background theories	PU/SU
<b>PIR21 PMST</b>	The PMST can send the conclusions of the project outcomes to the internal stakeholders.		
FR	Not demonstrated	Background theories	PU/SU
<b>PIR22 PMST</b>	The PMST can send a project management evaluation survey to the internal stakeholders.		
FR	Demonstrated	Background theories	PU/SU
<b>PIR23 PMST</b>	The PMST allows the project management team to create a survey about the project management.		
FR	Not demonstrated	Background theories	PU
<b>PIR24 PMST</b>	The PMST allows the project management team to create a survey about the project outcomes.		
FR	Not demonstrated	Background theories	PU

*Requirements related to the Project Settings*

<b>PSR1</b>	Only the project management team can add or edit project settings.		
TR	Not demonstrated	Project analysis, stakeholder evaluations	PU / SU
<b>PSR2</b>	The project settings can be reached from the menu.		
FR	Demonstrated	Common sense	PU / SU
<b>PSR3 PMST</b>	The PMST saves all settings of all (previous) projects and presents them to the project management team when a new project is created and the team has to make similar decisions.		
FR	Not demonstrated	Background theories	PU

