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Designing an efficient Project Portfolio Management tool

Creating a Project Portfolio Management tool using interaction design and the Asp.Net framework

Master's thesis in Interaction Design and Technologies

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Abstract

In this thesis we walk through the steps of creating a modern web design for a tool aiding project portfolio management and the resource management that follows. This is done by using interaction design methodology which helps finding relevant information in the context of where the tool will be used. The outcome of the research is used as a basis for the design and will affect design choices and functionality in the final prototype.

In the beginning theory will be gathered and researched to give a deeper view into the subject of project portfolio management and its underlying definitions. The theory will be used in interviews conducted at companies using the processes of project portfolio management, to find better questions regarding needs in the tools they use and to better understand the findings of the interviews.

The interviews will be analysed and used in the following prototyping phase where the design and its functionalities will be iterated on. These are later implemented in the final prototype which then is evaluated and based on the results of the evaluation it will be argued for if the prototype is a step in the right direction of creating efficient web tools for project portfolio management.

Glossary

AJAX – Asynchronous JavaScript and XML

MVC – Model View Controller

PPM – Project Portfolio Management

RM – Resource Management

R&D – Research and Development

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1. Introduction

As the market grows more competitive, companies are pressured to make their employees work as effective as possible in order to get ahead of the competition. This is what have made resource management so important for companies at the peak of competition. Resource management can be seen as a big process of how to get as much value from an employee as possible. It can sound very simple, however there is a big number of aspects to consider in resource management such as just the well-being of the employees. It is unfortunately not obvious to everyone that things like an employee's well-being and engagement are extremely important to build a healthy bond between an employee and their workplace. However, a study by Gallup, a public opinion measurement website, show us that these two are the keys for employee performance. The study also highlights that only 32% of the workers in the U.S. actually are engaged in their place of work, which is easily missed when not using a structure such as resource management (Gallup, 2017).

A tool is necessary in terms of overviewing time and work which an employee spends on specific projects as well as planning future projects and the use of resources on the projects. The best Project Portfolio Management (PPM) tools offer interfaces focusing user-friendliness and functionality as well as comforting analytics (LeanKit, 2017). There are hundreds of different software dealing with the problematics of PPM, each with a different approach to scheduling and algorithms for planning resources with ease (G2 Crowd, 2017). This also brings the question of what actually differs in these tools, which will be answered further into the thesis.

The PPM tool developed in this thesis project will be written in ASP.NET MVC with support from the Microsoft Azure cloud solutions. ASP.NET is Microsoft's open source framework for building web application development (The Official Microsoft ASP.NET Site, 2017) with a huge support from their Integrated Development Environment (IDE) Visual Studio (Visual Studio, 2017) and from the community, making it easy and fast for the prototyping.

By structuring the thesis from the four basic processes in Interaction Design described by Helen Sharp et al. (2007) a tool can be forged from the basics of resource management and

apply it with the input from users who deal with these tools on daily basis. Because of the user-focused processes such as interviews and contextual inquiries hidden patterns can be captured which the users are unaware of.

In this thesis the studies will be conducted very closely with some people that use these tools on a daily basis, this allows for the use of the design process called contextual design. Contextual design uses the interaction design methods that are used in the context of the research, for example, interviewing users at their workplace where they use related data for the interview.

Contextual design is a design process developed by Hugh Beyer and Karen Holtzblatt which contributes to innovative design by making the researcher dig deep into in-depth field research (Beyer and Holtzblatt, 1999). This is a structured design process within the field of interaction design which has a focus on research from the aspect of the user's context, which is used throughout this thesis.

1.1. Background

Many research and development (R&D) organizations have implemented IT systems to support resource management and planning. However, there are many organizations that still struggle to get a complete view of future resource utilization and proper decision support to know when there are resources available for new projects. Since resource planning is a vital part of controlling your project pipeline, poor resource management will deteriorate the complete R&D portfolio management.

There are many existing IT systems targeting Resource Management, but these tools are often part of a larger IT platform where the resource management functionality is far too complex and detailed. The administrative burden to handle the data is too high, and this makes stake holders like resource owners, project managers, portfolio and program managers, struggle to keep the information up to date.

The key to get resource management working is to find the optimal balance where the complexity and time needed to manage the data is kept to a minimum while still providing

enough detailed data to support proper decision making and reporting. This should be achievable by a very clean, efficient and user friendly interface.

Some of the most popular tools used today are distributed by Microsoft, Clarity Software and SAP. These all have one thing in common and that is the complexity, the time needed to be invested becomes too great and the efficiency falters.

1.2. Project goals

The objectives of this thesis is to find the basics of resource management tool functionality and applying the process of contextual design with the use of interaction design methods. Gathering data for an implementation of a tool deployed in the cloud will be taking place and the goal will be to have it fully functional featuring all key functions from the generated design. The tool should be a web application using latest technology when maintaining the core functionality.

Following the goals of the project the following research question is brought into light:

- **What are the design requirements for an efficient PPM tool that is used for a varying project portfolios?**

This questions will be answered with the information gathered throughout the research process and summarized in chapter 7 called Result.

1.3. Thesis scope

The definition of a PPM tool in this thesis will be a software supporting only the process of managing resources and a portfolio of projects.

The prototype will focus on resource management in the meaning of planning man hours. In a broader meaning, resources management also includes planning of all other project costs, but this is not in the primary scope.

The prototype will focus on the interface experienced by active users like Project Managers and Resource Owners. Administrative interfaces for managing master data and system configurations are not in primary scope.

The analysis, interviews and prototype work will focus on the central concepts of Resource Management, and not Project Management in general. Many existing systems covers a wide range of project management functionality, which is not the intention with the prototype.

1.4. Thesis outline

The aim of the *first chapter* in this thesis is to introduce and create curiosity about the subject. *The second chapter* is where the related theory is located. This is where the reader can read up on information related to the context of the thesis. *The third chapter* describes the methodology behind the research, every process will be thoroughly described. *The fourth chapter* outlines the plan and schedule that was being used throughout the research and explains changes together with special cases. *The fifth chapter* describes the process of actually doing the research, starting at the very beginning of the project where the literature study opens the chapter. *The sixth chapter* describes the web tool design and functionality created from the resulting guidelines of this thesis. *The seventh chapter* narrates the outcomes of the research. *The eight chapter* is used to discuss different aspects of the thesis. *The ninth chapter* concludes the thesis.

1.5. Ethics

Confidential information is handled with discretion and there is no reporting about names, information that can be tied with businesses or other harmful data. The thesis focus lies on researching an interface for management of project portfolios and nothing else. However, the interviews and contextual inquiries have been sound recorded if the interviewee has agreed on it which will produce a privacy issue. This is handled by me signing a confidentiality document.

Two major companies having different techniques when dealing with resource management have been giving input in forms of interviews and contextual inquiries. However, they wish to be anonymous in the thesis and therefore they will be referred to as Company A and Company B.

2. Theory

Resource management is a widespread term which can be applied to many contexts. For example, human resource management, which focuses on scheduling workers and planning their time to efficiently fit them into ongoing projects as well as making sure the staff are up to date on techniques and work related knowledge (Whatishumanresource.com, 2017). The term human resources management is often used with product line projects, also known as a group of products collected under the same brand (Staff, 2017).

Managing resources is what this thesis is focusing on but also taking a bigger perspective where portfolios of projects are considered in the calculation, also known as Project Portfolio Management (Levine, 2005).

2.1. Project Portfolio Management (PPM)

Whilst dealing with different projects within a company PPM is combining different business strategies which, applied onto a project pipeline, will help sort out bad projects and create space for better projects (Levine, 2005). One can simply from the name conclude that Project Portfolio Management is defined by grouping projects. Archer and Ghasemzadeh describes it even more elaborately, adding to it that it is also the carrying out of the portfolio under the management of a company or business (Archer and Ghasemzadeh, 1999).

2.2. Successful portfolios

A successful portfolio of projects is when each and every project in the portfolio can create value independently from other projects (Kodukula, 2014). There is a need of sorting out bad projects which is done by prioritization. In the means of prioritization there must be some value created from a project. If there is no value generated then there is nothing to compare a project against the other projects in a portfolio (Kodukula, 2014). A project might be a support project, creating value by being useful for other projects, however then it should be included in the other projects by creating a bigger project with sub-projects in it (Kodukula, 2014).

In an article by LaBrosse (2010), she describes best practices with the manager first needing to gather an inventory of all the projects and resources, and fill them with as many details as possible. The projects are then prioritized and from the prioritization scored so that the most necessary projects get their resources. The score together with a cost versus benefit ratio is used to create an optimized project-portfolio mix (LaBrosse, 2010).

2.3. Resource planning

It is not uncommon that a portfolio contains more projects than there are available resources (Blichfeldt and Eskerod, 2008). However, PPM is a major factor in harmonizing resources and efficiently planning these into projects. It provides structure and oversight of strategies, processes, resources and projects (Levine, 2005). In terms of resource planning, PPM's needs to have the skills most important to a project in consideration before quantity (Kodukula, 2014).

Planning the resources of a portfolio is most commonly made in waves (Kodukula, 2014). Iterating the process until a satisfactory result is in place. This is most often called Rolling Wave Planning, and is effectively used at a higher view such as the portfolio level. Basically you plan the most critical resources for the project in full-time equivalents (FTE) which stands for a ratio of workload per quarter of a year, a whole FTE unit (1) means that all working hours are spent on that project. A quarter of a year represents one wave in Rolling Wave Planning (Kodukula, 2014).

2.4. Supporting PPM software

There are many different types of software supporting the processes of PPM, however finding the right ones, the ones that responds to a specific organization's demands is eloquently described by Mark Price Perry (2011) as "putting together the pieces of a complex jigsaw puzzle, blindfolded" (Perry M, 2011, p.235).

2.4.1. Project Portfolio Management Tools

MS Project, Trello and Atlassian JIRA are three of the top five most used PPM tools today (G2 Crowd, 2017) which are described shortly below.

MS Project is a tool made by Microsoft which shares a similar user interface and several features in common with MS Excel, a co-existing software. The application is an advanced tool with a focus on creating tables and using these to structure the projects and resources. MS Project is not an application developed for the web, however, Microsoft has evolved the product into an online web based product that is called Project Online Professional (Products.office.com, 2017). The tool was first released in 1984 and has been improved upon since, which makes it one of the oldest project management tools out there. The tool is unfortunately very maintenance heavy which means that the company using it has to put a lot of time into the tool to update the documents and to create content. Specific tasks and dates are hard to derive since this demands the time and effort put into the tool from both administrators and the managers who updates the details when something happens. Many companies usually skip this tool because of the high time demand.
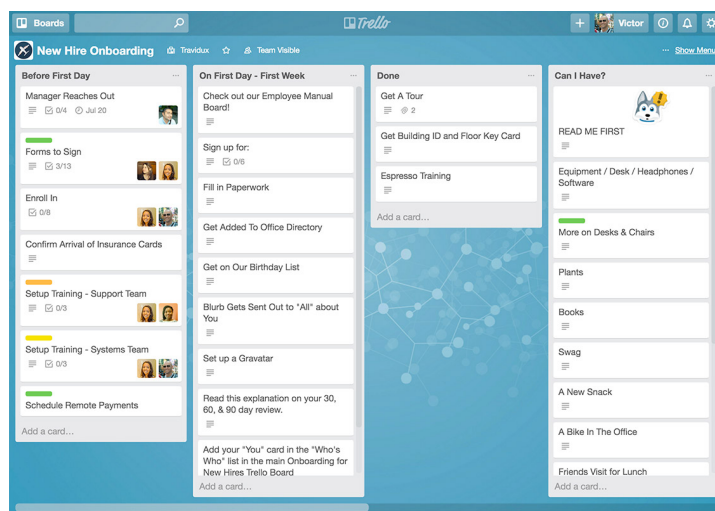
Image 2.1: Trello

Trello is a web based platform focusing on managing projects, portfolios and micromanaging tasks. Trello is incredibly easy to access since they even have an app where you can view everything you have done on the website. It hosts many features and delivers a functional style in a Kanban manner, which is a graphic way of showing content and comes very close to a digital billboard. Trello is illustrated in Image 2.1. The downside to Trello is that it does not support some key features such as a calendar.

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Atlassian JIRA is a web based PPM tool which focuses on being incredibly easily understood and visually appealing. They mix the use of Kanban style with issue tracking for agile projects, git management support and a lot of small extra features focused around helping software development. This is a perfect solution for small agile projects where the focus lies in developing software. Bigger companies often have varying projects and the software development is not always priority in which cases there are other software more adjusted for their needs.

3. Methodology

The aim of this chapter is to describe the methods used in the process of the research in this thesis.

3.1. Contextual Design

A design process developed by Hugh Beyer and Karen Holtzblatt which contributes to innovative design by helping the researcher dig deep into in-depth field research (Beyer and Holtzblatt, 1999). There are three basic steps in contextual design which are field research, consolidation and ideation, and design together with validation. These are used as a basis for the prototyping phase and can be applied for almost any technical product (Beyer and Holtzblatt, 1999).

3.1.1. Interviews & Contextual inquiries

A contextual inquiry is conducted with the interviewee either before or after the interview, most preferably before. This is to increase the knowledge around the tool and also because of letting the interviewer get a view of how the current tools are used. The contextual inquiries are also conducted to be able to ask the interviewee about reasons behind usage and being able to understand how they think when they are using the tools. Basically finding needs. The contextual inquiries lets the interviewee show how they work with the tool while another person stands behind or somehow studies the user while they are performing ordinary work, hopefully showing some habits they themselves are unaware of.

The interviews are focusing on finding interesting input on the PPM tool which the interviewee is using on a daily basis. The interviewed users will mostly consist of project managers and resource managers handling one or more cost centres, which can be described as divisions that resources work under.

It is important to note that humans do not have perfect memory and they tend to create memories from how they think the experience might have been (The Interaction Design Foundation, 2017).

3.1.1.1. Methods

To be able to gather as much data as possible during the interviews they will be recorded by sound if allowed by the interviewee, this will make it easier not to disturb the flow of the discussion and instead let the interviewer focus on probing around the questions. The interviews will be held at the workplace or in another contextual location to both enable the interviewee to relate to objects, events or other matters that the context might make them highlight.

During the contextual inquiry the observer shall let the user work without being interrupted to obtain an experience as close to the reality as possible.

3.1.1.2. Interview preparations

Before the interviews a structure is prepared and a list of questions will be iteratively constructed (See Appendix A).

3.1.2. Data consolidation & Ideation

Data collected from the interviews will be analysed and information about the fundamentals of a PPM tool will be gathered in this part of the contextual design. This step in the big process of contextual design can be seen as a bridge between information and design, the big step of understanding context. A common method to use in this analytical phase is to make an Affinity diagram with the help of post its where key information is grouped from the data gathered during earlier stages. This will reveal problems and features that are either wanted or unwanted.

The ideation phase will be one of the most important parts where using methods like brainstorming using post its will find many features and important design choices for the product. After a brainstorming session it is wise to use the KJ-method to narrow all the ideas down to the best ones. These parts are iterated through until a satisfactory result is gained.

It is important to note that this is done in a one-man team which makes it harder to discuss outcomes and only one person's opinions on the groupings will be gained.

3.1.2.1. Method

An affinity diagram is approached because of the many inputs from the interviews. It is necessary to group these and make the data understandable. The affinity diagram will show where the focus needs to lie when designing the PPM tool.

3.1.3. Design & validation

The design will be prototyped from sketching to actual development using C# in a Microsoft Visual studio environment. The framework will be ASP.NET Core version 1.1, which is the latest in the moment of writing.

The iterative outcomes will be conducted by remote testing with supervisors until an acceptable design has been produced. The prototype will be given a month of coding before a test will be performed to see if the design has become more efficient than the current tools used by Company A. This is thought of as a necessity because the development phase will also be an iteration and from prototyping in this manner functionality is thought to come forward which was not found in earlier stages.

The evaluation will be approached using Summative Usability Testing which is an empirical study most commonly used to benchmark and to measure how well an application, for example, does compared to another application (Usabilitybok.org, 2017). Summative Usability Testing will be used to evaluate how well the new design performs in comparison to the current tools used in Company A. The evaluation will be built on top of some hypothesises and will be structured by first letting a tester conduct a number of use cases. After the use cases have been done or a set time limit has been reached, there will be an interview which elaborates on the design and outcome of the prototype in comparison to the other tool it is compared to.

4. Planning

The schedule was created during the proposition phase of the thesis. Here changes are described and possible causes to delays.

4.1.Changes to the plans

The biggest change of dates was the interviews. There were however some other impacts on the planning as well, such as holidays which were not taken into account in the beginning.

4.2.Interviews

Unfortunately, the last interviews were conducted a lot later than anticipated and therefore the design phase was pushed into a later time. The last interview was planned to take place in February, however things don't always go as planned and it was instead conducted in late mars.

4.3.Data consolidation

The data consolidation was started after the first interview but because the interviews got very spread timewise it mostly got pushed a month forward, starting in April instead of late February.

4.4.Prototype

The prototype only had about two weeks instead of two months, which was very unfortunate. However, one cannot anticipate everything, there are always unknown events that is impossible to see from the beginning. Impacting on the prototype coding was also that it was written on a virtual machine that was running on a server which made it impossible to be writing without an internet connection, fortunately this was only an issue while on the train to Malmö and otherwise places with internet connection were always possible to find.

5. Research process

This chapter elaborates on the process of the research and describes all the steps along the way from the beginning of the research to the final prototype.

5.1. Literature study

To understand the concept of a project portfolio management tool it would be wise to first scope into project portfolio management. Project portfolio management includes resource management on top of project management of a portfolio of projets. Resource management focuses on planning workers and scheduling their time to effectively fit them into ongoing projects. Resource management is often used with product line projects.

Project management basically plans resources into projects based on needs, availability and priority. Project portfolio management is project management but with an overview of all projects and resources, with different solutions on how to optimize workload for all resources as well as always having enough resources on each project. It is the most attractive approach to companies having lots of projects on the go at the same time.

There are no writings on efficient design for PPM tools at the time of writing. This makes it harder to find an area to touch in the whole design part of these tools, instead the report will have to touch upon each part of the design functionalities as it is a new ground.

5.2. Interviews

The interviews were conducted at two major companies, they have asked to be anonymous and therefore they will be called Company A and Company B.

There were six interviews and the people consisted of project leaders, resource managers and administrators. The average time of an interview was 44 minutes and 43 seconds.
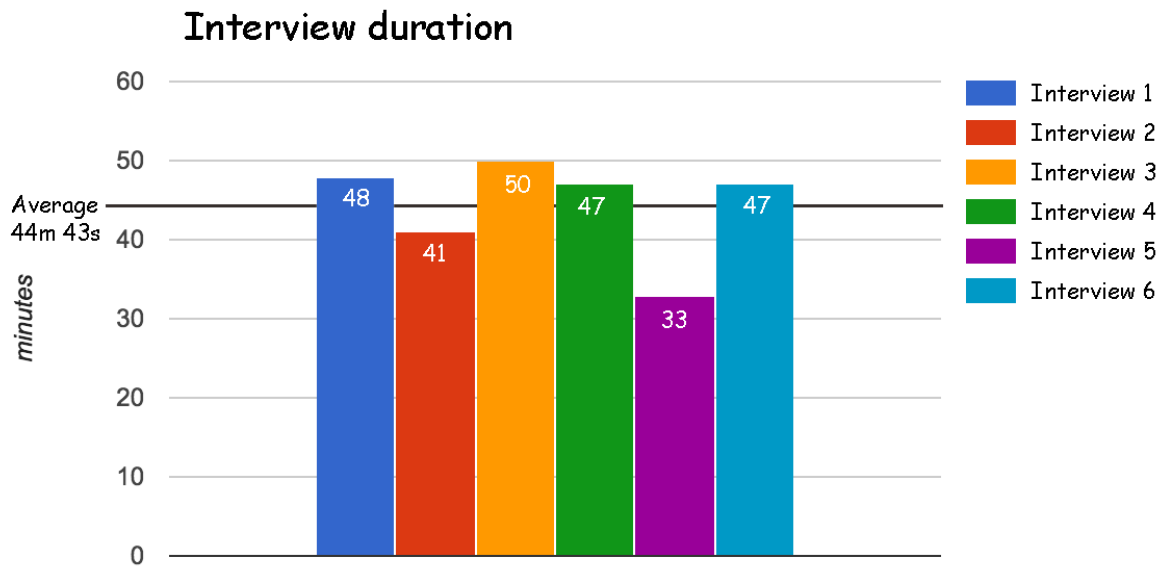
Interview duration

Legend:
- Interview 1
- Interview 2
- Interview 3
- Interview 4
- Interview 5
- Interview 6

Average 44m 43s

Values: 48, 41, 50, 47, 33, 47

Table 5.1 Average time duration for an interview

Every interview was granted permission by the interviewee to be sound recorded. They were analysed afterward and the key quotes or input was listed in a document (See Appendix B) for later use in data consolidation methods.

The interview questions were generally structured accordingly, they are translated from Swedish to English:

- Could you describe how you use your current PPM tool?
- What are the pros of your current PPM tool compared to other tools?
- What are the cons?
- How is the communication conducted between resource manager and project leaders?
- What is the process of adding or creating a new resource in your current PPM tool?
- What is the process of adding or creating a new project in your current PPM tool?
- How many of the functions featured in your tool would you estimate that you use on a normal day?
- What kind of information is extracted from the tool?
- What do you think are the fundamentals of a PPM tool?
- Do you have any thoughts on functions that would be attractive in your current tool?
- Would a web solution be attractive?
- Are there any pros of being able to reach the application from your mobile device?
- How would your dream PPM tool look like?

The questions were thought to improve the overall knowledge of how current workflow was conducted together with finding needs that were obvious to the interviewees but the interviewer was oblivious of. They were also aimed to be a compensation for the lack of contextual inquiries.

5.3. Contextual inquiries

The inquiries were conducted during the interviews and became more of a showcase of the tool than a contextual inquiry. These were supposed

5.4. Data consolidation

All key points extracted from the interviews were summarized onto yellow sticky-notes and points that were too similar to each other were removed. From there all notes were grouped and put under a title summarizing the notes in the group, illustrated in Image 5.1.
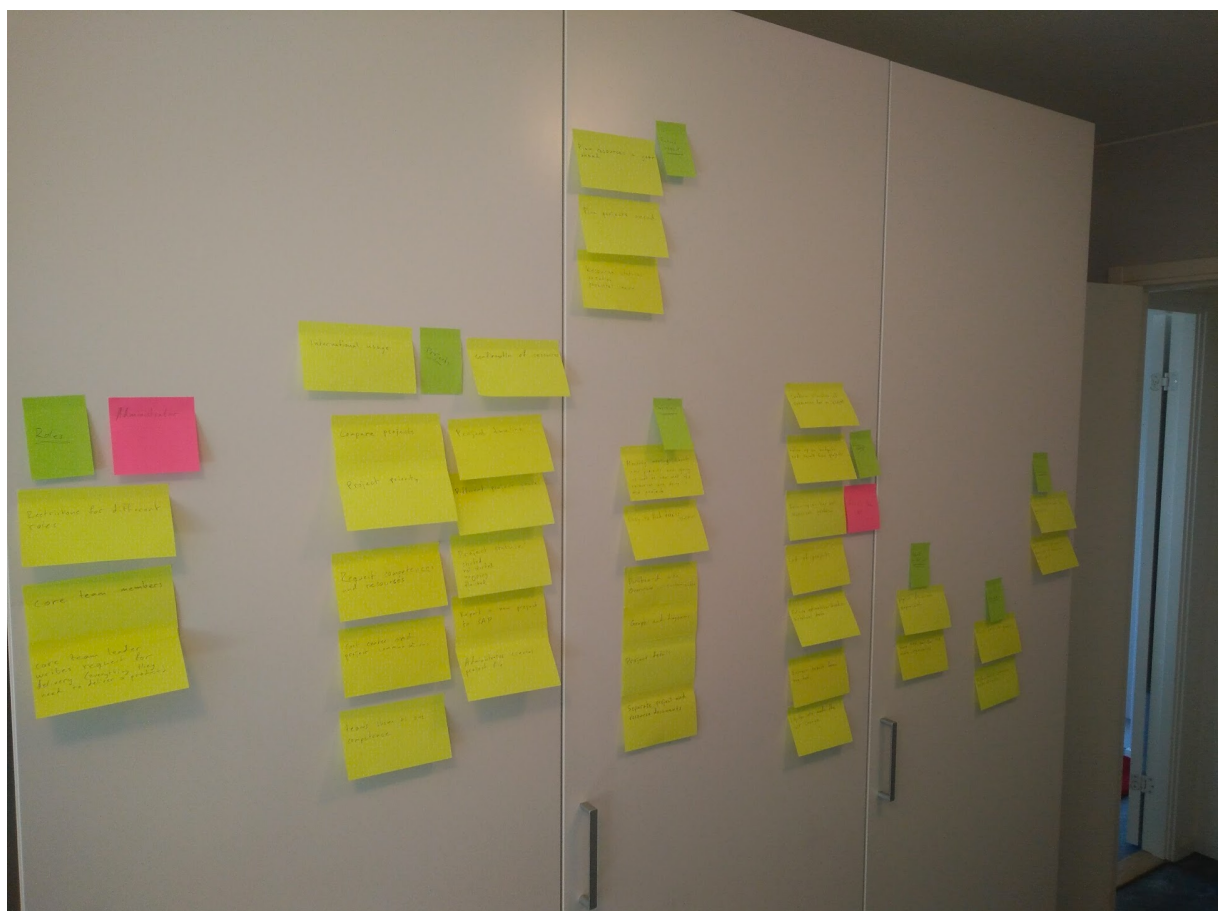

Image 5.1 Affinity diagram post-grouping

The headings are products from using the affinity diagram and below them are the notes that were gained from analysing the interviews illustrated in bullet lists followed with an

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elaborated motivation. These headings are later used and referred to as needs found from the interviews.

5.4.1. Roles

- Administrator
- Core team members
- Restrictions among roles
- Core team members can write requests for resources
- Log who made the last changes
- Teams can be shown as a resource

Something every interviewee agreed should exist in a PPM tool is roles, there needs to be at least two basic roles in a resource management tool and these two are project leader and resource manager. The key concepts can be found from analysing the core of the resource management systems that are used at the two companies that has been interviewed and analysed. Firstly, the projects should be able to borrow or hire resources from a resource manager, which creates a need of a project manager or project owner, sometimes this is the responsibility of the project leader. Secondly, a resource manager who should be able to lend out the resources to projects and should be efficiently having every resource in work. Having three roles instead of two, namely adding an administrator would mean removing a lot of weight from the resource managers and the project leaders.

5.4.2. Projects attributes and details

- Comparison of projects
- Project priorities
- Project timeline
- Project details
- Different project phases
- Project statuses – started, not started, ongoing, finished

The projects should be able to give fast answers to detailed questions so that quick check-ups can be made on exact numbers. This should also include being able to change numbers if needed.

In theory there could be an unlimited number of attributes in a project, therefore you need to be able to find those that matter fast and easy. The reason for using a PPM tool in the first place should be to increase efficiency and save time, which you will not do if you have to search for a needle in a haystack.

5.4.3. Planning

- Plan resources ahead
- Plan resources a year ahead
- Resource statuses – vacancy, sickness, parental leave

Many of the interviews have indicated on a need for planning of both projects and resources. Planning ahead is a must to know how much resources a company needs and to know that every resource will be put to work.

5.4.4. Overview

- Dashboard with overview
- Graphs and diagrams
- Separate documents for projects leaders and resources managers
- Same PPM tool for whole organization
- Filter resources in projects

An overview should be accessible for the managers for monthly check ups, report generation and for meetings where overall data is viewed so that you can easily view the most relevant topics for discussion. To save time a quick overview of the projects and the resources should be made available in form of info graphs. An overview is also necessary in order to compare data.

5.4.5. Outside the tool communications preferred

- Physical discussions emphasized
- Monthly meetings about how projects are going
- Monthly meetings about how well the resources are performing

- International use
- Cost centre and project communicates

The interviewees have shown persistent interest in having physical meet ups between resource managers and project leaders. Reasons have been that they want a connection between the workers so that employees can get to know each other. This is especially good for improving the relations between employees. This does, however, only work when project leaders and resource managers are on the same location, if the two needs to communicate over a longer distance phone or email has been the most common mediation tool. This could be included in the tool, for example by a messaging feature, but the tool should also be limited so that the physical meet ups are still preferred by the project leader and the resource manager. Communications between resource managers and project leaders are occurring physically in the present. In the most basic point of view a project sends a request for a person, with information such as what competence they want and when they need it, this should not take much time to do which it will if the project leaders have to walk away and talk to the resource manager.

5.4.6. History

- Follow up on budgets and results for projects
- Follow up on how good resources perform
- Cost of projects
- Future estimations based on historical data

Even though this was lacking in one of the companies, both showed interest in having a follow up on the projects in terms of feedback on the planned data. There should be indicators of how well the recent month has been taking place. An important aspect of human nature is to be able to learn from one's mistakes. If no feedback is given from historical aspects then there is no room for improvement, the project leaders cannot either give feedback to their team members on how well they have worked or if they need to step up a notch.

5.4.7. Easy to use with SAPs system

- Actuals from SAP
- Report new projects to SAP

- Extract report from the tool

Many organizations use SAP which is a system to manage financials. Projects can report their expenses and employees are expected to report their hours of work. It seems as commonplace to extract and analyse the financials from SAP every month. The resource management tool could have an input which could give feedback to both resources and projects on the results from the last month. This thesis is, however, limited from going into the aspect of handling third-party software and will therefore not go further into the financial scope.

5.4.8. Efficient algorithms

- Much data to process
- Redundant processes need elimination

In a system that uses many resources and has many projects there are bound to be much data. There should be a plan on how to work with bigger datasets if companies want to expand or use the resource tool in more places with more projects without risking crashing your computer because of the amount of data requested.

5.4.9. Confirmations and requests are necessary

- Confirm allocations of resources for a project
- Requests competences and resources
- Notifications if projects don't get all resources they want

There needs to be a clear confirmation that resources have been handed out to projects. The same applies the other way around, the projects should be able to make requests on what competence they want and when. There have been discussions if projects should be able to choose which individual they want instead of competence. People forget what they said when they talked to each other, which is why there needs to be a confirmation and a request somewhere in the tool.

5.5. Ideation

The prototype ideation phase started off by creating paper sketches. From discussing different aspect of these sketches we came to the conclusion of the final product. After a couple of iterations, the fidelity was improved upon and after the paper sketches a tool called Moqups.com (2017) was used to continue the sketches digitally. Photoshop was lastly used in the sketching phase to create prototypes of the tool as close as they could be to a real tool without using code.

5.5.1. First iteration

Moqups.com sketches were made in the first iteration to reflect upon ideas brought by a brainstorming session, one of these can be viewed in Image 5.2. The drawer was thought to add a web-application look. The drawer consisted of mainly three buttons excluding the hamburger icon which expands the drawer and shows descriptive texts. The drawer also had space for shortcuts if a manager felt they wanted a fast way to enter, for example, a specific project.
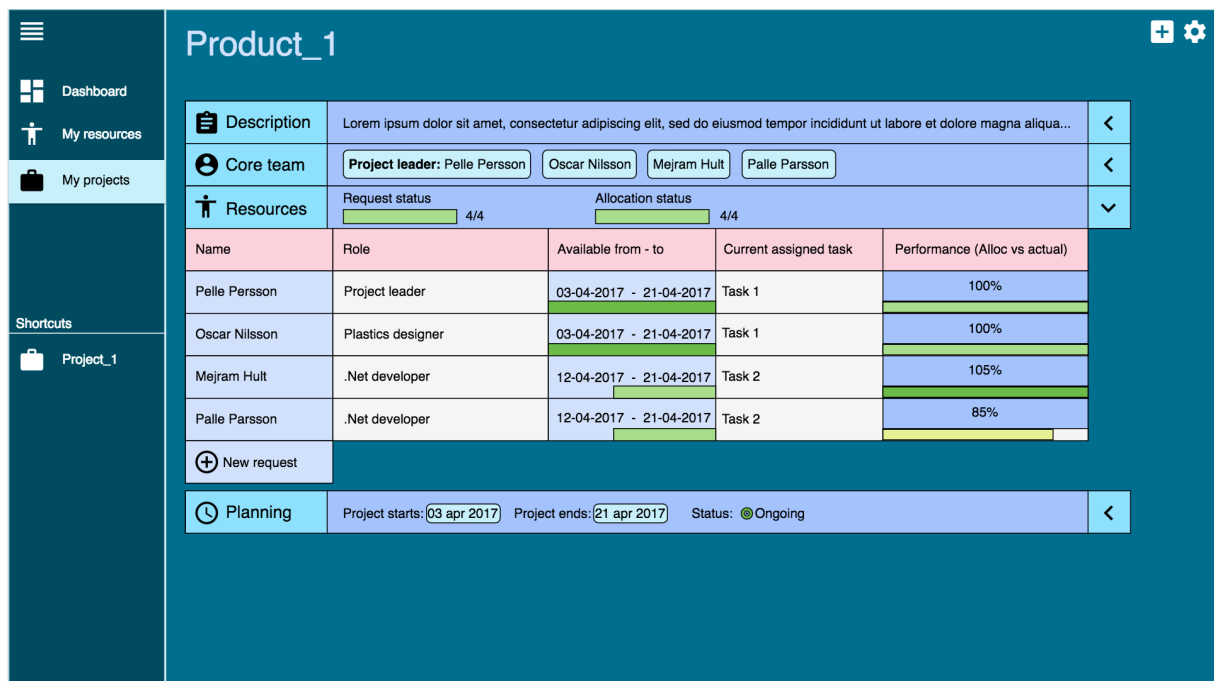

Image 5.2 One of the first sketches of the prototype

The first button, dashboard, was thought to go to a page were the user could create graphs and follow their specified projects or resources. The second icon represents "My resources" and this page is thought to be only accessible by a resource manager. In My resources the

resource manager was first thought to handle all personnel matters such as allocating a resource on to a project or editing resources among other things.

The last icon represents projects, accessible only to project leaders. This tab was intended to let project managers edit their projects in terms of dates, descriptions, and titles. This is also where they went to request and manage resources for the project.

5.5.2. Guidelines gained from the iteration process

The images 5.3 and 5.4 represents the different screens and scenarios that a project leader can come across in the prototype. The images 5.5 and 5.6 are the two different screens that the resource manager can come across.

The iteration process brought a number of basic functionalities. These was important in order to perform basic actions, required by a resource management tool. The most general functionalities are as follows:

- ❖ Roles, header 5.4.1, are a fundamental part of a resource management tool, the roles that are implemented in this tool are project leader and resource manager.
- ❖ Visual illustrations of data allow fast and efficient data management, a product of header 5.4.2, 5.4.4 and 5.4.6. Visual illustration such as charts make it possible to plan ahead more efficiently as well, which is demanded by heading 5.4.3.
- ❖ Header 5.4.5 shows that there is a need to be able to handle much of the communication in a physical manner to boost other aspects of a company such as social interactions between workers, this is thought to be advocated in the design
- ❖ Header 5.4.8 has a smaller focus because of the scope being design of the tool and not the study of efficient algorithms. However, the design is thought to boost the efficiency of the tool and might need complex solutions in terms of algorithms.
- ❖ Header 5.4.9 is implemented in the visual feedback in the design in terms of the charts and smart illustrations in design choices.

5.5.2.1. Project leader tools

In the iteration process of creating project leader functionality for the tool, the following needs were found and are based on the interviews and inquiries from the earlier stages of the research:

❖ An overview is necessary for the project leaders to quickly see were management is needed, derived from heading 5.4.4 and 5.4.2. This is also of great need if the projects are to be compared in any way (heading 5.4.6).

❖ Basic functions such as removing and adding resources to the project are trivial necessities, which also corresponds to heading 5.4.3 and heading 5.4.9.

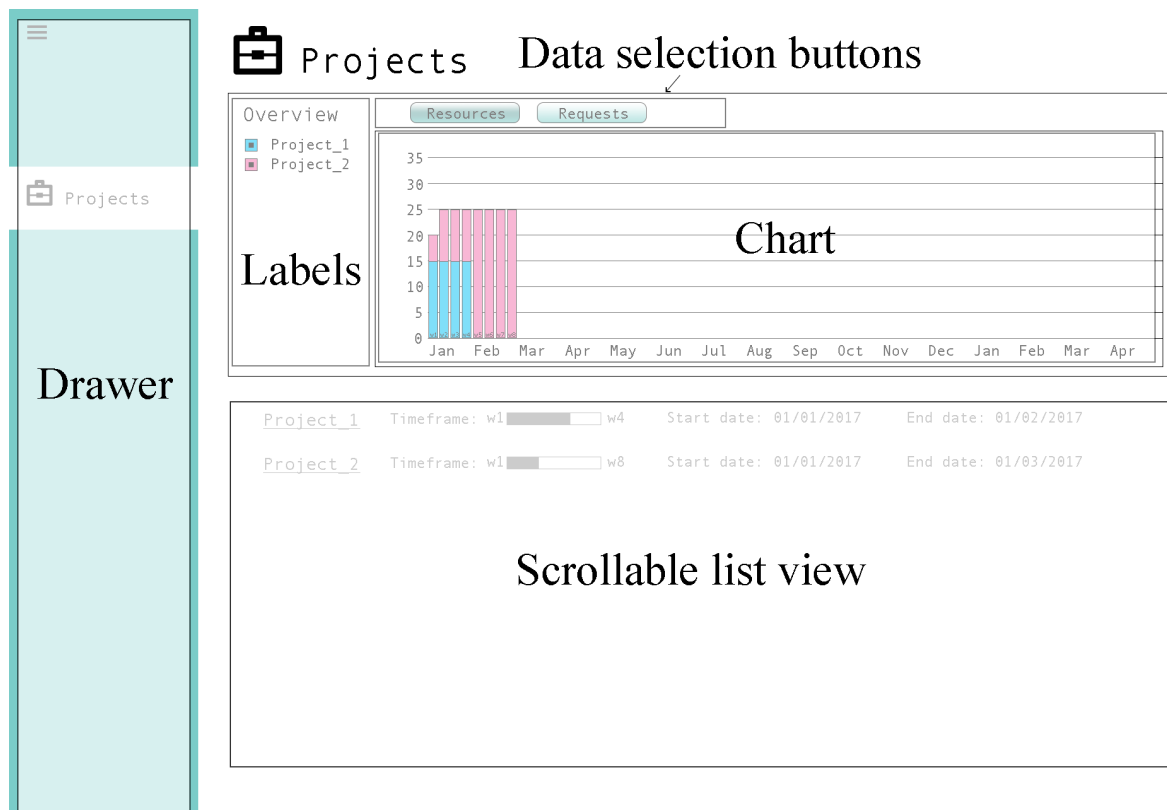❖ Editing project attributes such as start- and end-date, description, title heading 5.4.3.

Image 5.3 The projects overview page

The project overview page, which is only accessible as the role of project leader, is illustrated in image 5.3. The found interaction design patterns that fit their purpose was the following:

➢ A small dashboard with the contents shown in a chart and in the moment of writing the two most critical data to be viewed are resources and request. The chart should contain viewable data of the known differences and in this case the differences will be in how many resources or requests there are in relation to time.

➢ There should be an easy way of selecting a project of the purpose to edit its details. The solution was found to be a scrollable list view, listing all the projects available for the project leader.

➢ The drawer has no other purpose than creating the feeling of a web application. It is however made with a colour coded section pattern in mind.

It was found that a project leader has an average of 8.4 projects for optimal outcome, illustrated in figure 5.1, and therefore no search or filtering was needed in the listing of projects.

	High Performer	Low Performer
PMO Staff (median)	8	6
PM (74% of staff)	5.92	4.44
# of Projects/Yr	50	50
Budget	$375K	$500K
# Projects / PM	8.4	11.3

Figure 5.1 Average Project Management statistics (Pmsolutions.com, 2017)

The detailed content of a project was divided into two categories, details and schedule. The scheduling tab contains all resource functionalities such as requesting more resources or removing resources from the project. The details tab contains project specific editing such as title, project owner, start- and end-date and description.
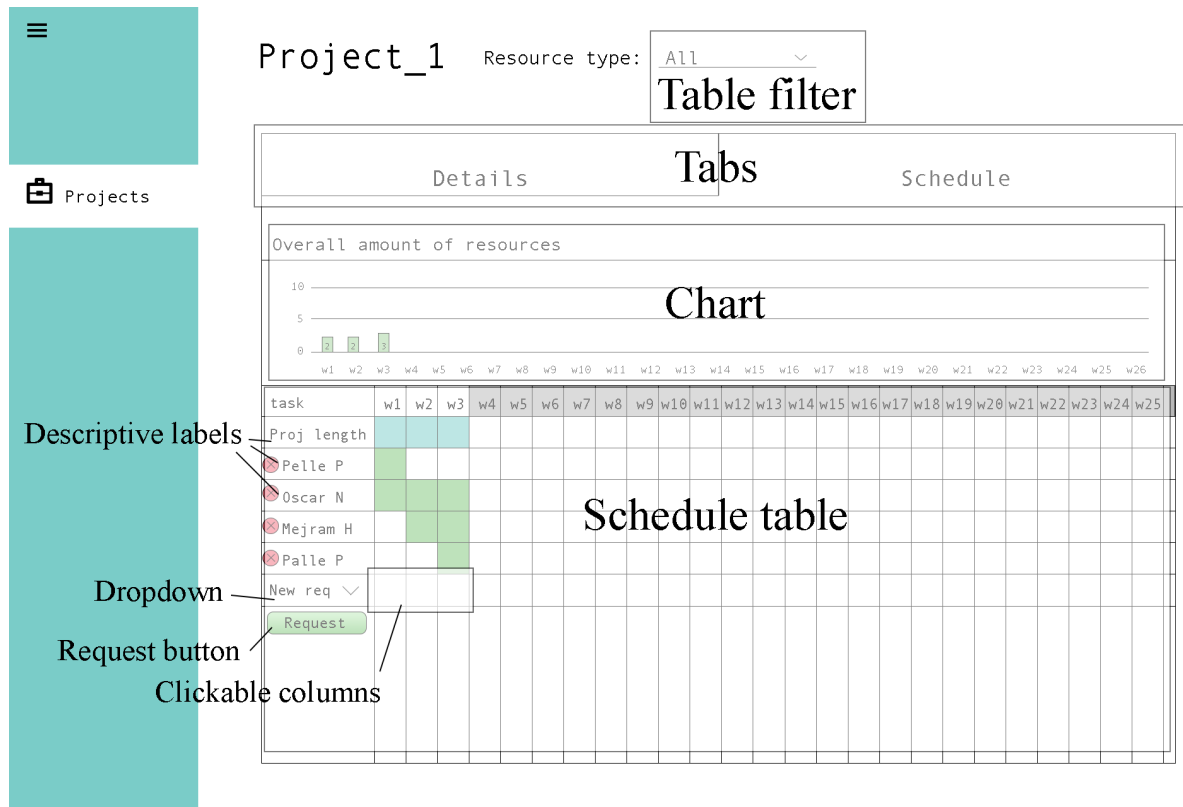
Image 5.4 A project schedule page

The project scheduling page is necessary for overviewing and editing resources in more detail. It was created to make use of the following interaction design patterns, also :

➢ A table filter is necessary if the resource list becomes too long, the filter will be focused on the resources professions.

➢ Two tabs in the top, which allows for navigation between scheduling and details of the project. This is necessary in order to not clutter the content and to let the user have a clear mind map of the navigation.

➢ A chart showing the amount of resources. To visually aid the user when many resources take place in the project and allows the project leader to see when the project is short on staff.

➢ A schedule table, simulating the visuals of excel tables which has been found as the tool used in the resource management from interviews at Company A and Company B. To remove an allocation or request simply press the red cross to the left of the descriptive label for the row.

➢ The scheduling table has been designed to allow for clicking columns when a request is wanted, clicking a column adds the corresponding week to the request. The request profession is selected in the dropdown list to the left of the columns and is created by

clicking the request button. This is thought to follow with a modal box where the user is prompted to select a workload for the request as well.

5.5.2.2. Resource manager tools

The iteration process found the basic functionality for a resource manager as follows:

- ❖ Overview of the resources is a necessity for being able to assess them to projects, argued by heading 5.4.4 and 5.4.3.

- ❖ Heading 5.4.2 tells us that attributes in projects should be easy to view, however it is argued that the resource manager is of equal need to view resource attributes.

- ❖ Trivial functions such as deciding when a resource can be allocated as well as how much workload the resource can be assessed together with the allocation.

- ❖ The resource should also be editable in terms of name, profession, max workload and the allocations that has been put on them.
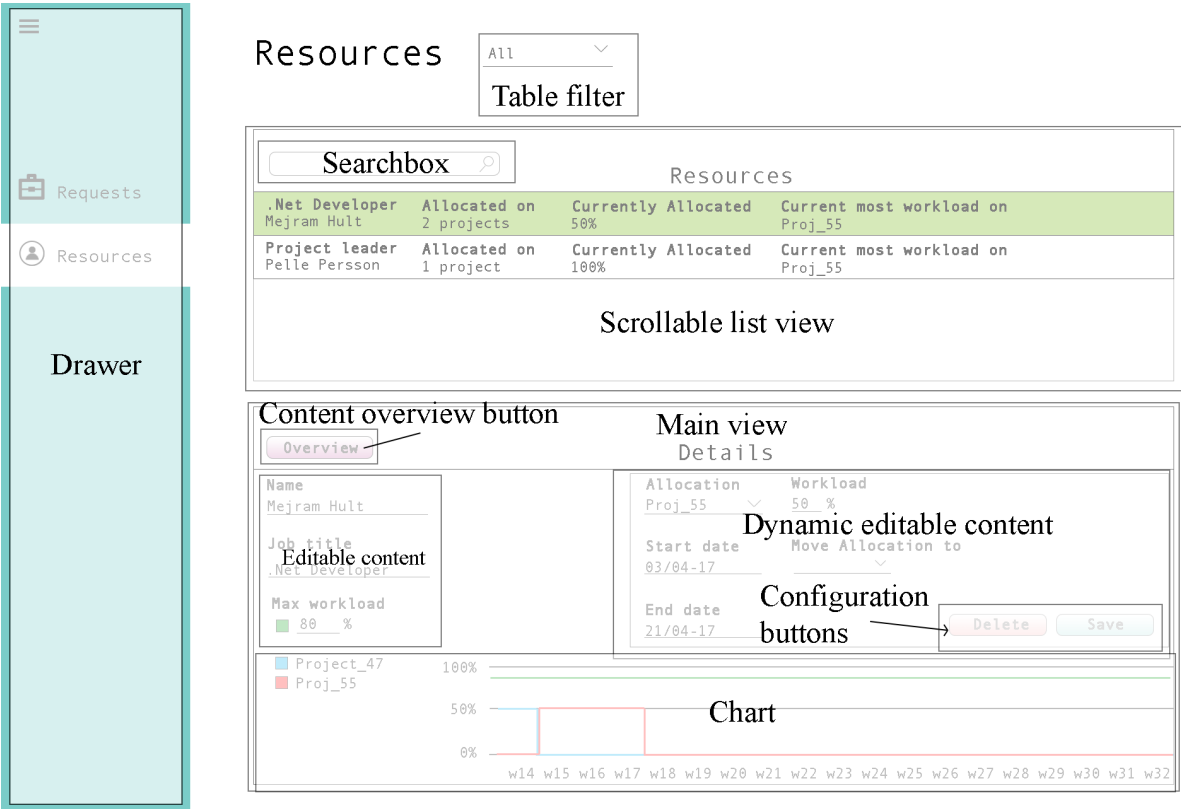

Image 5.5 Resources view page

The resource page has from the basic necessities been constructed in the following manner (illustrated in Image 5.5):

- ➢ To the left, a drawer navigation menu with possibilities to navigate between request page and resource page. Designed with colour coded section pattern in mind.
- ➢ At the top a table filter has been procured to establish a simple navigation around the resources available, this in the form of a dropdown list.
- ➢ A scrollable list view which contains all resources available for the resource manager. The resources are illustrated as list items. When a resource is selected by clicking, the main view will update with information corresponding to the selected resource.
- ➢ The main view consists of a content overview button, which once clicked will deselect the scrollable list view and show an overviewing graph all resources.
- ➢ An editable area for the attributes of the resource is set to the top left which is therefore the first object in the flow of the box. This is one of the fundamental features that is demanded by the basic functionality.
- ➢ A chart is placed in the bottom and will be illustrating the data on when and how much the resource is allocated in projects. An important component in the matter of easy and efficient viewing of data.
- ➢ Above the chart is an editorial view which features allocations placed on the resource, which is a necessity if the resource manager is to be able to edit allocation content on resources.
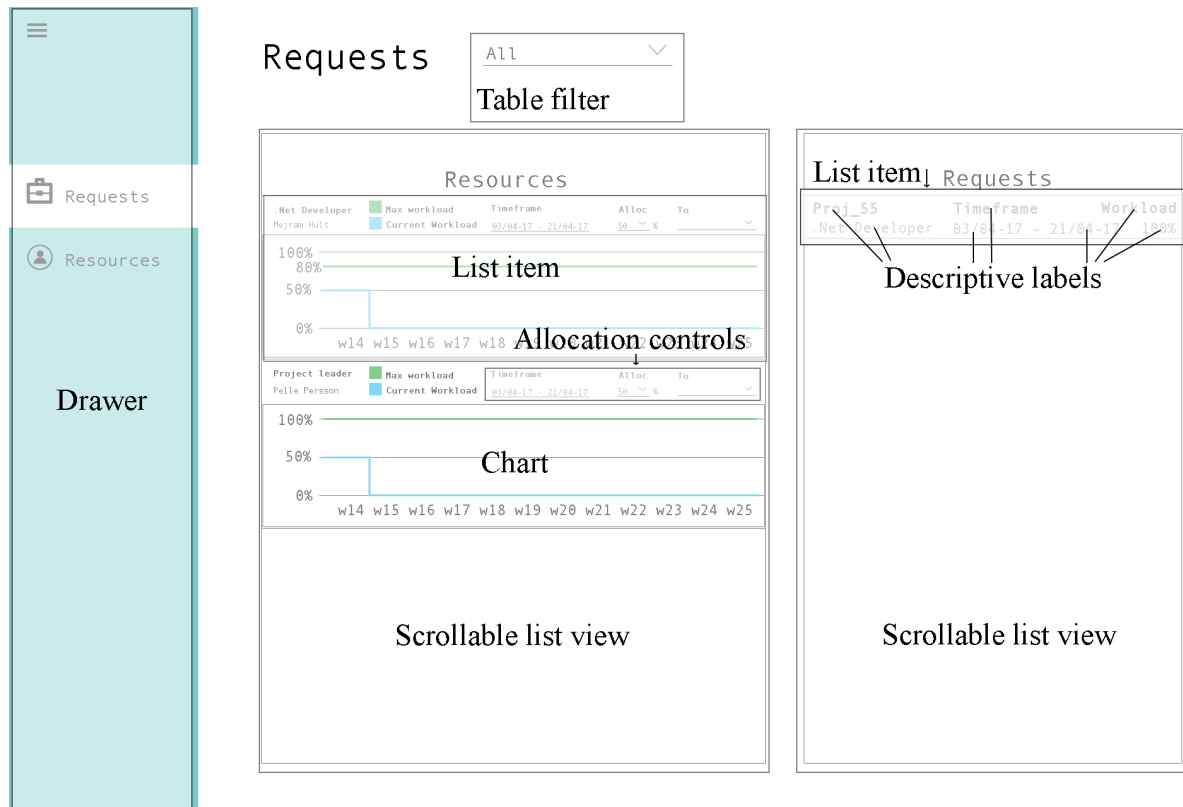
Image 5.6 Requests page

The request page is developed with pairing requests together with resources in mind and has with basic functionality from the tool been created with the following interaction design patterns (Illustrated in image 5.6):

- ➤ In the top, next to the header is a table filter, which makes it easier for the resource manager to find the right resources for a request.
- ➤ Two scrollable list views are used to view resources and requests.
- ➤ The list items in the scrollable list view containing requests are built with a number of descriptive labels, giving the fundamental information required to allocate a resource to the project which the request is connected with.
- ➤ The resource list items in the resource view have charts illustrating the corresponding resources current allocations.
- ➤ A number of allocation controls have been placed in the resource list items, which consists of input boxes of date pickers and dropdowns for workload and request id.

5.6.Validation

The iterations were followed with a remote usability test. The test was shaped to give input on both design and functionality of the web application.

The tests were conducted using a remote desktop software which allowed the tester to see how the application was developing and to introduce new function and design to the testers, which were also two of the supervisors. The testers then gave feedback on what they thought should be improved and how they thought the application design was feeling.

This allowed for discussions where, in some cases new functionalities would be found, which could be implemented in the next iteration. There were also problems found such as bugs and inconsistencies which could have easily been missed.

6. Web application prototype

The resulting application deployed to the web found new functions that save a number of clicks for the users. The application was built with ASP.NET Core version 1.1 which is a light weight cross platform development framework. An MVC structure was followed and together with AJAX and JQuery the features were completed. A database deployed on Azure was used and the web application was also deployed on Azure. The design was made in CSS together with pre-designed styles from the popular Bootstrap style sheets.

The web application was built with the roles of project leader and resource manager in mind and for ease of development all pages were accessible in the drawer to the left.

The application was built with the prototypes from the iteration process in mind, but in some places new and better functionality has been found and will be explained as well as argued for in this chapter.

6.1. Project leader functionality

Image 6.1 The project overview

As seen in Image 6.1 the projects are listed under a chart with overview on the resources of the projects. Two buttons are accessible above the chart where the user can switch between requests and resources for easy comparison. The chart also features filtering projects by clicking them in the labels positioned above it.

Hovering a list item, in this case a project, will give feedback with a light green background and a pointer indicating the list item is clickable, as illustrated in Image 6.2.

Image 6.2 A clickable list item.

After the user has chosen a list item they are shown the details page for the selected project, which, just as in the prototypes, consists of the two subcategories details and schedule.

Image 6.3 Details of a project.

The first page shown is the details page which consists of the detail attributes of the project. Here the project manager can edit who owns the project, the start- and end-date of the project, title and the description. Clicking the schedule tab changes the content to a more time-based interface, following the prototype graphics to full extent, illustrated in Image 6.4.
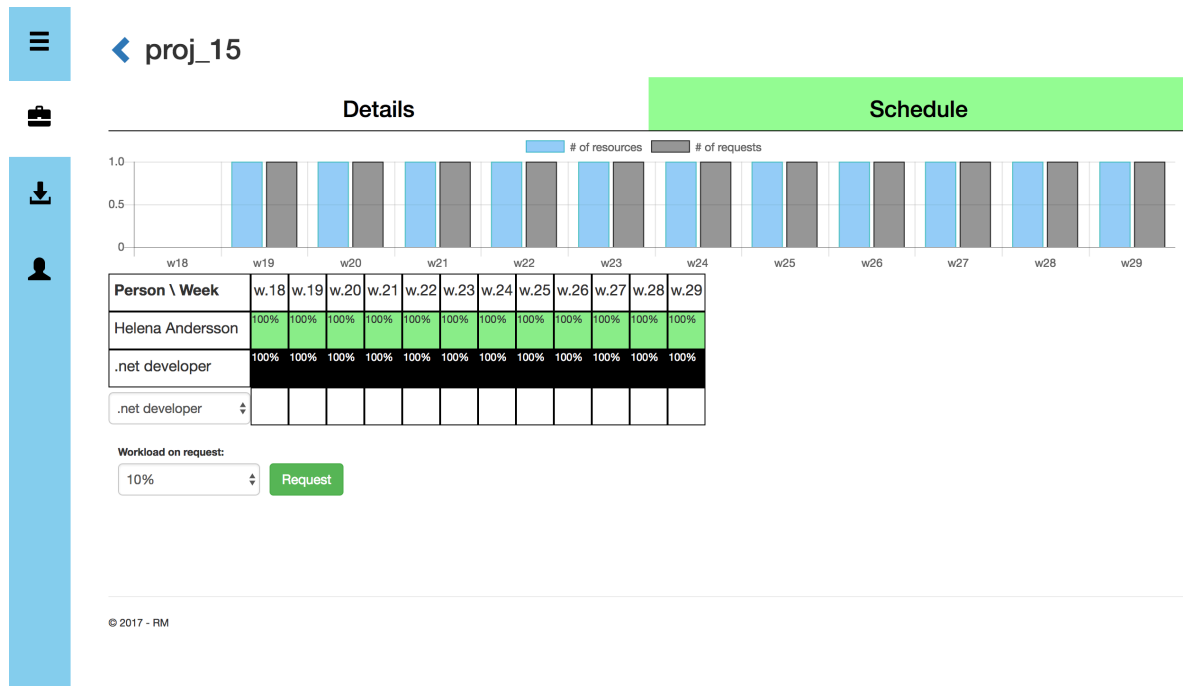
Image 6.4 The scheduling of a project.

The content in the scheduling tab start from the top with a chart, showing the amount of resources allocated to this project in light blue bars. Requests are also shown in the chart, these are coloured light grey.

Below the chart a scheduling interface is located. The size of this depends on the amount of resources, requests and the start- and end-date of the project.

The chart illustrates allocations and requests, the allocations are always above the requests and the weeks they are allocated to the project is filled with light green colour together with a small label showing how much they are allocated on the project each week. The requests have a black filling with white labels. To the left of the fillings the profession is seen, if the row is an allocation the name of the resource will be shown instead.

To request a new resource, the bottom part of the scheduling content is used. The steps of requesting a resource are illustrated on image 6.5.
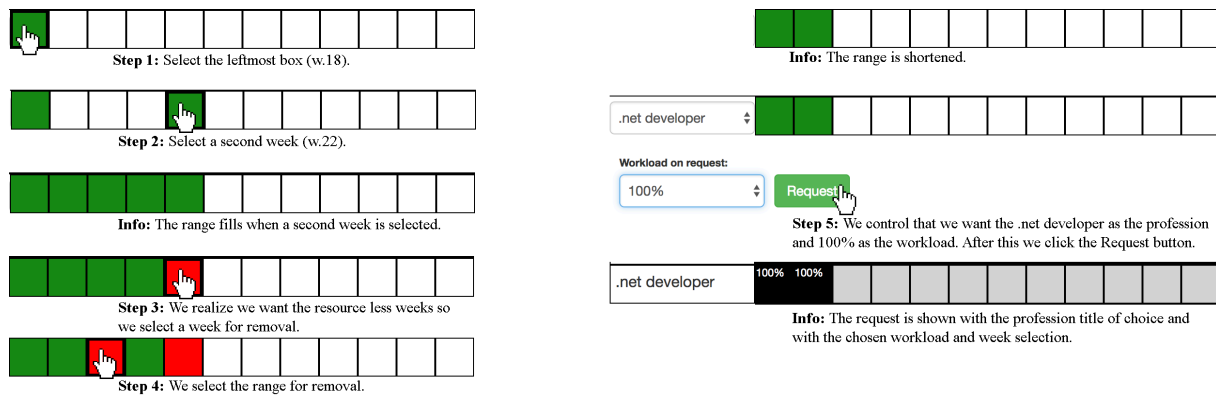
Image 6.5 The steps of requesting a resource.

The range picking is one of the features heavily focused on saving clicks for the project leader, however it can still cost much in efficiency if the manager wants to, for example, select only every other week.

6.2. Resource manager functionality

The first page that the resource manager can access is the request page. Here they are presented with a list with resources to the left and a list of requests to the right.

For simplicity the requests can be selected and when a request has been selected the resources with the corresponding profession will appear with dates and workload filled after the request. The list of requests can be filtered after professions. The request period also appears on the graph showing how much an allocation is currently allocated, illustrated on Image 6.6.

Image 6.6 The request page with a request selected.

The second page is the editorial page for the resources which the resource manager is responsible for. The top list represents all the resources, which can be filtered using the dropdown list next to the header.

Image 6.7 Resources page with overviewing graph

Selecting a resource will fill out the bottom box with the corresponding information of the resource. The bottom box consists of editorial boxes for name, max workload and profession. Above the graph you find an editorial space for allocations placed on the resource. The graph in the bottom right corner represents all allocated work time during the year, illustrated in Image 6.7.
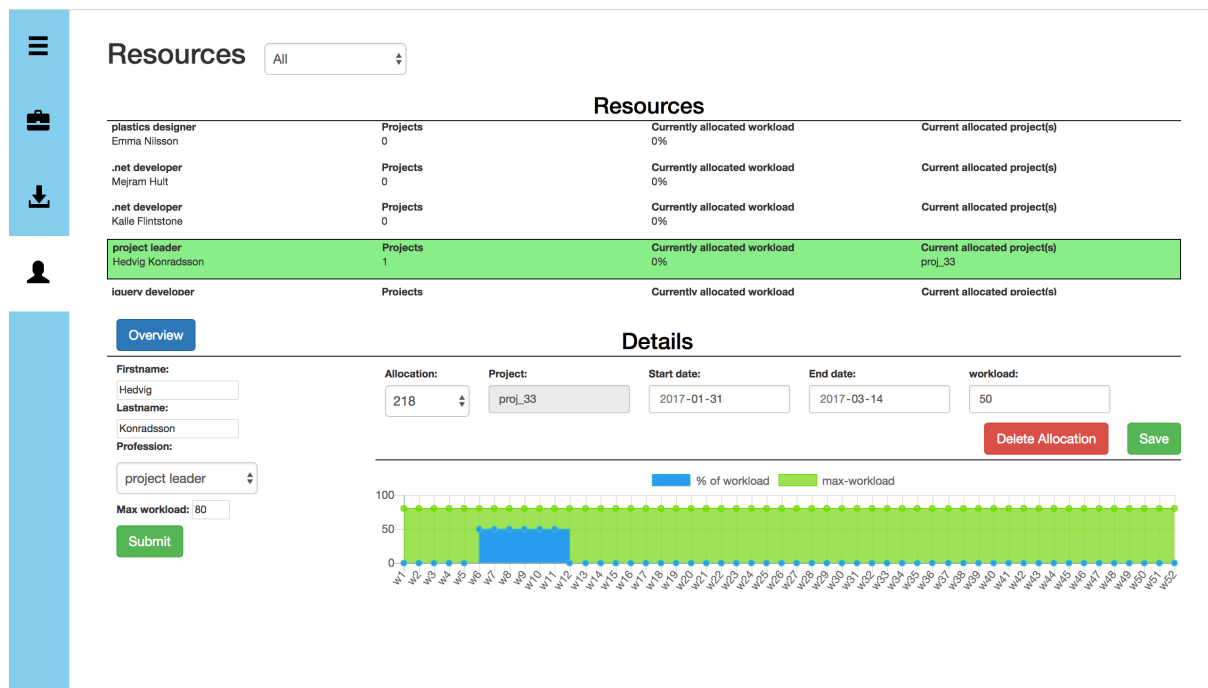
Image 6.8 The resource page with "Hedvig Konradsson" selected.

6.1.Evaluation

Continuing the research process, the last step, evaluation, is done using Summative Usability Testing. The scenarios and interview questions that were tested are listed in Appendix C.

6.1.1. Participants

There were two testers conducting the scenarios and the following interviews. These two have years of experience with resource management tools, by developing them, fixing them and using them.

6.1.2. Tasks

The two testers were asked to perform tasks, first in the role of a project manager and secondly as the role of a resource manager. The tasks were as follows:

As a project manager

0   Change the duration of a project with two allocated resources to 24 weeks.

In the same project:

1   Add a request for a full time .net developer worker for the whole project.

2   Add a request for a code tester every fourth week with 100% workload.

In another project with no requests or resources:

3   Change the title of a project "New project".

4   Add a request for a management expert with 100% workload for eight weeks.

5   Add a request for a jquery developer with 50% workload for the last three weeks.

6   Remove the request for a management expert.

7   Create a new request for a plastics designer instead with 100% workload and for the first four weeks.

As a resource manager

0   Change the profession of a project leader to a code tester.

Use the same resource to:

1   Allocate all the code tester requests.

Use a resource who has other allocations to:

2   Allocate the request of a .net developer.

Use a resource without any previous allocations to:

3   Allocate the request of a jquery developer.

4   Allocate the request of a plastics designer.

6.1.3. Measure

The test was measured in two variables, namely the number of clicks combined with key presses and the amount of time it took from beginning the first task to completing the last. These variables are later compared between the current PPM tool in Company A and the final prototype.

6.1.4. Procedure

The first step was to introduce the test to the participant, letting them read through the tasks they are to do in the prototypes and if they have any questions about any of the tasks this is the time they can ask them.

When they felt ready a timer was started and the test holder would use an app to measure the number of clicks and key presses. The tester was allowed to freely move around the web application and perform the tasks through the steps they sought optimal. Meanwhile the test

holder only was allowed to observe and not to give any indications on how to use the application.

After the test an interview was made to evaluate the design of the prototype. This was thought to be the best approach since time was of an essence and the test on the tool of Company A would have to be made remotely.

The test for the tool used in Company A was made with the test holder at a remote location and the testers gave the results when they had finished.

6.1.5. Apparatus

The study was performed on the testers own portable computers, they would go to the website where the application was held at the time of the test. To count clicks an application was installed on the test holders phone, creating the ability to click to add a click. The timer used to see how long the test took was also an application on the phone.

6.1.6. Results

The interview was divided into three parts, overall design, charts and functionality. The results were summarized as following:

Overall functionality:
- General feel was that the tool was efficient, however, it might need some time to get used to the more advanced features in the tool
- It can be hard to connect the weeks in project details to real dates.
- The scaling of the app on larger screens was not very satisfactory.

Charts
- Both interviewees were satisfied with the locations, information and how easy it was to understand the charts.
- Some charts showed too many weeks and the text became too small following from the number of weeks.

Functionality
- The two most effective functionalities with the tool was the requesting of resources, in project scheduling, and the allocation of resources from the resource manager's point of view.

- ❖ The colour connections throughout the page was very helpful.
- ❖ The interviewees had differing thoughts on if the tool was useful for a varying project portfolio, the argument against was mainly you want to be able to request on more varying basis's than the week basis which is currently implemented.

Statistics from the test show that the prototype saves approximately 92.5 clicks, see table 6.1, and saved an average of 21 minutes, see table 6.2, for the tasks in focus.
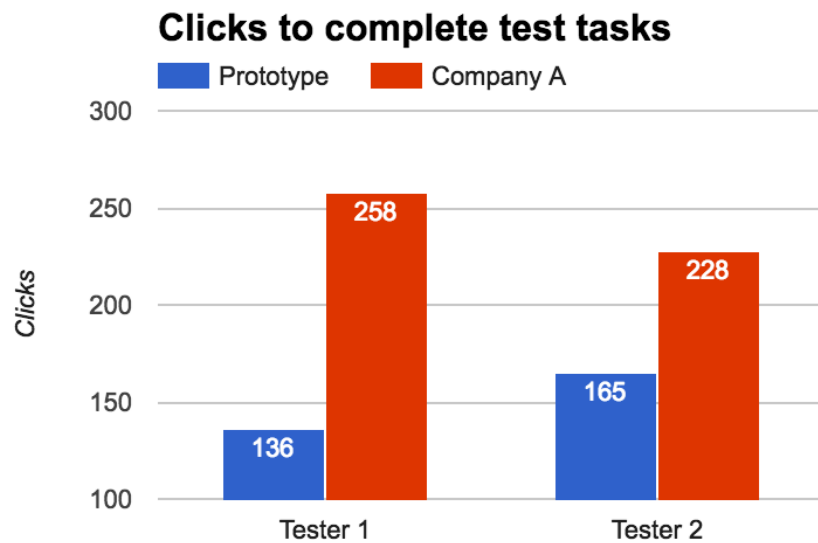
Table 6.1 statistics from evaluation in terms of clicks
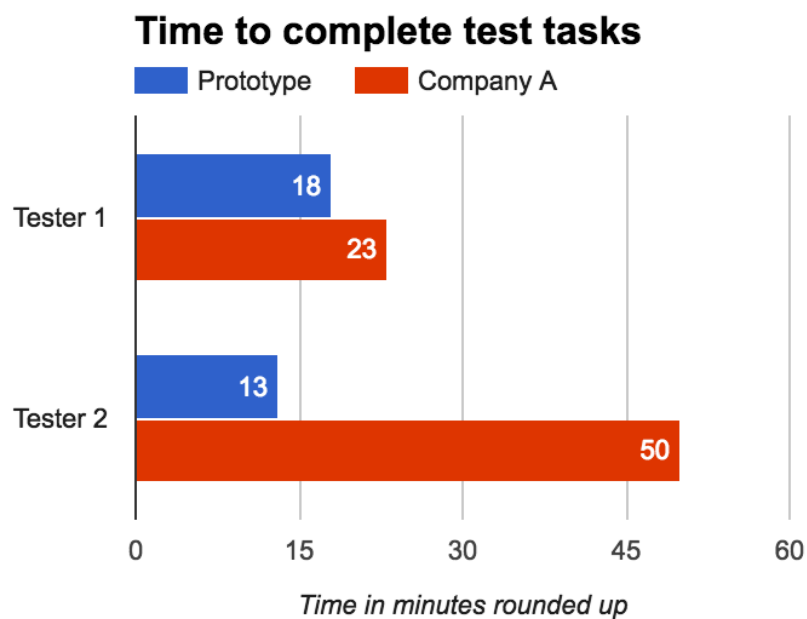
Table 6.2 statistics from evaluation in terms of minutes

6.1.7. Lessons learned

It is always best to be prepared that the methods might take more time than thought in the beginning. Always plan to have margins when conducting these evaluations.

Think carefully beforehand what variables are to be tested, even though it might seem like it is the most obvious choice to test time and some other variable, like in this test clicks. There are many other variables as well that could be tested or that could impact the test, such as model of computer or version of web browser.

7. Result

Here the results are presented, moulded from the research process in an attempt of answering the research question.

7.1. Basic requirements

From the iterative process a number of basic functions that are fundamental to building a tool for project portfolio management were found and these are the following:

- ✣ A page for the editing of resources.
- ✣ A page for the editing of projects.
- ✣ A page for adding and deleting requests.
- ✣ A page for adding and deleting allocations.
- ✣ Visual comparisons of data
- ✣ Visual feedback for actions
- ✣ Colour connections

The add and delete functionality of the resources and the projects are thought to be added by an administrator, this is done by injecting them directly into the database, where all the data is collected from. Editing requests and allocations were becoming a complex procedure and instead the deletion together with adding a new request or allocation was thought to be a more efficient process. The editing of resources had to include editing their corresponding allocations because of allowing the resource manager full control of the resources they are responsible for.

These functionalities are arguably a modification of the CRUD pattern implementations, which is common for applications using databases. CRUD is an acronym for Create, Retrieve, Update and Delete (Techopedia.com, 2017).

7.2. Requirements for varying portfolios

To allow for a varying portfolio to be used with the PPM tool prototype many project-specific features were stripped off to maximise versatility. The best practise for varying portfolios was found to have the project use specific management software for their type of project and only

use the PPM tool to plan resources without the micromanagement it would create from allocating resources to tasks within the project.

The evaluation showed that a requirement to handle varying project portfolios should also be to make data dynamically available as not only weeks but days, months and also years.

7.3. Design requirements

From the research and iteration processes a number of design requirements were found and these are the most significant:

- ✣ Comparison of data should be incorporated visually, such as by charts
- ✣ Basic functionality should be easily accessed
- ✣ Visual feedback is necessary for the user to understand functionality
- ✣ Filter functionality is important when data is visualized in a large scale

Basic functionality in this list refers to the basic requirements under header 7.1.

The design in terms of buttons and input fields are extracted from a Bootstrap library of styles, which is easy and in many terms pretty. All other design choices where created from the ground and changed along when new parts of the tool were constructed.

8. Discussion

This chapter aims to discuss different parts of the report.

8.1. Interviews

The interviews served as a great information gathering method which gave a huge amount of information. From the data gathered in the interviews one can very well argue for the efficiency factor at least at the two companies that these were conducted in. It was very interesting to see the difference in the two companies, they varied a lot in how strict and defined the structure of roles were.

As far as efficiency goes you could see in the PPM tools used in the companies how important it was to define the key components of projects and manage different parts of the companies so that you were entirely sure that everything was going in the right direction. This is of course only logical to do since it is important for companies to gain as much money as possible on their assets.

In the period of interviewing the picture of all the basics for the tool started to take form. It was a firm start on the thesis and a great gathering of data that one could invest a lot of time on analysing later. One thing that I regret is having another person with me, during the interviews, someone who could have taken notes. The sound recordings were alright but there were a lot of data that were missed. I think that if I would have had someone taking notes, I could have urged them to also look for when the person showed feelings about a topic, for example by making gestures with their hands or smiling. This would have been great to evaluate what features the interviewees would have wanted unconsciously. As a one-man team, however, the sound recording worked great in terms of helping the flow of the interview. It was also great because of the fact that I could focus on forming follow up questions.

Initially it was thought that there would be contextual inquiries after or before the interviews, the problem was only that this tool that I would be observing the use of, is only used about one or two times a month. On top of the low usage ratio, the time spent on it was found to be 30 minutes to 90 minutes per usage, which was hard to time with the interviewee's.

8.2. Affinity diagram

The suggested method to evaluate interviews by Beyer, H. and Holtzblatt, K (1999) was to do an affinity diagram to find out what the interviews actually was focusing around. The affinity diagram gave a lot of results that could have been interpreted in different ways and a lot of the notes that gave the headers their names could have been put into other groups. What made these groups might be influenced from reading about resource management and finding out a lot of information before processing the notes.

It is interesting to see how much the prototype has changed from the initial drawing, it also makes you question what the prototype would have looked like if we were to do the prototyping during a much longer phase. The most significant change was probably in iteration three when we went from using Moqups.com to creating the prototype in Photoshop.

The affinity diagram notes came from listening to the interviews and from the experience of the interviews. This was a part where I had to try and sort out quotes and information from the interviews and find which where the most relevant and significant to the thesis and the subject that was to be investigated. Listening to the interviews and finding the key points might have been one of the most time consuming parts of the thesis, if I would do interviews again I would probably take notes during and after the interview instead.

8.3. Iterated ideation

The most engaging part of the research process must have been the ideation. Designing and thinking of how the design will support different features of the application is a difficult task and takes a lot of time. However, the significance and difficulty may be the two things that make this part so fun. This is also where I could let my creativity free and just try all sorts of crazy ideas.

Two critical aspects of a project that weren't talked about in the thesis would arguably have been the cost and monetization. However, since the scope of the project excluded economy there was no data in the database that could have shown the aspect of the project economy and therefore this was hard to illustrate in the chart in the project overview page.

An alternative approach for the listing of projects in the overview for project leaders in Image 5.3 would have been the use of cards, however, this would from my point of view only have been favourable if the projects were allowed to have a representing imagery.

The drawer came with some interesting ideas, the first thought was to allow the project leader to add shortcuts to his or her projects, however, this was found to be unnecessary since the list is always only one click away and it is arguably a cleaner approach to remove clutter from having too many shortcuts in the drawer menu.

In the last iteration of the tool all the borders creating different boxes were removed to create a cleaner look thus making the design have less clutter and is much more easy on the eye. This was thought to improve the time spent for the user to find the information he was looking for, it also created a lot of space which creates a fresh feeling.

8.4. Final prototype

The final prototype was a difficult part of the thesis, mostly because of the lack of experience I had beforehand of ASP.NET but also because ASP.NET development was not very supported in OSX at the time of development. This led to the solution of doing the prototype on a virtual computer on a server which the supervisors at Montell & Partners helped me set up and let me use.

The development of the final prototype was not just a coding part of the thesis, it was actually also an iteration on the prototype sketches that were made to support this development. Many new features were found in this process as well. The most significant features regarding making the tool efficient were found in this process, one of them is the request part in the projects tab.

In the process of this prototype other languages had to be consulted for helping with some of the functions in the tool. One of these were Javascript, which is a language that can be used for dynamically changing the page after it has been loaded. A library that was used together with Javascript was ChartJS which is used to create all the charts in the application. ChartJS was not the first library tested in the process of finding a way to create graphical and dynamic

charts. However, it was the first and only one that was lightweight and easy to implement without much pre-knowledge.

The request page where the resource manager is pairing resources with requests was a part of the tool which required much thought. It was first thought that some drag and drop function would be the easiest way of use, however, this requires some experience and additional libraries, therefore the functionality of clicking the request and then clicking the resource was thought of. Instead of only having to use one click for the drag and drop, two clicks for this functionality feels like it is a decent alternative.

The results from testing the prototype showed that the prototype would do great in terms of efficiency against the tool used in Company A. It is however important to have in mind that the test was formed for the prototype in this thesis and not for the tasks that you can perform in the tool at Company A, which might have impacted the times and clicks somewhat. The test scenarios where although made with basic functionalities that I think should be possible to do in any PPM tool. One could of course argue that since I was the one that built the prototype and sat with nothing but the prototype for almost a month, I could be a little biased when creating the scenarios.

8.5. Results

One thing to consider with the results is that they are only backed up by two testers and this is certainly not optimal for finding the best feedback from the evaluation. However, since we only had two testers we also did interviews in the end of the tests instead of questionnaires and this was thought to improve the response and gain qualitative insight of the prototype test instead of a quantitative. The two testers also have years of experience with resource management tools which gives a good ground for the results, even if the testers only were two.

The results show the parts of the tool which were seen as most significant both in terms of fundamentality and in terms of efficiency. These are thought to be needed in terms of creating a PPM tool were the efficiency is in focus. I think that the charts are one of the major impacts helping the tool in being efficient and fresh, however, the charts can be hard to read if there are too much information in them. This is also commented by one testers. The argument for

having much information in some of the charts is though that in the cases where there is 52 weeks crammed in on a small chart, the general thought is to be able to see patterns and that they might not be fully allocated even though it can be hard to see when the allocations start and stop.

The basic requirements are thought of as a basic structure which can be built upon in many different ways, the thought is that these can be used when planning on what the fundamentals are when creating a tool for PPM. The final prototype in this thesis is one of the approaches based on the basic structure.

8.6. Future work

The tool could be improved in many ways depending on what seems necessary at the workplace, however, the most appealing first step would probably be to add a messaging functionality to the tool.

Another future addition to the application would be to have an undo button because if something was changed into something undesirable this would make it very helpful in terms of undoing the wrong step.

A smaller change to the application would be to look over the charts and make the colour coding be more synchronized between all the pages. At the time of writing the colours can be a little differing between components, for example in the project schedule page where the schedule uses green colours to show that a resource has been allocated while the chart uses a blue colour for the same thing.

9. Conclusion

The interviews gave a very good picture of what was missing in currently used tools and analysing these combined with iterating on the fundamental design of a PPM tool a new efficient tool was created. The research always used knowledge gathered from previous steps and therefore the prototype is a product from all the steps combined.

Efficiency is the main focus in the thesis and from the Summative Usability Testing an attempt is made to see if the prototype is efficient at all. Because of the tests being positive it will be presumed that the prototype is in the correct path to efficiency, however, more testing is needed to conclude how efficient it is.

The monetization of projects and costs for resources would have given an additional input on the prioritization factor. It is although an entirely different part of PPM and would demand at least another study to decide what costs and priority attributes should be considered.

For future use of this thesis it would be logical to start the work with usability testing to see that the results here match the results of the desired product to be prototyped or researched.

10. References

Archer, N. and Ghasemzadeh, F. (1999). An integrated framework for project portfolio selection. *International Journal of Project Management*, [online] 17(4), pp.207-216. Available at: http://ac.els-cdn.com/S0263786398000325/1-s2.0-S0263786398000325-main.pdf?_tid=9134b16c-33d2-11e7-9360-00000aacb35d&acdnat=1494236693_8cd5a8e2feb38fccda41546603322983 [Accessed 8 May 2017].

Beyer, H. and Holtzblatt, K. (1999). Contextual design. *interactions*, 6(1), pp.32-42.

Blichfeldt, B. and Eskerod, P. (2008). Project portfolio management – There's more to it than what management enacts. *International Journal of Project Management*, [online] 26(4), pp.357-365. Available at: http://www.sciencedirect.com/science/article/pii/S026378630700097X [Accessed 8 May 2017].

Gallup, I. (2017). *Well-Being Enhances Benefits of Employee Engagement.* [online] Gallup.com. Available at: http://www.gallup.com/businessjournal/186386/enhances-benefits-employee-engagement.aspx [Accessed 7 May 2017].

G2 Crowd. (2017). *Best Project Portfolio Management (PPM) Software in 2017 | G2 Crowd.* [online] Available at: https://www.g2crowd.com/categories/project-portfolio-management-ppm [Accessed 2 Mar. 2017].

Helen Sharp. Yvonne Rogers. Jenny Preece. (2007). *Interaction Design: Beyond Human-Computer Interaction; Second Edition.* 1st ed. John Wiley & Sons.

LaBrosse, M. (2010). Project-portfolio management. *Employment Relations Today*, 37(2), p.75-79.

LeanKit. (2017). *What is Project Portfolio Management?*. [online] Available at: https://leankit.com/learn/kanban/project-portfolio-management/ [Accessed 7 May 2017].

Levine, H. (2005). *Project portfolio management*. 1st ed. San Francisco, CA: Jossey-Bass Inc.

Michael Bible & Susan Bivins., (2010). *Mastering project portfolio management : a systems approach to achieving strategic objectives*. 1st ed. J. Ross Publishing.

Moqups.com. (2017). *Online Mockup, Wireframe & UI Prototyping Tool · Moqups*. [online] Available at: https://moqups.com/ [Accessed 26 May 2017].

Pennypacker, E. (2009). *Project Portfolio Management : A View from the Management Trenches*. 1st ed. John Wiley & Sons.

Perry, M. (2011). *Business driven project portfolio management*. 1st ed. Ft. Lauderdale, Fla.: J. Ross Pub.

Pmsolutions.com. (2017). *Optimal Project Manager Load | PM Solutions*. [online] Available at: http://www.pmsolutions.com/blog/view/optimal-project-manager-load/ [Accessed 25 May 2017].

Prasad Kodukula., (2014). Organizational Project Portfolio Management: A Practitioner's Guide. 1st ed. J. Ross Publishing.

Products.office.com. (2017). *Projektledningsprogram | Microsoft Project*. [online] Available at: https://products.office.com/sv-se/project/project-and-portfolio-management-software [Accessed 2 Mar. 2017, 7 May 2017].

Staff, I. (2017). *Product Line*. [online] Investopedia. Available at: http://www.investopedia.com/terms/p/product-line.asp [Accessed 6 May 2017].

Techopedia.com. (2017). *What is Create, Retrieve, Update and Delete (CRUD)? - Definition from Techopedia*. [online] Available at: https://www.techopedia.com/definition/25949/create-retrieve-update-and-delete-crud [Accessed 25 May 2017].

The Interaction Design Foundation. (2017). *How to Conduct User Interviews*. [online] Available at: https://www.interaction-design.org/literature/article/how-to-conduct-user-interviews [Accessed 11 May 2017].

The Official Microsoft ASP.NET Site. (2017). *The Official Microsoft ASP.NET Site*. [online] Available at: https://www.asp.net/ [Accessed 3 Mar. 2017].

Usabilitybok.org. (2017). *Summative Usability Testing | Usability Body of Knowledge*. [online] Available at: http://www.usabilitybok.org/summative-usability-testing [Accessed 27 Jun. 2017].

Visual Studio. (2017). *Visual Studio IDE*. [online] Available at: https://www.visualstudio.com/vs/ [Accessed 3 Mar. 2017].

Vredenburg, K., Mao, J., Smith, P. & Carey, T. 2002, "A survey of user-centered design practice", ACM, , pp. 471.

Whatishumanresource.com. (2017). *Human Resource l Concepts l Topics l Definitions l Labour Laws*. [online] Available at: http://www.whatishumanresource.com/ [Accessed 6 May 2017].

11. Appendix

Appendix A: Interview question template (in Swedish)

Intro - berättar lite om mig själv

\# Namn

\# Exjobb på Chalmers genom M&P där jag skrivit under ett non-disclosure avtal

\# Går ut på att förstå vad som är viktigt i PPM verktyg

\# Fråga om det är okej att spela in intervju, inspelningen kommer endast användas för att dokumentera intervjun. Den kommer inte publiceras på något sätt.

Skulle du kunna beskriva med ord vad du använder programmet till eller kanske visa lite hur du använder programmet?

Vilka är fördelarna på ert nuvarande program?

- Någon/några funktioner/delar av verktyget som är roligare/trevligare/bättre än andra att använda?
- Smidiga funktioner?

Vilka är nackdelarna med ert nuvarande program?

- Flaskhalsar?
- Irriterande funktioner?
- Långsamma?
- Tråkiga?

Hur fungerar kontakten mellan resursplanerare och projektplanerare?

- Kommunikationsmedel?
- Hur fungerar ett "godkännande" för ett projekt?
- Vill man kunna se godkännanden?
- Hur många gånger behöver du i genomsnitt kontakta resursplanerare/projektplanerare/portföljhanterare innan ett projekt är klart för start?
- Hur lång tid brukar det ta från att ett projekt är skapat till att det är klart för start? (Planeringsfasen alltså)?

Hur går det till när ni skapar/lägger till en ny resurs i verktyget?

- Behöver man göra samma saker varje gång som tar mycket tid?

Hur går det till när ni skapar/lägger till ett nytt projekt i verktyget?

- Behöver man göra samma saker varje gång som tar mycket tid?

Hur många funktioner av de befintliga skulle du uppskatta att du använder under en vanlig dag?

Används informationen från programmet till portföljhanteraren?

- vad för information summeras uppåt?

Vad tycker du är grundpelarna för ett projekt/resursplaneringsverktyg?

Har du några tankar/idéer på saker som skulle kunna göra att det nuvarande program ni använder skulle kunna användas snabbare/mindre tid per dag?

Vilken plattform skulle ni föredra? Web, datorprogram, excel etc.

Finns det fördelar med att komma åt programmet genom mobilen?

Hur skulle ditt drömresurshanteringsverktyg se ut?

- Skulle det ha någon speciell design?
- Finns det något PPM verktyg som är mer lockande än det ni använder här?

Finns det någonting du känner att jag har glömt fråga eller som jag kan ta med mig till kommande intervjuer

Appendix B: List of input from interviewees

- Administrator – Overview
- Separate project documents from resource documents:
  - Especially good when you have limited resources

- Plan resources a year ahead
- Running varying projects with different needs but everyone should use same PPM tool
- Tool used in two different countries
- Lack of use of tool gives bad planning
- You add all the upcoming year's projects in the end of the year
- Analyses the reports that are generated from project results every month.
- A learning curve
- No advanced functions currently
- Finance in SAP
- SAP cannot plan forward
- SAP delivers actuals in how many hours' workers have worked during the last month and other costs
- Projects should be able to add hours in the tool
- PLOM – Project Line Operating Model
- Projects are responsible for what (competence, resources) and when (timeline)
- Lines (Cost centers) are responsible for how and who
- PLOM phases – "Tollgate 1 to 6"
- Swimlanes – every product has Project leader and depending on what the project is aimed at it also has someone from product management, system engineering, someone from package, someone from tekniker service etc. Becomes a core team.
- Core team leader writes RFD (Request for delivery) where they write everything they need for the end product.
- The line wants the projects to be more detailed so they can estimate what competences they can appoint.
- Communications are mostly face-to-face discussions, other methods are email and phone conversations. Jabber, some messaging service.
- Monthly cycle where a meeting is at the start of the month and another at the end.

- The early meeting is with the finance department to discuss new needs.
- The late meeting is a pipeline review, here they discuss if there are enough resources and if they are all used etc. Can we start new projects, are there resources?
- Project statuses – started, not started, ongoing, closed/finalized. However, not always update since there is one person appointed to update all projects, she does not always get all information about the projects.
- The project management director is the one to officially start projects.
- Another meeting called Product tollgate review, where VP is involved.
- New projects are made by contacting an administrator who can create a file and put it online on the tool. Then the project leader can go in there and add all information for the project there.
- Before a project starts the administrator needs to create a file in SAP where the workers can report their working hours.
- The planning phase depends on size of projects and when they are thought of and can vary, timewise, indefinitely.
- If there is not enough resources then the projects need to be prioritized and some might be shoved timewise into the future.
- Some core team members can enter the project files and see how they are allocated in hours throughout the project.
- A resource tool should be easy to use and easily understandable.
- Would like to see cost developments vs resource usage.
- Currently you cannot cross check projects vs resources since projects are measured by costs and resources are measured by hours.
- Currently excel based tool
- Would like to see projects information and be able to cross check with resources
- Mobile usage would be nice for viewing documents but currently there are so much information that it would be hard to see in a small screen.
- Not important to update documents through the phone.
- Maybe those who work in a smaller area of the documents would think it could be nice to update through the phone.
- Currently it is hard to find some documents since they are in a folder structure today, would be nice with a search function.

- Confirmation of resources is a bit hard/clumsy today, would be nice with a smoother process to do this, to 'allocate' resources in project documents.

- Some projects have enormous documents with a big number of resources, this might make it hard for project managers to keep track of their projects.

- Feature: Filter out resources in projects that are not in use.

- Feature: Filter out non-core team members.

- Discipline of use is not perfect, enforce the need of use somehow?

- A need of updating projects and resources in the tool every month.

- Hard to update projects, resources etc. timewise, currently manual change of every cell is needed.

- Uses the generated reports, takes out the information he needs from these and puts them into own report models.

- Currently needs to push everything in project files the number of months one would want to stall a project, very inconvenient.

- The user interface is currently hard to navigate around.

- Everything is built on pivot tables today.

- Would like graphs and diagrams.

- Tool works decently for the current usages.

- You don't want to lose the physical meeting between a project manager and a cost centre manager.

- The project manager can make requests for a person to the cost centre without talking.

- The current protocol is that the project manager sends a request for a person and then he gets an answer that he can have a person, let's call him Patrick. The project manager then needs to go back into the file and say that he has gotten this resource of Patrick.

- They can sometimes contact each other by phone or mail.

- The (portfolio managers/resource managers) needs to see if there are projects that doesn't have enough resources or if there are projects that are taking too many resources.

- You usually plan resources around a half-year before up to two years or more.

- Project files basic functionality usually equals projects start- and end-date together with project leader and sometimes a core team, and a project description.

- Basic functions are sending requests for resources, allocating resources to projects and availability of updating attributes of the projects/resources.
- Some kind of feature that makes it easier for the project manager and resource manager to communicate.
- Some way to showcase that a resource has been allocated with for example a green colour on the numbers.
- I use the reports generated from the project files.
- I like to view the information about how the project is going forward.
- I also check to see if people actually update the information in our resource management tool. Because shit in shit out.
- I look at the available resources and plan new projects, the most important is to see if there are resources available for new projects.
- Projects should be able to request competences such as plastic model expertise.
- Would like to see more specific data, currently many projects just shove the total expenses into a cell in the excel tool.
- Would like to see estimations from historical data.
- Project managers need to talk to the respective resource managers so they can discuss how to get enough resources and finally a "handshake" so that the project manager knows he got the resource.
- Be able to follow up and manage budgets.
- See which resources that delivers and which does not.
- It should not have too many inputs and take too much time to uphold.
- One excel document with many tabs
- The excel data is uploaded to a server where they are saved (version handled) so you can back if something goes wrong
- Project managers sends requests
- Line managers meets the requests
- The requests are to be in before a date every month so the line managers can view these at the end of the month and meet them as well as possible
- After the line managers discuss the requests the financial departments are informed, and if the requests are not being met then there will need to be discussions between line managers and project leaders until a handshake is made.
- 3 first months are viewed in weeks and the 15 rest are in months.

- Can mark workers if they are on parental leave

- Tool only used locally for software departments

- Different time zones

- Project features were added before however not used anymore

- Budget for future projects and resources in the end of the year

- Compare projects budgets and resources

- Qlikview for viewing data from SAP

- Log that checks who changed the data and when

- Only the finance department can see outcomes of projects and resources vs planned outcomes

- Every project wants their own extra tools in the PPM tool

- Someone needs to update, a responsibility

- The data is always entered with a margin, probably never is exact

- The tool has assumptions about vacations

- Head count

- Cost of projects

- Cost per resource for projects

- You can always be more detailed in the tool but that takes more time and there needs to be a balance found between these

- Easy to find details when someone is questioning data

- Excel add in that downloads data from a database and then shows all the data in structured columns and rows

- Takes time with bigger amounts of data

- Columns for database id, employee id, name, role, project, boss, if the row is for capacity (how much time the employee could work) or allocated time or if it is just a head count, last changed by (id), last change (time), 3 closest months are shown in weeks and how many % the resource can work that week (0 … 1) and then 15 months are shown only monthly.

- Restrictions (which resources can see which data?)

- Roles such as planner, architect (system), developer etc. (would be easier to use now since they aren't as exact anymore).

- Everyone can change and add directly in the excel document (with the right restrictions).

- Refresh button to refresh the excel file if someone else has made a change during my session.

- Responsible that everyone exists in the system.

- If someone is sick it won't show in the system because of too high detail level.

- Priorities between projects, if there are not enough resources higher priority projects will be prioritized.

- In the system only allocations are made.

- If there are something that goes wrong in the projects, maybe just the planning is wrong or something like that, then there needs to be discussions to update projects. Should be shown in the system, currently not shown if the projects are not going as they should.

- The system is resource side heavy so the projects have almost no details.

- My team currently does not work project-wise but they get problems that they need to solve and these problems can come from multiple projects.

- You can only allocate people to projects but what they will do in the projects are not shown, no tasks, nothing.

- No follow up on how well the employees did in projects, only finance can check through other systems.

- Skipped the person allocation to a project, instead lend the team to different projects but keep the team intact.

- Working with the team intact balances the workload and when there are much to do everybody can pitch in and then they can still handle it.

- Sceptical about web solution, it might be too slow for if there are this much data.

- The pro for having a tool on the computer is that the computer is often faster than the web-solution.

- Product owners make priorities

- Uses many tools for different managements, for projects the project leaders can decide to use own project management tools, finance gets data from SAP, data is analysed in a tool called Qlikview.

- Easy to add rows, just create a new row in the excel tool and then click upload to have a new created row. Could create a new employee like this as well.

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- Create requests for competences/resources from projects.

- Often just requests for a person.

- Feature suggestion: easy way to see prioritization of projects.

- Easy project requests for all the line managers when one from the resource management group is set as contact person for fixing all resource to a project.

- Want to be able to compare different projects, currently has to open two excel windows and cross check them that way.

- Would like to see follow up more detailed in the projects.

- Projects can't see any costs.

- Needs follow up budget wise to see faults and improve to following projects.

- Projects are divided into features with a start and end date.

- Weekly meeting where errors are highlighted and prioritizations are followed up.

- Use in mobile would mostly be to see data not edit.

- Creates requests once a month.

- Currently can't see if project members are going on vacation, can lead to having too few members a time period. Needs to go into other tool to see and plan when people are on vacation.

- Not every time resources that are in projects are set into the project through the tool.

Appendix C: Summative Usablitiy testing process

Variables

The PPM tool used in Company A versus the prototype created in the thesis.

The comparisons will be done in the means of time and number of clicks and key pressings necessary in order to complete a task.

Hypothesises

The prototype design allows for more efficient management in terms of fewer clicks and shorter time required to execute a majority of the same procedures as in current PPM tools.

Scenario test

<u>As a project manager</u>

8 Change the duration of a project with two allocated resources to 24 weeks.

In the same project:

9 Add a request for a full time .net developer worker for the whole project.

10 Add a request for a code tester every fourth week with 100% workload.

In another project with no requests or resources:

11 Change the title of a project "New project".

12 Add a request for a management expert with 100% workload for eight weeks.

13 Add a request for a jquery developer with 50% workload for the last three weeks.

14 Remove the request for a management expert.

15 Create a new request for a plastics designer instead with 100% workload and for the first four weeks.

<u>As a resource manager</u>

5 Change the profession of a project leader to a code tester.

Use the same resource to:

6 Allocate all the code tester requests.

Use a resource who has other allocations to:

7 Allocate the request of a .net developer.

Use a resource without any previous allocations to:

8 Allocate the request of a jquery developer.

9 Allocate the request of a plastics designer.

Interview

<u>Overall design</u>

How did the design feel?

Was there something missing from the design?

- o Which could have increased the efficiency?

Did the design feel like it was easily understandable?

Did the tool generally feel efficient?

<u>Charts</u>

Did the charts show useful information?

Were the charts located on useful places?

Was it hard to understand the data from the charts?

Were there enough charts?

<u>Functionality</u>

What parts of the design did you think was most impactful?

- o Name two specific functions

Did you have trouble with anything?

Did you find the filtering features useful?

Do you think it is suitable for varying project portfolios?