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**Analysis and Improvement of the IT Analysis
Process - A Case Study at Helmes**

Master's Thesis (30 ECTS)

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Analysis and Improvement of the IT Analysis Process – A Case Study at Helmes

Abstract:

There are many studies about software development processes and developers' efficiency. The role of the IT analyst is just as important as the developer's role in a software development process. It is very important that an IT analyst does their job well because they are the ones who the client sees and communicates with the most out of the development team. However, there are no studies found about the whole process of analysis or improvement of IT analysis.

The goal of this thesis project is to develop a method for IT analysts to improve their work process and the quality of their work. To reach the goal, the current situation was analysed. Then, interviews with five professional IT analysts and a literature review were conducted to establish potential areas for improvement, that were later prioritised. Based on those, a new IT analysis process was proposed.

The new IT analysis process was evaluated by the interviewed IT analysts, who all agreed that the new IT analysis process might help to improve the IT analysis quality. After the thesis project, the next step will be to implement the new IT analysis process to collect enough data to assess whether the new IT analysis process has improved the IT analyst's work quality or there are some changes needed.

Keywords:

Process improvement, IT analysis, IT analyst

CERCS: P170

IT analüüsi protsessi analüüs ja parandamine – juhtumikäsitus Helmeses

Lühikokkuvõte:

Tarkvaraarendusprotsesside ja tarkvaraarendajate töötõhususe kohta on olemas mitmeid uurimusi. IT analüütiku roll tarkvaraarendusprotsessis on aga sama oluline. On väga oluline, et IT analüütik teeb oma tööd hästi, sest neid näeb ja nendega suhtleb klient kõige rohkem arendustiimist. Siiski ei ole leitud uurimusi analüüsiprotsessi või selle parandamise kohta.

Antud magistritöö eesmärk on välja töötada meetod IT analüütikutele nende tööprotsessi ja töö kvaliteedi parandamiseks. Et eesmärki saavutada, analüüsiti algset seisundit, viidi läbi intervjuud viie IT analüütikuga ning kirjanduse uuring, et tuvastada võimalikud parandamise valdkonnad, mis hiljem prioritseeriti. Põhinedes eelnevale, pakuti välja uus analüüsiprotsess.

Intervjueeritud IT analüütikud hindasid uut analüüsiprotsessi, kes kõik nõustusid, et uus protsess võiks aidata parandada IT analüüsi kvaliteeti. Järgmine samm on uut protsessi kasutada, et koguda andmeid mille põhjal otsustada, kas uus protsess parandas analüütiku töö kvaliteeti või on vaja teha mõningaid muudatusi.

Võtmesõnad:

Protsessi parandamine, IT analüüs, IT analüütik

CERCS: P170

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1. Introduction

This thesis project is conducted in the context of Helmes, more specifically the project focuses on the role of the IT analyst.

It is important that the IT analysts do their job well because they are the ones who communicate with the client the most. They are also the ones who the client sees the most out of the whole development team and the output of the IT analyst's process is the input for developers, so it is important that it is done correctly and has a high quality.

1.1 Motivation

There are many studies that discuss software development processes and how developers can do their work better and more efficiently. The role of the IT analyst is just as important as the developer's role in a software development process. Having done a literature survey, I have found information about tasks that IT analysts do (more details in section 4.3), but I found nothing that cover the whole IT analysis process or the improvement of the process. Perhaps it is like that because it is not so easy to do a study about an IT analyst's process because there are much more subjective aspects to it than in the developer's processes for example client communication and satisfaction. Following the method developed in the thesis project helps IT analysts to analyze and improve their own work, also it helps junior IT analysts to understand the process of an IT analyst when they first start their careers. While writing this thesis, I can analyze my own work and by using my own IT analysis process as a case study, I could improve my own work as well. A case study is chosen because a case study in software engineering is mostly aimed at investigating how some processes are conducted by software engineers and other stakeholders to increase knowledge [1].

Also, it is more time consuming for senior IT analysts to teach junior IT analysts the basics. Because of that they do not really want to do that from their own time, because they have a lot of work themselves.

The results of this thesis are mainly meant for:

- Junior IT analysts, who are just starting their career to understand the IT analyst's work process in practice not just in theory.
- Experienced IT analysts, who want to get new ideas on how to improve their work. They might not use the exact same process as the one in the case study, but they might use some areas of development that were just mentioned but not specifically implemented. They can also get ideas on how to analyse their own work and how to get better at it.

Although the IT analysis process is in a government project, that is presented as a case study, the same principles and methods apply to private sector projects. Those who are working on private sector projects can still get ideas from the thesis, the method can be applied to both public and private sector projects.

1.2 Goals

This thesis aims to develop a method for IT analysts to improve their work process, so that the IT analyst's quality of work increases, and the IT analysis process is faster and more efficient. The IT analyst's quality of work is usually measured by the client's satisfaction, for example how many times does the IT analyst need to make corrections to the analysis, not because new information arises, but because of their own mistakes, how understandable is their analysis, etc.

To reach the goal, first, the current situation will be analysed. After that, interviews with professional IT analysts and a literature review will be conducted to establish potential areas for improvement. Based on that, an new and hopefully improved IT analysis process will be proposed.

The scope of the thesis is developing and presenting the new improved IT analysis process within a development unit of Helmes. Which means that although it is possible to implement the new IT analysis process and then make alterations to the improved IT analysis process according to the results, the implementation itself is not in the scope of this thesis project. The result of the thesis, which is the new IT analysis process, will be implemented during the same timeframe as the original IT analysis process. When the implementation period is over, I will gather data, then analyze it and make required changes if needed.

The list of criteria that will be used to decide whether the stated goals of the thesis have been achieved, are the following:

- The new (improved) IT analysis process has less waiting time (for example when IT analyst has to wait for confirmation to do next steps)
- The new (improved) IT analysis process has less repetitive loops
- The interviewed IT analysts that are interviewed in the thesis agree that the proposed (new – and hopefully improved) areas might help to improve the IT analysis process

If the new IT analysis process has less waiting time, it means that the IT analyst's time is efficiently spent, and they are not waiting around which wastes time that the client is paying for.

If the new improved IT analysis process has less repetitive loops, then it means that an IT analyst cannot get stuck in a loop. An example of a loop is when the IT analyst completes something, then sends it to the client to confirm and then the client sends it back and the IT analyst must correct it and so on.

Lastly, if the interviewed IT analysts also agree that the implemented areas might help to improve the IT analysis process then there is a bigger chance that the implemented area increases quality and is relevant to the issues that will be encountered.

The thesis is structured as follows. Section 2 discusses the organizational context of the study, which is Helmes as a company, and gives an overview of a typical IT analysis process and its measures. Section 3 describes the method which was used to achieve the goal of the thesis. After that, section 4 provides the results when applying the method that was described in the previous section. Section 5 describes the introduction of the new IT analysis process and discusses future steps. Lastly, section 6 concludes the thesis.

2. Background

This section gives an overview of the company Helmes and its team model, the typical role and process of the IT analysis in Helmes, career levels of the IT analysts in Helmes, the typical problems that IT analysts face in their work and the performance indicators for IT analysts.

Usually, IT analysts define their own work process. If they have a mentor in the beginning of the career, it will be with the help of a mentor. If not, then it will be up to them to create an IT analysis process that works for them. On the contrary, developers usually have a set process depending on the project - it is usually set when they write unit tests, when they do code review, the frequency of deployment, etc. But for IT analysts the process is quite flexible. The most important thing is that in the end the analysis is correct and understandable to everyone who needs it. The process how they achieve it, is usually up to them.

2.1 Helmes AS and its team model

Helmes is a software company that has been producing business critical software mostly for large companies and government enterprises for almost 30 years. Helmes has over 1000 employees that are working in different offices across the world. Helmes does not only produce software in an agile way, but also the whole company is agile, which also results in the following team structure that is presented in Figure 1.

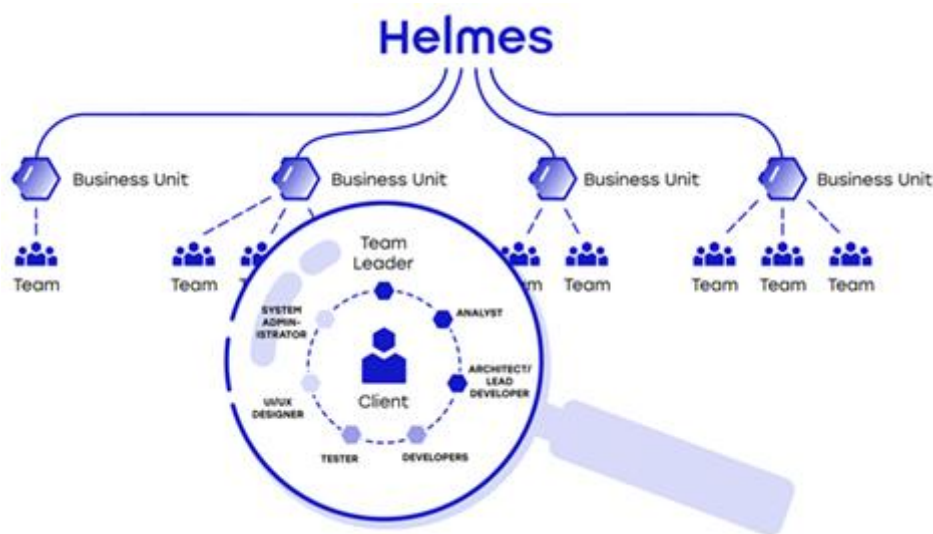


Figure 1. Helmes team model¹

All teams in Helmes are independent and self-organizing, which means that each team takes full responsibility for their results. In a typical team in Helmes, there are usually between 6-10 people. In one team there is always a team leader, an IT analyst, a lead developer, and developers. Depending on a project, there can also be a need for testers, UI/UX designers and other professionals. The number of developers and IT analysts depends on the project size. Usually, the ratio between IT analysts and developers is one IT analyst for 3-4 developers [2].

¹ Figure is taken from Helmes marketing documents with permission.

2.2 Role of IT analyst and process of IT analysis in Helmes

The exact role of an IT analyst is different in each project in Helmes, but it is possible to define the typical roles that an IT analyst typically assumes. In many projects, IT analysts in Helmes are both business- and system analysts. Sometimes, if the project is bigger, the role of an IT analyst is divided among multiple IT analysts, depending on their strengths.

The typical responsibilities for an IT analyst in Helmes are:

- Conducting client meetings
- Specifying requirements and the scope of the project
- Conducting preliminary analysis and validating it
- Creating specifications for developers
- Supporting developers if they have any questions during the implementation
- Acceptance testing before delivering project to client

It is quite difficult to describe a typical process of an IT analyst's work, since projects and IT analysts are different, and preferences are different. But all IT analysis processes have some common ground as well. Figure 2 shows a typical IT analysts' work process.

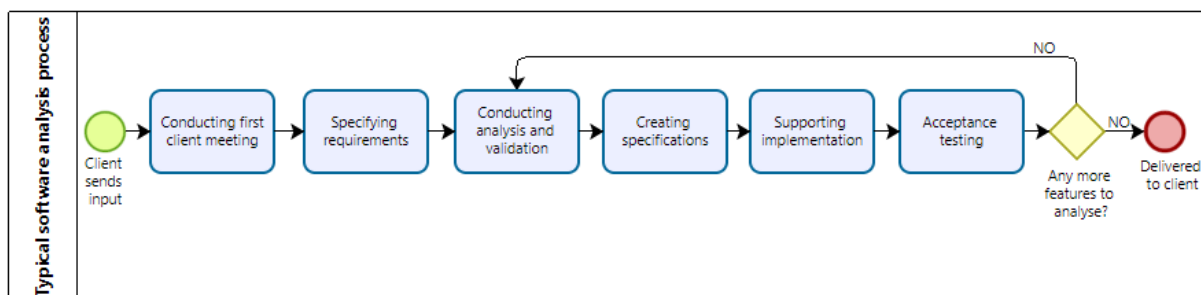


Figure 2. Typical IT analysis process

In Helmes, the first thing that IT analysts usually do when they receive input from client, is to conduct a first client meeting. In the meeting, everything in the project gets organized and agreed upon – roles will be set, meeting times will be set, everyone gets access to everything they need, etc.

When that is clear, then the IT analyst specifies the requirements, asks questions from the client to better understand the requirements. The method or way how the IT analyst specifies and presents the requirements is up to them. From the specified requirements it is possible to set the scope of the project.

When the requirements are established, then the step of conducting the analysis and validation also varies between IT analysts. Different IT analysts do it differently, it is up to them how they want their analysis to be presented. Most important is that it is understandable, and the scope is clear.

If analysis is ready and is validated with the client, meaning that the client approves it, then the IT analyst can create specifications for the developers to start the implementation phase. The way how IT analysts write specifications is different, depending on the project and the IT analyst's own process.

After that, the IT analyst has a supportive role during the implementation. They answer the questions that developers have and if needed, they keep in contact with the client in case it is needed to discuss something with them.

The last step of the IT analysis process is to conduct acceptance testing before the team delivers the project to the client and if there are any more features to analyse, then the process goes back to conducting analysis and validation.

2.3 Career levels for IT analysts in Helmes

The performance that is needed from each IT analyst in Helmes depends on their level of competency. In this subsection, the list of different levels of IT analysts and what is usually expected of them is described.

In Helmes, the levels for IT analysts are defined as follows:

1. Junior IT analyst
2. IT Analyst (mid-level IT analyst)
3. Senior IT analyst
4. Lead IT analyst

The level of a specialist (for every specialist, not just IT analysts) is based on different measures, such as how many years has the person worked in their profession, how many projects has the person done, how is their skill level in different categories, etc. Each year every specialist has an opportunity to be evaluated during a developmental interview with a lead specialist. If they match the criteria, they can be promoted to the next level.

For each level, the idea is that the more experienced and capable the specialist is, the more responsibility and complexity they can take on. For example, if a junior IT analyst is very skilful, they can also take on some tasks that are usually expected from mid-level or senior IT analysts and usually not expected from junior IT analysts. Those mentioned levels are only in the context of Helmes and Helmes team model to ensure the quality inside the company. These levels are not a worldwide standard or other companies' standards. A junior in Helmes might be a senior in another company or vice versa.

At each level, there are different skills and tasks that are expected from IT analysts. Junior IT analysts get tasks based on their capabilities. For them, the main expectations are people skills and good self-expressing skills, because IT analysts work closely with the client. Usually, junior IT analysts have a mentor inside the team who has more experience in the field. Also, junior IT analysts are expected to have good analytical skills in general, so that they can conduct some easier analysis and assist the senior IT analyst in more complex areas. If they prove themselves to be more capable, they can take on more complex tasks.

For mid-level IT analysts, the expectations are the same as for junior IT analysts, and because they have proven themselves to be more skilled, they are expected to be able to conduct the analysis individually. Also, they are expected to be capable of analysing more complex parts of the system, such as integrations, message exchange between different systems and data mapping.

Senior IT analysts are expected to do all the mentioned activities and they should be able to mentor a junior IT analyst. They are expected to be capable of carrying out a new information system analysis from the beginning to the end. A senior IT analyst has an important role in a team since they are expected to give feedback to the team and help improve the team.

Lead IT analysts in Helmes are expected to be able to manage a team of IT analysts, lead, carry out workshops and meetings with multiple parties. Since they work a lot with potential new clients and they are in a high position in the company, they are expected to have good diplomacy skill. Lead IT analysts in Helmes contribute a lot to the development processes to enhance the company's service quality.

2.4 Typical challenges that IT analysts face in their work

IT analysts can have different challenges during their work, starting from figuring out technical solutions to figuring out how to best communicate with the client. Some challenges depend on aspects that are project related, and some depend on the IT analyst's experience and skill.

The most common challenges that IT analysts face in their work are [3][4]:

- How well they can understand the client's business/industry
- How well they can communicate with the client
- How well they can comprehend complex requirements
- How well they can help the client to establish what they need and want
- How well they can understand and meet all the requirements
- How well they can solve the problems that arise
- How well they can manage the client's frequently changing requirements

Of course, there are more challenges than the ones listed above. The ones listed are just some of them that have come up in conversations with other IT analysts during my career, but IT analysts face different challenges throughout their careers.

To address these challenges, IT analysts must work on their skills. The IT analyst must learn to understand the client's business/industry to give the client the best service, because when understanding the client's business, an IT analyst can propose different solutions when the client is stuck.

The IT analyst must also learn to communicate with the client, which helps the IT analyst to understand the client better. IT analysts must learn to comprehend complex requirements, because once IT analysts get to the next level, they will start to analyze more complex systems.

It happens often that the client does not know how to phrase what they need or want in their new system. Because of that the IT analyst needs to learn how to help the client establish all their needs for the new system. Then the IT analyst needs to learn to understand and meet all the requirements that come from the client's needs.

Since during the project many problems can occur, the IT analyst needs to learn to solve arising problems. Also, they need to learn to manage the client's frequently changing requirements when new information comes, or the client changes their mind.

2.5 Performance indicators for IT analysts

While it is not so easy to know which skills are needed to improve these challenges mentioned in Subsection 2.4, it might be possible to identify at least some performance indicators that help assess whether an IT analyst has appropriate skills or not.

Performance indicators for IT analysts can be both quantitative and qualitative, which means that some indicators can be measured in numbers (interval or ratio scale), for example how many questions does the client ask. And some can be measured qualitatively, for example how happy is the client with the IT analyst (ordinal or nominal scale).

The measures that are selected for the scope of this thesis are the ones that can be measured quantitatively, so it is easier to compare later. Quantitative measures can also indicate that potentially the client is not happy if they need to comment or question my work too much.

The measures that are used to measure the performance in this thesis are:

- The number of comments from the client
- The number of questions from the client
- The number of questions from the developers
- The number of comments from the developers

The mentioned four measures are inspired from a more comprehensive set of KPI's proposed by International Institute of Business Analysis [5].

Returning an analysis might have several reasons. Maybe it is miscommunication, maybe a wrong understanding of the requirements. It is not very clear that the reason is linked to the bullet points mentioned in the subsection 2.4 but can be an indicator that there is an area that an IT analyst needs to work on.

The reason that the number of comments and questions from the client is measured, is that whenever they leave a comment or question on the analysis, it indicates that they either did not understand what was written there or there was a mistake.

The number of questions an IT analyst gets from the developers can indicate that the written analysis is not very clear and understandable which can lead to errors in the implemented functionalities.

Also, the number of comments the IT analyst gets from the developers indicates potential errors in the analysis, because developers understand the technical side from the code as well, so they can see if there are any contradictions between the analysis and the existing code. It is important to note here that the number of comments also depend on the competency level of the developer. A senior developer probably sees more potential errors than a junior developer because of their experience.

Measuring and improving those measured values does not automatically tell what skills mentioned in the subsection 2.4 have improved if they have improved at all. These measures do not show the full picture, because there are still qualitative measures, such as client satisfaction. But when the mentioned measures improve, it gives some expectations that the quality improves as well.

Of course, just reducing the number of comments or rewritten analysis does not mean that the IT analyst will achieve the next level in their career. But reducing the measures mentioned indicates that the quality of work has increased, and the IT analyst will gain more experience and eventually achieve the next level when evaluated. Reducing those measures also indicates that the client is potentially happier if they need to send analysis back less.

The main purpose of the four measures defined above is to analyse and improve my own IT analysis process. However, these measures are general enough so that they can be used by other IT analysts to assess and improve their own processes, even if they have different challenges and issues.

However, these measures are not fully objective. For example, deciding what counts as a question or comment can be subjective and different comments have different weight, some can have a heavier impact than others. Thus, to ease the counting, all questions and comments are considered to be equal.

3. Methodology

This section describes the steps that are followed in the thesis project to improve the IT analysis process. Figure 3 shows the method and the steps that will be taken.

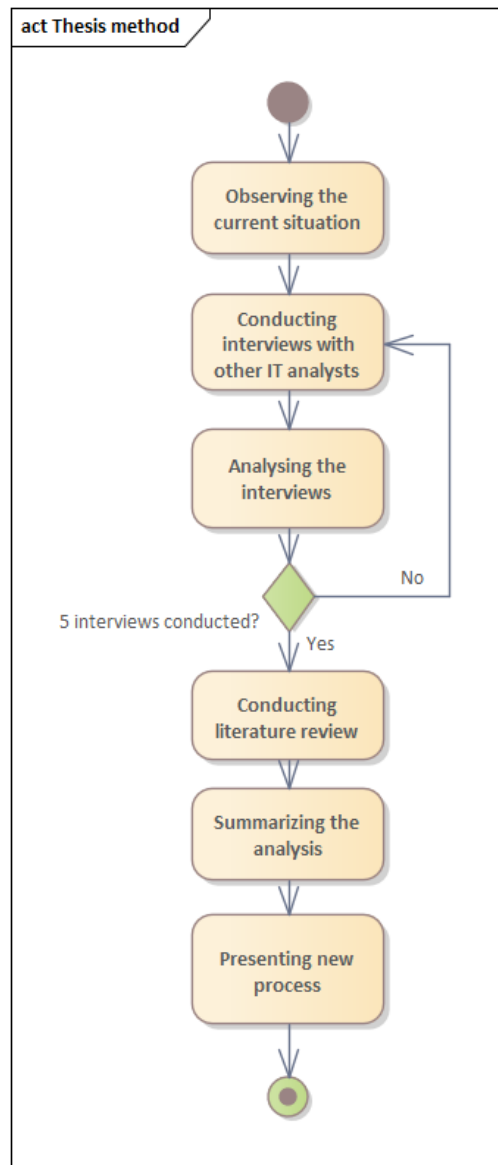


Figure 3. Methodology for improving IT analysis process

The method is inspired from Observe-Plan-Do-Check-Act (OPDCA) method [6], which itself is developed from the Plan-Do-Check-Act (PDCA) method [7]. The PDCA method is a four-step model for carrying out change, which can be carried out as many times until the desired result is achieved.

The original PDCA method consists of four main steps:

1. Plan – a step used for describing processes surrounding the problem to understand the process and identifying areas for improvements.
2. Do – once the plan for improvement is established, the Do step is for implementing the plan for the first time.

3. Check – this is the step where significant learning can take place by observing the implemented processes.
4. Act – in this step, the solutions are prepared for improving the new process after the new knowledge from the previous phase.

As mentioned, this thesis is inspired from the OPDCA method, which has the Observation step in the beginning. The observation step is for observing the current condition to establish what are the main issues of the current process to identify the root causes.

The PDCA (and OPDCA) method is most used when [8]:

- Starting a new improvement project
- Developing a new or improved design of a process, product or service
- Defining a repetitive work process
- Planning data collection and analysis to verify and prioritize problems or root causes
- Implementing any change
- Working toward continuous improvement

This thesis concentrates on the observation and planning step and the other mentioned steps are out of scope from this thesis to focus on the planning. The following subsections explain in detail what each step of the method includes.

3.1 Observing the current situation (Baseline)

To know what the areas for improvement for the IT analysis process are, it is needed to know what the main issues and weaknesses in the current IT analysis process are.

Following is the summary of steps that are taken in the first step of the thesis:

1. Describing my work process as an IT analyst as a case study using Bizagi Modeler²
2. Establishing the weaknesses and issues in the current IT analysis process
3. Proposing my own areas for improvement that I think would help increase the quality of work.

In order to know what the weaknesses of the current IT analysis process are, it is needed to describe first what is the current IT analysis process. To illustrate the current IT analysis process, the current process will be modelled using Bizagi Modeler. Bizagi Modeler is used in this thesis because it is a very good and widely used tool to model processes, and it is the tool that I am already familiar with.

After the current IT analysis process is known, the issues and weaknesses of the current IT analysis process can be established. Since all communication with the project's client and the developers is done using online communication tools, everything is traceable, and information is easy to collect. The data is collected throughout the entire ongoing project from January 2021 to September 2021.

² <https://www.bizagi.com/en/platform/modeler>

The ways to conduct data collection to establish issues are:

- Comments and questions I get from the client and developers through Skype³
- Comments and questions I get from the client and developers through Atlassian Confluence⁴
- Comments and questions I get from the client and developers through Atlassian Jira⁵

Counting comments and questions from Confluence and Jira is more qualitative and counting comments and questions from Skype is also qualitative, but it can be more subjective due to the possibility of human error in the counting. I try to make it as subjective as possible, making all the comments and questions count as equal, but there is still an aspect of human error. The interpretation of the number remains subjective, because some comments have heavier impact than some lighter comments.

This thesis focuses only on the weaknesses and issues and does not present strengths of the current IT analysis process, because the scope of the thesis is to address the issues and propose solutions to mentioned issues.

When the issues are established, then it is possible to generate initial areas for improvement that I think would help address the issues and improve the quality of the analysis. The proposed areas will be discussed with the other IT analysts later in the interviews, to see if the other IT analysts think that the proposed solutions would help improve the IT analysis process.

3.2 Conducting interviews with other IT analysts

When the current IT analysis process is observed as a starting point (baseline), the next step is to conduct interviews with five other IT analysts in Helmes. The five IT analysts that will be chosen for the interviews are:

- Two senior IT analysts
- Two mid-level IT analysts
- One junior IT analyst.

Five IT analysts will be interviewed and not more or less, because it would give me the variety I need and if I interview more people, then most of the answers will start to repeat too much. The five IT analysts who are chosen, have different levels of competence to get more variety. For example, IT analysts who have 15 years or more experience will have insights that are more experience based and a junior IT analyst will have insights fresh from school. All the IT analysts will be anonymous, which means that no IT analysts' names, projects' names, nor clients' names will be mentioned, so that the interviewees will not be intimidated to give influenced answers.

To get the most relevant results the chosen IT analysts need to meet a certain criterion. The following lists the criteria that is used to choose the specific IT analysts:

³ <https://www.skype.com/en/>

⁴ <https://www.atlassian.com/software/confluence>

⁵ <https://www.atlassian.com/software/jira>

- IT analysts who are currently working on government projects because I am working on government projects, so that would make the process analysis more relevant. For senior IT analysts it is also accepted if they have worked on a government project in the past, since they have more experience and can discuss IT analysis processes on government projects.
- IT analysts who are in different teams in Helmes to get more variety in other analysts' processes. It is high probability that IT analysts who are in the same development teams have the same IT analysis process since they work closely together, and one is probably the other's mentor. This helps to get more different ideas.
- IT analysts who are working on different projects. It is possible for two IT analysts who are in different teams to still work on the same project. This will also help to get more ideas and proposals for improvement because if clients and projects are different, then the IT analysis processes are different as well.

The interviews with other IT analysts are one-hour long sessions to establish their IT analysis processes and then get their feedback on my current IT analysis process. The interviews will not be longer because after one hour, usually a person's focus will start to fade, and the interview will be less productive. To make the interview as productive as possible, the information about the interview process and questions will be given to the IT analysts beforehand, so that they can think about their own IT analysis processes before the interview session starts.

The following describes the interview process:

1. Describing their IT analysis process on the government project
2. Showing the IT analyst my current IT analysis process and establishing their proposed areas for improvement for my IT analysis process
3. Showing the IT analyst my proposed areas for improvement for my IT analysis process

To describe their IT analysis process, the IT analysts will be given a starting point which is when the client gives them the input for their IT analysts for the first time. The IT analyst will start describing their IT analysis process, which will be documented so that they can see the writing and can correct it on the spot if needed. To make the IT analyst's process as detailed as possible, some extra questions are asked according to the IT analysis process if needed. To make the IT analyst's process as biased as possible, they will not be showed mine or others' IT analysis processes before. I will also make sure that the IT analyst does not have the same issues as me in their IT analysis process. Otherwise, the steps that they make during their IT analysis process cannot be taken as something that should be used in the new improved IT analysis process.

After the IT analyst's process is described in detail, they will be introduced to my current IT analysis process with the weaknesses and issues, which is followed by establishing what they think would help solve the weaknesses that I have. They are asked to point out the areas of improvement right away, because the weaknesses that have the most impact on the quality will be noticed the fastest and usually right away. This derives from the Pareto principle, which states that 20% of the causes have 80% effect. So, if the other IT analysts just point out the

biggest areas for improvement, in theory it should have 80% effect on the IT analyst's process [9].

In the last step of the interviews the interviewees will be explained the areas for improvement proposed by me, so that they can give their opinion about those points.

3.3 Analysing the interviews

After the interview, it is possible to analyse the other IT analyst's process and their proposed areas for improvements.

The steps that are taken to analyse the output from the interview:

1. Describing and modelling the other IT analyst's process using Bizagi Modeler
2. Listing the areas for improvement that were proposed by the other IT analyst
3. Comparing the other IT analyst's process and propositions with mine and analysing it.

To best illustrate and give the big picture about the other IT analyst's process, it is first modelled using Bizagi Modeler. After that the IT analysis process is described in detail to complement the model.

Following will be the list of all the areas for improvement that the other IT analyst proposed together with description and analysis.

When the previously listed steps are done, then the IT analyst will be sent the model, description of the model and all listed areas for improvement, so that they can confirm whether they were understood correctly during the interview and whether the IT analysis process description and their thoughts about improvements were accurately presented. If some corrections are needed, then the IT analysis process description and their proposed areas for improvement will be modified accordingly.

If the IT analyst confirms the description and their proposed areas for improvement, then it is possible to start analysing them. When analysing, all the differences from my current IT analysis process and the IT analyst's process will be established.

The steps that are described in subsections 3.2 and 3.3 are repeated until all five IT analysts are interviewed, and their processes analysed. They are all analysed separately at first so that it is easier to focus on one analysis. Later in the thesis will be presented the summary of the analysis which is led by the new improved IT analysis process.

3.4 Conducting literature review

After all the interviews are done and analysed, then the literature review can be conducted. A systematic literature review is a means of evaluating and interpreting available research relevant to a particular topic area [10].

The goal of the literature review is to see if there is any literature about the IT analysis process or not, and if so, then how does literature describe the tasks performed by the IT analysts. The research question is: what analysis tasks are mentioned in available research papers?

The method that is used to conduct literature review is snowballing. Snowballing method can be done in two ways: forward and backward snowballing. In this thesis project, the backward

snowballing is used. Backward snowballing is using the reference lists of papers to identify new papers to include [11].

To conduct the snowballing method, there is a need for initial set of papers from which it is possible to start looking for related papers that answer the research questions. For backward snowballing, the first step is to look at the titles of research papers in the reference list. To know which paper might or might not be relevant, there is a set of criteria, and the title of the paper needs to meet at least one of the criteria.

The set of criteria is following:

1. Title mentions “IT analysis process”
2. Title mentions “system analysis”
3. Title mentions “IT analysis”
4. Title mentions “business analysis”
5. Title mentions “software analysis”

After finding possible relevant papers from the reference list, the second step in backward snowballing is to look at the abstract of the paper. If the abstract does not meet the criteria, then the paper will not be included in the set of papers. The abstract needs to meet the goal of the literature review.

The last step of the backward snowballing is to look at the full paper. If the paper meets the goal of the literature review, then it can be included in the set of relevant papers. The literature review method can be iterated many times until there are no new papers to be found or until the method has given enough papers.

Since it is not expected to find too many articles, then there is no time range criteria set for the included papers.

The result of the literature review will be to establish some steps or proposed areas for improvement that is mentioned in the literature that IT analysts do that might help to improve the current IT analysis process that is presented as a case study in this thesis.

3.5 Summarizing the analysis

To prioritize and decide which areas for improvement get implemented in the new improved IT analysis process, it is needed to summarise the analysis of all the interviews and the literature review.

The input for the summary will contain:

- My proposed areas for improvement and the interviewed IT analysts’ opinions about my proposed areas for improvement
- All the areas for improvement proposed by the interviewed IT analysts
- All the differences between mine and the interviewed IT analysts’ processes
- IT analysis tasks mentioned in the literature review.

First, all the areas for improvement proposed by me together with the opinions of the interviewed IT analysts will be gathered. Based on the interviewed IT analysts’ opinions, some

of the areas for improvement will be included and some will be excluded from the final list of areas for improvement if the IT analysts think that it will not increase IT analysis quality.

Second, all the areas for improvement proposed by the interviewed IT analysts will be gathered. It will be counted how many times each proposal occurs. The areas for improvements that occur the most will be included in the final list of areas for improvement.

Third, All the differences between mine and the interviewed IT analysts' processes will be gathered and counted. The differences that occur the most will be included in the final list of areas for improvement.

Fourth, the IT analysis tasks that are mentioned in the literature review are gathered. The tasks that will get excluded from the final list of areas for improvement are the ones that are already a part of the IT analysis process or the ones that are not a part of an IT analyst work process in Helmes.

To get the final list of areas for improvement that will be implemented in the new IT analysis process, the areas for improvement that were included from the summary, are grouped since some of the areas for improvement have the same meaning.

The output of this step is a final list of the areas for improvement that get implemented in the new improved IT analysis process.

3.6 Presenting new IT analysis process

The final step is presenting and describing the new IT analysis process that will hopefully be an improved IT analysis process. The new IT analysis process is derived from the previous step described in subsection 3.5, where the analysis was summarized.

For that, the Bizagi Modeler is used again to illustrate the new IT analysis process and to get a clearer overview of the IT analysis process. The model is followed by a textual description that goes into more detail about the new process and the implemented changes.

To determine, whether the new IT analysis process is an improvement, all the interviewed analysts are sent the new IT analysis process and asked for their feedback.

4. Results

This section discusses how the steps of the method from section 3 were carried out and what their outcomes were. The structure of this section follows the steps showed in Figure 3 (Method).

4.1 Baseline

In this chapter I describe my own process as an IT analyst, establish the weaknesses and issues in the current IT analysis process, and later, depending on the issues, I am going to propose my own potential areas of improvement for my IT analysis process.

4.1.1 Current IT analysis process description

The current process of my IT analysis is described using Bizagi Modeler. The current IT analysis process gives an overview of how the software analysis is conducted now in the current project. Figures 4, 5, 6 and 7 show my current process as an IT analyst.

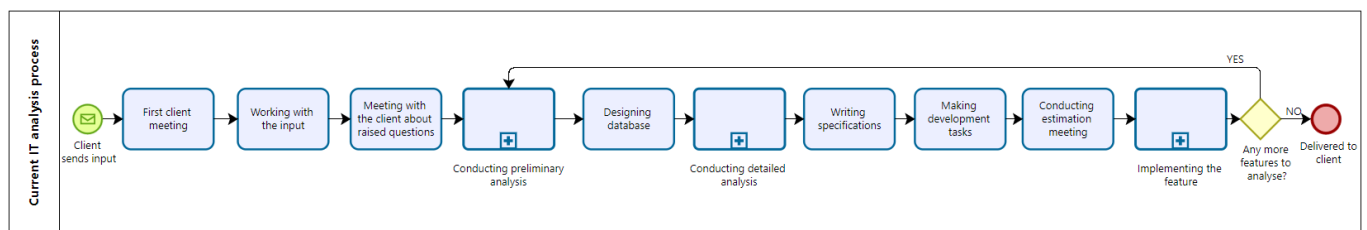


Figure 4. Current IT analysis process

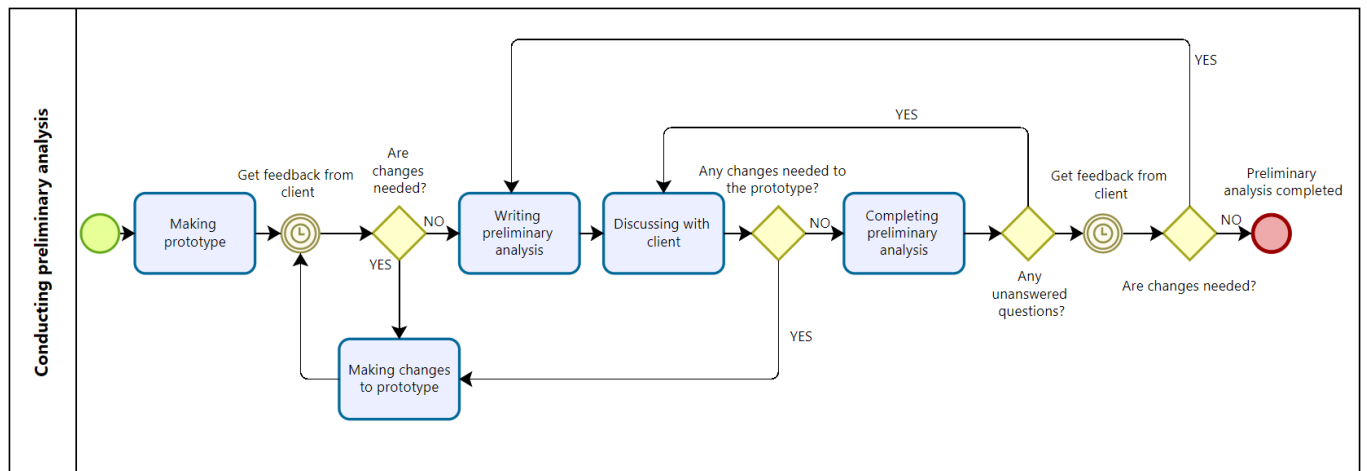


Figure 5. Current sub process “Conducting preliminary analysis”

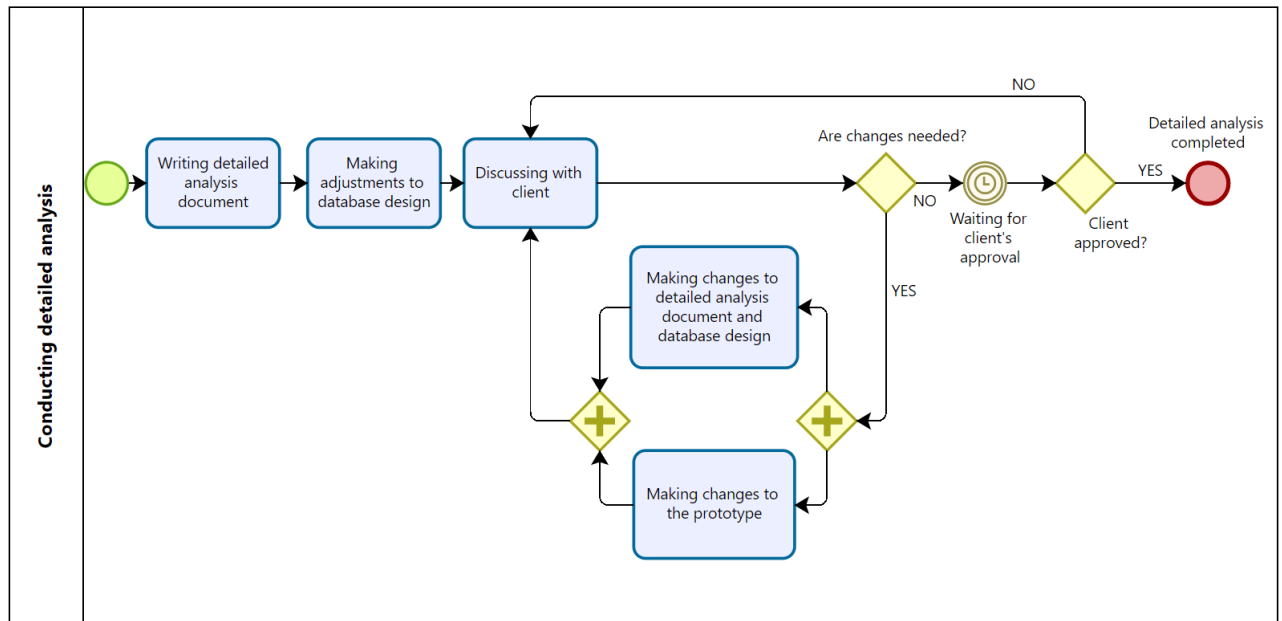


Figure 6. Current sub process “Conducting detailed analysis”

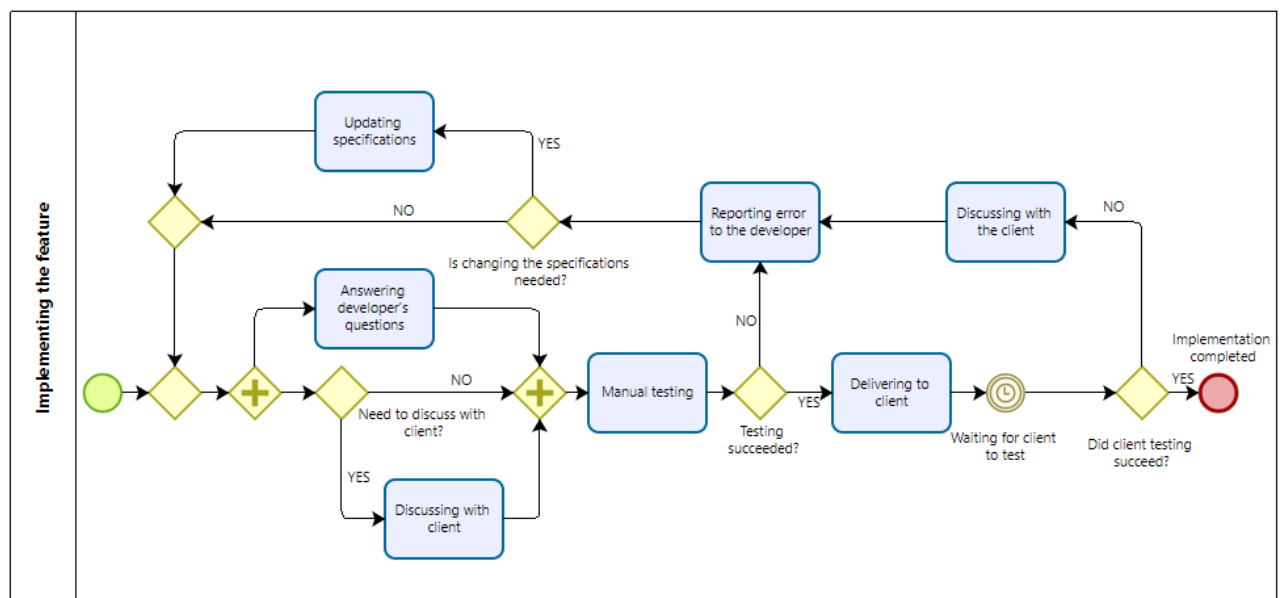


Figure 7. Current sub process “Implementing the feature”

Figure 4 gives an overview of the current IT analysis process. The IT analysis process starts when the client sends their input. Then we set up the first client meeting, which is usually a few hours long, where they describe the background, the system that they already have, they describe their business process that is relevant to the project and they give their requirements of the TO-BE process. I can also ask some initial questions about the input. After that I work with the input, I work through it and write down questions that I have. This step usually takes me a day to a few days, depending on the project size. Then we set up another meeting with the client where I can ask all the questions that I have. I have organized these meetings because then I just don't get plain answers, but we can generate a discussion about the answers I get and what is required of the new system. This meeting is also about a couple of hours long usually.

Figure 5 gives an overview of the current sub process “Conducting preliminary analysis”. I start with making the prototype, which helps me to create a bigger picture of how the system will look like. When I have drawn up the first prototype, I send it to the client and then wait for their feedback, because if I just continue with the preliminary analysis and the prototype wouldn’t suit them, then I would need to do a lot of extra work. When the client has taken a look at the prototype, they will send me the feedback. If the feedback indicates that there are changes needed in the prototype, then I will make changes to the prototype. After the changes, I send the prototype to the client again to get feedback. This loop will continue until there are no changes needed for the prototype so that I have the most accurate information to start writing up the preliminary analysis to avoid any extra work that might take time.

When the prototype is ready, then I start writing the preliminary analysis that matches the prototype. The preliminary analysis is simply a text document with prototype images. In the preliminary analysis I focus more on the business requirements and business logic than technical solutions and specifications. I do that because if I send the preliminary analysis to the client, who has more business knowledge than technical knowledge, and if in the preliminary analysis there is a lot of technical information, then it is harder for the client to focus on the business logic and requirements. All the questions that come up during this step, I write them down and then I have a discussion with the client to discuss all the questions that I have, and the client lets me know if there is anything I need to change or add to the preliminary analysis. It is rather a discussion not a meeting, because we don’t always have a meeting, sometimes we discuss smaller aspects using online chat tools. Although most of the time it is an actual online meeting. If from the discussion the client concludes that there are some new requirements or bigger changes needed that require a prototype change, then I go back to the step where I do changes to the prototype to get feedback from the client. If there are no changes needed, then I go to the next step to complete the preliminary analysis based on the information that I have. If I still have any unanswered questions, I will have a discussion with the client that will determine if the preliminary analysis still needs some bigger changes, or I can finish the preliminary analysis. When I don’t have any questions left, I will send the preliminary analysis for the client to evaluate and get feedback. During that time the whole IT analysis process is on hold because if I continue with the next step and there is a bigger change required to the preliminary analysis, then the next steps will be affected by these changes and the work and time that I have put into it will be wasted.

When I get the feedback, which is usually left by commenting on the text I have written, I will see if there are any changes required to the preliminary analysis. If there is, I go back to the step where I write the preliminary analysis and it is followed by a discussion with the client. If needed, I make changes to the prototype, etc. If from the feedback there are no further changes needed, then the preliminary analysis is finished, and I go onto the next step. Of course, that doesn’t necessarily mean that there won’t be any changes to the preliminary analysis later in case there are some new requirements that have come up.

When the preliminary analysis is done, I start designing the database. I look at the preliminary analysis, gather all the data that needs to be stored in the database and I will design the database according to that. I also keep in mind the business requirements of the system when I design

the database, for example if the database needs to keep the version history of the data objects, what are the types of the data that needs to be stored, etc. When the database design is ready, then I will start writing the detailed analysis.

Figure 6 gives an overview of the current sub process “Conducting detailed analysis”. The detailed analysis is also text documents with links to the prototype or images of it. Detailed analysis consists of both requirements - business and technical. Usually during the writing, I see that there is something missing or I have to change the initial database design, then I make adjustments to the database. During the time when I am writing the detailed analysis, I gather all my questions and then I have another discussion with the client. If needed, the discussion is in a meeting format and if not, then we just communicate through chat tools with each other. In the meeting we discuss all the questions I have, also if they have any questions. We discuss if there are any changes needed and how big these changes are. In the end of the meeting, we agree on the solutions so that I can implement those in the detailed analysis.

If changes are needed, then depending on the new requirements or changes I make changes to the prototype if needed and I will make the required changes to the database design and the detailed analysis document. After that I will have a discussion again with the client to be sure that I have understood them, and everything should be right in the detailed analysis. If no further changes are needed for the detailed analysis, then I give the document to the client. Now someone from the client’s side who has more technical knowledge and enough business knowledge will look over the detailed analysis and propose their changes if needed. If everything is okay, then the detailed analysis is finished, and I can go on to the next step. If the client doesn’t approve, then I have to make some changes in the document. The client usually doesn’t approve because of two reasons - either there are still some changes in the requirements or there is a systematic error in the detailed analysis. When I have to make changes to the detailed analysis, I will have a discussion with the client again about the changes and errors. Sometimes from the discussion we conclude that some changes are not needed and if the changes are needed then the next steps will be to make the changes in the prototype, database design and the detailed analysis. After that I will have a short discussion again with the client to make sure that everything is correct. This loop will continue until the detailed analysis is finished and the client approves it.

When the detailed analysis is finished, I start with writing specifications of the detailed analysis for the developers. For the developers these are the documents that they take as a basis for their programming. The specifications are usually multiple documents that have been linked to each other. When the specifications are done, then I divide the specifications into separate development tasks for the developers and I write them into a task management software (JIRA). When the tasks are done, I set up an estimation meeting where we sit down with the team’s developers. During the meeting I describe to them what is the AS-IS system or process that the client has in place at the moment, what is the TO-BE system or process and then we go into separate tasks, where I describe what needs to be done for each individual task. For every task, developers give their estimate about how long it takes to develop the functionality that is required in the task. This helps the client and the development team to evaluate and plan the

project in the long term since government projects usually have a set budget and the price of the development cannot go over the agreed budget.

Figure 7 gives an overview of the sub process “Implementing the feature”. In this sub process my role as an IT analyst is mostly to support the developers in case they have any questions or in case I need to discuss with the client. When the developers ask me questions about the specifications and if I can’t give them an answer myself then I discuss with the client first to be sure that I have everything right. After that I let the developers know the answer to their questions. When the developers have finished their tasks then I do the first manual testing to be sure that there are no issues regarding the new functionalities. I usually test the most important parts and the edge cases of the tasks. If the testing succeeds, then we deliver them to the client. If the testing fails, then I report the errors to the developers. If I see that there was an error in the specification, then I make changes to the specification and the developers can make changes in the code. If there are no changes needed, then the developers can fix the error right away. If they have questions in the meantime, I will answer them or I will discuss with the client again if needed. When the errors are fixed then I test again, and the loop continues until the tasks pass my manual testing.

The client can start testing right after we have delivered the tasks to them. If the client’s testing does not pass, then they let me know. Usually, we discuss what was the error and how it should be fixed. Sometimes the client wants a change in the requirements, because from testing they conclude that the initial solution is not the most comfortable or optimal. When the new solution has been agreed, I report the error to the developers. Next, the same process applies as when I report an error from my testing. This loop continues until the client approves the feature. If there are more features to analyse, then the process goes back to preliminary analysis.

4.1.2 Weaknesses and issues in the current IT analysis process

In this subsection, the weaknesses are established that occur in the current IT analysis process that was described in the previous subsection. The established weaknesses are my own reflection based on the measurements presented in this Subsection.

To define the issues, it is first needed to list the ways of communication with the client. The communication with the client happens with the following tools:

- Skype
- Confluence
- Jira

Since all communication with the project’s client and the developers is done using online communication tools, communication is traceable and data collectable. The data is collected throughout the entire ongoing project from January 2021 to September 2021.

The performance indicators that were measured and the measurements are as follows:

- Comments and questions gotten from the client and developers through Skype
 - Questions and comments from the client through Skype were 0, because they ask their questions mostly through Confluence.

- Questions from the developers through Skype was 294. All together there was four developers working on the project (not all at the same time). The developers had all together 61 comments or suggestions.
- Comments and questions gotten from the client and developers through Atlassian Confluence
 - The client added all together 45 comments on the analysis during the project. They did not ask any questions related to the analysis.
 - Since the communication with the developers is mostly through Skype, then they did not comment on anything through Atlassian Confluence, but they did ask 3 questions in the analysis.
- Comments and questions gotten from the client and developers through Atlassian Jira
 - In Jira, the client added 10 comments in the tasks about the analysis.
 - The developers all together asked 2 questions and added 1 comment in Jira.

Figure 8 illustrates the summary of the measurements.

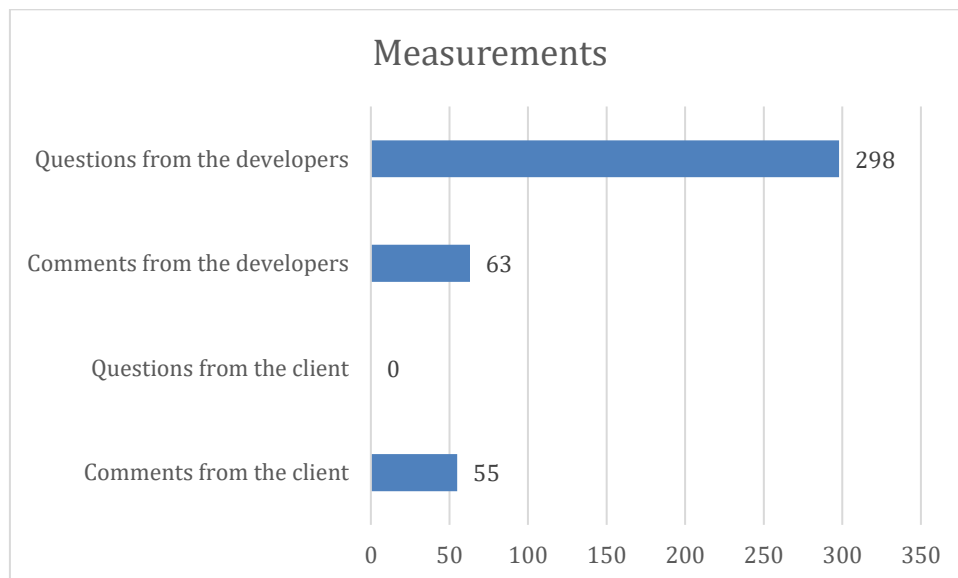


Figure 8. Summary of the measurements

From figure 8 it can be calculated that an average of 33.1 questions were asked by the developers per month. Also, an average of 6.1 comments were made by the client and 7 comments were made by the developers per month.

These numbers can mean several things. Some of the reasons might be related to the IT analyst, some might not.

The reasons that are related to the IT analyst, are the following:

- Not understanding the client's business or industry
- Not comprehending complex requirements
- Not understanding or meeting all the requirements
- Not being able to communicate with the client well

Of course, there can be more reasons and it cannot be established which of those reasons are certainly the cause, but it is possible to speculate and establish which reasons are most probable. One reason can be that the IT analyst does not understand the client's business or industry that well since it is their first project in this industry. This problem however can probably be solved with time and experience if the IT analyst puts in the effort to understand it.

It is possible, that one of the reasons can be that the IT analyst cannot comprehend the complex requirements since the system that is being developed is very large and complicated. This reason can be derived from the previously explained reason. It is harder to understand the complex requirements of a system when the knowledge of the client's business is low as well.

When the IT analyst does not understand the complex requirements, it can also mean, that some other, more simpler requirements were also not understood and met. This can be caused by poor communication with the client or also because the client's business is not understood. So, one of the reasons of these metrics can be that the communication between the client and the IT analyst is not very good.

4.1.3 My proposals for improvement

In the last subsection the weaknesses of the current IT analysis process were established, so in this subsection it is possible to establish the areas of improvement that I think would improve my process as an IT analyst and would improve the metrics presented in the last subsection.

When I am proposing my own areas of improvement, I keep in mind that the improved IT analysis process should be:

- Not causing anyone else in the team or the client more work
- Increasing quality of work, meaning that there are less errors and uncertainties in the analysis
- Helping to determine the requirements in the beginning phase of the analysis, so that there is less need for changes in the later stages of the analysis which results in less comments by the client and the developers
- More efficient, meaning there are less loops, that can repeat endlessly, in the IT analysis process and less waiting time, etc.

My proposed areas of improvement are:

- Using UML diagrams
- Using AS-IS and TO-BE process models
- Explicitly writing down the system and business requirements
- Doing some things simultaneously
- Conducting less meetings

When conducting the preliminary analysis, the UML diagrams, such as use case diagrams, class diagrams, sequence diagrams and activity diagrams, might help to give the client a better overview of the bigger picture of the system. This might help the customer to see if I have understood the requirements right. It might help to discover some flaws earlier, not when I am already writing the detailed analysis and there is more work to rewrite. If we discover flaws earlier, then we can change the requirements and make necessary changes early in the IT

analysis process and it results in a smaller cost. Although it is extra work for the IT analysis process, in the later stages of the process it helps to prevent cases when the client does not approve the analysis because of some error.

Using AS-IS and TO-BE diagrams might help to understand the client's business and needs more. Using AS-IS diagram can help to understand how the client's process at the moment is and can help to establish some requirements that are yet unknown but will come up later in the work, which can result in rewriting more documents later.

Writing down the system and business requirements explicitly might help to understand more in clearly what the client needs and what is the scope of the project. In case, when the client goes out of scope in the future, it is possible to refer to that. This can prevent the probability that the project will be overdue. Also, the client sees clearly what the written requirements are and if needed can add, or remove some business or system requirements.

Doing some things simultaneously might help to save some time, for example designing the database and writing detailed analysis at the same time. This might help to prevent the need to redesign the database that many times if those tasks are done simultaneously.

Conducting less meetings with the client helps to save time. In my experience most of the times in the meetings I just need the final decision, so that it is possible to continue with the analysis. However, not doing any meetings at all is also not possible, because some meetings are still important, but many of them can be avoided too.

4.2 Interviews

In this chapter, five other IT analysts will be interviewed, and their IT analysis processes will be described. The interviews are one-hour long sessions, where they describe their processes as IT analysts. After that they will be shown my current IT analysis process followed by a discussion to establish their proposed areas for improvement for my current IT analysis process. I go interview by interview describing not only how I conduct the interviews, but also how I analyse them separately by IT analyst, so later mine and the other IT analyst's processes will be compared to find differences.

To protect the other IT analysts' anonymity, no person names, project names nor client names will be mentioned.

4.2.1 Interview with IT analyst 1

In this subsection, the first IT analyst's (junior IT analyst) process and the analysis of their IT analysis process will be presented along with their presented areas for improvement for my current IT analysis process.

4.2.1.1 IT analyst 1 process

Figures 9, 10 and 11 show the process of IT analyst 1 in detail.

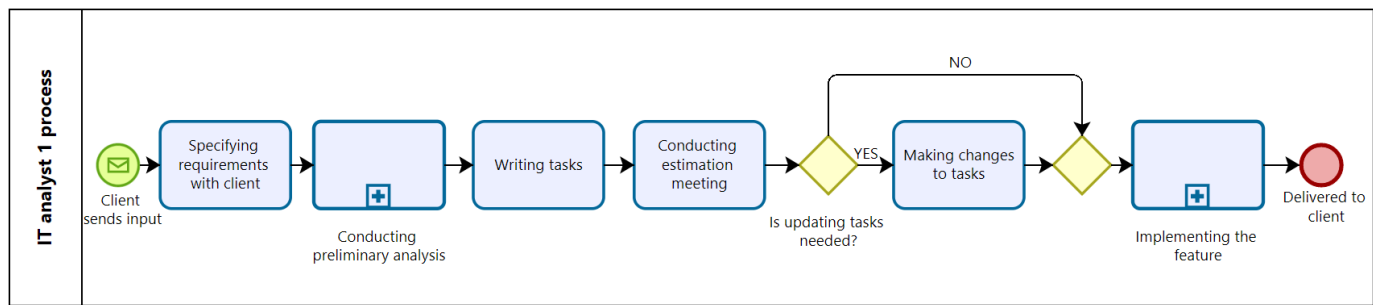


Figure 9. IT analyst 1 process

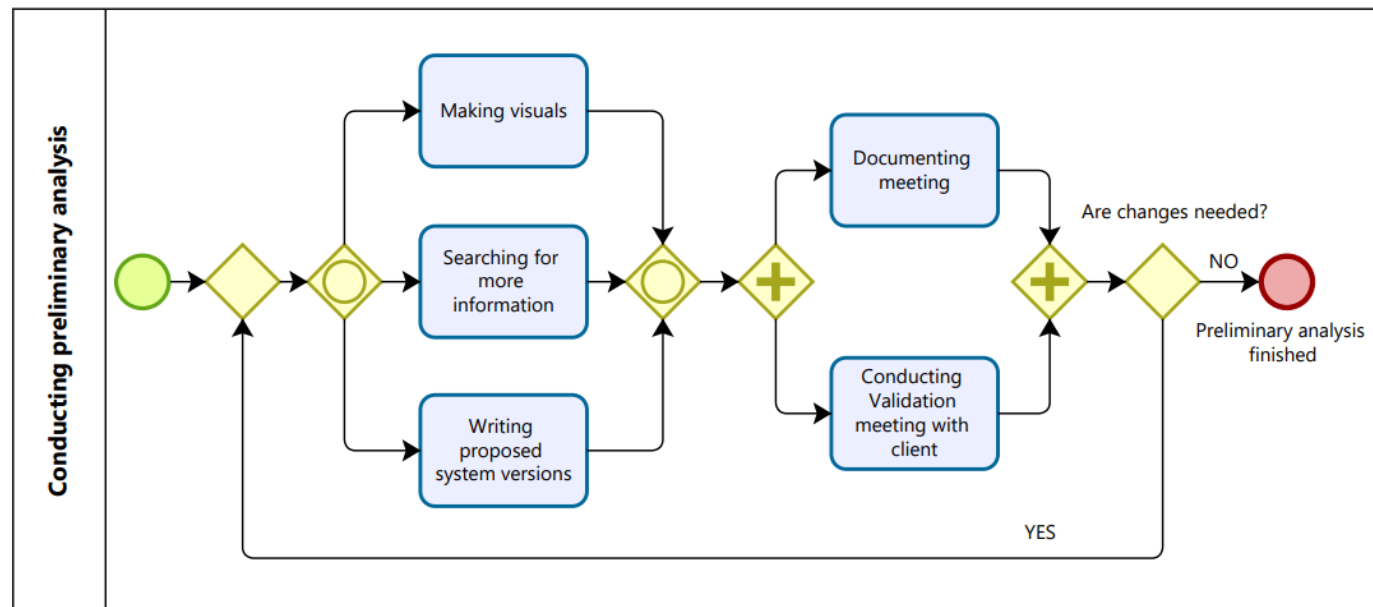


Figure 10. IT analyst 1 sub process “Conducting preliminary analysis”

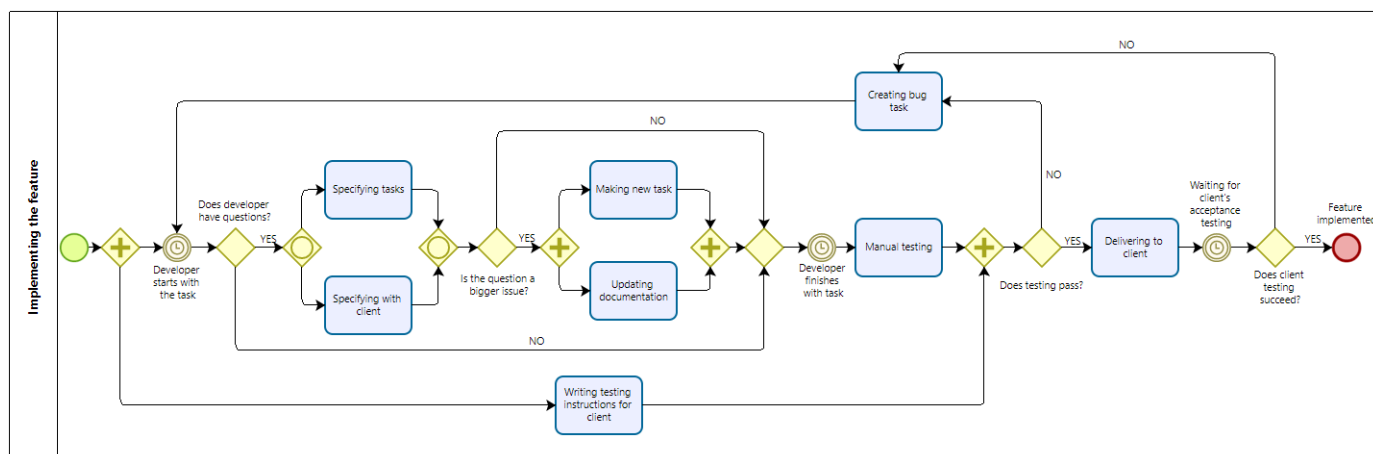


Figure 11. IT analyst 1 sub process “Implementing the feature”

Figure 9 gives an overview of the IT analyst 1 process. The IT analysis process starts when the client sends their input. The first step after that will be specifying the requirements with the client. In this step they will not write any specific document or processes. They will just have a meeting in person or online, where they ask specifying questions from the client to make sure that they understand the client’s needs.

Figure 10 gives an overview of the IT analyst 1 sub process “Conducting preliminary analysis”. Depending on the requirements, they see if they need to search for more information, for example if they have an integration requirement, then they need more information to know the scope. Also, they see if they need to make some visuals, for example UML process diagrams or prototypes if they need to illustrate the requirement or they will just write a text document.

Every week they have a validation meeting with the client, where they oversee all the proposed solutions that the IT analyst has created before. The IT analyst documents everything. If the client is not happy with some solution, the IT analyst writes it down. After the meeting, if there is anything that the IT analyst must change in the future solution, then they will go back in the IT analysis process to make the prototype and make the changes needed. After that they will have the validation meeting with the client again.

If there are no further changes needed, then the IT analyst will write tasks for development. After that they will have an estimation meeting with all the developers in the team to give evaluation to the written tasks. If during the meeting, the IT analyst sees that the tasks need to be changed or updated, then they will make the changes to the tasks. The IT analyst will need to make changes for example when the developers do not have enough information to develop the functionality in the task.

Figure 11 gives an overview of the IT analyst 1 sub process “Implementing the feature”. When the developer starts working on the task and they have questions, then the IT analyst will either specify the tasks, or specify with the client, or both to answer the developer’s question. If it is a smaller issue, then the developer will fix it with the same task. If it is a bigger issue, then the IT analyst will make the new task and update the documentation for the task.

After the developer has finished with their task and if needed, the IT analyst will test the functionality manually together with a professional tester to see if everything works. If they find an error, they will create a task to fix the bug, so that the developer can start working with it. If the developer has any questions, the IT analyst will discuss with the developer or the client, or both, and so on, but this happens quite rarely.

During the implementation, the IT analyst writes testing instructions for the client in cooperation with a tester. It is an important detailed documentation that the client will use once they test the implemented functionalities.

If the IT analyst’s testing passes, then they deliver the functionality to the client. When client receives the tasks, they will conduct their own acceptance testing. If it does not pass, then the IT analyst will create a bug task and the IT analysis process goes back to the beginning of implementation phase. If the client testing passes, then the feature is considered to be delivered to the client.

4.2.1.2 Proposed areas for improvement by IT analyst 1

In this subsection, the proposed areas for improvement are listed that were presented by the IT analyst 1. The proposed areas of improvement for my IT analysis process are:

- Creating less documents
- Involving a software architect for designing the database

- Using visualizations
- A regular meeting with the client
- Using the waiting moments to do some things that are not critical.

The IT analyst's main concern was that in my IT analysis process, I create three different documents - the preliminary analysis, detailed analysis, and specifications. It makes it harder to maintain all these documents to make sure that every document has the right information. If I need to change something or new requirements emerge, then I have to make changes in all three documents, and also the prototype. The IT analyst proposed that I should somehow connect the detailed analysis and the specifications, to make sure that I have fewer sources and the analysis is more compact and easier to maintain.

If possible, I should involve a software architect from the client's side to make sure that the database solution I provide is the best one. Then I do not need to make any changes to it in the later phase of the analysis. However, this is only possible if the client has a software architect.

The IT analyst pointed out that the usage of UML diagrams is a good idea. Any time when it is possible to visualise, I should visualise, so that it is easier for the client to understand the analysis and get the bigger picture. It might not always be reasonable to do it, for example if it takes too much time or does not give much value, so sometimes just a text description is enough. It is important to find a good balance between text documents and visualizations.

They thought that I should have a meeting with the client regularly, for example once a week. During meetings I can get answers from the client quicker than waiting for the answer in Skype. In the meetings someone should always have a prepared visual to help illustrate the points.

Also, they advised that I should use the waiting moments to do some things that are important for the project, but not critical that depend on the client's feedback. This helps prevent the need of rewriting the analysis if I resume on the more critical aspects and then I receive feedback, which requires to rewrite the work.

4.2.1.3 Analysis of the process of IT analyst 1

In this subsection the analysis of the IT Analyst 1's process will be conducted. All the differences from my current IT analysis process and the IT analyst's process will be listed.

The differences between my IT analysis process and the process of Analyst 1 are as follows:

- The first thing they do is specifying the requirements
- They make visuals, search for new information if needed and if needed, they write proposed system versions simultaneously
- They have a validation meeting with the client regularly
- They are not writing only one textual document for preliminary analysis, but they use different tools depending on the requirement
- They do not conduct detailed analysis separately

The first thing they do is that they start specifying the requirements right away. In my current IT analysis process, I first have a meeting with the client and then I start working with the input and after that I start specifying the requirements in the input.

When I first start with making the prototype, then I wait for the feedback from the client and then I start writing the preliminary analysis document. The IT analyst 1 starts right away with making visuals, searching for more information if needed and writing proposed system versions. They do all those things simultaneously and on an as-needed basis.

They have a validation meeting with the client once a week so that they can detect errors earlier. Right now, in my IT analysis process, the meetings are conducted when needed and mostly when there is need for feedback.

In my IT analysis process, there will be one textual document for the entire preliminary analysis and a prototype. The IT analyst does not present same requirements with many different tools in parallel. They present the requirements either with visuals like prototype or diagrams or textual documents depending on the certain requirement.

Lastly, the other IT analyst does not conduct a detailed analysis separately, but after the preliminary analysis, they will already write the development tasks.

4.2.2 Interview with IT analyst 2

In this subsection, the process of IT analyst 2 (mid-level IT analyst) and the analysis of their IT analysis process will be presented along with their presented areas for improvement for my current IT analysis process.

4.2.2.1 IT analyst 2 process

Figures 12, 13, 14 and 15 show the process of IT analyst 2.

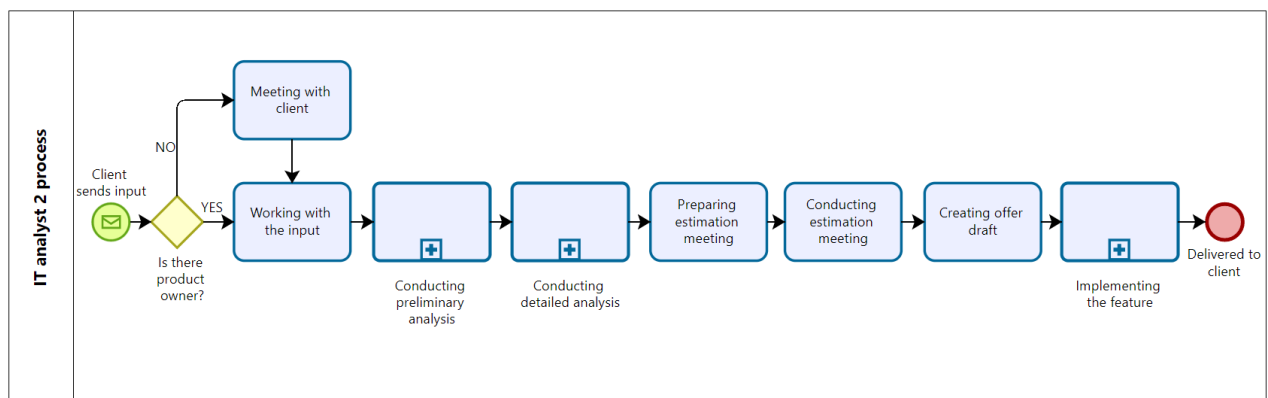


Figure 12. IT analyst 2 process

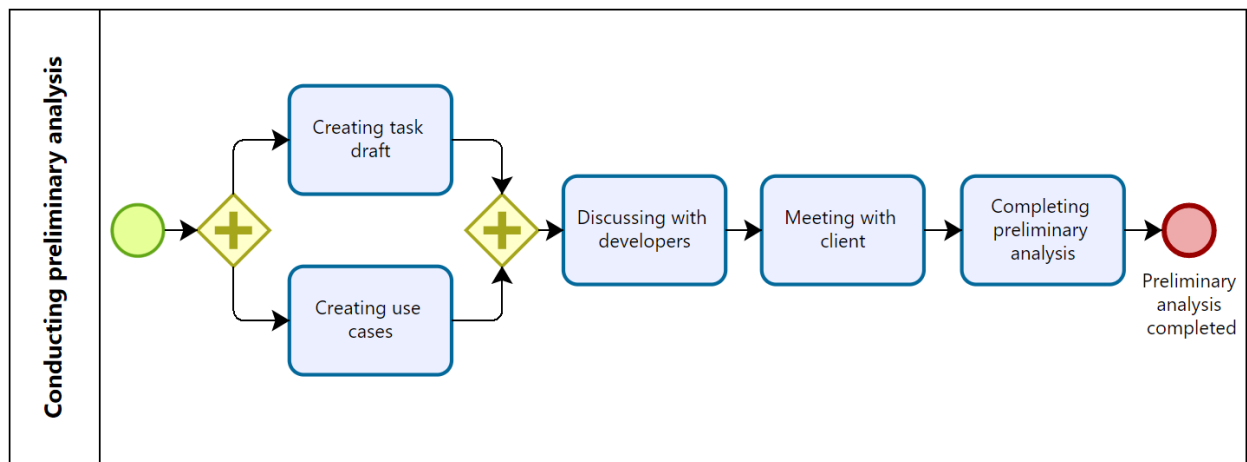


Figure 13. IT analyst 2 sub process “Conducting preliminary analysis”

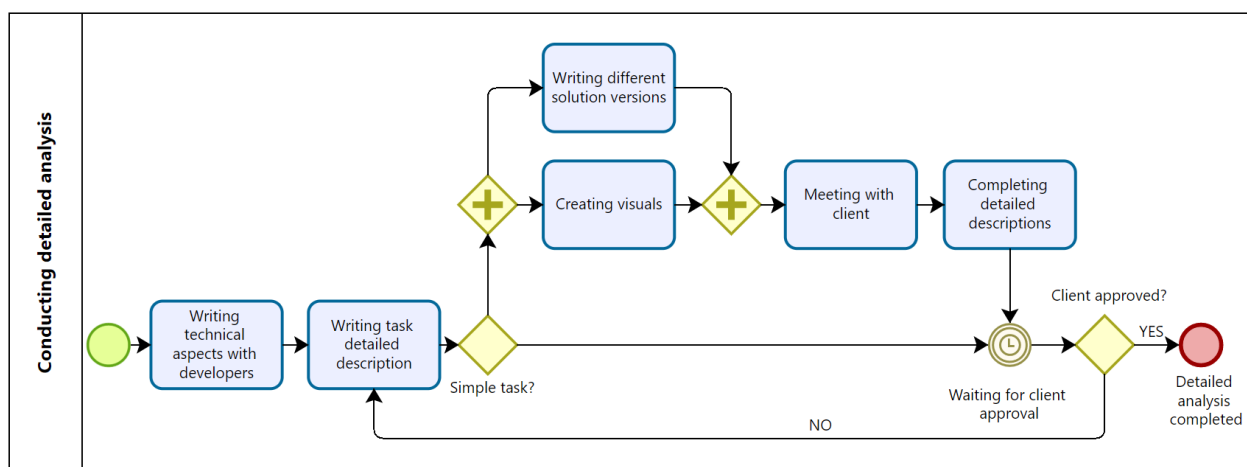


Figure 14. IT analyst 2 sub process “Conducting detailed analysis”

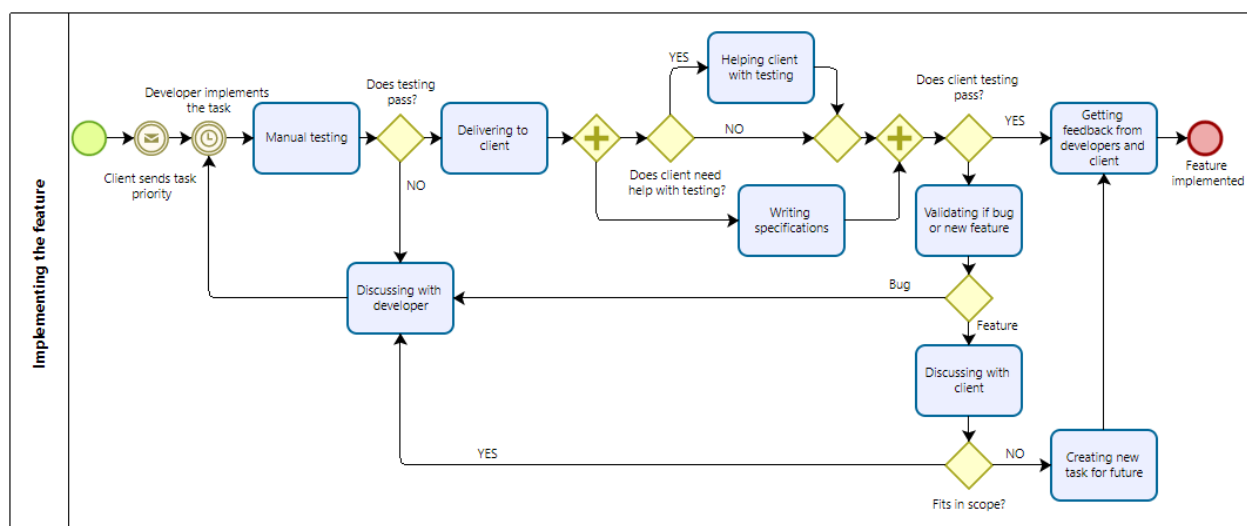


Figure 15. IT analyst 2 sub process “Implementing the feature”

Figure 12 gives an overview of the IT analyst 2 process. The IT analysis process starts when the client sends their input. The first step after that depends on if the client has a product owner or not. If they do not, then the IT analyst will conduct a meeting with the client to understand

why the client needs this functionality to be sure that the client has thought it through. If they do, then the meeting is not necessary, because most probably the product owner already has these answers. Then, the IT analyst will work with the input and read it through.

Figure 13 gives an overview of the IT analyst 2 sub process “Conducting preliminary analysis”. For that, the IT analyst will create a task draft, which includes a placeholder for the prototype and, they will create the use cases. When the draft is ready, they will discuss the tasks with the developers. When developers have any questions, they will answer the questions or write them down if they do not know the answers right away. When the discussion with the developers is done and all the questions have been established, the IT analyst will have a meeting with the client, where they can ask all the questions that they have. When all the questions have been answered, the IT analyst complete the preliminary analysis. After the preliminary analysis, the IT analyst will conduct the detailed analysis.

Figure 14 gives an overview of the IT analyst 2 sub process “Conducting detailed analysis”. First, they will write the technical aspects together with developers. The developers will give their input about different technical approaches where necessary. Then the IT analyst will write the detailed descriptions to the tasks. What happens next in the IT analysis process depends on the task complexity. If the task is simple, then the IT analyst will let the client read the analysis through and get an approval. If the task and the requirements are complex, then the IT analyst will create visuals, such as prototype, diagrams as necessary and they will write different solution versions. Then they will have a meeting with the client to decide which solution is the best and which one they will implement. Later, the IT analyst will complete the detailed descriptions as agreed. The IT analyst will need a written approval from the client to move on. If the client does not approve, the IT analyst needs to make changes in the detailed description and get an approval again. If the client approves, then the detailed analysis is completed.

When the detailed analysis is done, the IT analyst will prepare for the estimation meeting. They will send the task list to the developers at least two days before the meeting. This is because then the developers have a chance to ask any questions that they have if they do not understand something. After that, the IT analyst will conduct the estimation meeting which is followed by creating an offer draft which is later sent to the client.

Figure 15 gives an overview of the IT analyst 2 sub process “Implementing the feature”. First, the client will send a task priority list and then the developer can take the task into work. When the task is finished, then the IT analyst will do manual testing. If the testing does not pass, the IT analyst will discuss about it with the developer and the developer will fix the task and then the IT analyst will test again. If the testing passes, then they will deliver the task to the client so that the client can start testing. When the client is testing, then at the same time depending on the need, the IT analyst will help the client with testing, and they will write specifications for the implemented task. If the client’s testing passes, then the feature is implemented. If not, then first the IT analyst will validate together with the client if the error was either a bug or a new feature or requirement. If it is a bug, then the IT analyst will discuss with the developer again and the developer will fix the bug. If it is a new requirement, then the IT analyst will discuss with the client if the new requirement fits in the scope. If yes, then the new requirement will be implemented right away, and if not, then the IT analyst will create a new task for future

developments. Lastly, the IT analyst will get feedback from both the client and the developers to learn what they did well and what could have been better.

4.2.2.2 Proposed areas for improvement by IT analyst 2

In this subsection, the proposed areas for improvement are listed that were presented by the IT analyst. The proposed areas for improvement for my IT analysis process are:

- Involving the developer in the preliminary analysis
- Involving the developer in the detailed analysis
- Plan to avoid waiting
- Map out client's thought patterns

The main idea from the IT analyst was that I should involve developers more in the IT analysis process. It is important already in the preliminary analysis because the developers might see some problems and risks already in the beginning even if I think the solution is logical and thought-out. If the problems are detected early in the beginning, then there will be less waste of time if there is a need to rewrite the analysis.

The reason is the same when involving the developers in the detailed analysis. The developers have better technical knowledge, and they might be more motivated if they feel like they are involved in the project from early on.

To avoid a lot of waiting time, the IT analyst suggested that I should do more planning when dividing my work. I should use deadlines with the client too because that will create some sense of urgency in them, and it is possible to get feedback quicker from them. Also, I should divide my work so that when I am waiting for feedback for one part, I can work on another part that does not rely on the previous part.

Lastly, the IT analyst advised to map out the client's thought patterns. This might be useful if the client presents some new information, then I would know already all the questions I need to ask from them already before the meeting. Asking all the questions helps the client to think the new information through before answering in the meeting.

4.2.2.3 Analysis of the process of IT analyst 2

In this subsection, the analysis of the process of the IT analyst 2 will be conducted. All the differences from my current IT analysis process and the IT analyst's process will be listed.

The differences between my IT analysis process and the process of IT analyst 2 are as follows:

- They have a first client meeting according to the need
- They involve the developers in the preliminary analysis
- They do not create visuals in the preliminary analysis yet
- They do not design the database
- They involve the developers in the detailed analysis
- They create visuals in the detailed analysis
- They write specifications after the implementation not before

The IT analyst has less meetings at first. They only have one meeting if necessary (if the client does not have a product owner), but I have two meetings in the beginning.

They involve the developers already in the preliminary analysis, whereas I conduct the preliminary analysis alone. This might help the IT analyst to avoid some errors already in the beginning phase of the project.

In the preliminary analysis, they only create a quick draft to write down first thought and solutions to get a quick feedback and answers to questions, but I create the prototype in the beginning of the preliminary analysis already.

When I create the entire database design, the IT analyst does not do that in their IT analysis process. They leave that task to the developers, since they have better technical knowledge and probably can create a better solution too.

Like in the preliminary analysis, they also involve the developers in the detailed analysis phase, but in my IT analysis process, I am writing the detailed analysis alone. The reason is the same as in the previous points as the developers have better technical knowledge, and many of the errors can be avoided in the end.

Also, the IT analyst creates the visuals in the detailed analysis phase, whereas I make the prototype in the preliminary analysis phase.

If I write the specifications right after the detailed analysis, then the IT analyst writes the specifications after the implementation, because only then it is known exactly how the functionality was implemented. This helps the IT analyst to avoid rewriting the specifications in case something changes.

4.2.3 Interview with IT analyst 3

In this subsection, the process of IT analyst 3 (mid-level IT analyst) and the analysis of their IT analysis process will be presented along with their presented areas for improvement for my current IT analysis process.

4.2.3.1 IT analyst 3 process

Figures 16, 17, 18 and 19 show the process of IT analyst 3.

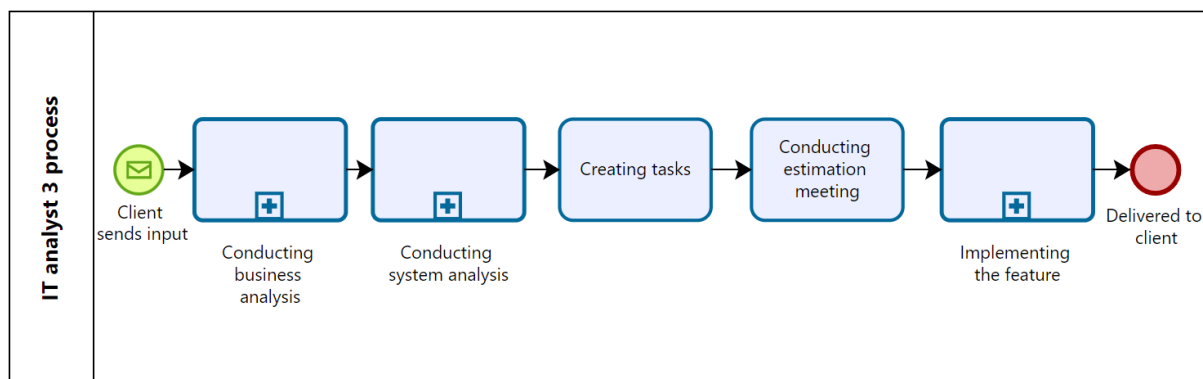


Figure 16. IT analyst 3 process

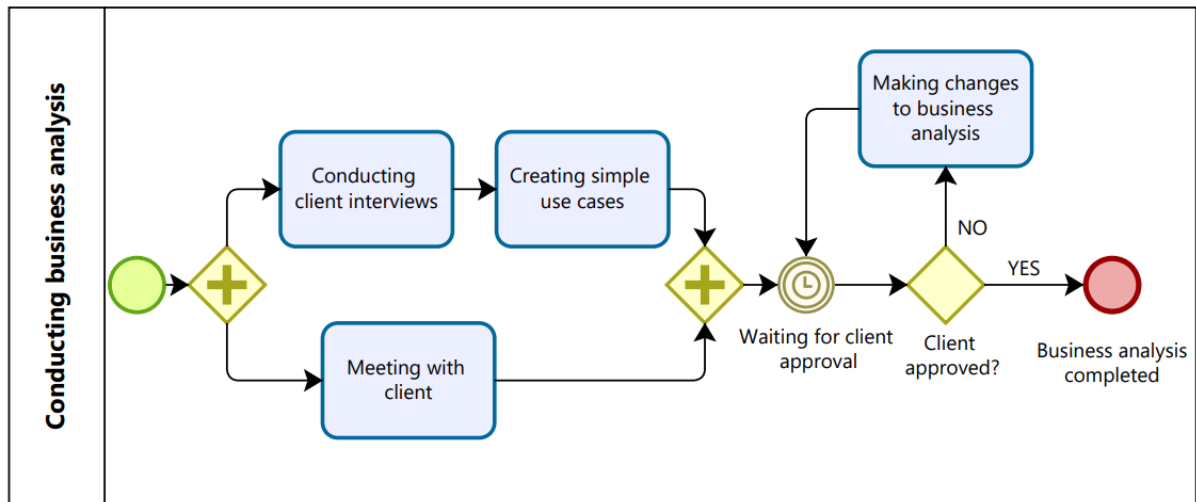


Figure 17. IT analyst 3 sub process “Conducting business analysis”

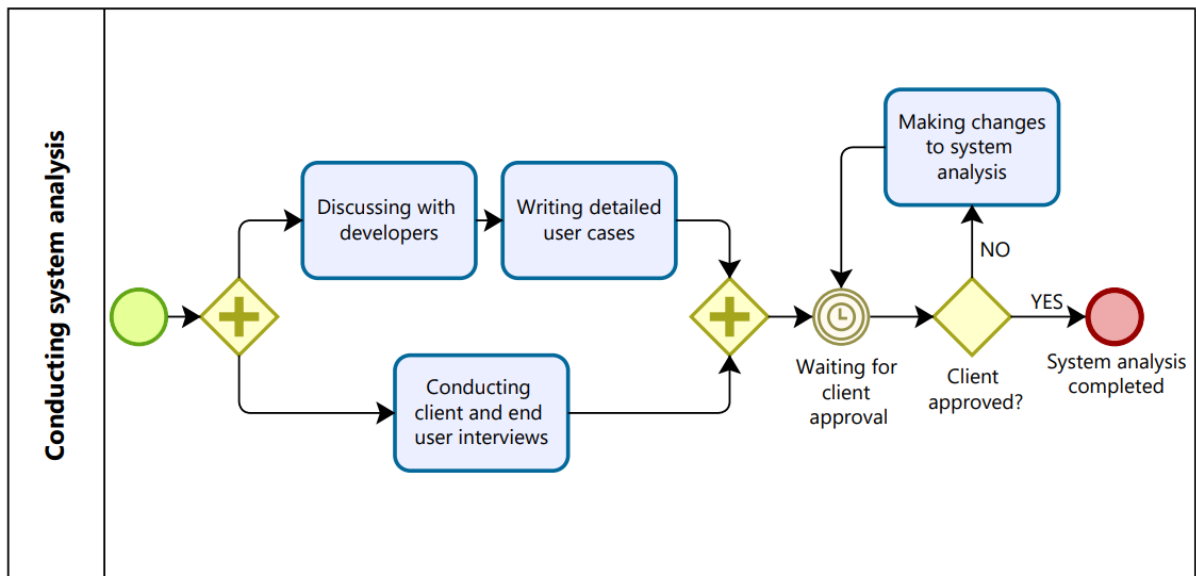


Figure 18. IT analyst 3 sub process “Conducting system analysis”

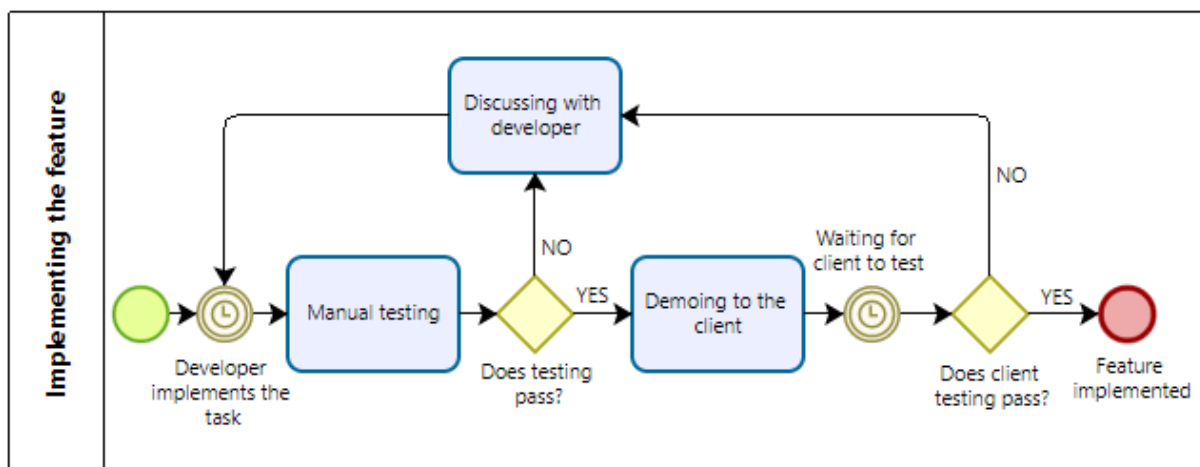


Figure 19. IT analyst 3 sub process “Implementing the feature”

Figure 16 gives an overview of the IT analyst 3 process. The IT analysis process starts when the client sends their input. The next step of the IT analysis process is conducting the business analysis, which is the same as the preliminary analysis in my IT analysis context.

Figure 17 gives an overview of the IT analyst 3 sub process “Conducting business analysis”. When conducting the business analysis, the first thing they do, is that they conduct client interviews to understand and map their business needs. When the business needs are established, then they start to create use cases based on the requirements. For that, they create a word document, that consists of the list of the use cases and their basic descriptions. During this time, the IT analyst has regular meetings with the client, so that the client is caught up with the analysis. When the use cases are created, then the client needs to approve the completed document. If the client does not approve, then the IT analyst makes the required changes in the document. When the client approves the analysis document, then the business analysis is completed. After the business analysis, it is possible to move on to the system analysis, which is the same as the detailed analysis in my IT analysis context.

Figure 18 gives an overview of the IT analyst 3 sub process “Conducting system analysis”. The first step in the system analysis sub process is to discuss with the developers about the technical aspects, such as database design and prototypes. After that, the IT analyst will update the preliminary analysis document and write the use cases in more detail, including the technical solutions. While updating the use cases, the IT analyst conducts interviews with the client and end users. When the document for system analysis is created, the client needs to approve it. If they do not, then the IT analyst needs to make changes to the system analysis. If the client approves the analysis, then the system analysis is completed.

After the system analysis, the IT analyst creates the tasks together with the developers, which is followed by the estimation meeting.

Figure 19 gives an overview of the IT analyst 3 sub process “Implementing the feature”. After the developer has finished with the task, the IT analyst will conduct manual testing. If the testing does not pass, then the developer fixes the task. If the testing passes, then the tasks that are ready are demoed to the client and then the client can test themselves. If the testing does not pass, then the developer fixes the issue and if it passes, then the feature is implemented.

4.2.3.2 Proposed areas for improvement by IT analyst 3

In this subsection, the proposed areas for improvement are listed that were presented by the IT analyst. The proposed areas for improvement for my IT analysis process are:

- Doing research before
- Coming up with different solutions already before client discussion
- Not doing the database design alone
- Writing tasks in story format without technical aspects

The first thing that the IT analyst suggested is that I should first do the research before conducting the first meeting with the client. That way I can be up to date with the topic already in the beginning and I can guide the meeting better.

The IT analyst also suggested that before the client discussions, I should already come up with couple of different solutions. This will help the client to choose the solution quicker, which helps to reduce the waiting time.

To ensure that the technical analysis is done better, they suggested that I should not do the database by myself, but together with the architect. This will help save time, I can use myself in other parts of the analysis at the same time. Also, because developers have better technical knowledge, this will decrease the chance of needing to rewrite the analysis.

The last suggestion from the IT analyst was that the tasks should be written in a story format without the technical aspects. The task should contain the use case and information what is needed to implement it. The technical aspects should be for the developers to decide since they know more about the most optimal solutions regarding the code. Also, a story format helps to think through the requirement. If it is hard to establish the goal of the use case, then probably there is an issue with the story and will not give much value to the client.

4.2.3.3 Analysis of the process of IT analyst 3

In this subsection, the analysis of the process of the IT analyst 3 will be conducted. All the differences from my current IT analysis process and the IT analyst's process will be listed.

The differences between my IT analysis process and the process of IT analyst 3 are as follows:

- They start the business analysis together with client meetings and they have client meetings regularly during the business analysis phase
- They only write use cases in the business or preliminary analysis document
- They do not design the database or make prototypes
- They have regular client meetings during the system or detailed analysis phase
- They write the technical aspects to the use cases together with the developers
- They demo the implemented functionality to the client once their testing passes

The first thing that the IT analyst does differently, is that they start with the business analysis phase right away and they have client meetings regularly, but in my IT analysis process, I first have the first client meeting and then I discuss discussions with them as needed during the preliminary analysis. Having the meetings regularly might help to detect issues earlier in the analysis.

The only thing that they do in the business analysis, is writing use cases. However, during the preliminary analysis, I make the prototype and write the analysis for the business requirements.

They do not design the database and they do not make the prototypes. These tasks are done by developers, but in my IT analysis process, I make both the prototypes and the designs for the database.

Similarly, to the business analysis phase, the IT analyst has regular meetings with the client and end users during the system analysis phase. Like in the business analysis, this might help to detect issues and new requirements earlier and might reduce the risk of needing to rewrite the analysis in the end. I on the other hand, have meetings with the client as needed.

When I write all the analysis documents myself, then the other IT analyst includes the developers in the IT analysis process. They write the technical aspects of the system analysis together with the developers since they have more technical knowledge.

Lastly, they demo the implemented tasks to the client once the IT analyst's testing passes, whereas we let the client test the functionality right away.

4.2.4 Interview with IT analyst 4

In this subsection, the process of IT analyst 4 (senior IT analyst) and the analysis of their IT analysis process will be presented along with their presented areas for improvement for my current IT analysis process.

4.2.4.1 IT analyst 4 process

Figures 20, 21 and 22 show the process of IT analyst 4.

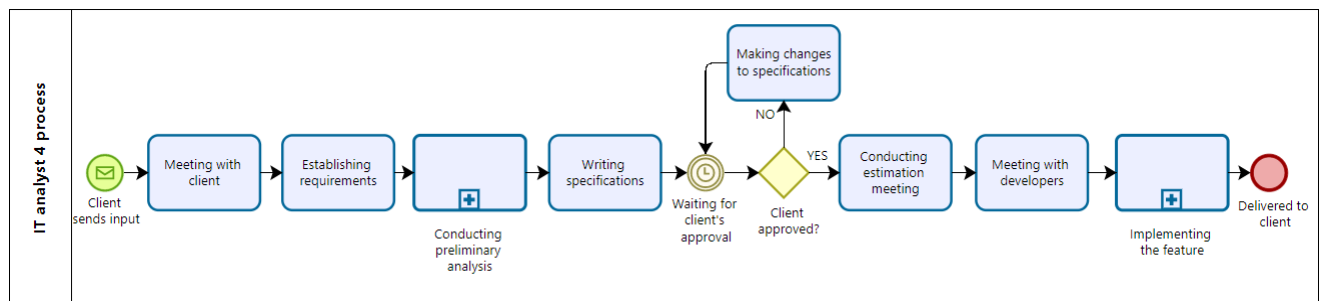


Figure 20. IT analyst 4 process

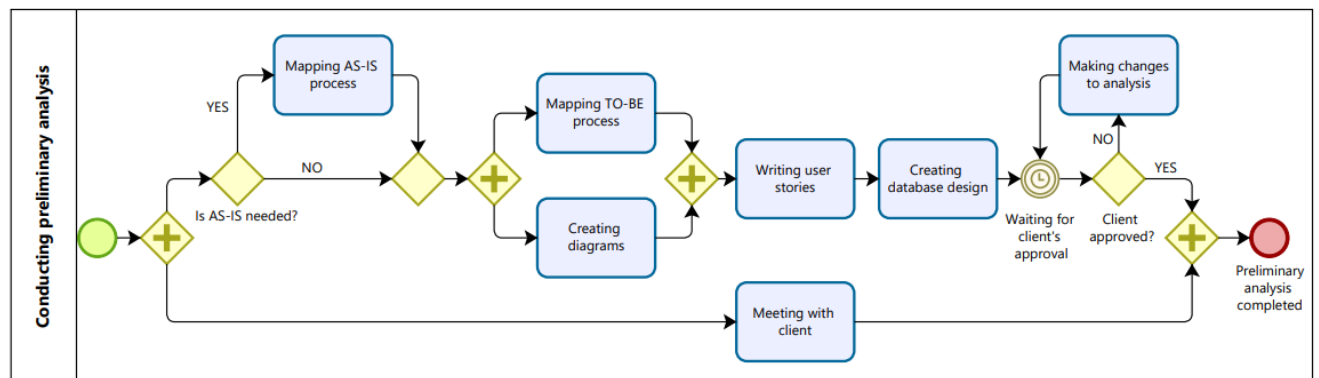


Figure 21. IT analyst 4 sub process "Conducting preliminary analysis"

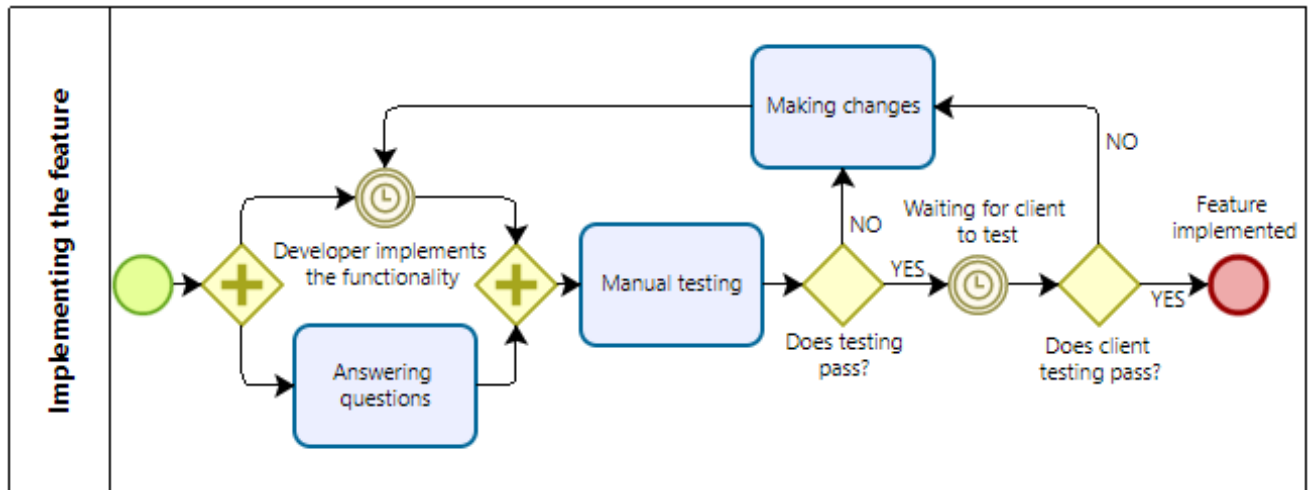


Figure 22. IT analyst 4 sub process “Implementing the feature”

Figure 20 gives an overview of the IT analyst 4 process. The IT analysis process starts when the client sends the input. The next step for the IT analyst is to have a meeting with the client to understand their domain. During the meeting, the IT analyst asks all the materials that they need. Then they will work through the materials and after that it is possible to start establishing the requirements.

Figure 21 gives an overview of the IT analyst 4 sub process “Conducting preliminary analysis”. During the preliminary analysis if it is needed and the client wants it, then they map out the AS-IS process, which can help to understand the base and how much is needed to implement. If it is not important to map out the AS-IS process, then the next step is to map out the TO-BE process along with the important business requirements. Together with the TO-BE process the IT analyst creates diagrams like class diagram for data modelling. If some objects are more complex, then they will create state diagrams for those objects. When the TO-BE process is established, then the IT analyst starts writing user stories, which is followed by creating the database design. Later, an approval from the client is needed. If the client does not approve, then the IT analyst needs to make some changes to the analysis. If the client approves, then the preliminary analysis is complete. During the preliminary analysis stage, the IT analyst has frequent meetings with the client to check on the things they have done. This ensures that asking a confirmation from the client in the end of the preliminary analysis is just a formality. All the issues from the analysis come up during the frequent meetings.

When the preliminary analysis is done, then the IT analyst writes the specifications for the developers. For moving forward, the IT analyst needs an approval from the client. If the client does not approve, then the IT analyst needs to make changes to the specifications. If the client approves, then they will conduct the estimation meeting with the developers. Before development, they have a meeting with the client to go over the part that need to be implemented.

Figure 22 gives an overview of the IT analyst 4 sub process “Implementing the feature”. During the implementation sub process, the IT analyst answers the questions the developers ask. When the functionality is implemented, then the IT analyst quickly tests manually to see if the implemented functionality is as needed. If the testing does not pass, then the needed changes

are made, and the IT analyst needs to test again if they are implemented. If the manual testing passes, then the client will test. If the client's testing passes, then the feature is implemented. If the client's testing does not pass, then some needed changes will be made again either to the specification or code.

4.2.4.2 Proposed areas for improvement by IT analyst 4

In this subsection, the proposed areas for improvement are listed that were presented by the IT analyst. The proposed areas for improvement for my IT analysis process are:

- Not doing the database design
- Explicitly writing down business requirements
- Creating a concept model in the beginning
- Finding all the stakeholders in the beginning

The first thing that the IT analyst proposed is that I should not design the database myself but leave it for the developers. Even though this is something that they do as well, they still think that this is something that the developers should do. IT analysts are usually not experts in databases. If the developers do it, they can already take the system architecture into account and probably will come up with a better solution.

Secondly, they suggested that I should explicitly write down the system requirements and I should hold them in the tasks or user stories. That would help me keep the scope and always keep the requirements in mind. Also, it helps to understand from where the tasks or user story comes from, whether it is important or not.

They also suggested that I should create a concept model in the beginning. I should generally describe what are the other systems or modules that the new one will communicate with. Details can be added later with the user stories. This again helps with the scope, to understand how much needs to be done.

Lastly, the IT analyst suggested that I should find all the stakeholders in the beginning of the project. Then I can ask all the questions from the right people, which helps to eliminate the risk of not getting all the requirements in the beginning and can lead to constantly changing requirements in the end of the project.

4.2.4.3 Analysis of the process of IT analyst 4

In this subsection, the analysis of the process of the IT analyst 4 will be conducted. All the differences from my current IT analysis process and the IT analyst's process will be listed.

The differences between my IT analysis process and the process of IT analyst 4 are as follows:

- They explicitly write down requirements
- They do not make the prototype themselves
- They map out the processes
- They use user stories in preliminary analysis
- They do not have a detailed analysis phase, but start with the specifications right away after the preliminary analysis
- They have a separate meeting with the developers before starting the implementation

The first thing that the IT analyst does differently, is that they explicitly write down the requirements. They do it right after the first meeting with the client.

Another thing that they do differently is that they do not make the prototype themselves like I do, although they mentioned that this is just a specificity of the project.

They also map out the business processes, whereas I after making the prototypes go straight to the preliminary analysis text. If needed, then they map out the AS-IS process, which is followed by the TO-BE process.

In preliminary analysis, they use user stories to describe the requirements, but like mentioned before, my preliminary analysis is just a textual document.

To reduce the number of written documents, they do not write a detailed analysis. They start writing the specifications right after the preliminary analysis. On the other hand, I first write the detailed analysis after the preliminary analysis, and only then I start writing the specifications.

Lastly, they have a separate meeting with the developers before starting the implementation to go over the requirements.

4.2.5 Interview with IT analyst 5

In this subsection, the process of IT analyst 5 (senior IT analyst) and the analysis of their IT analysis process will be presented along with their presented areas for improvement for my current IT analysis process.

4.2.5.1 IT analyst 5 process

Figures 23, 24 and 25 show the process of IT analyst 5.

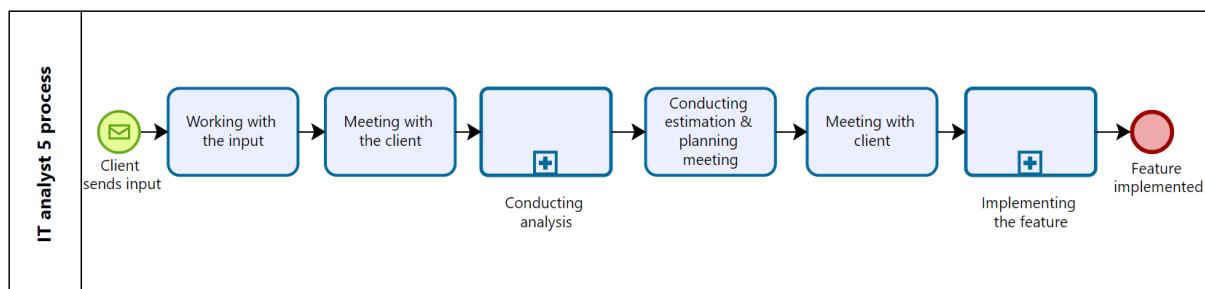


Figure 23. IT analyst 5 process

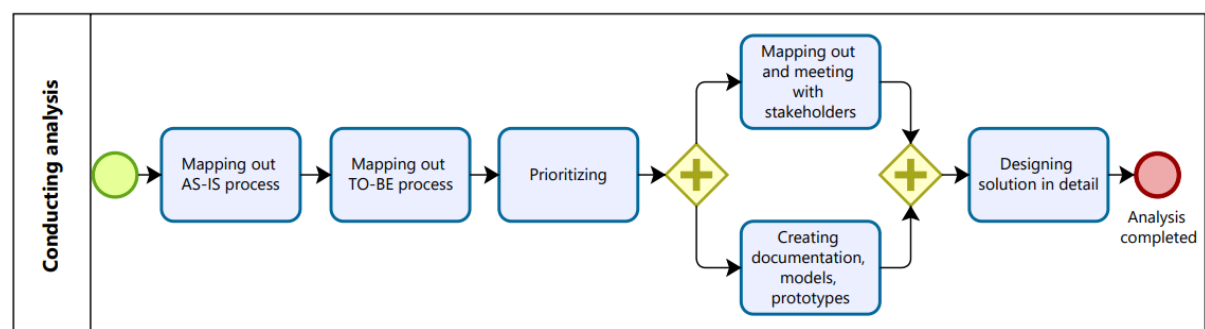


Figure 24. IT analyst 5 sub process "Conducting analysis"

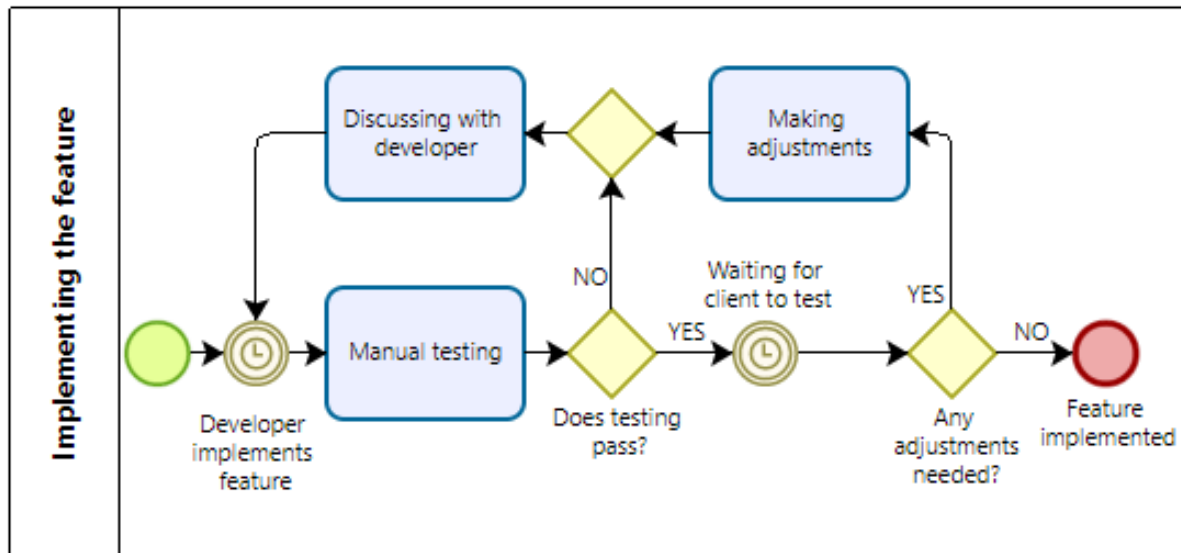


Figure 25. IT analyst 5 sub process “Implementing the feature”

Figure 23 gives an overview of the IT analyst 5 process. The IT analysis process starts when the client sends their input. First, the IT analyst will work with the input and get ready for the first meeting with the client. In the first meeting with the client, they map out the scope and the general process so that the client can get some idea about it. They specify who are the end users, where the new system will be used and what will be the volume of the new system. If the general process is mapped out, then the IT analyst will start with the analysis.

Figure 24 gives an overview of the IT analyst 5 sub process “Conducting analysis”. First, they will map out the AS-IS process. They will find out if there is already something implemented for the system and how it works now. This helps to understand what needs to be added or replaced in the new system. Also, the client will get an understanding what the new system will consist of. After that the IT analyst will map out the TO-BE process on an idea level, depending on the complexity.

Next, the IT analyst will prioritize and specify the scope to make a development plan. After that, they will map out all the stakeholders for different priorities and requirements. They will ask all the materials and accesses they need, so that they can investigate and find out as much information as possible. Then they will conduct meetings with the stakeholders to find out all the thoughts, wishes and requirements. At the same time with the meetings, the IT analyst will create prototypes, models, and documentation on a business level. After that, the IT analyst will start designing the solution in detail. If there are many options for a solution, then all the options will be described together with the constraints. Everything will be described on a business level, but in detail.

After the analysis, the IT analyst will conduct an estimation and planning meeting together with the developers to go over the requirements and answer the questions. Then, the IT analyst will have a meeting or a discussion with the client to decide what will be implemented.

Figure 25 gives an overview of the IT analyst 5 sub process “Implementing the feature”. When the developer finishes with the implementation, the IT analyst will test manually. If the testing does not pass, then they will report it to the developer. If the testing passes, then the

functionality goes to the client for testing. If the client wants some adjustments, then they will make the needed adjustments and report it to the developer. If the client testing passes, then the feature is implemented.

4.2.5.2 Proposed areas for improvement by IT analyst 5

In this subsection, the proposed areas for improvement are listed that were presented by the IT analyst. The proposed areas for improvement for my IT analysis process are:

- Counting the detailed analysis as a specification
- Including the developer in making technical decisions
- If possible, then including a designer in the IT analysis process

The first thing they pointed out was that I make too many analysis documents. The detailed analysis should already be the specifications followed by the development tasks.

They also pointed out, that I should include the developer in the detailed analysis phase for technical decisions. The developer should find all issues and problems in the idea and they should ensure that it is possible to implement the idea.

Lastly, the IT analyst proposed that if possible, I should include a UI/UX designer in the analysis, who would help to figure out how the new system should look like. I as an IT analyst should decide when there is enough information available from the client, so that the designer and architect can start their tasks. This is ideally when the TO-BE process is mapped out.

4.2.5.3 Analysis of the process of IT analyst 5

In this subsection, the analysis of the process of the IT analyst 5 will be conducted. All the differences from my current IT analysis process and the IT analyst's process will be listed.

The differences between my IT analysis process and the process of IT analyst 5 are as follows:

- They work with the input before first client meeting
- They have one analysis phase
- They create one documentation
- They do not design the database alone
- They map out the AS-IS and TO-BE processes
- They interview the stakeholders

The first thing the IT analyst does differently, is that they work with the input before meeting with the client so that in the first client meeting, they can already ask all the questions they need. But I have two meetings in the beginning.

The IT analyst has only one analysis phase, whereas I have both, the preliminary analysis, and the detailed analysis phase, after which I start writing the specifications, creating all together three documents. This helps the IT analyst to create only one documentation, so it is easier to maintain.

Another thing that they do differently, is that they do not design the database alone, like I do. They include the developer in their technical decisions.

Also, in the analysis phase, the IT analyst maps out the AS-IS and TO-BE processes, whereas I start right away with the detailed TO-BE process description in my preliminary and detailed analysis phases.

Lastly, they interview the stakeholders. Oppositely, I do not interview or discuss with the stakeholders, but I discuss with the client as needed, but the client might not be the actual stakeholder.

4.3 Literature review

In this section, a literature review is conducted. The goal of the literature review is to see if there is any literature about the IT analysis process, and if so, then how does literature describe the analysis tasks. To conduct the literature survey, the backward snowballing method is used. The research question is: What analysis tasks are mentioned in available research papers?

To conduct the snowballing method, there is a starting set of 7 papers used (denoted P1-P7). From the start set, 2 iterations of backward snowballing was conducted, and 7 relevant papers were found from the start set.

The start set of papers are:

P1. Sugiandi A, Kerlooza Y, “Competency Assessment Parameters for System Analyst Using System Development Life Cycle” *IOP Conf. Ser.:Mater. Sci. Eng*, May 2018.

P2. Haga W A, Morris G J, Mawhinney C H, “Changes in the Systems Analyst Skill Set: 2006 versus 2001” *ISECON 2007*, v24 (Pittsburgh), November 2007.

P3. Morrell J S, Mawhinney C H, Morris G J, Haga W A, Smolkina A, “The systems analyst: a post mortem?”, n.d.

P4. Somma R, “The Systems Analyst as Polymath”, n.d.

P5. Doucek P, Maryska M, Nedomova L, “Development of Requirements on the Role Business Analyst”, *Information Systems: Development, Learning, Security* (pp 17-26), 2013.

P6. Vongsavanh A, Campbell B, “The Roles and Skill Sets of Systems vs Business Analysts”, *19th Australasian Conference on Information Systems*, December 2008.

P7. Richards D, Marrone M, “Identifying the education needs of the business analyst: an Australian study”, *Australasian Journal of Information Systems*, 2014.

4.3.1 First iteration

From the start set of 7 papers, the backward snowballing method was conducted, studying the references of the 7 papers. The 7 papers had all together 123 references listed in the reference list. Some of the references were the same, so duplicated papers were excluded from the set. To conduct the backward snowballing, first, the references’ titles were looked at, and those irrelevant, were excluded. To decide whether to include or exclude a paper from the set, the titles had to match the set criteria. Then, the abstracts of the remaining papers were studied to see if these papers talk about the IT analysts’ process or the skills needed for IT analysts. Those papers that did not, were excluded from the set. Also, the research papers that were inaccessible, were excluded from the set.

After this step, the full papers were looked at to be sure, if the papers talk about the IT analysts' process or the skills needed for IT analysts. In the end, from the first iteration, in total of 5 papers (denoted P8-P12) were included to the study.

The included papers are:

P8. Lee C K, "Analysis of Skill Requirements for Systems Analysts in Fortune 500 Organizations", *Journal of Computer Information Systems*, January 2016.

P9. Misic M M, Graf D K, "Systems analyst activities and skills in the new millennium", *Journal of Systems and Software*, April 2004.

P10. Nord G D, Nord J H, "Information systems project development: knowledge and domain requirements for the systems analyst", *Industrial Management & Data Systems*, February 1997.

P11. Payne S C, Awad E M, "The Systems Analyst As A Knowledge Engineer: Can The Transition Be Successfully Made?", *ACM*, 1990.

P12. Evans N, "The Need for an Analysis Body Of Knowledge (ABOK) – Will the Real Analyst Please Stand Up?", *Informing Science and Information Technology*, n.d.

4.3.2 Second iteration

The second iteration was conducted from the 5 papers found in the first iteration. The papers had all together 123 references listed in the reference list. From the list, the duplicates and papers that were found in the previous iteration were excluded. Then the remaining references were evaluated based on the criteria mentioned initially, and irrelevant papers were excluded. After this step, the remaining papers' abstracts were looked at evaluated if these papers potentially answer the research question and if not, then the papers were excluded from the review. As a last step, the whole papers we looked at and after the second iteration, in total of 2 papers (denoted P13-P14) were included in the study.

The included papers are:

P13. Misic M M, Russo N L, "Reading between the lines: an examination of systems analysis and design texts", *Journal of Systems and Software*, January 2000.

P14. McCubbrey D J, Scudder R A, "The Systems Analyst of the 1990's", *ACM*, 1988.

4.3.3 Literature review analysis

After 2 iterations of backward snowballing, 14 papers were found including the 7 initial papers. Table 1 presents the analysis of the 14 papers to see which IT analysts' tasks are mentioned in the literature.

Denotation	IT analyst's tasks mentioned
P1	Establishing requirements, creating use cases, designing database, making diagrams and process models, designing interfaces, designing system, testing.
P2	Programming, designing databases, prototyping, designing service.

P3	Programming, working with documents, testing, analysing requirements, designing software, identifying problems.
P4	Understanding complexity (working with input), designing interfaces, database, and systems, understanding AS-IS processes, making UML diagrams, establishing requirements, and making them understandable.
P5	Establishing requirements, modelling, and analysing processes, conducting risk analysis, implementing standard software, creating documentation.
P6	Communicating with client, establishing requirements, and analysing business problems, designing business functions, modelling processes, testing, and evaluating, implementing solution, maintaining the system, generating ideas for business process improvement.
P7	Gathering requirements, designing system.
P8	Modelling, programming, documenting, designing database.
P9	Defining scope, establishing requirements, conducting AS-IS analysis, conducting interviews, testing, documenting, designing database, prototyping.
P10	Process modelling, defining requirements, making diagrams, designing output, prototyping, training users.
P11	Conducting user interviews, identifying solutions and processes, prototyping, testing, overseeing ongoing maintenance.
P12	Designing business processes and modelling processes, conducting user acceptance testing, making use cases, establishing requirements, evaluating different solutions, making diagrams, documenting, testing, implementing, maintaining the system.
P13	Defining requirements, defining scope, documenting specifications and requirements, analysing processes, making diagrams and models, prototyping, planning the development, conducting user interviews, assessing cost and benefits.
P14	Modelling, documenting, defining requirement, using graphics.

Table 1. Analysis tasks mentioned in literature

4.4 Summary

In this section, the summary of all the five conducted interviews and the literature review will be described. In the interviews and literature review, the following data was collected:

- Areas for improvement proposed by other IT analysts in Helmes
- Differences between my current IT analysis process and other IT analysts' processes
- Other IT analysts' opinions about my proposed areas for improvement
- Tasks performed by IT analysts that are mentioned in the literature

In the next subsections, the summary of the collected data is described.

4.4.1 Summary of my proposed areas for improvement

This subsection describes what were the opinions of the interviewed IT analysts about the areas for improvement proposed by me.

The areas for improvement that were proposed by me in the beginning of the thesis project are following:

- Using UML diagrams
- Using AS-IS and TO-BE process models
- Explicitly writing down the system and business requirements
- Doing some things simultaneously
- Conducting less meetings

All the IT analysts thought that using UML diagrams and visuals is a good idea that might help improve the IT analysis process since a visual says more than words. Although they pointed out that the specific choice of a diagram depends on the project complexity and what the client can understand. For example, if the client cannot understand sequence diagrams, then it does not make sense to make that diagram.

All the IT analysts thought that using AS-IS and TO-BE models might help to establish the scope. Having those two models help to understand how much needs to be done. IT analyst 2 pointed out that using the models depend on the project complexity, maybe it is not always necessary to do it. IT analyst 4 pointed out that TO-BE is even more important than AS-IS model. They thought that if there is a clear starting point for the analysis, then the AS-IS model will not have much impact.

When explicitly writing down requirements, the four of the IT analysts thought that this might too, like process models, help to keep the scope of the project. IT analyst 3 thought that preliminary analysis already covers the requirements in some part. IT analyst 5 pointed out that I should also write down things that will not be implemented during the project besides the requirements. That will help to keep the scope in case new requirements emerge during the project.

The IT analysts did not think that doing some things simultaneously might have a big effect on my IT analysis process. IT analyst 1 thought that there are things that cannot be done at the same time, but while I am waiting for feedback, then I can do some uncritical things for the project. IT analyst 2 thought that I could divide my work into smaller parts so if I am waiting for feedback, I can start with another part. IT analyst 4 pointed out that if I had regular analysis meetings with the client, then I would get my feedback during the meetings and would not need to wait for feedback after each phase.

Lastly, the IT analysts did not agree that conducting less meetings might help to improve my IT analysis process. They pointed out that it is important to conduct meetings that have value for me. If a meeting does not have value for me, then I should not be in that meeting. IT analyst 4 thought that I should conduct regular weekly meetings with the client, so that I get constant feedback on the analysis and changes and issues emerge more quickly.

4.4.2 Summary of areas for improvement proposed by interviewed IT analysts

This subsection presents the summary of the areas for improvement that were presented by the interviewed IT analysts in Helmes.

There were all together 20 areas for improvement proposed. From those, 13 areas for improvement were unique.

Figure 26 presents the summary of the proposed areas for improvement and how many times some area was proposed.

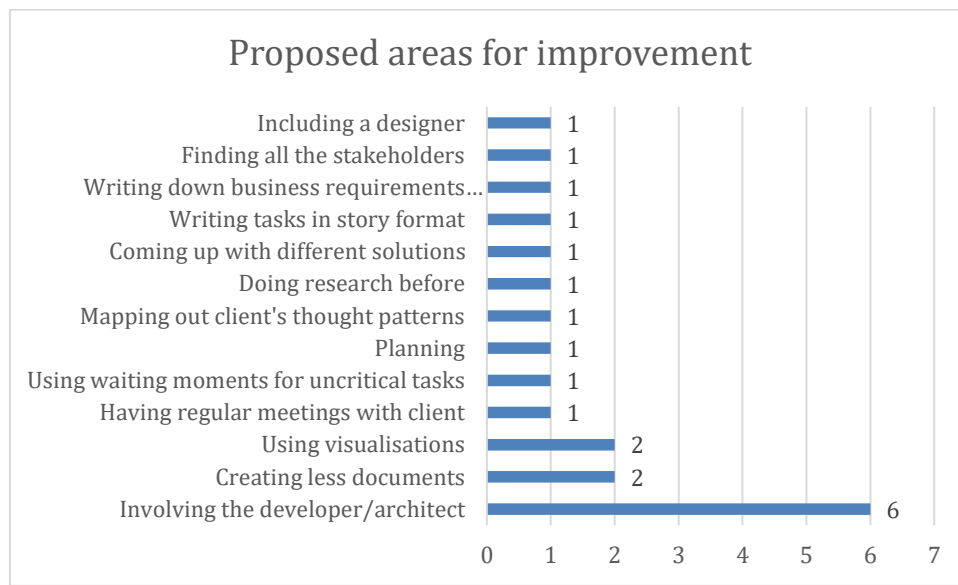


Figure 26. Summary of proposed areas for improvement

The areas for improvement that were proposed the most by the interviewed IT analysts in Helmes, were following:

- Involving the developer/architect in the analysis
- Creating less documents
- Using visualisations

Involving the developer or architect in the analysis phase was proposed 6 times. The reason why it was proposed more than the number of IT analysts interviewed was that one IT analyst proposed it in two different phases in my IT analysis process.

Creating less documents was proposed 2 times by IT analyst 1 and IT analyst 5 and using visualisations was also proposed 2 times by IT analyst 1 and IT analyst 4. All the other areas for improvement were proposed once.

4.4.3 Summary of the established differences between my IT analysis process and interviewed IT analysts' processes

This subsection presents the summary of differences that were established between my current IT analysis process and the other IT analysts' processes.

From the interviews, there was a total of 30 types of differences from my IT analysis process and other IT analysts' processes found. From those established differences, 14 were unique.

Figure 27 presents the number of times each difference was established.

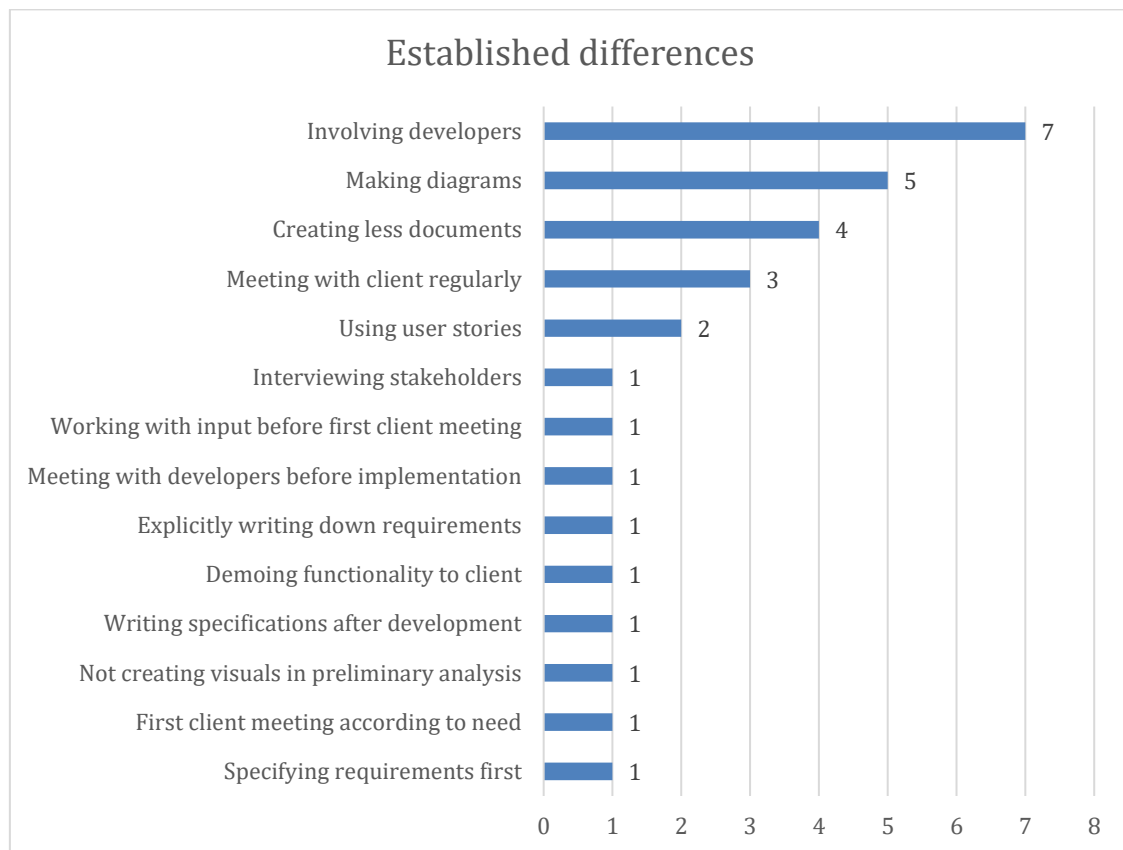


Figure 27. Summary of established differences

The differences that were established the most from my current IT analysis process and the interviewed IT analysts' processes in Helmes, were following:

- Involving developers
- Making diagrams
- Creating less documents
- Meeting with client regularly

All the other IT analysts involve the developers in their IT analysis processes. This difference was found all together 7 times. The IT analysts who have more than one analysis phase, involve the developers in all the phases.

Most of the IT analysts also use different diagrams in different phases of their IT analysis processes. All together this difference was found 5 times.

All together four IT analysts create less documents or they have one analysis phase instead of two and three of the IT analysts conduct regular client meetings with the client throughout their IT analysis process.

4.4.4 Summary of the literature review

This subsection presents the summary of the literature review and what are the analysis tasks that are mentioned in the literature.

Literature mentioned all together 21 different tasks that IT analysts do in their work. Figure 28 presents the number of times each task was mentioned.

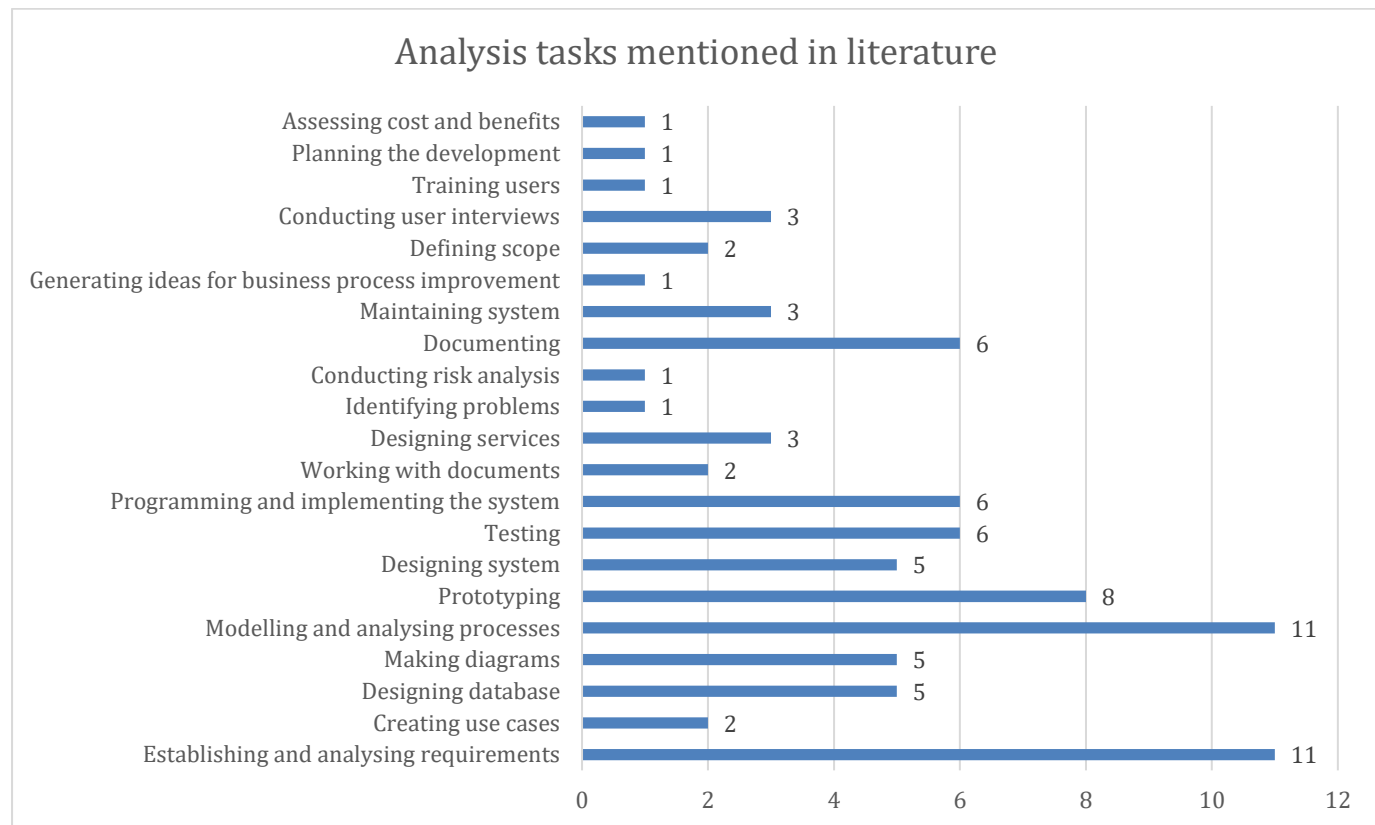


Figure 28. Summary of the analysis tasks mentioned in literature

In the literature analysis, only the analysis tasks that were mentioned the most were handled in the summary, since there are many tasks that IT analysts do in their work. The analysis tasks that were mentioned the most in the literature were following:

- Establishing and analysing requirements
- Modelling and analysing processes
- Prototyping
- Documenting
- Programming and implementing the system
- Testing
- Designing system
- Making diagrams
- Designing database

Establishing and analysing requirements and modelling and analysing processes were mentioned the most, in total of 11 times, in the found literature. These tasks are also performed by almost all the interviewed IT analysts.

Prototyping was mentioned all together 8 times in the literature and all the interviewed IT analysts do some type of prototyping somewhere in their IT analysis processes.

Programming, implementing the system and testing was mentioned 6 times in the literature. None of the interviewed IT analysts do programming because IT analysts in Helmes usually do not do it unless part of their work is being a developer.

Designing system, making diagrams, and designing database was mentioned 5 times in the literature. Most of the interviewed IT analysts create diagrams during their IT analysis process. All the IT analysts design the system and database too, but it is together with the developers, since they have better knowledge of the technical aspects, which helps to avoid errors in the work.

4.4.5 Prioritising areas for improvement

In this subsection, the proposed areas for improvement for the new IT analysis process are prioritised. The areas for improvement include the ones proposed by other IT analysts, the differences between my IT analysis process and the interviewed IT analysts' processes, the areas for improvement proposed by me and the tasks mentioned in the literature. Prioritization is based on the four different sources mentioned in the last subsections in the summary section. Table 2 describes how certain areas for improvement were selected to be implemented in the new IT analysis process. The column on the right lists all proposed areas for improvement that were collected from the various sources. Those that are struck out are excluded from the final list of areas for improvement for a reason that will be explained below.

Source of proposed area for improvement	Proposed areas for improvement
My proposed areas for improvement	<ul style="list-style-type: none"> • Using UML diagrams • Using AS-IS and TO-BE process models • Explicitly writing down the system and business requirements • Doing some things simultaneously • Conducting less meetings
Most frequent areas for improvement proposed by interviewed IT analysts	<ul style="list-style-type: none"> • Involving the developer/architect in the analysis • Creating less documents • Using visualisations
Most frequent established differences between my IT analysis process and the interviewed IT analysts' processes	<ul style="list-style-type: none"> • Involving developers • Making diagrams • Creating less documents • Meeting with client regularly
Most frequently mentioned tasks performed by IT analysts found in the literature	<ul style="list-style-type: none"> • Establishing and analysing requirements • Modelling and analysing processes • Prototyping • Documenting • Programming and implementing the system

	<ul style="list-style-type: none"> • Testing • Designing system • Creating diagrams • Designing database
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Table 2. Proposed areas for improvement from different sources.

Among the areas for improvement proposed by me that will be implemented are “using UML diagrams” and “using AS-IS and TO-BE process models”, because other areas for improvement were either discouraged by interviewed IT analysts or they themselves did not use it in their IT analysis process.

Among the most frequent areas for improvement proposed by interviewed IT analysts and the established differences between my IT analysis process and the interviewed IT analysts’ processes everything will be implemented in the new IT analysis process.

Among the most frequently mentioned tasks performed by IT analysts found in the literature that will be implemented in the new IT analysis process are “modelling and analysing processes” and “creating diagrams”. “Programming and implementing the system” will not be implemented because programming is not in the IT analyst’s job description in Helmes. “Designing database” will not be implemented because as it was proposed by all the interviewed IT analysts, I should involve the developer in the technical aspects of the IT analysis process. All the other most frequently mentioned tasks are already part of my IT analysis process.

Some of the proposed areas for improvement from different sources have the same meaning but are named differently. From the list of proposed areas for improvement from Table 2 that were not struck out were analysed and they have the same or very closely related meanings. Therefore, a more concise list of unique proposed areas for improvement were generated (see Table 3). The column in the left of Table 3 lists the areas for improvement that were included in the final list after removing the duplicates.

Final area for improvement	Proposed area for improvement from the different sources from Table 2
Involving developer in the analysis of technical aspects	<ul style="list-style-type: none"> • “Involving the developer/architect in the analysis” - Most frequent areas for improvement proposed by interviewed IT analysts. • “Involving developers” - Most frequent established differences between my IT analysis process and the interviewed IT analysts’ processes.
Creating less documents	<ul style="list-style-type: none"> • “Creating less documents” - Most frequent areas for improvement proposed by interviewed IT analysts • “Creating less documents” - Most frequent established differences between my IT analysis process and the interviewed IT analysts’ processes
Creating diagrams	<ul style="list-style-type: none"> • “Using UML diagrams” - My proposed areas for improvement. • “Using visualisations” - Most frequent areas for improvement proposed by interviewed IT analysts. • “Making diagrams” - Most frequent established differences between my IT analysis process and the interviewed IT analysts’ processes. • “Creating diagrams” - Most frequently mentioned tasks performed by IT analysts found in the literature.
Creating process models	<ul style="list-style-type: none"> • “Using AS-IS and TO-BE process models” - My proposed areas for improvement. • “Using visualisations” - Most frequent areas for improvement proposed by interviewed IT analysts. • “Modelling and analysing processes” - Most frequently mentioned tasks performed by IT analysts found in the literature.
Conducting regular client meetings	<ul style="list-style-type: none"> • “Meeting with client regularly” - Most frequent established differences between my

	IT analysis process and the interviewed IT analysts' processes.
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Table 3. Different names of proposed areas for improvement

All the areas for improvement mentioned in Table 3 in the left column will be implemented in the new IT analysis process.

The first area for improvement (Involving developer in the analysis of technical aspects) will be implemented in the new IT analysis process because all the IT analysts and the literature mention that designing the system and database is part of the IT analysis process, but the interviewed IT analysts pointed out that it should be in cooperation with the developer since they have better technical knowledge. This helps to avoid errors in the analysis.

The second area for improvement (Creating less documents) will be implemented in the new IT analysis process because creating documentation is also a part of every IT analyst's process according to the interviewed IT analysts and the literature. The IT analysts pointed out that creating less documents reduces the work load and is easier to maintain, which in the end helps to save time and avoid errors.

The third area for improvement (Creating diagrams) will be implemented in the new IT analysis process because this area was proposed by me initially, it was mentioned in the literature as tasks that IT analysts do, and the interviewed IT analysts also use it.

The fourth area for improvement (Creating process models) will be implemented in the new IT analysis process for the same reason as the area for improvement "Creating diagrams" because one of the biggest differences between my IT analysis process and the interviewed IT analysts' processes is that they use more visuals.

The fifth area for improvement (Conducting regular client meetings) will be implemented in the new IT analysis process because one of the most occurring differences was that the interviewed IT analysts conduct regular client analysis meetings. Therefore, the new IT analysis process will include regular client meetings to get constant feedback from the client, which hopefully helps to reduce the time of waiting for the client's feedback and needing to rewrite the analysis.

4.5 Proposed new IT analysis process and initial feedback

In this subsection the new IT analysis process is presented together with the opinion of the five interviewed IT analysts' evaluation whether they think the new IT analysis process will increase IT analyst's work quality.

4.5.1 Description of the new IT analysis process

In this subsection, the new and hopefully improved IT analysis process is presented and described, using the prioritised areas for improvement that were established in the previous section.

Figures 29, 30, 31 and 32 show the process map of the new IT analysis process and its sub processes. Tables 4, 5 and 6 describe the changes in the sub processes. Since sub process "Implementing the feature" is the same as in the original IT analysis process there is no

corresponding table. The sub process will stay the same because no significant weaknesses were established there.

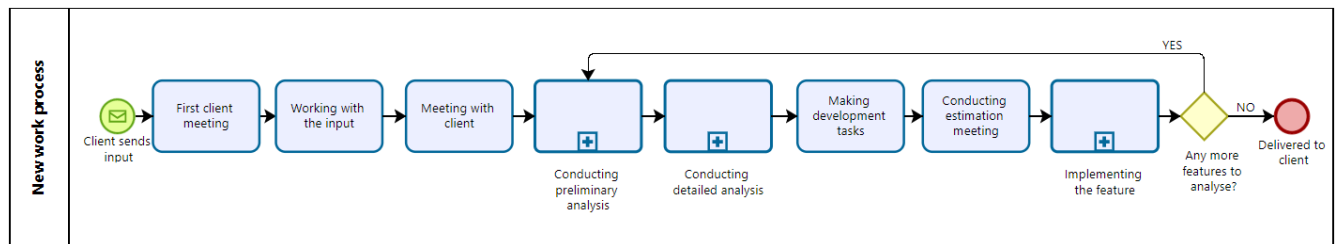


Figure 29. New IT analysis process

	IT analysis tasks	Explanation
Unchanged	<ul style="list-style-type: none"> First client meeting Working with the input Meeting with client Making development tasks Conducting estimation meeting Sub process “Implementing the feature” (Figure 32) 	
Changed	<ul style="list-style-type: none"> Sub process “Conducting preliminary analysis” (Figure 30) Sub process “Conducting detailed analysis” (Figure 31) 	<ul style="list-style-type: none"> Explanations are given in Table 5. Explanations are given in Table 6.
Removed	<ul style="list-style-type: none"> Designing database Writing specifications 	<ul style="list-style-type: none"> The database will be done by developer. Corresponds to the area for improvement “Involving developer in the analysis technical aspects” in subsection 4.4.5. Specifications are written in detailed analysis sub process in cooperation with the developer. Described in Figure 31. Corresponds to the areas for improvement “Creating diagrams” and “Creating less documents” in subsection 4.4.5.

Added	Nothing was added.	
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Table 4. Changes in the new IT analysis process

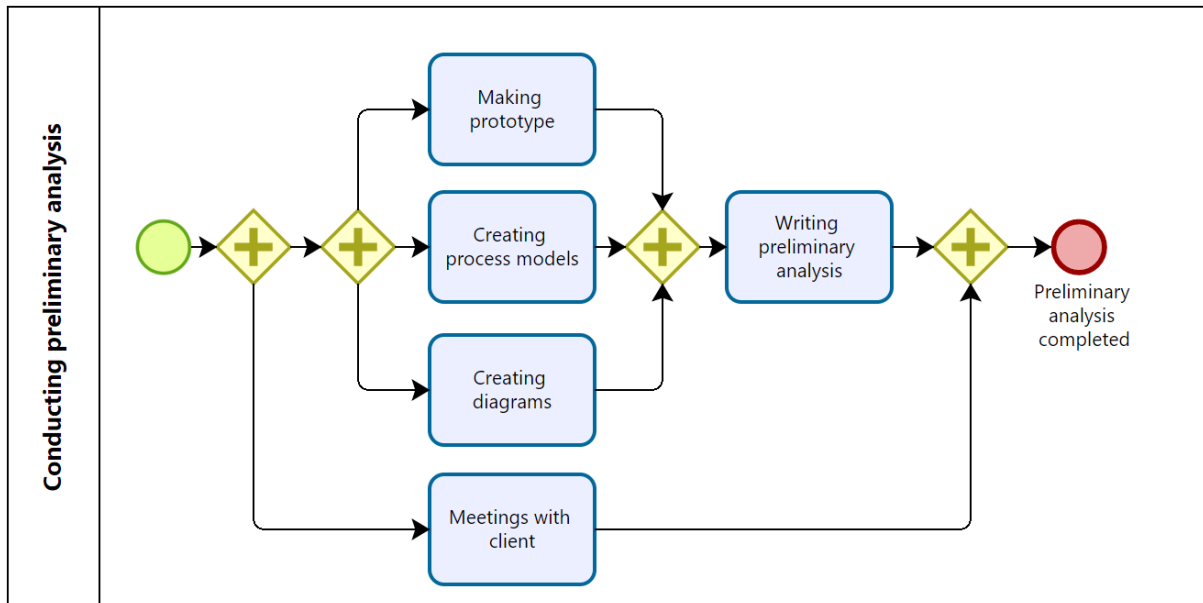


Figure 30. New sub process “Conducting preliminary analysis”

	IT analysis tasks	Explanation
Unchanged	<ul style="list-style-type: none"> • Making prototype • Writing preliminary analysis 	
Changed	<ul style="list-style-type: none"> • Meetings with client 	<ul style="list-style-type: none"> • Meetings with client are conducted regularly instead of as-needed basis. Corresponds to the area for improvement “conducting regular client meetings” in subsection 4.4.5.
Removed	<ul style="list-style-type: none"> • Making changes to prototype • Completing preliminary analysis • Waiting for feedback 	<ul style="list-style-type: none"> • Prototype is made in parallel with client meetings with constant feedback. • Preliminary analysis is written in parallel with client meetings. • There is no need for feedback in the end because feedback is given constantly in meetings with client.
Added	<ul style="list-style-type: none"> • Creating process models • Creating diagrams 	<ul style="list-style-type: none"> • Corresponds to the same area for improvement in subsection 4.4.5. • Corresponds to the same area for improvement in subsection 4.4.5.

Table 5. Changes in the sub process “Conducting preliminary analysis”

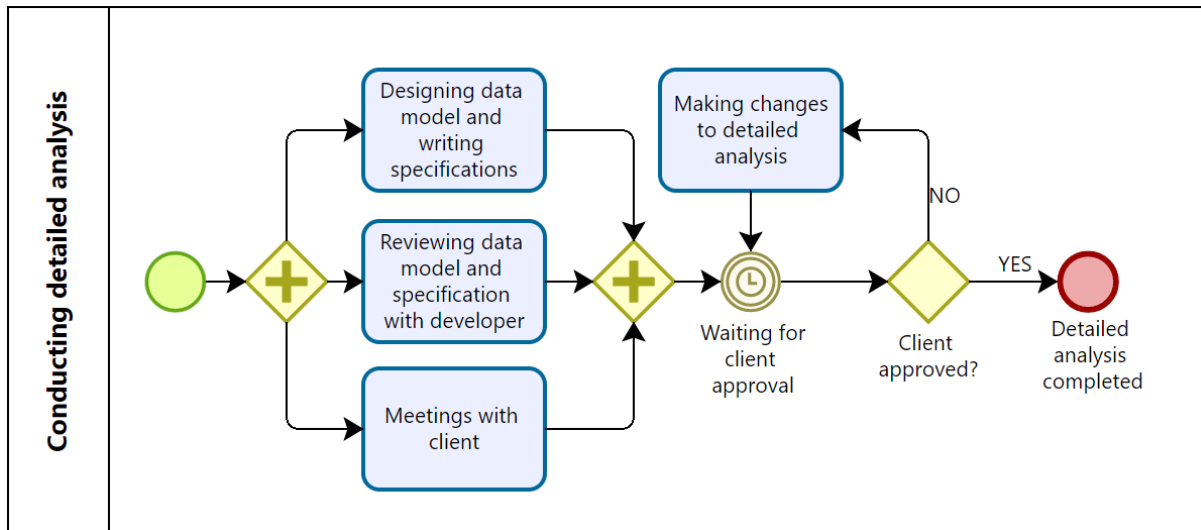


Figure 31. New sub process “Conducting detailed analysis”

	IT analysis tasks	Explanation
Unchanged	<ul style="list-style-type: none"> Making changes to detailed analysis Waiting for client’s approval 	
Changed	<ul style="list-style-type: none"> Meetings with client 	<ul style="list-style-type: none"> Meetings with client are conducted regularly instead of as-needed basis. Corresponds to the area for improvement “conducting regular client meetings” in subsection 4.4.5.
Removed	<ul style="list-style-type: none"> Writing detailed analysis document Making adjustments to database design Making changes to prototype 	<ul style="list-style-type: none"> There will not be a detailed analysis document in the new IT analysis process. Corresponds to the area for improvement “creating less documents” in subsection 4.4.5. The database will be done by developer. Corresponds to the area for improvement “Involving developer in the analysis technical aspects” in subsection 4.4.5. Prototype is done and approved in preliminary analysis during regular client meetings.
Added	<ul style="list-style-type: none"> Designing data model and writing specifications 	<ul style="list-style-type: none"> Corresponds to the areas for improvement “Creating diagrams”

	<ul style="list-style-type: none"> Reviewing data model and specification with developer 	<ul style="list-style-type: none"> and “Creating less documents” in subsection 4.4.5. Corresponds to the areas for improvement “Involving developer in the analysis technical aspects” in subsection 4.4.5.
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Table 6. Changes in the sub process “Conducting detailed analysis”

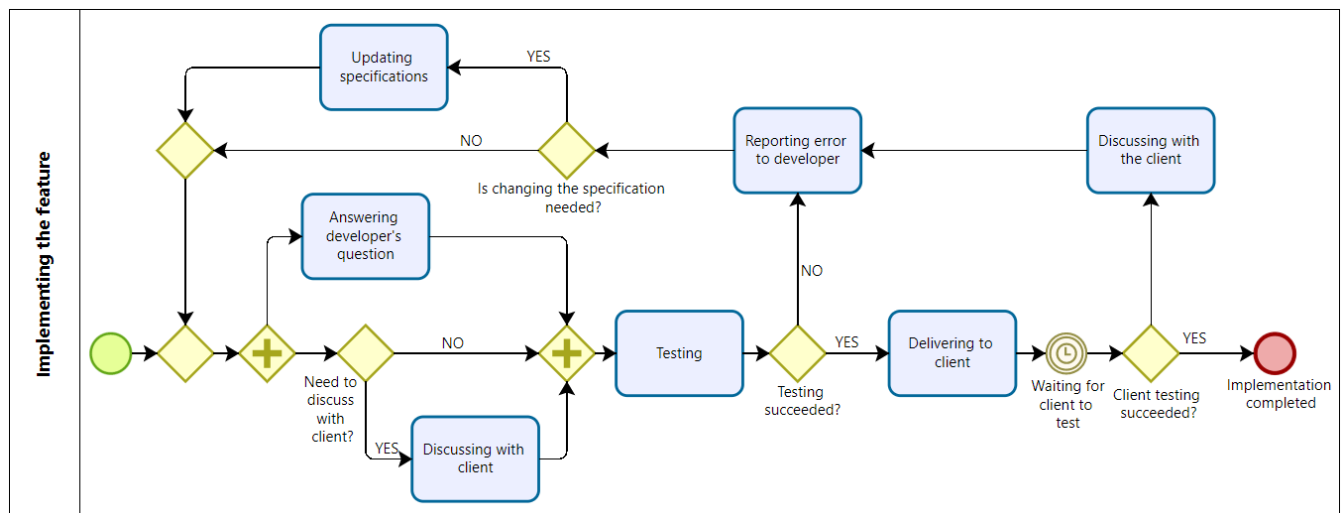


Figure 32. Sub process “Implementing the feature” (unchanged)

Figure 29 gives an overview of the new IT analysis process. The changes to the old IT analysis process are listed in Table 4. The new IT analysis process starts when the client sends the input. After the first client meeting, I will work with the input to already establish some questions, which is followed by a meeting with the client.

Figure 30 gives an overview of the new sub process “Conducting preliminary analysis”. The changes to the old sub process are listed in Table 5. The preliminary analysis starts with making visuals to help paint a better picture of the new system to the client. The visuals include prototypes, process models and diagrams. Compared to the original IT analysis process, there is no need to wait for the client’s approval after the visuals, because in the new IT analysis process, there will be regular client meetings where I can ask questions and feedback will be given by the client regularly. Next step in the IT analysis process will be to write the preliminary analysis document and then the preliminary analysis phase is completed.

Figure 31 gives an overview of the new sub process “Conducting detailed analysis”. The changes to the old sub process are listed in Table 6. In the new detailed analysis sub process, designing data model, writing specifications and meeting with the client are done simultaneously. The data model design and specification are written and at the same time reviewed together with the developers, meaning I write the business rules and describe the business flows and user interfaces and together with the developers we add the technical solution to the specification. This is because developers have better knowledge in that area, so in the end, it saves time and helps to avoid errors that later result in needing to rewrite the analysis. Unlike in the original IT analysis process, where questions and feedback were asked

in the end, in the new detailed analysis phase, meetings with the client will be conducted regularly. When the specification document and the data model are ready, then it is needed to get an approval from the client, before moving to the implementation phase. If they do not approve, then it is needed to do changes to the specification, but if the client approves, then the detailed analysis phase is completed. After the detailed analysis, it is possible to create development tasks, that is followed by an estimation meeting.

Figure 32 gives an overview of the sub process “Implementing the feature”. Since there are no changes to the sub process, there is no corresponding table of listed changes for the sub process. During implementation, when the developers ask questions, I either answer them right away or discuss with the client first. When the developers have finished their tasks, then I do testing to be sure to evaluate if the most important business requirements are met. If the testing succeeds, we deliver the functionality to the client. If the testing fails, I report the errors to the developer. If I see that there was an error in the specification, then I make changes to the specification and the developers can make changes in the code. If there are no changes needed, then the developers can fix the error right away. If they have questions in the meantime, I will answer them or I will discuss with the client again if needed. When the errors are fixed then I test again, and the loop continues until the tasks pass my manual testing.

Like in the original IT analysis process, after the feature is delivered to the client, they can start testing. If there are any errors or changes needed, the client lets me know and I report it to the developer. Next, the same process applies as when I report an error from my testing. This continues until the client approves the feature. If there are any more features to analyse, then the IT analysis process goes back to the preliminary analysis.

4.5.2 Feedback from interviewed IT analysts about the new IT analysis process

All the five interviewed IT analysts were sent the new IT analysis process to evaluate whether the new presented IT analysis process might help improve the analysis quality, given the measurements and weaknesses established in the baseline (section 4.1).

Every IT analyst agreed that the new presented IT analysis process might help to improve my analysis quality and effectiveness. IT analyst 2 brought out that using visualisations might help to avoid misunderstandings already in the beginning. They also mentioned that at first, knowing what the right moment is to include the developer in the analysis for the technical aspects, might take a little time to get used to. IT analyst 3 was interested how will be transition between the old and the new IT analysis process and what will the results be after the implementation period. IT analyst 5 said that the new IT analysis process seems more effective, because it uses more agile approaches, such as more cooperation, modelling, prototyping and frequent feedback.

5. Introducing the new IT analysis process

At the time of writing this thesis, I was already implementing the new IT analysis process in Helmes. I will implement it for nine months, which is the same timeframe the initial data was collected. When this period is over, I will collect the same data mentioned in the baseline to compare the measurement values. After the comparison, I will make conclusions and decide whether I need to change something in the IT analysis process. If I do, then I will implement the updated IT analysis process again until the necessary results. The new IT analysis process will be introduced to my colleagues.

6. Conclusions

The goal of this thesis was to develop a method for IT analysts to improve their IT analysis process in the context of Helmes. To reach the goal, my current situation was observed and analysed. Next, interviews with other IT analysts in Helmes were conducted to establish potential areas for improvement and to find differences between my IT analysis process and the interviewed IT analysts' processes. Then, a literature review was conducted to find out how the literature describes the IT analyst's tasks. Lastly, a new and hopefully improved IT analysis process was presented.

The scope of this thesis was to develop and present a new IT analysis process, implementing it did not fit in the scope, so the next step in Helmes will be to implement the new IT analysis process in my work to validate if the IT analysis process indeed improved. The new IT analysis process will be used for 9 months and then the same measures will be collected and then compared to validate if the IT analysis process improved or not. In case the IT analysis process did not improve, then it is possible to iterate the method, analyse what are the weaknesses in the new IT analysis process and then come up with a new set of proposed areas for improvement to be implemented.

To verify whether the thesis project was successful or not, the new IT analysis process should have less waiting time, because the number of times when feedback was asked, was reduced. This also results in having less repetitive loops in the IT analysis process because feedback is given regularly, so there is less situations where there are changes needed in the analysis. In the end of the project, the interviewed IT analysts were asked their opinion whether they think the new IT analysis process would be an improvement. All the five interviewed IT analysts agreed that the new IT analysis process might help to improve the current IT analysis process and the weaknesses established in the baseline, but it is important to validate the new IT analysis process with the same measurements as the original IT analysis process, after the implementation period is over.

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