CHANGING WEBSHOPS AS WE KNOW THEM

Supporting customers to be in control

Abstract

A questionnaire that gathers software requirements without human interference, can be a valuable addition to the traditional software sales process.

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MANAGEMENT SUMMARY

Customized business software sales have traditionally always been conducted by a consultant working together with the customer through the entire sales process until delivery. This thesis will show a new possibility of replacing the start of the process with a custom-made questionnaire, which the potential customer fills in without help. This questionnaire then produces the requirements needed to create the software for the client.

This thesis contains the following:

1. A literature study this thesis is based on.
2. A description of the current situation, with a description of where in the sales process the solution can be valuable.
3. A methodology for creating this questionnaire.
4. Implementation of the method, using the automotive sector as an example.
5. Validation of the implemented model using the theory discussed earlier.

Problem description

This thesis attempts to 'fix' the following. Novulo has a web shop on their web site which barely sees any use. The idea behind it is that potential customers could piece together their own business application from the components that Novulo provides. In practice, it sees no use. This is because of the following reasons: The web shop is not user friendly, the web shop does not give enough guidance in identifying business processes, and the product selection is overwhelming. Creating a questionnaire that identifies the client's business processes and the software that is used for this, is the proposed solution.

The overarching theory that is used for creating the methodology to do this, is called *design science* (Ken Peffers, 2007). Design science describes a way that any so called 'artefact', which is the prototype, can be created using an iterative process.

Literature

The literature gives us information about the parts required to create the questionnaire for requirements gathering. It begins with a question about how to define business processes. A general definition is: "*a set of related activities".* Understanding the entire business is therefore key to understanding a specific part (a process). While there are many modelling languages/notations, BPMN fit this situation best.

There are many best practice documents for creating a questionnaire. What most of them have in common is that all the information you give a respondent has to be clear, concise, and relevant. If a creator does not do one of these things well, the information will not be as useable as if they did.

Furthermore, using relevant KPI's is essential to long-term validation of the solution. Relevant means they describe a part of the situation that they want to measure accurately.

Last, newly developed privacy regulations (GDPR, etc.) form no problem for this thesis.

Current situation

Currently, a potential client hears about Novulo through various channels (internet, conventions, word of mouth etc.), and calls or e-mails them. A Novulo consultant then visits the company to talk to them and figure out their wants and needs. A quotation is made and improved until it meets the client's needs. Then development starts. The web shop could replace this first part where the consultant figures out the clients' wants and needs together, but as said before, it doesn't function well.

Methodology

The methodology has 4 main parts. Map out processes, create and validate questions, create and validate mock-up, and build real application/create testing KPI's. Each of these steps have their own requirements. Doing interviews and academic research into best practices are the main techniques used. Between the creation and validation steps, one can go back and forth until they are satisfied with the result. Between any of the not-linked steps the same can be done. The methodology is designed so that the goal is to flow through it from beginning to end, but going back a few steps is expected.

The implementation to test the methodology was done in the automotive sector. There was a project going on at Novulo at the time of writing in this sector, so working on that gave the experience to understand the sector and implement the methodology into it.

To get an idea of a final product, a design and a functional product were created separately. The reason for this split is that in the timeframe combining the two wasn't feasible. The mock-up (design) was created based on theory and then tested at the same company the Novulo project was going on at.

The functional product was created in excel. It is split up in three main parts. The beginning asks a few questions to get an idea of the size and main activities the company is involved in. The customer is then given a choice between if they want to figure out all the details themselves or let the Novulo consultants do an estimate. At the end the customer is given an overview of the final decisions, the costs, recommendations what other customers might want and an option to download, contact Novulo, or start over.

Validation

The model was validated according to a list of questions created specifically for situations like this by Viswanath Venkatesh, (2003). These questions were then adapted to fit the situation, and given to a few people to fill in, together with the mockup, the real working excel version of the questionnaire, and some instructions. The results very overall very positive, with a bit of variation on questions on how clear the questionnaire is.

Conclusion

In conclusion, using this methodology it is made possible for users to figure out part of their software requirements themselves. This eliminates the need to have a human consultant present from the very beginning in the quotation process and has the possibility to save costs this way. It also makes it more accessible to try out what possibilities the software has, since it is so easy to get started in and get basic results in a few minutes.

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1. INTRODUCTION

1.1 COMPANY BACKGROUND

Novulo is a company that creates business software. They differentiate themselves from the competition by combining the customization that comes with custom built software with the speed of implementation and lower costs that come with premade software. They utilize Model Driven Development (MDD) in a custom called 'The Architect'. They create software with generic functionality in such a way that the very specific piece of software that one company needs can be re-used by another, saving a lot of time and money. Novulo have been working on improving the implementation and roll-out processes previously and have now moved on to working on the web shop.

1.2 PROBLEM DESCRIPTION

At this moment, Novulo has multiple channels to sell their product. The channels are the "direct" way and the web shop. The direct way involves sending a consultant to a customer. This consultant then maps the business processes that the company is involved in and creates an application that meets their needs. The web shop lets customers design an application themselves from a list of possible modules, after which a consultant puts it together. Novulo is a first mover in this way of selling business software online

The problem here is that the web shop is not used often. The goal of this thesis is to figure out why that is and create a solution for that problem.

1.3 PROBLEM DEFINITION

In figure 1, the problem cluster can be found (H. Heerkens, 2012). This problem cluster explains step by step what the core problem is, what causes this, and what consequences this problem has. It also shows an action problem; this is the problem that the company experiences. Most often the result is not the same as the problem, as can be seen in figure 1. Explained below are the labels as seen in the same figure.

1.3.1 LEGEND

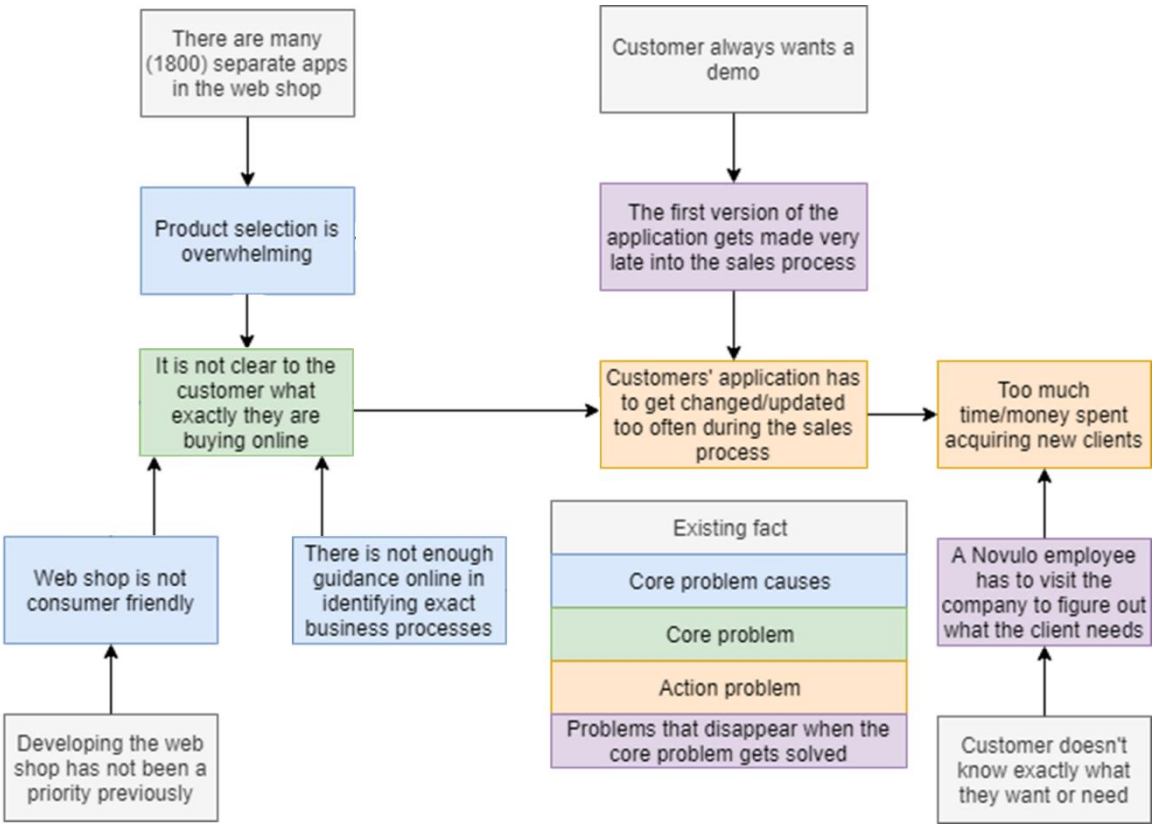


Figure 1 - Problem cluster

The legend in figure 1 explains what type each problem is using colors. What these colors means is explained below.

Existing facts are simply things that are part of the business that cannot or will not be changed. These things just have to be accepted and worked around.

Problems that disappear when the core problem gets solved can be seen as inefficiencies. These problems exist simply because of other problems in the cluster, and will be solved as they get solved. They do not have a direct cause, but can be described as workarounds to be able to work properly in the current system.

Core problem is what should be solved at the end of this thesis. It has been identified as the problem that causes all other problems and thus was deemed the most important one. How this came to be is explained by the *core problem causes*.

Action problems are problems that fall in the same category as the core problem but have causes themselves. This means that to be able to solve a specific action problem, another problem must be solved first. The core problem is an action problem, but not necessarily the other way around.

Core problem causes are problems that closely relate to the core problem. They can be described as a cause part of the core problem, but not capturing the enough of it to be considered the core problem themselves.

1.3.2 CORE PROBLEM

It is not clear to the customer what exactly they are buying online

It is unclear to the customer what exactly they are buying in the web shop. The web shop was created for customers to be able to customize and order their custom business application by themselves, online. At the moment, it is unclear what the customer is buying, how much it will cost, and how to order the product. This has multiple causes, listed below.

1.3.3 CORE PROBLEM CAUSES

Product selection is overwhelming.

The current web shop does not clearly tell potential customers what the individual modules do and how they work together. The customer is simply let loose to choose modules from a huge list without any guidance on how to select these.

There is not enough guidance online in identifying exact business processes.

When using the direct (current) approach, the consultant guides the company in identifying exactly what business processes the client uses to operate and what apps are needed to continue doing this successfully. Currently the web shop does not guide the customer in choosing these apps. This results in customers getting the wrong apps, unnecessary apps, missing essential apps, etc. Best case still they call customer service to help them and you are back to the direct approach. Worst case they get a bad application that doesn't do what they want, which is something to avoid at all costs.

The web shop is not consumer friendly.

Developing the technology to improve the web shop has not been a priority. In the process of automating the sales and roll-out process multiple business processes had to be improved. The other aspects of this automation added value to the current way of doing sales, while improving the web shop did not, meaning they had priority before. This has since been completed up to a point that there is room to devote resources to the last step in automation, the web shop.

1.3.4 EXISTING FACTS

There are too many (1800) separate apps in the web shop.

Novulo has been developing their platform for 15 years now, and the list of modules has piled up.

Developing the web shop has not been a priority previously.

The other aspects of automation added value for the customer to the current way of doing sales, while improving the web shop did not, meaning they had priority before.

Customer always wants a demo.

This simply means that before a customer buys a product, they want to see what they are buying first.

Customer doesn't know what exactly they want or need.

Potential customers generally call Novulo with a general statement of "I heard/saw that your software works, please help us as well". This means that apart from a general description, they often do not know what kind of software they need exactly.

1.3.5 PROBLEMS THAT DISAPPEAR WHEN THE CORE PROBLEM GETS SOLVED

The first version of the application gets made very late into the sales process.

Because the application has to get put together by hand entirely, the first working version doesn't get made until the contract is signed. The only demo that the customers can see relatively early in the process is other companies' apps.

A Novulo employee has to visit the customer to find out what they need.

Because of the previous problem that the customers don't exactly know what they want or need, combined with other problems, a Novulo consultant has to physically visit the company do figure out what exactly they need.

1.3.6 ACTION PROBLEMS

Customers' application has to get changed/updated too often during the sales process.

Because it is not clear to the customer what they are buying online, it is hard for the customer to know what apps exactly they need or don't need. This causes there to be many changes later into the sales process, because Novulo has to figure all of this out during this process.

Too much time/money is spent acquiring new clients.

Because of all the reasons combined, acquiring new clients simply takes more time and money than needed.

1.4 RESEARCH GOAL

The goal of this project is to create a new and improved design for the web shop. One of the first ideas was to have the redesign include a questionnaire that helps gather the user requirements. The research is there to obtain the knowledge required to create this. This is achieved by a combination of the literature study and interviews. The requirements for the questionnaire itself can be found in chapter 4.

1.5 RESEARCH QUESTIONS

The main research question is: **How to design a questionnaire to gather requirements for designing a business application?** This question encompasses everything that is required for the research goal to be achieved.

In order to accomplish the literature study part of the research goal, the study has to be split up into research questions. It starts with two practical research questions and then adds more theoretical ones.

The first practical question is: *"How to design a methodology?".* Creating a methodology is one of the main aspects of this thesis. The way this is done will be explored and explained in chapter 4.

The second question is: *"How can a questionnaire be implemented?".* To be able to test the methodology and know how to implement it later, it is essential to know how to do this. This question will be answered by implementing the methodology and reporting the findings. The answer to this and how it is done can be found in chapter 5.

The theoretical part starts with: "*How to define business processes?*". To be able to identify a business' inner workings, and give advice on what software they might want or need based on these processes, they first need to be defined.

Next, *"What factors influence customer satisfaction?".* If the goal is to create a better functioning web shop, it is important to know what makes it so customers leave a web shop satisfied. Getting an overview of these factors can help during the design.

"What tools and theories can be used to create a questionnaire for gathering user requirements?". To be able to create a questionnaire that gathers the user's requirements, it is often considered a good idea to first research all the documentation out there and get a good idea of all the best practices. Using this as a basis for the rest of the research helps avoid mistakes and improves the quality of the final product.

"How to measure the success of a project?". Once the project is complete, there needs to be some way to measure how successful it was. This question answers that.

Lastly, *"What kind of privacy/regulation concerns are there?".* In early 2016 new legislation was created for the European union, making privacy much more important. Considering if this has influence on this thesis project is essential to be able to successfully complete it.

1.6 SCOPE, CONSTRAINTS AND DELIVERABLES

1.6.1 DELIVERABLES

The goal of this thesis is to produce a methodology for creating a questionnaire that produces user requirements for a business software application. It was started because there was a problem at Novulo regarding this web shop, and this project seeks to improve it. This means the project contains the following.

First, an explanation to cover the current situation, including a BPMN model describing it. This is to get an understanding of how it works currently, and where in the process the problem lies.

Next, the methodology that aims to solve it is explained. It contains an overview of all the required steps to complete it and how they interact with each other.

The implementation is described as well. It contains a description of the setting, the "real" questionnaire as it was created and a BPMN model of the changes it can make to the sales process described before. It also contains a mock-up of the real design of the questionnaire itself. It includes a validation questionnaire, including results.

Lastly, the conclusions include: A summary of the process, shortcoming and recommendations, conclusions per research question and contributions to literature and practice.

1.6.2 SCOPE AND CONSTRAINTS

This entire project had a limited timeframe. This resulted in a limited scope. This chapter will explain the choices that were made of what not to do in the beginning.

The scope is limited to Novulo clients for testing and testers being geographically around Enschede to closely work with.

The testing is not as extensive as is often used for these types of projects (creating a questionnaire, creating a methodology), but was partly compensated for by doing extensive literature research. Since there was a similar project going on at Novulo as when this thesis was being written, the practical experience was very useful.

Another constraint is the amount of guidance required from Novulo. Their consultants are all extremely busy, so when their help is needed a lot of thought has to go into making it go as efficiently as possible.

Next, only one sector was being considered from the start. Testing the method in multiple sectors would be out of reach for the timeframe.

Confidentiality was discussed and specific figures have been removed, but more than that it was no issues.

1.7 THE METHODOLOGY IN THEORY

Two theories were used as a basis. One for the problem identification, as mentioned above by H. Heerkens, (2012), and another for the rest of the design. The reasoning behind this is that while, MPSM (Solving Managerial Problems Systematically, described in the book) is very good at identifying problems, it doesn't fit a project that is based on iterating on designs very well. This is because it describes a step by step plan for solving a problem, not for designing something new.

Another methodology that does fit this description very well is called *Design Science.* There are multiple researchers who have used similar approaches for creating/designing new things, but the one that will be used is the most popular one by Ken Peffers, (2007).

The way it works is by essentially using 6 general steps. Often these steps are repeated more than once during the iteration process, but this is the general guideline that was used.

1. **Identification** of the problem, defining the research problem and justifying the value of a solution.

This step can be found in chapter 1.3. It shows that the main problem is that customers are unsure of what they are buying online.

2. **Definition** of objectives for a solution
   What problems should be solved when done? What should the solution achieve? From here on steps often get re-used when iterating designs.

This step can be found in chapter 1.4 and 1.5. It shows the goal of this research and what the scope and limitations are.

3. **Design and development** of artefacts (constructs, models, methods, etc.)
   This step involves the actual design of the methodology. An artefact is a general term for the thing you're designing.

This step can be found in chapter 2, 3, and 4. Chapter 2 is about researching theory, chapter 3 about the current situation and chapter 4 then explains how it will get solved.

4. **Demonstration** by using the artefact to solve the problem
   Demonstration in this step should be seen as the testing phase. Using the solution to try and solve the problem to then evaluate it in the next step.

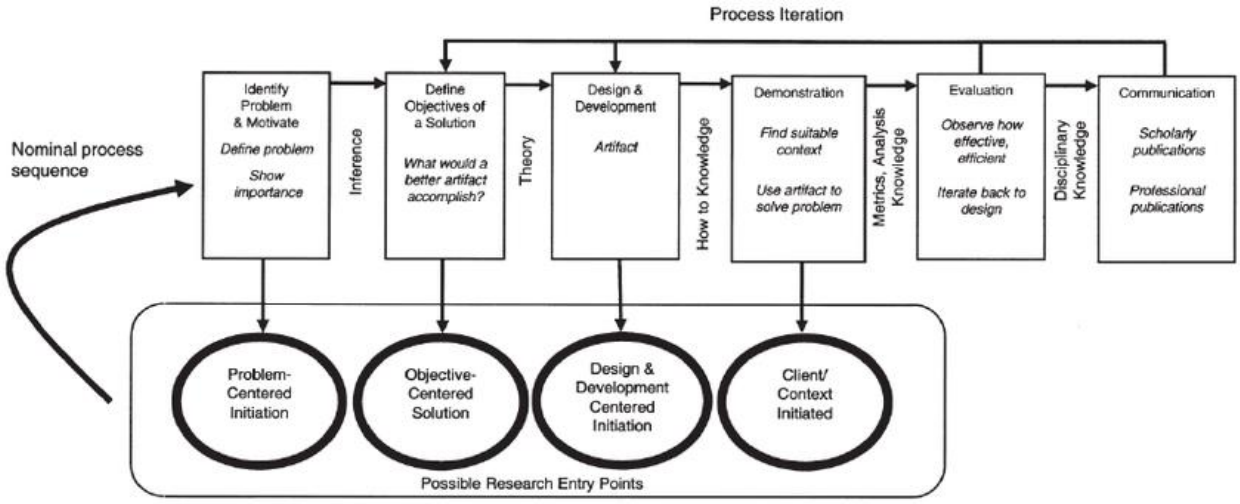
This step can be found in chapter 5. It shows how the solution gets implemented in reality.

5. **Evaluation** of the solution, comparing the objectives and the actual observed results from the use of the artefact
   Before going to the next step, any of the steps 2-4 can be repeated when necessary, in any order that is required.

This step can be found in chapter 5 as well. It goes together well with step 4.

6. **Communication** of the problem, the artefact, its utility and effectiveness to other researchers and practicing professionals.
   The last step is (in most problem-solving methodologies) communicating the solution to the stakeholders, and in this one it is not any different.

This was done in the form of a small presentation at Novulo. It is not included in this thesis.



(Design Science Process Model, 2019)

1.8 DATA COLLECTION METHODS

This chapter aims to explain the types of data collection methods used in this thesis.

Desk research means to research from your desk. One tries to answer research questions by using existing secondary and available sources. The key here is secondary. This type of research does not include data collection or creation through experiments or field research.

Interviews are used to extract information from people. They are used in many different types of context, but the overarching theme is that the people that get interviewed have information about the respective subject that is needed for the research. Interviews can take the form of having a five-minute conversation, to a full hour of pre-scripted questions.

Literature study is used to create a foundation of knowledge which the rest of the thesis is based on. It uses other academic sources to find information which has been peer-reviewed and can thus be expected to be true. Using literature as a basis for this thesis makes it so that when people ask: why is the subject of this thesis a good idea? The answer is based on many factors, not just one person's idea.

Questionnaires are used in a few ways in this thesis. A questionnaire is a list of questions used to extract information from the participant. The creation of one is the main subject of this thesis, however it is not only

used here. It is used in combination with interviews to gather information, and used at the very end to validate the end product.

1.9 VALIDITY AND RELIABILITY

Validity and reliability are major components of any research. Concerns that can be foreseen will be addressed here (Shuttleworth, 2008).

The idea behind reliability is that the findings have to be repeatable. To address this, apart from creating only one questionnaire, the underlying methodology will be written down to support the claim. Furthermore, the questionnaire will be tested using KPI's that have proven themselves in literature to make sure that the effect is consistent with what is expected.

The idea behind internal validity is that the results of all experiments meet the requirements of the scientific research method. This project plan is part one of four (Lyndsay T Wilson, 2009). Afterwards during the project, it's important to keep in mind the other steps as well.

External validity is the process of checking if there are any other causal relationships that might cause what you think is the effect of your project. Designing standardized tests and interviews is essential to be able to get good valid results.

To ensure validity and reliability were tried and tested throughout the research and chapters are named after them.

1.10 STRUCTURE OF THE THESIS

This chapter explains the structure of the thesis.

Chapter two explains the theoretical framework the thesis is based on. It explains the research questions, answers them and presents a conclusion.

Chapter three explains the current situation, it explains what the web shop looks right currently, what the current sales process looks like and explains the ways the measure the problem.

Chapter four describes the created methodology for gathering user requirements. It describes the goal, the requirements and then the methodology itself. The chapter explains each of the steps and how the relate to each other.

Chapter five explains the implementation. It describes the sector it is implemented in, and the system used to create the questionnaire and the requirements. The rest of the chapter describes the implementation process, this includes a mock-up of the design, and a description of the differences between the mock-up and the implementation design. It also describes the proposed changes to the sales process. Lastly, it shows the validation of the questionnaire, including the feedback and a small amount of statistical analysis.

The last chapter, chapter six, shows the conclusions and recommendations. It gives a summary of the whole process, shows the shortcomings and further research, and conclusions per research question. It ends with contributions to literature and practice, to show what others can reuse from this thesis.

Chapter 7 is the bibliography and chapter 8 contains the appendices.

2. THEORETICAL FRAMEWORK

This chapter aims to answer relevant research questions using literature. It aims to answer the main question: **How to design a questionnaire to gather requirements for designing a business application?**

2.1 HOW TO DEFINE BUSINESS PROCESSES?

To be able to redesign a part of the sales process at Novulo, the current process has to be mapped out first. If there is no clear overview, it is hard to know what and where to change. Mapping these processes is often an extremely difficult undertaking. Fred Nickols summarized many articles on the subject and created a general guideline on how to define these processes (Nickols, 1998).

The definition of the word "process" is hard to pin down. In the literature the term "process" is often defined as a set of related activities. If you accept the idea that a process is as set of related activities, then any set of related activities, regardless of scope and scale, can be considered a process, and any type of activity can also be labelled a process. This lack of exact meaning creates a lot of difficulty in defining a company's business processes.

There are, however, a few things that help narrow down the business processes.

First, *processes are portions of a larger stream of activity.* It is essential to realize that a process does not have an exact beginning and an exact end. They always flow from one to the other, often with overlap. This means that process boundaries must be set in a larger context, not only identified. Once the boundaries of the entire process have been established, it can get broken up into smaller pieces.

Setting boundaries is the way to break a big process. These boundaries must be set; they cannot be discovered or identified. This means that a process can be broken up in as many pieces as someone would want, as long as they give each part a different name. In practice, establishing these boundaries can be done by looking for places where the state changes, hand-offs, and transfers of custody or ownership occur. Still, using all these guidelines, there still has to be a person who decides where these boundaries lie in the end.

To model this, multiple modelling techniques exist. There are **three** main modelling techniques for these types of processes: UML activity diagrams (Unified Modelling Language), Flowcharts, and BPMN (Business Process Modelling and Notation), summarized below. (Polančič, 2014).

A Flowchart is a diagram that represent a process in a high-level way. It maps decisions and steps as boxes and shows a solution model to a given problem (Vocabulary, 2008). Flowcharts are often used for designing simple processes and solutions, to find the not so obvious flaws in them. Flowcharts often do not specify details of each step, only the specific goal or result.

UML activity diagrams and BPMN have similar goals with similar results. They both define processes in a detailed way, split between all actors involved, from beginning to end. Cristina Venera (Venera, 2012) did a literature study comparing the two languages. They tested both using three criteria. "Capacity of being readily understandable", "Adequacy of the graphical elements of BPMN and UML AD to represent the real business processes of an organization", and "Mapping to Business Process Execution Languages". Without going into too much detail, the conclusion was that they were extremely similar. So similar in fact, that which one of the two one uses almost completely comes down to personal preference and what one is more familiar with.

In conclusion, for this thesis flowcharts are too high-level, while UML and BPMN can both work. BPMN was chosen because of the simple reason that the author was more familiar with it to begin with. Using UML would have made little difference in the end result.

2.1.1 BPMN NOTATION EXPLANATION

This chapter will cover a simple explanation of the BPMN notation. It's the one true way to graphically map your processes and is a globally recognized, standardized method. In other words, it's information any business looking to draw reliable process maps needs to know (Brandall, 2017).

The pictures below are all taken from the Camunda modeller website (Modeler, 2019). BPMN models are created by giving every actor involved in the process its own *lane*. Every lane starts with an *event* that gets this actor involved in the process and ends with an event that ends the actor's involvement. Between this beginning and ending, *activities* happen. The basic syntax as well as a very basic process, is pictured on the next page. For a full extended explanation with all the symbols as well as what more complex processes look like, visit the camunda modeller website (https://camunda.com/bpmn/reference/). To be able to understand the models created in this Thesis, this should be enough.

Figure 2 explains the syntax. Participants can be *pooled* together (if they have an overlapping property, for example multiple people at the same company), and each have their own *Lane* with their own *activities*. This is what makes up most of the processes. The *gateways* are there to show where decisions must be made. These are often conditional, with the condition attached as a *text annotation*.

Figure 3 shows a very simple process. Every participant has its own lane with activities. As shown, every lane has a starting event and a closing event.

Figure 2 – Syntax

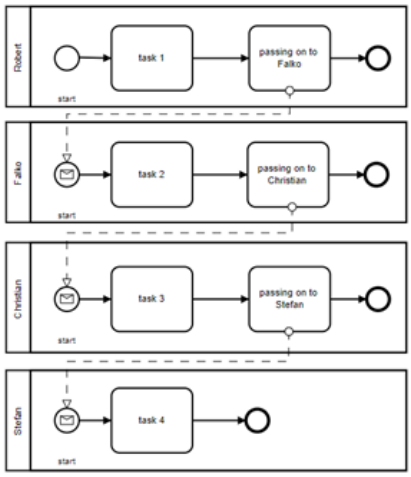


Figure 3 - A simple process

2.2 WHAT FACTORS INFLUENCE CUSTOMER SATISFACTION?

When designing a platform to sell a product, the customers' needs have to be put first. Their experience is what essentially drives the platform, what they value most has to be known. Joao Dias, (2019) did a study on what factors influence customer experience most with financial institutions. This study can possibly be interpreted for use in a more general context, depending on if other studies affirm the findings (which they do).

Joao Dias showed that, the three most important drivers of customer satisfaction that were found are about Transparency and simplicity. Ordered from most to least important.

1. Transparency of prices and fees
2. Ease of communication
3. Keeping track of the order status

They also showed that the next drivers relate to personalization and value-added services. Ordered from most to least important.

1. Assessment of broader customer needs
2. Products and services received immediately after setup
3. Ease of identifying needed product
4. Ease of navigating through order process
5. First interaction with the company
6. Time needed to complete order

These factors all contribute to customer satisfaction and must be kept in mind when designing a new product.

Muzammil Hanif, (2010) affirms these findings, by showing that the variables customer services and price fairness play a very important role in making the customer satisfied. Each of these variables do not only influence customer satisfaction, but also complement each other very well.

Customer satisfaction is often hard to measure. John Goodman, (2003) shows that a lack of complaints does not necessarily mean that the customer is satisfied. In fact, it even shows that in a study surveying electronic broadcast equipment, over 50% showed that it would be easier to simply switch vendors than to complain. Of course, in the business software branch, investment is quite a bit higher so the percentage will probably not be as high. This is reiterated by the same author: "The propensity to complain is directly proportional to the perceived severity of the problem and damage to the respondent.". Since Novulo supplies software that runs an entire business, the perceived severity of any problem will be quite high. Still, creating and maintaining an open channel of feedback should be done to keep customers satisfied.

To conclude, the factors that have influence customer satisfaction have to be kept in mind when designing a new product. Fix problems quickly when they arise and customers will be happy to pay for services.

2.3 WHAT TOOLS AND THEORIES CAN BE USED TO CREATE A QUESTIONNAIRE FOR GATHERING USER REQUIREMENTS?

To make a questionnaire, specifically for gathering user requirements, there are a few guidelines and best practices that can and should be followed.

In the article *Research into questionnaire design* (Lietz, 2010) the author did a meta study about literature and survey methodology well, which is why this study can be used as a basis for most of the information in this chapter. It tells us that there are many models that describe questionnaire design. The thing that they have in common is that both models conclude that minor details in the formulation of questions and answers can have a major effect on the responses obtained and ultimately on the conclusions drawn from the research (Lietz, 2010). This is why the different ways of encoding and decoding questions is reviewed first, after which the impact of these different forms is discussed.

2.3.1 QUESTIONS

Questions have many aspects to them that all have to be considered. The research has resulted in best practices for aspects like for example question length, question wording and question order (Lietz, 2010). Good practice in terms of these issues are especially important in international research, to reduce the impact of culture and language on survey results.

For question length, the literature consensus is to keep it as short as possible (Lietz, 2010). Depending on where you read it, somewhere between 16 and 20 words for the English language. Additionally, prefacing a group of questions by a medium length introduction around (30-40 words) increases data quality. Incidental longer questions can sometimes lead to more accurate answers, as they make the questions seem more important.

Grammar complexity should be kept to a minimum (Lietz, 2010). This means using an active instead of a passive voice, repeating nouns instead of using pronouns and avoiding possessive forms. This is so people can use all their mental capacity on answering questions instead of thinking about the phrasing.

To reduce the cognitive load on respondents even more, more means are available. Lietz, (2010) tells us that using specific terms instead of general, breaking down m complex questions into simpler ones, providing illustrations of certain concepts (e.g. “extreme pain” means not able to walk), and avoiding vague words like “probably”, “maybe”, etc. Scenarios to avoid are questions that ask about hypothetical future behaviour. It is recommended to instead sketch alternative scenarios when asking about anything but the past or present.

Studies have shown that when asking questions about an event in the past, it is important to consider that when talking about anything other than the immediate past, invalidity of responses due to cognitive overload increases (Lietz, 2010). The level of invalidity depends on the importance of the event itself. This means that the previous factors all become more important the longer ago the event the question is about happened.

Social desirability is an effect that makes respondents answer in ways that might not reflect reality. It is defined as ‘a tendency to respond in self-report items in a manner that makes the respondent look good instead rather than to respond in an accurate and truthful manner’ (Lietz, 2010). In order to get accurate answers on sensitive subjects indirect questioning is advised. For example, asking what they believe other people think about a certain subject is a way to get around this problem. The introductory phrase “do you happen to know…?” is another way to make respondents think more about their answer and not feel as bad when they do not know, instead of pretending and giving an invalid answer. Other suggestions like wording questions a neutrally as possible and others. These however have had limited success.

Another concept to avoid are so called “double-barrelled” questions. These are questions or statements that contain two different verbs or concepts. Asking questions like this makes it hard for the reader to know what the main subject of the question is, and thus researchers are more likely to get invalid answers.

There is a general advice against asking negatively worded questions, including double negatives. They take longer to process and have greater likelihood of respondents making mistakes (Lietz, 2010). Rephrasing questions like “should people not talk in the library?” to “should people be quiet in the library” helps reduce error.

The next recommendation around clear wording is about using adverbs that indicate frequency. Research has shown that terms like ‘rather often’, ‘frequently’, and other adverbs like that have a different meaning for every individual (Lietz, 2010). This makes them hard to use if the researcher wants reliable results. A solution to this is to change, for example ‘frequently’, to ‘once a week’. This makes questions have the same meaning for every respondent and eliminates the chance of there being a misunderstanding.

Question order matters when a respondents’ behaviour changes depending on the position of the question in the questionnaire (Lietz, 2010). This is problematic when they threaten the validity of results, but also when trying to generalize the results to a whole population.

This effect can occur when asking a specific and a general question about the same topic, for example happiness. Best practice in this case is to put the general question first, so the specific instance of that topic cannot influence the general concept (Lietz, 2010). It can also occur when asking questions at the same level of specificity. Research for these cases shows that results are extremely topic and cases dependent, without any real best practice.

In short, Lietz, (2010) tells us that questions should be as clear, simple, specific and relevant as possible. Participants should be able to understand the reasoning and use behind each question, and should not feel attacked or judged for their answer. The questions should focus on present matters or matters shortly in the past. General questions should precede specific questions. Lastly, demographic questions should be saved for the end to ensure respondents will answer questions truthfully, which could change depending on how much information is asked of them in the beginning.

2.3.2 RESPONSES

The way participants respond is just as important as the way the questions are asked. It is not as extensive as the theory on questions, but still essential.

One of the main issues that researchers often face is if respondents need to answer every question or not. There is no wrong option here, it depends on what the goal of your questionnaire is. When offered a DK (don’t know) option people will select it about 25% of the time, no matter how familiar they are with the topic (H. Schuman, 1996). When comparing the same questionnaires with and without the DK option, (H. Schuman, 1996) found that only in 1 out of 19 cases there was a significant difference between them. Respondents who respond when there is no DK option, and do not when there is one, are labelled *opinion floaters*. The conclusion was that if the goal is to get an informed opinion, the DK option should be added, and if the goal is to get “an underlying disposition” it should be left out (H. Schuman, 1996).

Another way to deal with this is so called *opinion filtering*. This is a way to filter out respondents by asking questions such as “Do you have an opinion on this or not?” (Lietz, 2010). While this is a way to filter out people with uninformed opinions, a couple of things have to be remembered. ‘Uninformed’ is a very loose term that everyone defined differently depending on demographic. It also means one might filter out a specific group of people making the entire questionnaire not representative. A commonly used rule in survey research is to

consider a sample not representative if the information obtained comes from less than 80% of the originally intended population (N. Bates, 2006).

The optimal number of response scale options varies from question to question. A lot of research has been done on the topic, and the general conclusion is that, first, an odd number of answers is optimal. Without a 'middle ground' people's answers have a higher random error and lower validity. This is confirmed by a meta-analysis of 87 experiments by (W.E. Saris, 2007). Second, shorter scales (such as 3 or 5 point scales) are more suited towards questions with absolute judgements, while longer scales (7, 9 or more point scales) are more suited towards situations with more abstract judgements (Foddy, 1993).

(Taylor-Powell, 1998) researched the structure, formatting, and layout. They created a best-practice document that describes some tips on how to create a questionnaire. Below the most relevant findings are listed.

The main tips about questionnaire design in general. These tips help the researcher get the right information, keep the respondent on point, and avoids unnecessary information.

1. Don't ask a question unless it has a use; that is, unless it relates to the purpose of the study.
2. From the beginning, think through what you will do with each piece of information.
3. Be selective and realistic. Know what information is needed, why, and how you plan to use it.
4. Double check if information you need is already available elsewhere.

Then after that Marshall mentions many more tips about wording, the most important ones for the type of research used in this thesis listed here. When these tips are adhered to, the responses should be more reliable.

1. Avoid the use of abbreviations, jargon, or foreign phrases. The questionnaire has to be useable by people from all backgrounds.
2. Use clear wording.
3. Avoid bias in questions.
4. Include all necessary information.
5. Avoid making assumptions.

Once the question selection is finished, formatting the questionnaire begins.

1. Begin with an introduction that includes the questionnaire's purpose, identifies its source, explains how the information obtained will be used and assures respondents of confidentiality.
2. The first questions should be easy. Write interesting questions that are clearly related to the questionnaire's purpose.
3. Address important topics early, rather than late, in the questionnaire.
4. Arrange questions so that they flow naturally. Keep questions on one subject grouped together. Start with general questions, then move to those that are specific.
5. Try to use the same type of question and response combination when talking about the same topic.
6. Give directions on how to answer. Include these in parentheses directly after the question.
7. Filter or screen questions. Make sure people don't get questions that are not relevant to them.

Then, the last step is pretesting the questionnaire. This might seem trivial, but it is an indispensable part of questionnaire design.

1. Start by asking colleagues to review the questionnaire critically.
2. Assess whether the questions produce the information needed.
3. Make sure that the questionnaire yields data that can be analysed in the way that is needed.
4. Revise. Recheck each question using the guidelines listed above.

General tips were described on how to create a questionnaire, but the question remains, how does this translate into user requirements? (Kujala, 2001) found that creating user stories is a good way to get requirements from customers. By creating a story that everyone understands, the client can then agree or disagree with parts of it, and then adjust the answer to meet their needs.

This is further confirmed by A. Sasse & C. Johnson (M. Imaz, 1999). They conclude that in order to develop effective human-computer systems, there is a need to understand and represent contextual information. Including the user's stories in the main system is essential to be able to get project requirements accurate and correct. They propose using UML to document these user stories, and thus create a clear overview of use cases. This study was done to study software development requirements, which is why they describe UML as the modelling method of choice. As stated in the previous chapter, BPMN was used for this thesis, but looks very similar. A possible use for this is to incorporate use cases and user stories into the questionnaire, which then has parts of the BPMN model attached to parts of it. After the client is done filling in the questionnaire, the relevant business processes that are connected to those specific use cases can then be automatically modelled using BPMN (since the use cases are standardized), and the client gets a process model describing their business without any human helping them.

In conclusion, lots of research has been done about questionnaire formatting. Following guidelines proposed in this research is essential to be able to create a good questionnaire myself. Furthermore, integrating user stories and use cases into the questionnaire makes sure you get consistent and reliable data.

2.4 HOW TO MEASURE THE SUCCESS OF A PROJECT?

Key performance indicators are often the main tool used to measure success. (U. Dombrowski, 2013) did a meta-study on KPI's and found seven main rules for creating key performance indicators.

To begin with, "Relevance for the Enterprise targets". These days it is extremely easy to gather an enormous amount of data. However, making sure it aligns with the target of the company or project is the first step in designing a KPI.

Next is "Quality of data". The quality of data is critical for a KPI to be effective. The quality of an indicator is based on the validity and timeliness of data. The validity is based on the recipient. The people affecting the indicator should influence them directly. The timeliness depends on the circumstances. High frequency gives people faster feedback; however, this requires more effort in capturing said data.

Third is "Compatibility to the Hierarchy". Key indicators have to be adapted to the hierarchy. Some indicators are useful for all levels of employees, while others might only be useful for high-level staff. For example, annual net income is not very useful for a low-level employee, while an indicator like turnover per employee can be much more useful.

"Variability" means that key performance indicators must be able to be adapted to change. Businesses change depending on the business environment, so the indicators that represent them have to change too.

The "Periodicity" of an indicator depends on the intended effect the indicator. If an indicator is used at a corporate level, longer periods are often used for easier handling of the data. At the operational level, shorter periods can sometimes be more useful. This is because this way the effects of any changes made are seen quicker and can be used better.

"Visualization" is key performance indicators is important, so that the people that receive them can use them properly. Graphics can be used to help here, to understand them quickly.

Lastly "Effort". Collecting data for use with KPI's takes time and effort. Often a lot of this can be replaced with computer systems. Still, making sure that creating and maintaining the KPI is worth the effort is an essential last step to the creation of them.

Measuring project success will mostly be done through web analytics, since this is a web-based application. (J. Jarvinen, 2015) stated that "the authors review performance measurement literature and apply it to the use of Web analytics, which offers companies a metrics system to measure digital marketing performance.". This leads to some interesting KPI's which Novulo can use as well.

The main three that were used to measure website behaviour were as follows:

- Number of sales leads
- Sales leads growth (%)
- Conversion rate[1]

Examples of other KPI's are:

- Visits in product information pages
- Product information sheet downloads
- Product video reviews
- Visits in contact request form
- Sales leads per traffic source

Using KPI's is essential to be able to understand the effect that this project has on the performance of the Novulo web shop, and most importantly on what part specifically.

(Hoffman, 2011) explained that as expected, the "quality" of the IT system has a significant influence on the economic success in electronic retail. The system, however, has to be seen as a whole. Meaning that aspects of pricing and economic sociology also play a vital role.

In conclusion, all these factors listed here are good indicators on how to measure project success, but they can never be seen as the sole indicator of success. The system as a whole has to perform well, and that is why multiple relevant KPI's are always needed. These KPI's have to be designed well, else they might not reach their goal, not be used by the right people or simply be too hard to keep up to use.

2.5 WHAT KIND OF PRIVACY/REGULATION CONCERNS ARE THERE?

The last, but definitely not least, thing to consider is the relatively new EU privacy regulation: GDPR. This regulation makes data collection harder than before and has to be kept in mind during the research.

There are three types of data (Takens, 2017):

1. Personal data, for example device-ID's and IP-addresses
2. Pseudo-anonymous data, meaning personal data that has been processed in such a way that it can no longer be reduced to the person it belongs to. It does however make a trackable individual. For example, encrypted user-id or encrypted email address.

[1] "Conversion rate: the percentage of visitors who take a desired action such as purchasing products, leaving a contact request, subscribing to newsletters, and downloading brochures."

3. Anonymous data.

Personal and pseudo-anonymous data can only be used with explicit opt-in and op-out options and can only be used for lawful purposes stated there. Most important here are tracking-scripts. Often heard is that these are anonymous, but in most cases, they are pseudo-anonymous. Some websites make you opt-in to their policies to be able to use their website to get around this. Novulo has an automatic opt-in on their website, meaning that these concerns have mostly dealt with.

GDPR also has effects on how you make questionnaires (Moattar, 2018). There are a few rules to consider.

1. you must obtain freely given, specific, informed, and unambiguous consent from your respondents when you collect their personal data. In other words, you shall not force people to respond to or fill out your surveys or forms, or somehow trick them to collect their personal data.
2. Additionally, must explain how you plan to use their personal data, in a clear and easy to understand way.
3. Also, as individuals have the right to be forgotten, you must delete information that you have collected from them if they request.

To conclude, while there are privacy issues to keep in mind, none of them are that severe they interfere with this project. Getting consent from interviewed individuals is needed, and the GDPR regulations have to be kept in mind as well. If this is all done correctly, no issues should arise.

2.6 CONCLUSION

The main research question was defined as follows: **How to design a questionnaire to gather requirements for designing a business application?**

Business processes that the application helps need to be defined before starting to make an application. To do this, a full understanding of the entire business process has to be obtained. Only after that can it be cut up into individual smaller processes. Once this is done, either UML activity diagrams or BPMN can be used to write down the individual processes. BPMN was chosen, but they are more or less the same.

Designing a questionnaire might look like a very subjective matter, since they change very much depending on the subject matter. There are however, very real guidelines that can be adhered to make sure the questionnaire provides valid and useable results. Sticking to these guidelines when designing both the questions and the potential answers, will ensure this result.

To measure the success of a questionnaire, KPI's can be used. The overarching KPI's that measure the success of these types of projects are related to growth. More people using the platform and finishing the questionnaire, is a good measure of success.

Lastly the privacy and regulation concerns are not much of an issue. As long as Novulo does not store data they use without the consent of the customer, no issues should arise.

To answer the question in one sentence: *Using user stories, use cases connected to BPMN Models to turn a questionnaire into accurate business process descriptions and then verifying the information using appropriate KPI's.*

3. CURRENT SITUATION

In this chapter, the current workings of the web shop, the sales process, and how they work together will be explained. To be able to improve the current situation, it is essential to know how it currently functions.

3.1 CURRENT WEB SHOP

Figure 4 shows the current web shop.

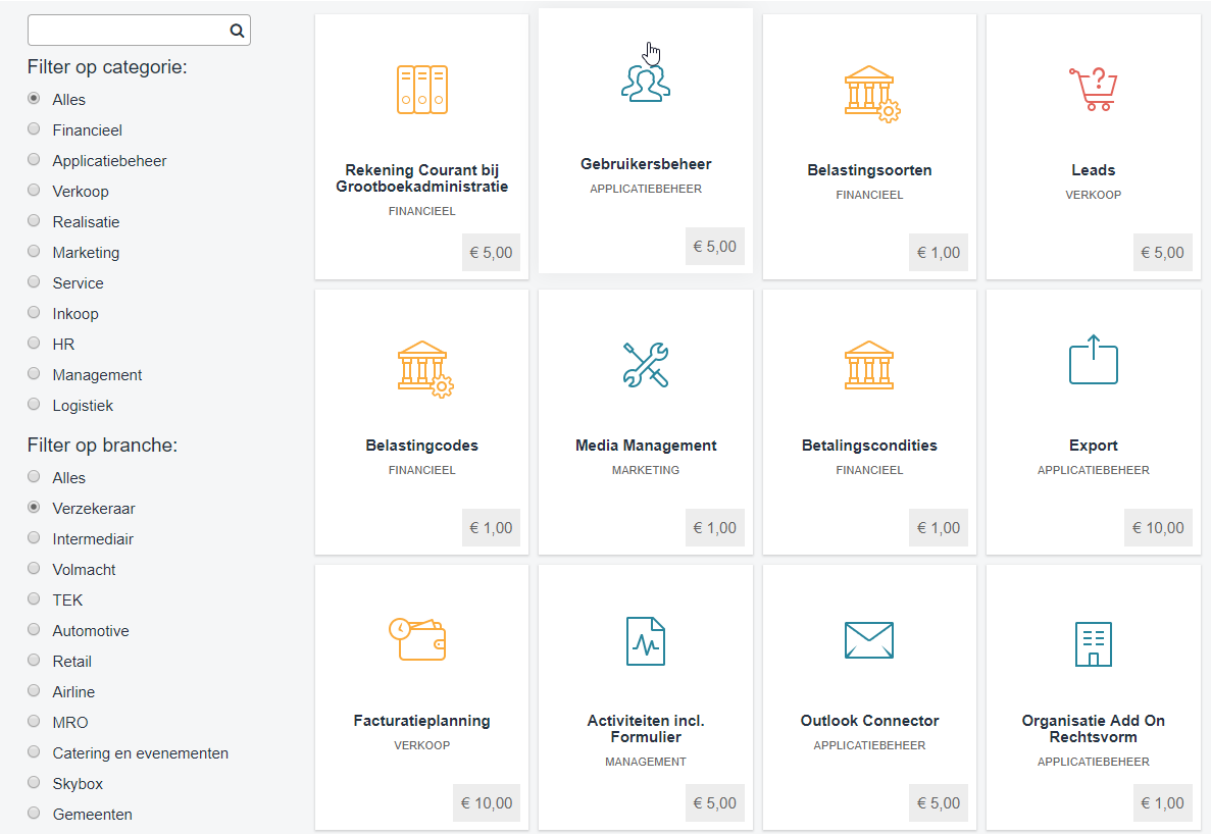
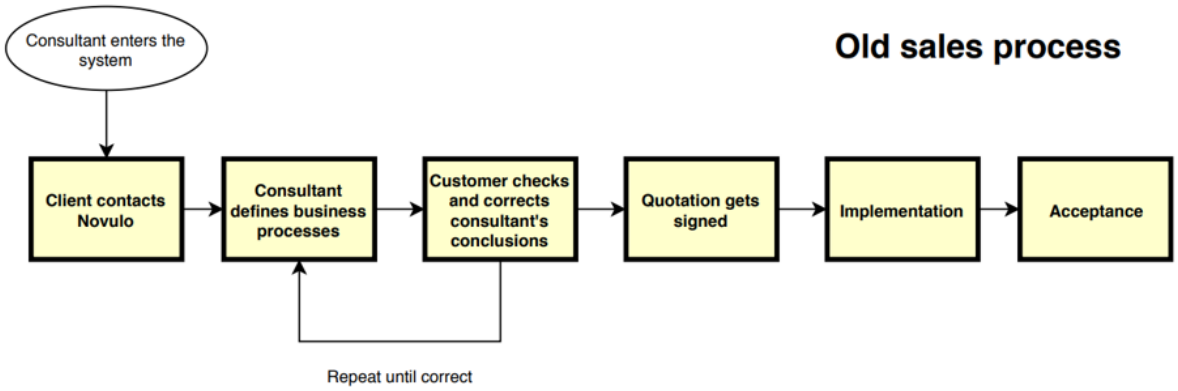


Figure 4 - Current web shop

It is basically a big list of components. The top left side lets a potential customer filter based on the task the software, and the bottom left side lets the customer filter based on branch. Evident from the picture is that it can be unclear. It is very hard to see what each individual component does and how it is used. Clicking on a component does give a description, which is good, but it doesn't show how it integrates with the others or how much it actually costs. Both of which are needed when choosing to use, or not use, a component.

3.2 CURRENT (COMPLETE) SALES PROCESS

A simplified model describing the current sales process can be found in below. This, and other more detailed models will be discussed more in-depth in chapter 5.



When a customer finds Novulo in any way they can (conferences, word of mouth, internet, etc.), they call Novulo to ask to set up an appointment. A Novulo consultant then visits the company to figure out what activities they are involved in and creates an initial quotation. This is then reviewed by the customer, and sent back with feedback. This cycle repeats a few times until everything is correct. Once the quotation is signed, implementation begins.

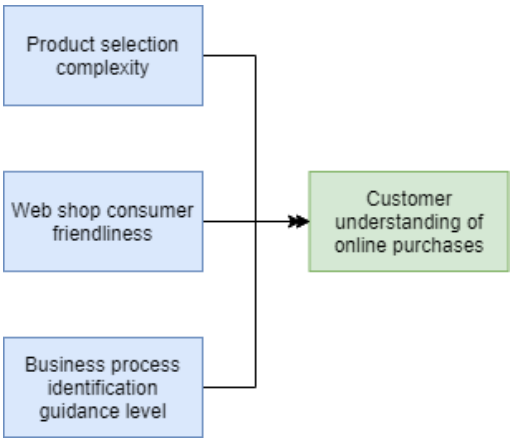
The implementation process has three parts. Development, testing, and training. Development is the part done to create new components that the client may require. Testing is as the name implies, testing the software to see if it works together and in the way the client wants. Training means teaching the people that will be using the software how it works. Development is done mostly in the early stages and testing/training is usually done simultaneously. Meetings continue until the product fulfils the requirements set in the signed quotation.

3.3 MEASURING THE PROBLEM

When attempting to solve a problem, one of the most important things to consider is how you will know when the problem is solved. To do this, a model of the problem can be made (H. Heerkens, 2012). The only difficulty there is with measuring if this project actually solves the problem, is that the ways to measure it are all over a longer period of time, after the project is completed. The ways to test during the design are mostly subjective and based on feedback from individual people at Novulo and companies that were interviewed. Those indicators are not shown here.

These indicators were designed after interviewing consultants at Novulo. They were asked how the effectiveness of these types of solutions are currently being measured. The answer was mostly they were only tested subjectively, as mentioned before. Discussions were had back and forth and the result are listed below.

This model shows what indicators can be used to measure the problem over a longer period of time.



1. Amount of company visits that take place between the first time the customer interacts with Novulo and the signing of the contract compared to before. This measures the business process identification guidance level.
2. The hours spent on a client before signing the contract compared to the size of the contract. This measures the business process identification guidance level as well.
3. Several google analytics indicators which measure the effect the changes have on the web shop consumer friendliness and product selection complexity.
    a. Bounce rate
    b. Session length
    c. How far people get in the questionnaire (page visits, can be tracked).

The figures that show the google analytics data can be found on the next few pages.

Figure 5 shows the 'funnel'. It shows where people start their journey through the Novulo web site and how they end up at the page they leave the web site. This can be used for tracking questionnaire page visits and figuring out when people leave.

Figure 6 shows more statistics per page with a similar goal as figure 5, just more detailed. This figure specifically shows the indicators mentioned in indicator 3.

Figure 7 shows figure 6 statistics in an overview so pages can be compared more easily.

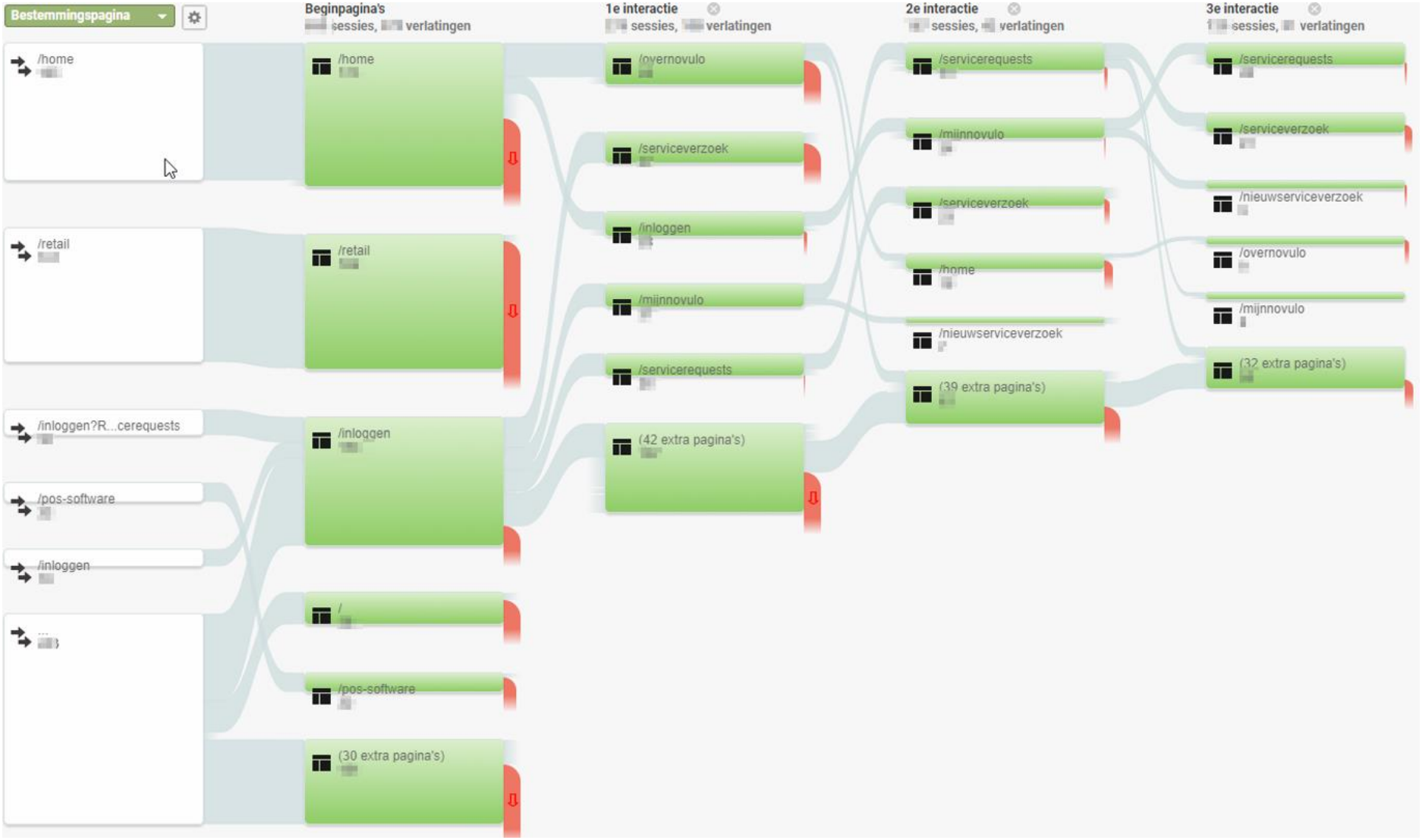


Figure 5 - Movement of page visitors

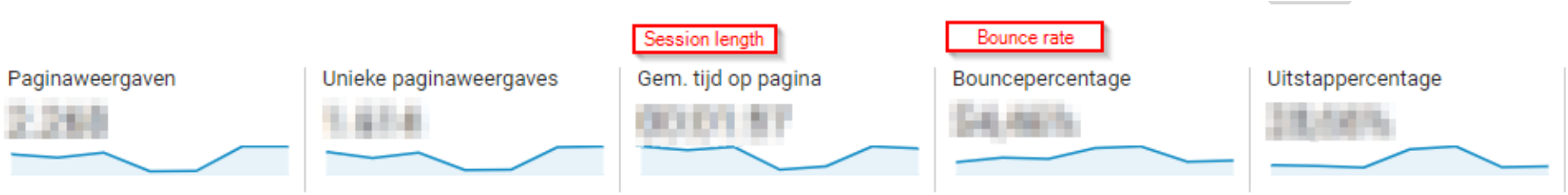


Figure 6 - Page statistics over time

Niveau 1 van paginapaden	Paginaweergaven ↓	Unieke paginaweergaves	Gem. tijd op pagina	Bouncepercentage	Uitstappercentage
			Gem. voor dataweergave:	Gem. voor dataweergave:	Gem. voor dataweergave:
1.	(30,47%)	(28,31%)			
2.	(12,39%)	(5,27%)			
3.	(8,77%)	(11,28%)			
4.	(8,60%)	(10,16%)			
5.	(5,38%)	(4,40%)			
6.	(3,97%)	(4,21%)			
7.	(2,87%)	(2,23%)			
8.	(2,47%)	(2,73%)			
9.	(1,81%)	(1,80%)			
0.	(1,63%)	(1,86%)			

Figure 7 - Page statistics details

4. THE SOLUTION

This chapter aims to explain the general methodology, after which chapter 5 explains the implementation.

4.1 THE PURPOSE

The goal of this thesis is to create a generalized methodology which in which a questionnaire gets created that gathers a customer's software requirements without any, or minimal, human help.

4.2 THE GENERAL REQUIREMENTS

The goal when setting the requirements was to enable the creation of a minimum viable product (MVP). The goal of a MVP is to create a product with the minimal amount of effort required to get the maximum amount of feedback (Lenarduzzi, 2016). The methodology and the questionnaire both have their own requirements.

The methodology has to accomplish multiple things. First, it has to be clear and readable. It does not matter how well a methodology works, if it does not have a clear structure and is hard to read, nobody can use it.

The methodology has to be useable by people from many backgrounds. One cannot call a methodology "generalized" if it has information specific to one industry or background in it.

According to Paul Catchpole (1986), an information systems methodology should cover the entire systems development process, from the planning phase, to the transition from the old to the new system. It ensures consistency and proper documentation and compatibility.

The methodology should also facilitate iterations, since it is based on design science. Creating multiple designs and improving them every time is a basis for this methodology to be successful.

Tozer, (1984), suggest that the techniques that are incorporated into a methodology should be easy to use, understand, and learn. Tables, trees and structured language are all valuable tools for describing processes. They are easy to learn while being a powerful tool for expressing logic.

Another point Catchpole made is that a methodology should demonstrate its usefulness in the form of increased productivity, a financial benefit, or exhibit other selling points.

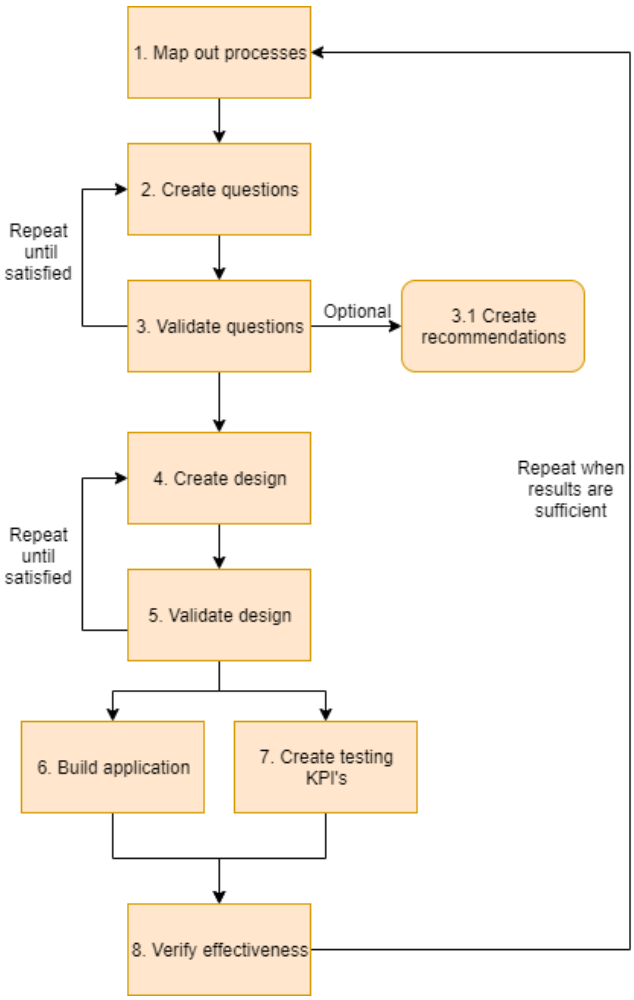
The methodology should also facilitate continual development. Information systems constantly evolve and change, and the methodology should incorporate a changing environment for it to be able to be properly used. (Catchpole, 1986).

4.3 THE REQUIREMENTS QUESTIONNAIRE METHODOLOGY

This chapter aims to show the requirements questionnaire methodology. Every step will be explained using the input-process-output model (Schemeri, 2012). Using these three factors, *process* was split up into two, and one was added for clarity, resulting in the following five factors: Objectives, meaning what are the goals for this step; Input, meaning what input is required to be able to start this step; Activities, meaning what happens during this step; Techniques, meaning what types of processes are required for this step; Output, what does the completion of this step result in. This model is based on *design science*, from chapter 1.7, but modified to fit this case. Chapter 5.4 shows how this methodology is implemented.

Using this requirements questionnaire methodology will result in a questionnaire that helps the user identify their own business processes.

The model below shows how all the steps interact with each other. It includes an explanation that describes the model, with each step being explained in more detail later on.



It starts out by mapping all the business processes in the sector. This is required to get an overview of what kind of questions are needed.

Next, an initial list of questions has to be made. This is then validated, and the question list is changed according to the feedback. User stories get added. Afterwards this is then repeated until the creator is satisfied with the results.

After the questions, the design has to be made. This is more or less the same process as before. Create design, validate design, and repeat until satisfied.

After these two aspects are done, it is time to build the application and simultaneously create testing KPI's. Building the application means to combine the questions and the design, creating testing KPI's results in KPI's that can keep track of the performance of the questionnaire.

Last, using these KPI's the creator (or colleague) has to keep track of the performance of the questionnaire. Once sufficient data is collected (very subjective, sufficient means when it is expected that the work required to use the feedback is worth the results), one can go back to step 1, and repeat the process.

Figure 8 - Model overview

<table>
<tr><td rowspan="3">1</td><td>Input:
- Completed/signed quotations in the relevant field
- Field research</td><td>Objective:
Mapping out the business (define and verify all processes)</td></tr>
<tr><td>Activities (process):
- Interviewing colleagues with sector knowledge
- Interviewing clients to verify list</td><td rowspan="2">Techniques (process):
- Interviews
- Literature study</td></tr>
<tr><td>Output:
- Verified list of all possible business processes in the chosen sector</td></tr>
</table>

The goal of step one is to map out all the possible business processes in the sector. Use Interviews and literature study to get an overview of all of them and, verify this list by asking people in the field.

<table>
<tr><td rowspan="3">2+3</td><td>Input:
Verified process list
Academic best-practice research</td><td>Objective: Create and verify questions</td></tr>
<tr><td>Activities (process):
Turning processes into questions asking about them
Categorizing the questions in a logical manner
Using the feedback gathered to improve and/or change the questions
Making sure categories are logical and intuitive
Creating user stories to accompany the questions</td><td rowspan="2">Techniques (process):
Literature study
Any questionnaire software or excel
Interviews</td></tr>
<tr><td>Output:
Verified question list, including user stories</td></tr>
</table>

The goal of step two and three is to turn these processes into question form and categorize them logically. Use literature study to get the best practices on how to document this and interview relevant actors to verify the list. Create user stories to accompany the questions to give context to the reader and ensure they have the required knowledge to be able to answer the question properly.

<table>
<tr><td rowspan="3">(3.1)</td><td>Input:
Verified question list</td><td>Objective (OPTIONAL): Create recommendations</td></tr>
<tr><td>Activities (process):
Relating processes to company properties
Interviewing colleagues with experience in the sector
Interviewing clients</td><td rowspan="2">Techniques (process):
Any questionnaire software or excel
Interviews</td></tr>
<tr><td>Output:
List of recommendations related to company properties</td></tr>
</table>

Optional at step three is to make a list of recommendations. Once the question list is complete, one could, again, interview people with relevant experience to get an idea of what type of company does what kind of process/activity. This recommendation list can then be used in the questionnaire as an extra feature.

<table>
<tr><td rowspan="3">4+5</td><td>Input:
Improved question list
Research into questionnaire design</td><td>Objective: Create and verify design (mock-up)</td></tr>
<tr><td>Activities (process):
Creating the initial mock-up of the design
Entering the question list into the mock-up to show how it would work
Using feedback from co-workers to improve the design
Using feedback from clients to verify the design</td><td rowspan="2">Techniques (process):
Program to create mock-up
Literature study on best practices</td></tr>
<tr><td>Output:
Initial and improved design</td></tr>
</table>

Step four and five are about creating the design. The goal is to create a mock-up which can then be used as a basis for the design in the final application. The same principles apply, make a first version, show it to co-workers or people with relevant experience and improve it until satisfied.

<table>
<tr><td rowspan="3">6</td><td>Input:
Improved design
Improved questions
Research into KPI’s</td><td>Objective: Build the application (combine mock-up and question list) & create testing KPI’s</td></tr>
<tr><td>Activities (process):
Combining both the design and questions into a final version
Creating KPI’s to test it once it goes live</td><td rowspan="2">Techniques (process):
Building the app</td></tr>
<tr><td>Output:
Functioning questionnaire
Testing KPI’s</td></tr>
</table>

Step six combines all the previous efforts into the final application. This can be done in many ways in many systems, it depends very much on the situation. The simplest solution would be something like google forms, with the hardest varying wildly.

7+8	Input: - KPI data - Potential feedback from clients	Objective: Verify effectiveness (after live)
	Activities (process): - Go back to the relevant step and redo that part according to feedback	Techniques (process): - Google analytics data - Custom KPI Data
	Output: - Information to improve the project	

Step seven and eight are useable after the application goes live. After the application has been created its essential use at least a few KPI's that were created beforehand to keep track of the questionnaire's performance and use, to possibly improve it.

4.4 SUMMARY

By delaying the moment until a consultant is needed in the sales process, a lot of time and money can be saved. The questionnaire enables all this and produces the basic software requirements and identifies most of the business processes that a potential client's company uses.

5. IMPLEMENTATION

This chapter aims to explain the implementation of the methodology from chapter 4.

5.1 CONTENT MANAGEMENT SYSTEM

Novulo creates all of their software on their own platform. The part of the Novulo system that was used for the creation of the questionnaire is called Novulo Content Management System (CMS). “A content management system (CMS) is a software application or set of related programs that are used to create and manage digital content.” (Rouse, 2019). One feature of the Novulo CMS is the ability to create forms. These forms are able to change depending on what kind of data is already filled in and thus usable for a dynamic questionnaire. The system is then able to process all the data provided and convert it into corresponding pre-set text (business processes, etc.).

For this thesis, however, the Novulo CMS was way too complicated for to use in the available time. It was more reasonable for the functionality to be created using excel and visual basic. The end product, when actually implemented however, should be made in the CMS.

5.2 THE AUTOMOTIVE SECTOR

When talking about the automotive sector, the topic specifically relates to garage companies, companies that supply garage companies, and those that supply those. These companies often have some kind of software in place to manage their register dealings, but a lot of the online ordering and planning is often done using different systems and/or paper documentation. This is where Novulo can provide a solution by offering a system that covers everything.

5.3 SOFTWARE REQUIREMENTS

Apart from the methodology having requirements, the software implementation has requirements as well. These requirements were created by conducting interviews and researching the industry in general.

The questionnaire has to:

- produce software requirements without any involvement from a Novulo consultant.
- be entirely web-based.
- be clear to use for people from all backgrounds and all levels of knowledge.
- be designed in such a way that it can be easily adapted to new information and components.
- produce an overview of business processes used, company size, and other relevant information.
- have multiple options for different levels of depth and time that potential customers want to spend.
- be fully functional without any bugs

These requirements together should ensure a product that meets all the needs of the client.

5.4 THE METHODOLOGY IN PRACTICE

This chapter describes the process and design choices.

It started out by figuring out what all the possible processes are that Novulo supports. It turned out that they support everything, when it does not exist, it will be developed. When this step was started there was a parallel

project going about implementing the Novulo system at a small garage company. There the idea came to use the quotation as a basis for the processes. Since the current process revolves around consultants going to companies and creating these quotations by hand, they had to be complete. After looking into that and finding that it was a very valuable resource, it was compared to other quotations that were sent out, and a complete list of all business processes was made. This can be seen as step three (design & development) in design science, combined with step one from the requirements questionnaire methodology.

Then, it had to be made into questionnaire form. Finding the original research lacking, the theory first had to get expanded. Once sufficient information was acquired the first version of the questionnaire could be made. It was basically a PowerPoint listing all the processes with some general categorization, see figure 21. This PowerPoint was reviewed at the aforementioned company, and a few Novulo employees as well. The feedback from most of them was more or less the same. Most questions are valid and in the right direction, the main thing that was left to do is to categorize them, trim them (the questions were way too long and detailed), and make the entire thing not as much of a chore to fill in. This can be seen as step 4 (Demonstration) of design science, combined with step 2 of the requirements questionnaire methodology.

Figure 9 - First version

A solution had to be found to create a setting for people who have differing amount of time and knowledge to be able to fill in the questionnaire. The solution to this was splitting the questionnaire into two parts. The first part is there to classify the business, to get an idea of its size, its general activities and customer base. Using only this very basic information quite a few assumptions can be made and it only takes a few minutes to fill in. Back to step 3 of design science.

Quite a bit of time was spent trying to understand Novulo CMS well enough to create the questionnaire. This turned out to be a lot harder than expected and after some discussion it was dropped in favour of excel and VBA. In the meantime, the questions were refined and categorized better. Around this time the user stories were added as well. They are not very long, but they should give enough information for people to answer the questions with enough knowledge and context. The dependencies (for example: if the customer says in the beginning that they do not offer lease contracts, don't ask them about lease-specific options later) were worked out. This all resulted in the final version of the questions. The last thing that remained was the recommendations. There was a pretty good idea of what a small company needs from the experience gained with the parallel project, but the specifics of bigger clients were lacking. More interviews were had with Novulo employees and a draft was made. This draft is not a 100% finished product, but a very good indication of what the customer will most likely want. Once the questionnaire is in actual use, the data gained can be used to perfect the algorithm. During this part steps 3, 4, and 5 (evaluation) of design science were all used in order a few times, as well as step 2.1 of the requirements questionnaire methodology.

The mock-up was created using the theoretical framework from this thesis as a basis. This mock-up shows the visual design of the questionnaire. It was created using an online mock-up tool of which there are many available for free. The goal of this mock-up was to give an idea of the layout. The colours, font, and everything in that category can be adapted to personal company style. This relates to step 3 of the requirements questionnaire methodology.

In step 4 of the requirements questionnaire methodology the “Build application” part was skipped, since it was only a demo, but the KPI’s were designed. These KPI’s were designed all the way in the beginning, but then adapted when there was a better idea of the final product.

5.5 MOCKUP DESIGN

The next few pages show the design of the questionnaire. This chapter only describes the visual design.

To begin with, the overall menu at the top and progress bar at the bottom are there so the customer knows how far into the questionnaire they are.

The beginning consists of questions to quickly assess what kind of company it is and what size it is. The questions ask about number of employees, what type of company they are, what types of customer they serve and what services they provide. This is essential information to be able to continue. The layout was created so that only one question is visible at the time, but the customer still is aware of how far into the questionnaire they are. This is an overarching theme. The customer has to not get presented too much information at once, but still has to know how far into the entire thing they are.

Now a choice must be made depending on how much time and effort the person filling in this questionnaire wants to spend. There are three pre-sets: Basic, which only has the most basic functionality; Recommended, which uses the functionality Novulo thinks is best for the activities and company size; and Full, which contains all the available content at the time. Again, with an explanation what the buttons do.

Once one of the three is selected an option to choose to continue or not appears. When end is clicked the customer is taken to the end and presented with the results. When verify is clicked way more questions are ‘unlocked’. These questions aim to get to the customers’ needs in a lot more detail.

The questions are split into multiple categories. Namely: the exact processes that need to be supported, what information needs to get registered, what kind of planning has to be created, what kind of support for financial administration is required, and lastly a few questions that fall in no other categories. It is set up this way, again, so the reader has an overview of all the available information, but it not overwhelmed by the amount of text on the screen. Every page has an explanation why is it there, and has multiple categories of its own to make the page clearer.

At the end a summary page pops up which tells the customer what application fits them best and what extensions other customers chose. The customer can then save these as PDF to save them for later, contact Novulo with these results, or go back to the beginning to start over.

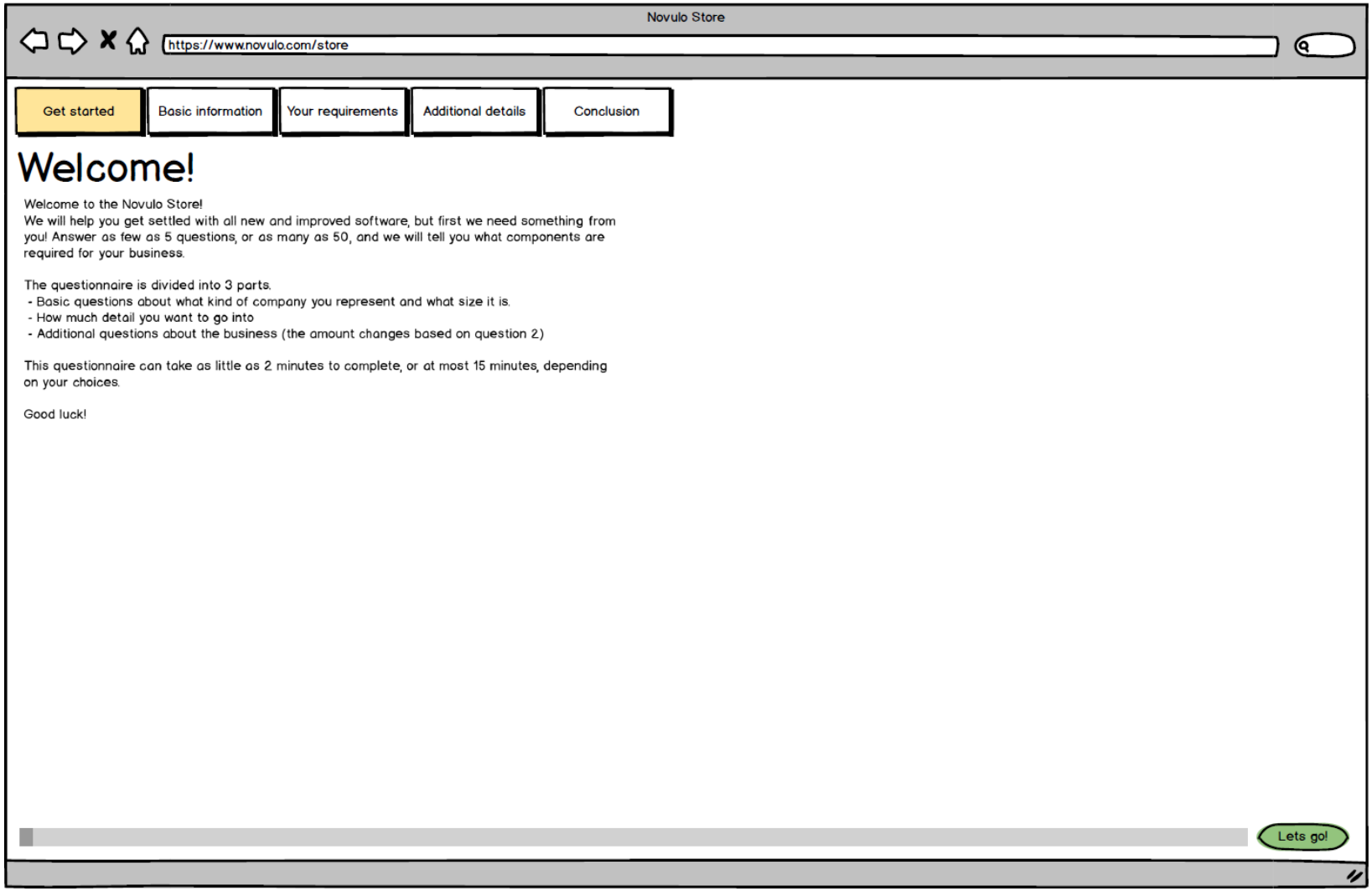


Figure 10 - Welcome screen

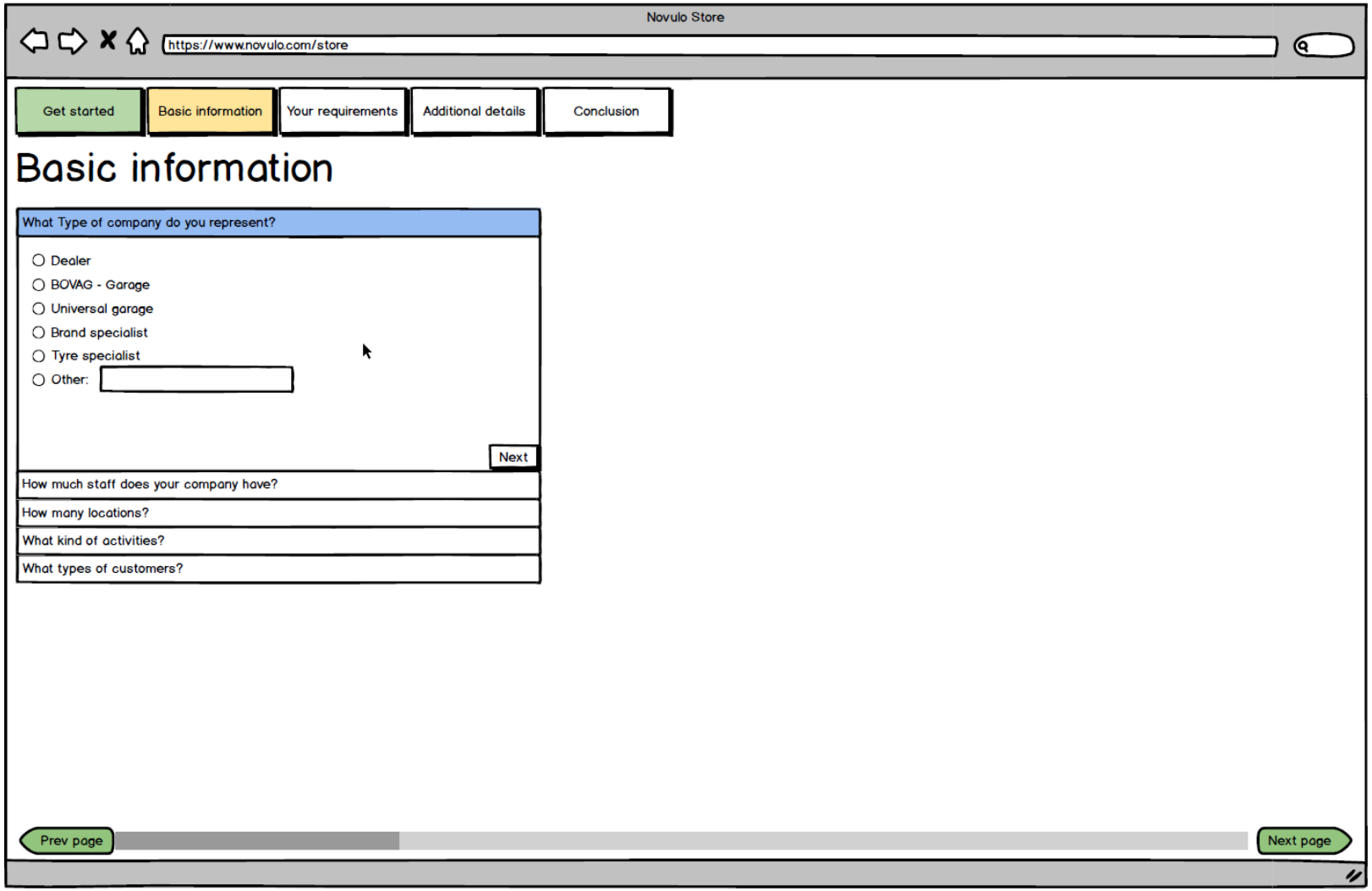


Figure 11 - Basic information

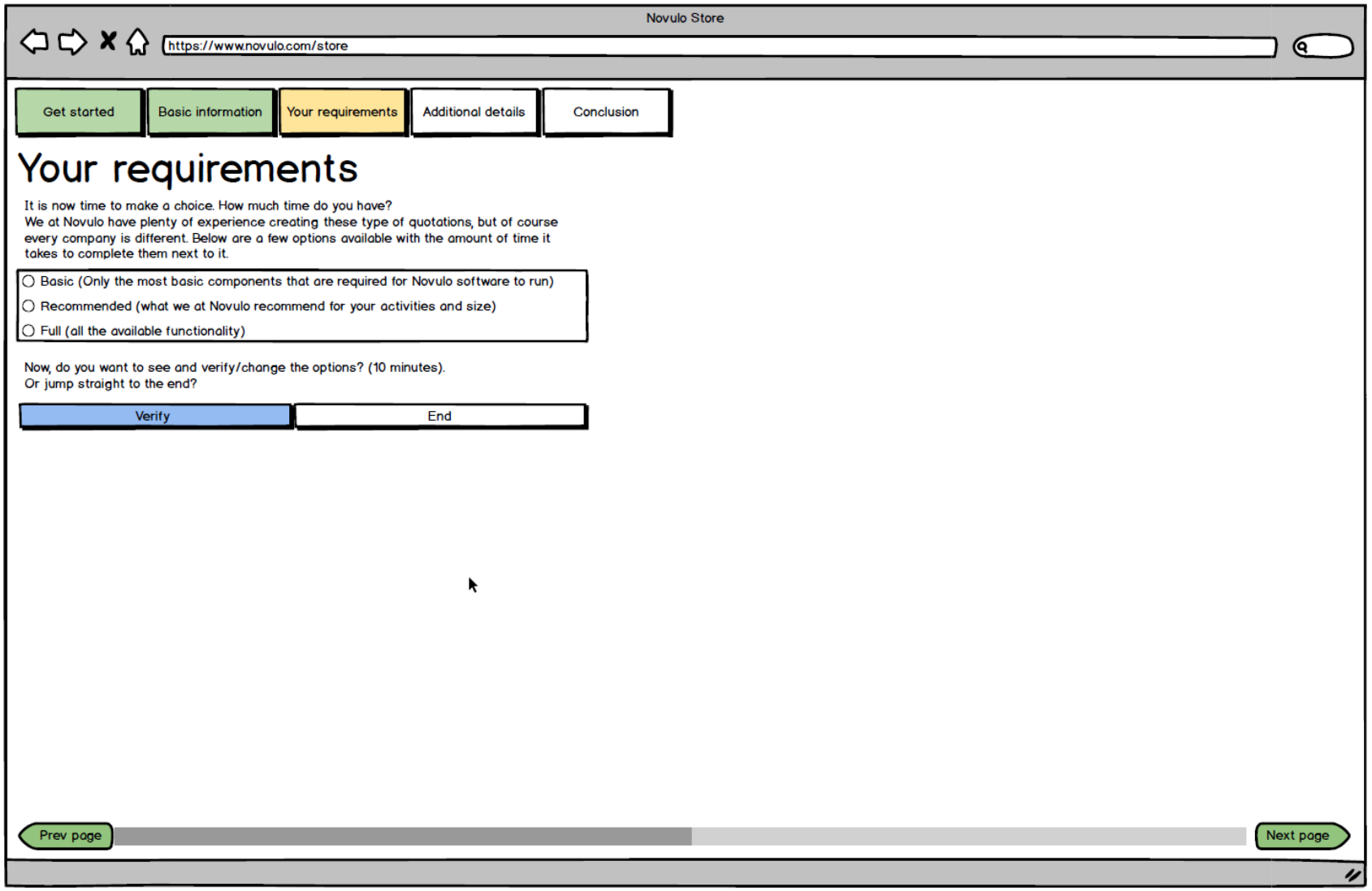


Figure 12 - Requirements

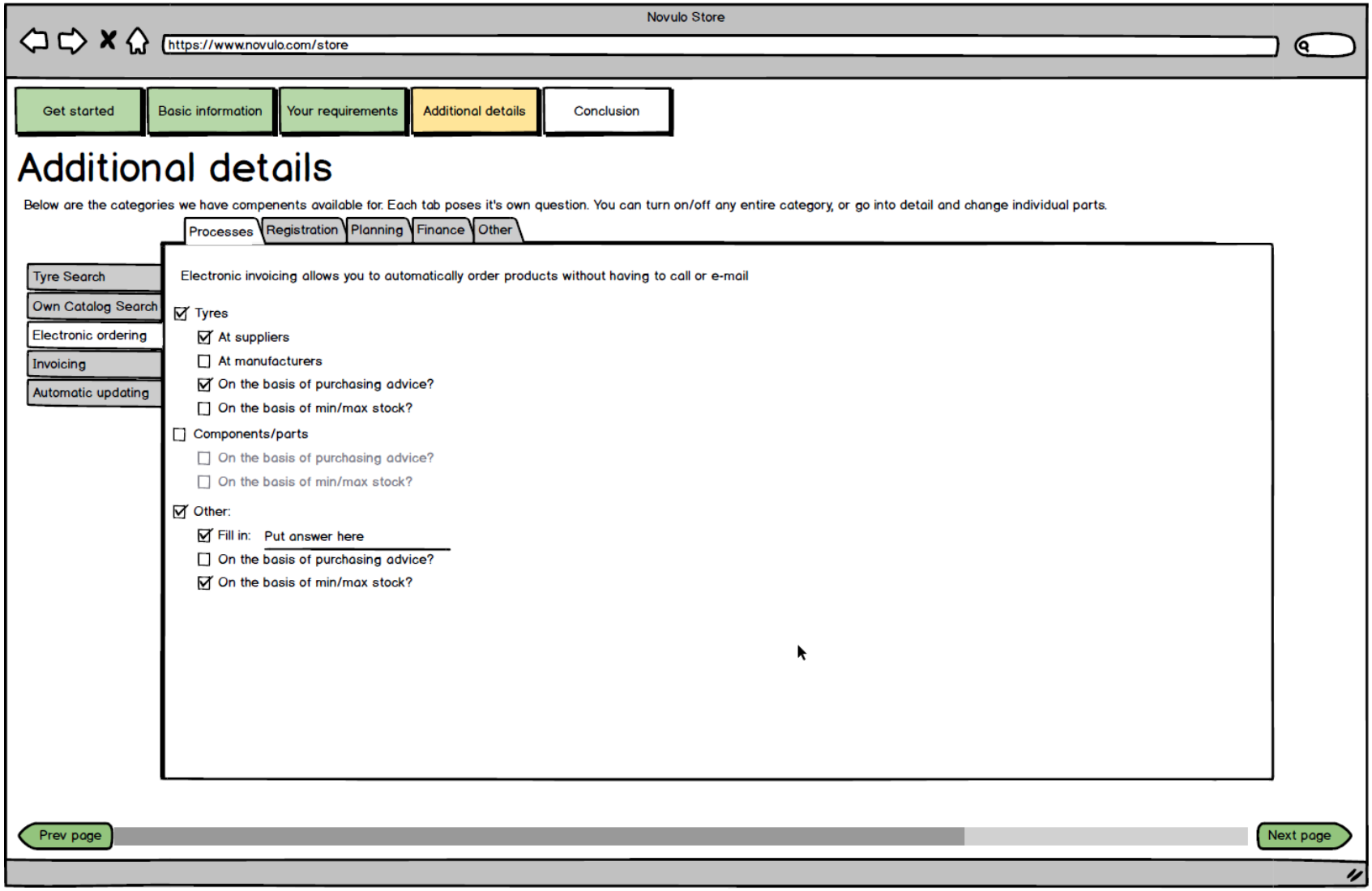


Figure 13 - Additional details

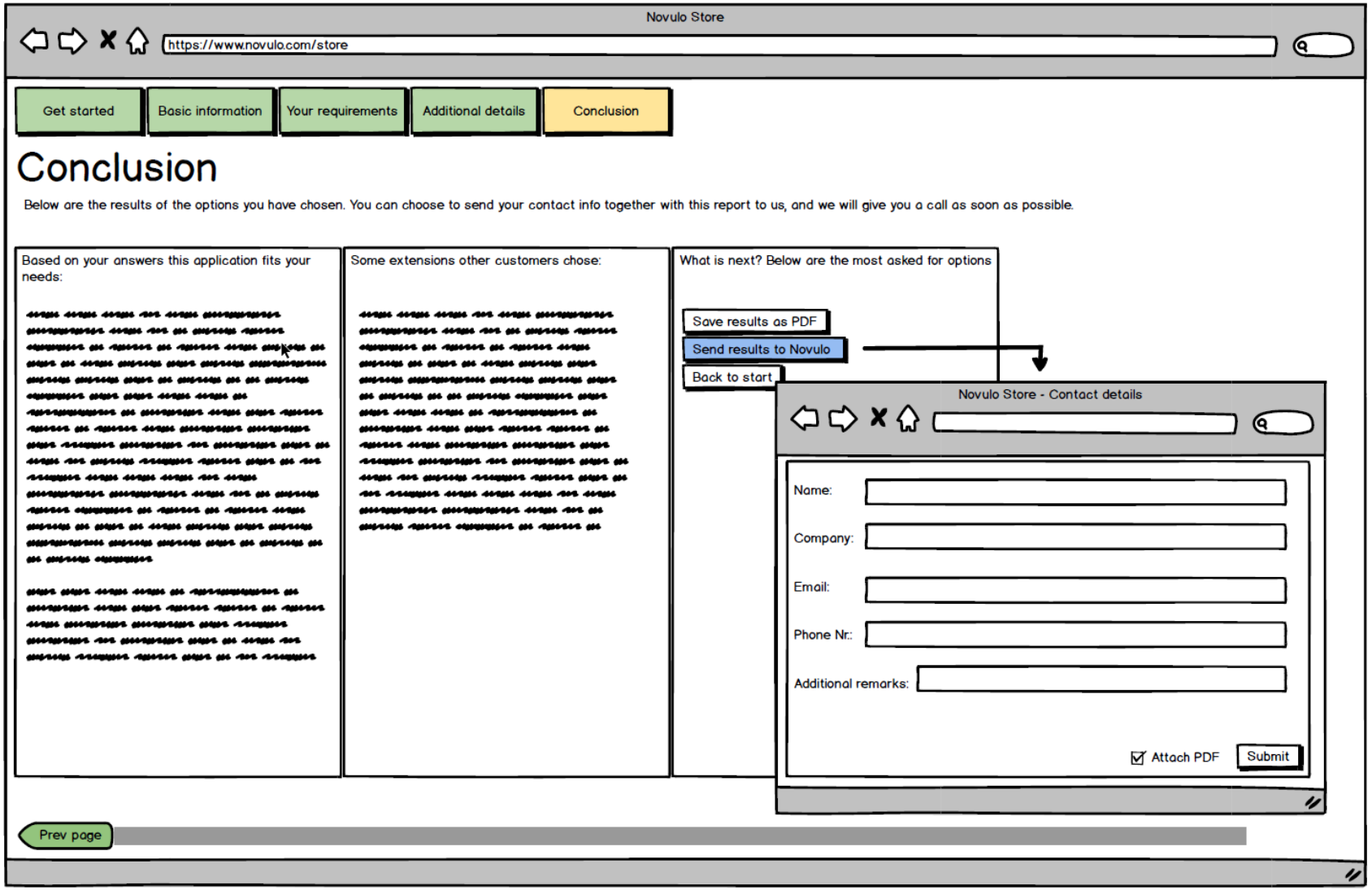


Figure 14 - Conclusion

5.6 DIFFERENCE BETWEEN MOCKUP AND REALITY

The next few pages show the design as it was created for testing (the artefact). This chapter will discuss the differences page by page. Most of the functionality is more or less the same, some features that need more work were skipped, but none of those were essential to prove the validity of the thesis.

The first page about the intro is basically the same. The menu at the top is replaced by excel tabs at the bottom, and the progress bar that was available at the bottom is not there. This is all just lay out differences, no functionality difference.

The second page is about basic information. Instead of radio buttons, choices can be made by putting 1's and 0's in boxes. This was done to make creating a conclusion at the end a lot easier. The layout is also not as nice, too much information is shown at once, but the information is the same. The theory that discussed why presenting this much information on a single page is a bad thing, can be found in chapter two. This will be repeated in other pages as well, but for the purposes of testing this was no problem. Lastly, the questions are in Dutch. This was done so that testing at Dutch companies was made easier.

The third page, like the first page, is also basically the same. The layout is different, but the buttons all function the same. The buttons. fill in different options in each page, based on what the customer picked in previous questions.

The fourth page is most complex. In order to keep the original structure of the navigation menu, all the questions had to be put on one page. This has the same problem as with page two, but makes no real difference in functionality. The real artefact is designed in such a way that if the main question gets answered "no" (or 0), the sub questions do not show up. This is to reduce clutter.

The last page is where most of the differences become apparent. The conclusion simply shows a list of chosen components. With a "report" and "clear" button. The choice was made to not have the questionnaire send emails, create forms, etc. since it is not needed to check the functionality. The connection with back-end is also not there. Figuring out what components are connected to which par

Overall the main functionality is the same. The difference between the mock-up and the real artefact is mainly the layout, graphic design, and links to the components themselves. After much discussion at Novulo the decision was made to not link to the components at the time of writing. To create that functionality, way more development at the company had to be done as well, and that was not worth it for Novulo at the time.

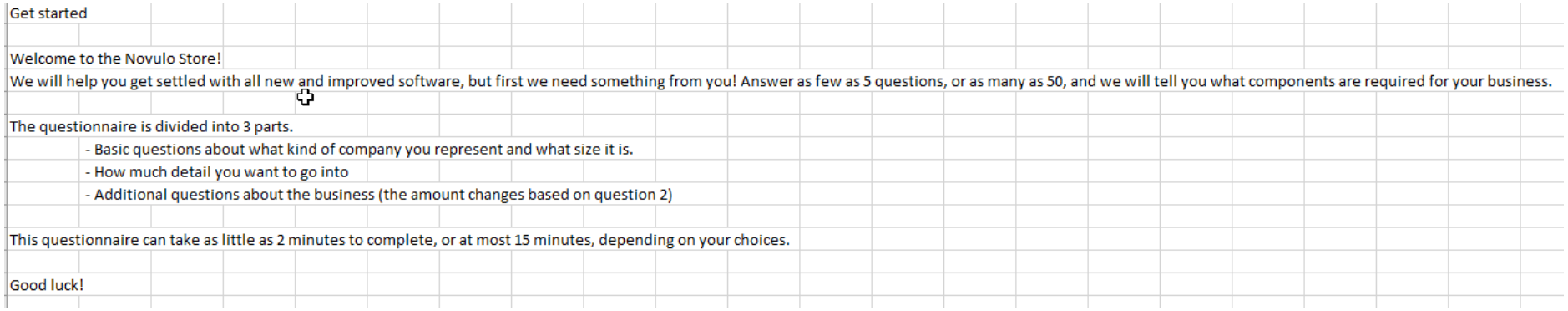


Figure 15 - Get started

Wat voor type bedrijf?	1 invullen bij de relevante optie
- Dealer	0
- BOVAG-garage	1
- Universele garage	0
- Merkspecialist	0
- Bandenspecialist	0
- Overig: vul in	0
Hoeveel personeel heeft uw bedrijf?	1 invullen bij de relevante optie
- 0-10	1
- 10-25	0
- 25-50	0
- 50-100	0
- 100+	0
Wat voor werkzaamheden verricht uw bedrijf?	1 invullen bij de relevante optie
- Banden wisselen	1
- Onderhoud uitvoeren	1
- Onderdelen vervangen	1
- APK – Keuring	1
- In/Verkoop voertuigen	1
- In/Verkoop onderdelen	1
- Groothandel	1
- Verschillende soorten service	1
o Pech service	1
o Glas service	1
o Vervangend vervoer	1
Wat voor typen klant help u?	
- Particulier	1
- Bedrijven	1
- Leasemaatschappijen	1

Figure 16 - Basic Information

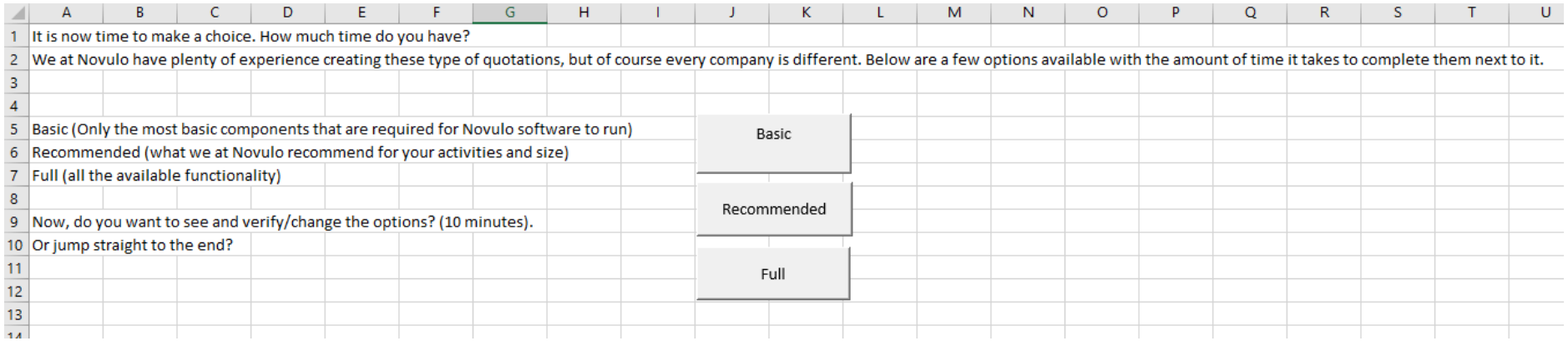


Figure 17 - Complexity

Additional details	
Below are the categories we have compenents available for. Each tab poses it's own question. You can turn on/off any entire category, or go into detail and change individual parts.	
Welke processen moeten ondersteund worden?	1 invullen bij relevante optie
- **Zoeken van banden (bij externe leveranciers)**	1
o Op basis van bijbehorende eigenschappen	1
§ Inclusief registratie van heffingen	1
§ Inclusief registratie van montageprijzen	1
- **Zoeken in eigen productcatalogus**	1
o Op basis van bijbehorende eigenschappen	1
- **Elektronisch inkopen**	1
o Banden	1
§ Bij leveranciers	1
§ Bij producenten	
§ Op basis van inkoopadvies?	
§ Op basis van min/max voorraden?	
o Onderdelen	
o Overige producten	
- **Facturatie**	1
o Aan de balie	1

Figure 18 - Additional details

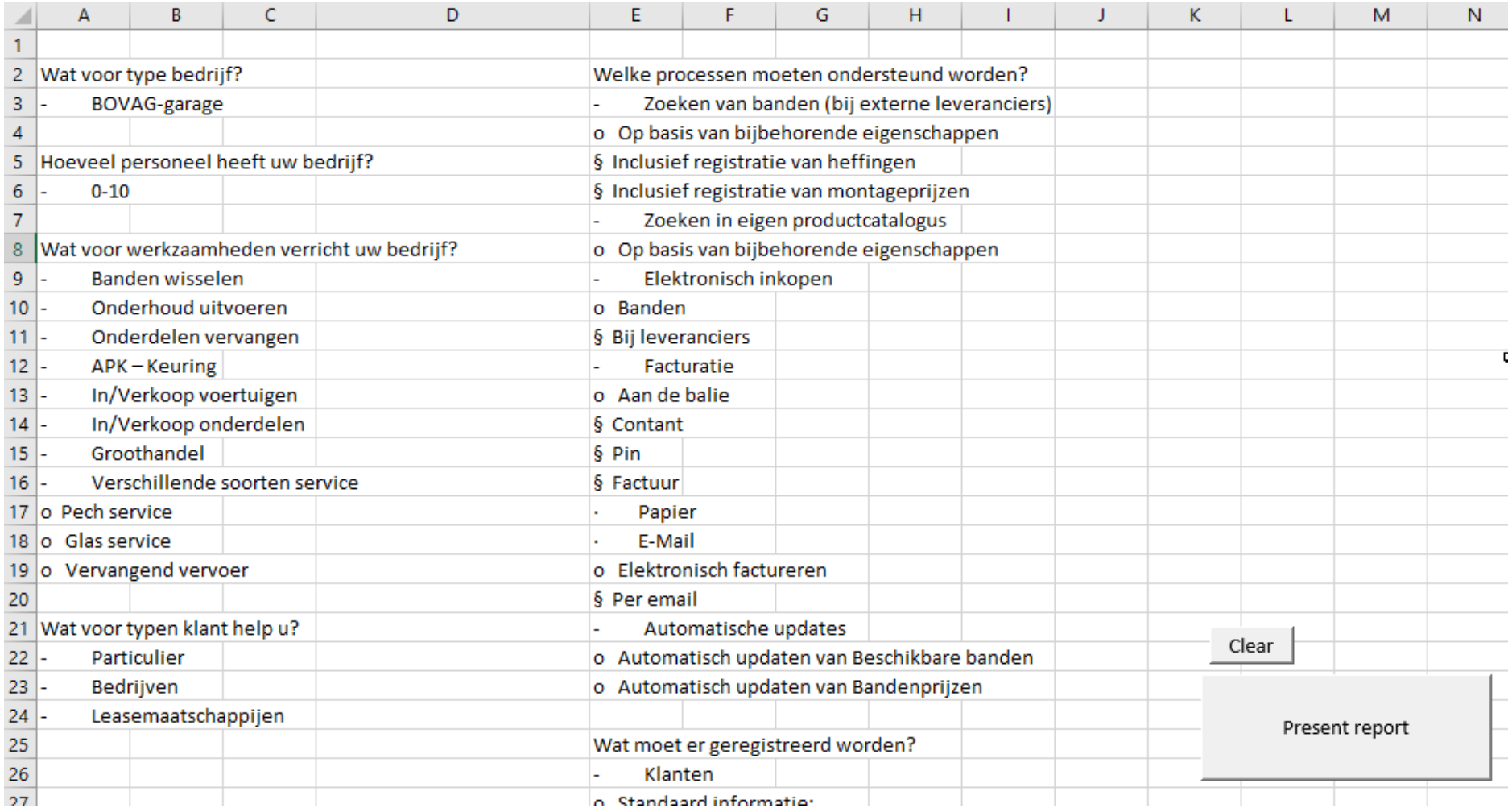


Figure 19 - Conclusion

5.7 THE SALES PROCESS CHANGES

This chapter aims to explain how the result changes the sales process. Figure 8 shows the simplified version of the old and new sales process. Note the change in when the consultant enters the process. The next 2 pages contain the extended versions correctly modelled using BPMN. For an explanation on how the BPMN notation works, see chapter 2.1.1.

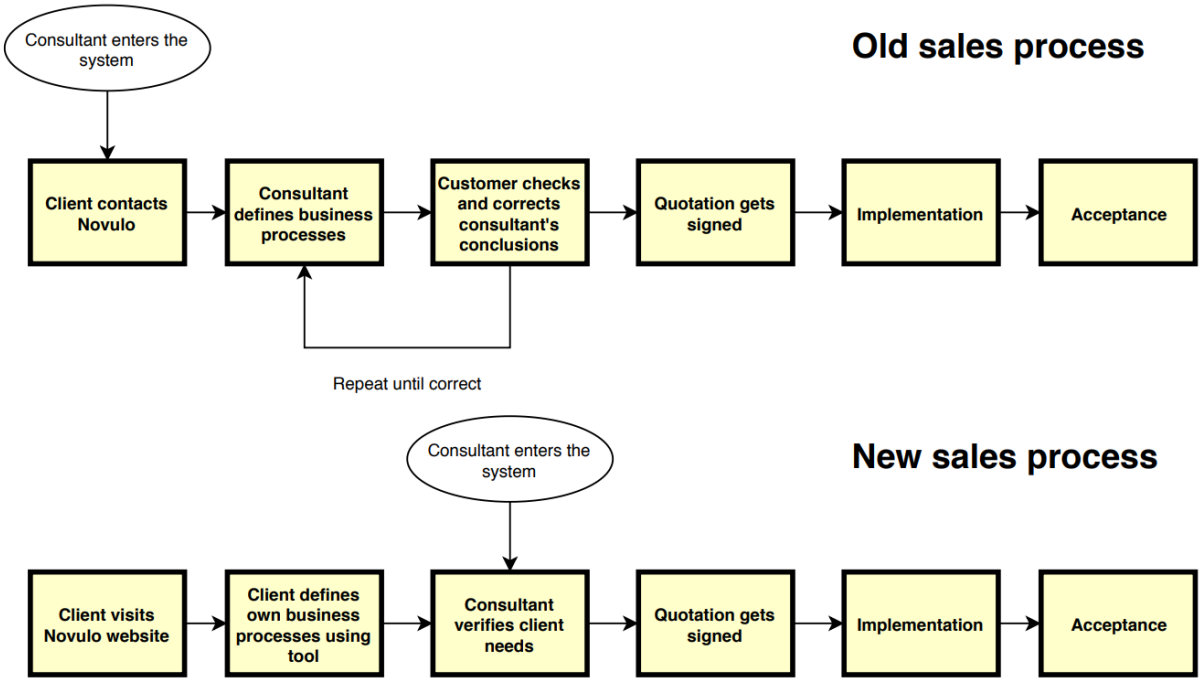


Figure 20 - Old vs New sales process simplified

In the old (current) sales process, as explained before, the consultant is involved from the first moment the client comes in contact with Novulo.

In the new proposed process, the very time-consuming identification of business processes is replaced by the questionnaire. This means that the consultant gets involved far later into the entire process, saving time and money. The rest of the process remains the same.

5.7.1 DETAILED SALES PROCESS CHANGES MODELED IN BPMN

The difference between the old and new process can mainly be seen by the addition of the extra actor in the process. Previously the part that was replaced by the Novulo website was done manually by a Novulo consultant. This is marked with a red box. As shown, the consultant enters the system at a later date, making the entire process require less manpower while producing similar or better results.

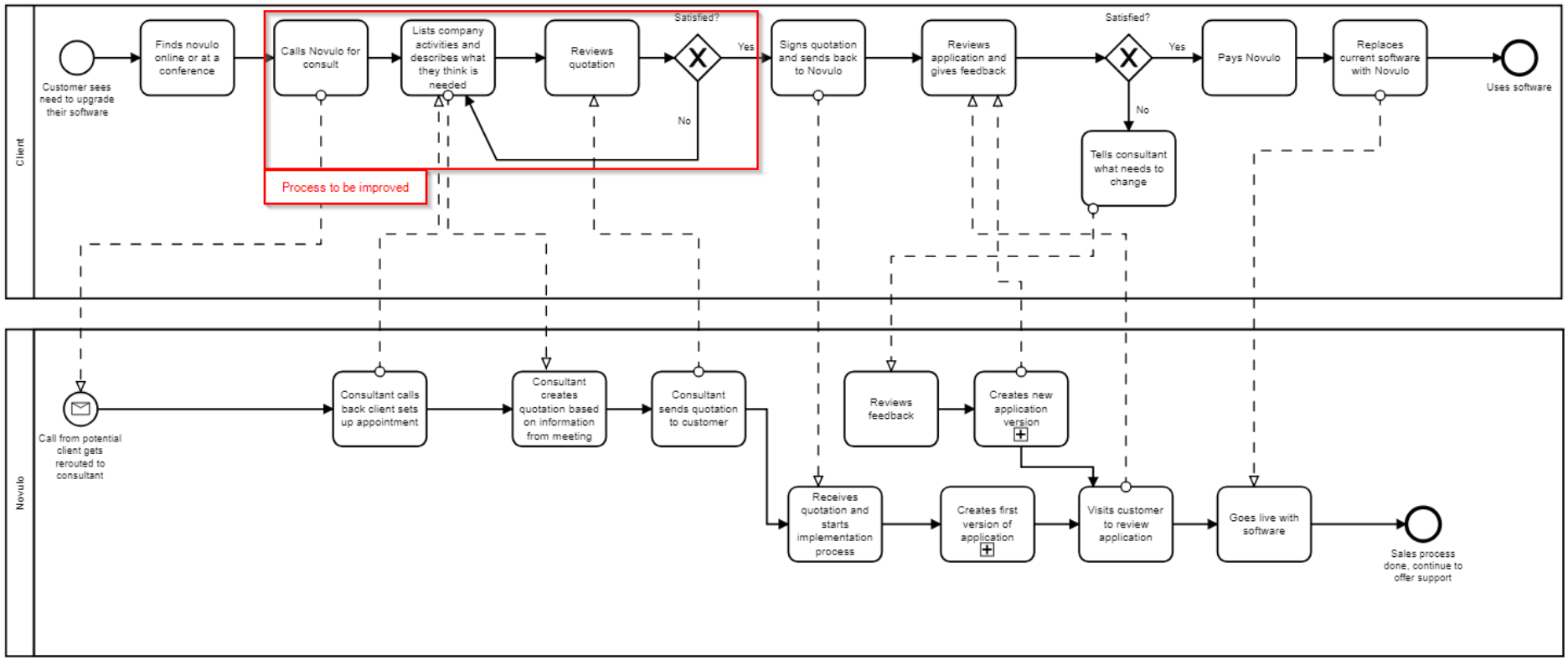


Figure 21 - Old sales process

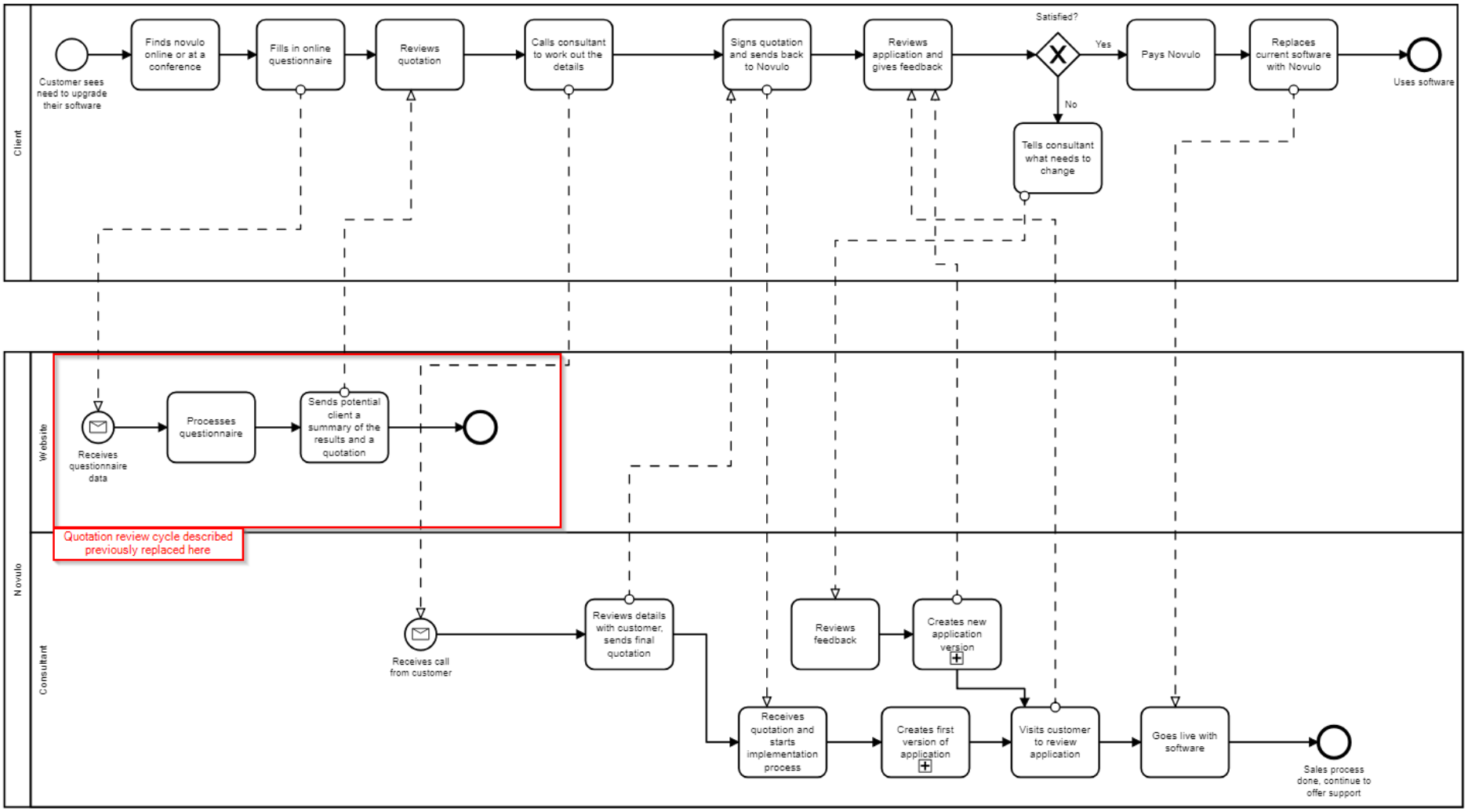


Figure 22 - New sales process

5.8 VALIDATION

5.8.1 REQUIREMENTS

To validate the artefact created during this project, the end result is compared to the requirements set beforehand. In chapter 5 the requirements were defined.

The questionnaire has to:

- produce software requirements without any involvement from a Novulo consultant.

The questionnaire can be filled in without any help, and produces requirements.

- be entirely web-based.

The current artefact uses excel to create a proof of concept. Implementing it online proved to be a lot more work than anticipated, and was thus scrapped. The end product should be 100% web-based without any issues.

- be clear to use for people from all backgrounds and all levels of knowledge.

The questions are worded in such a simple manner that anyone should be able to understand them. If the user does not know enough about certain parts (e.g. finances), the Novulo recommendations should be able to help them out. After that there is always a consultant that can help them out if it is still unclear. After all the questionnaire is only there to get a base set of requirements.

- be designed in such a way that it can be easily adapted to new information and components.

Questions can easily be added and removed, and the connection to components is also really easy to change.

- produce an overview of business processes used, company size, and other relevant information.

This can be seen at the last page.

- have multiple options for different levels of depth and time that potential customers want to spend.

This is exactly what happened. The questionnaire has three depth options. The basic, recommended and full options are there so that when a customer does not have enough time to go through every part of the software, they can choose one of these options and be done in minutes.

- be fully functional without any bugs

This it currently the case, but obviously has to be revisited when implementing the real version.

Throughout the entire design process much care was taken to not make assumptions based on general ideas, but to always consult people with knowledge pertaining to the subject. Still, after all this, it is still a design with multiple iterations, so it is not possible to create *the perfect solution.* The goal is to create the *best possible solution* using the knowledge at hand.

5.8.2 TESTING

Questionnaires have no internal validation. They can be designed keeping in mind certain best-practices, but there is no real proof. To still be able to get an indication that the project was a success, Viswanath Venkatesh, (2003) designed a series of standardized questions that one can ask a test audience to figure out an artefact's

effectiveness. A Likert scale was used, (Harry N. Boone Jr., 2012) since it fits best with this type of questionnaire.

Not all of the questions are as relevant to this project however, so an inclusion/exclusion list was made based on a few criteria.

YES	Definitely a relevant question
MAYBE	Probably a relevant question (not as important as a YES)
DUPLICATE	Similar question accomplishes same goal in this scenario
NO	Definitely not a relevant question

The first column in next table shows all the original questions, not adapted yet to the current situation. The second column then shows the relevance.

Performance expectancy	**Relevance**
I would find the system useful in my job.	YES
Using the system enables me to accomplish tasks more quickly.	YES
Using the system increases my productivity.	MAYBE
If I use the system, I will increase my chances of getting a raise.	NO
Effort expectancy	
My interaction with the system would be clear and understandable.	YES
It would be easy for me to become skilful at using the system.	NO
I would find the system easy to use.	YES
Learning to operate the system is easy for me.	YES
Attitude towards using technology	
Using the system is a bad/good idea.	YES
The system makes work more interesting.	NO
Working the system is fun.	NO
I like working with the system.	NO
Social influence	
People who influence my behaviour think that I should use the system.	NO
People who are important to me think that I should use the system.	NO
The senior management of this business has been helpful in the use of the system	NO
In general, the organisation has supported the use of the system.	NO
Facilitation conditions	
I have the resources necessary to use the system.	YES
I have the knowledge necessary to use the system.	YES
The system is not compatible with other systems I use.	NO

A specific person (or group) is available for assistance with system difficulties.	YES
Self-efficacy	
I could complete a job or task using the system…	
If there was no one around to tell me what to do as I go.	YES
If I could call someone for help if I got stuck.	YES
If I had a lot of time to complete the job for which the software was provided.	YES
If I had just the built-in help facility for assistance.	DUPLICATE
Anxiety	
I feel apprehensive about using the system.	YES
It scares me to think that I could lose a lot of the information using the system by hitting the wrong key.	YES
I hesitate to use the system for fear of making mistakes I cannot correct.	DUPLICATE
The system is somewhat intimidating to me.	YES
Behavioural intention to use the system	
I intend to use the system in the next <n> months.	YES
I predict I would use the system in the next <n> months.	YES
I plan to use the system in the next <n> months.	YES

The resulting questionnaire can be found in appendix 8.2.

Furthermore, the questionnaire was tested in two more ways. First, the development and testing at a garage company. The final product was tested there by doing an interview while they were filling in the product. Questions were asked during every step filling it in and the answers were used to improve the questionnaire. Second, testing was also done at Novulo itself, but in a bit of a different manner. Employees were asked to use their knowledge of the sector to pretend to be a company of a certain type, and then fill it in. The same type of interview as with the garage company was held, and again, the results used to improve the questionnaire. At the end, the only problems they had with the artefact was the look and layout, but that was a deliberate shortcoming designed from the beginning.

5.8.3 RESULTS

The validation questionnaire was filled in by a few people with experience in the field, taking the averages results in the figure below. 4 people helped in total. One owner of a garage company, one amateur mechanic with experience in dealing with garage companies, and two Novulo employees who handle the sector often.

The choice was made to email (or give) an instruction, the mock-up and the excel version of the questionnaire to each respondent, to mimic as possible real situation as much as possible, and not give any help.

Table 1 - Validation results

Performance expectancy, how well does the product work?	**Average**	**Stdev**	**Min/max**
I would find the questionnaire useful for my job.	4,25	0,58	4/5
Using the questionnaire enables me to accomplish tasks more quickly.	3,75	0,58	3/4
Using the system increases my productivity.	4	0,58	3/5
Effort expectancy, how much effort does it take to use?			
My interaction with the questionnaire is clear and understandable.	4	1,00	3/5
I find the questionnaire easy to use.	4	1,15	3/5
Learning to operate the questionnaire is easy for me.	5	0,00	5/5
Attitude towards technology, is this a good use of technology?			
Using the questionnaire is a good idea.	5	0,00	5/5
Facilitating conditions, am I able to make use of the questionnaire?			
I have the resources necessary to use the questionnaire.	3,75	1,00	3/4
I have the knowledge necessary to use the questionnaire.	4,25	0,58	4/5
A specific person (or group) is available for assistance with difficulties.	4	1,00	3/5
Self-efficacy, how much help do I need to use the questionnaire?			
I could complete the questionnaire…			
If there was no one around to tell me what to do as I go.	3,75	0,58	3/4
If I could call someone for help if I got stuck.	3,75	0,58	3/4
If I had a lot of time to complete the job for which the software was provided.	3,5	1,53	2/4
Anxiety, how do I feel about using the questionnaire?			
I do not feel apprehensive about using the questionnaire.	5	0,00	5/5
It does not scare me to think that I could lose a lot of the information using the questionnaire by hitting the wrong key.	4,75	0,58	4/5
The questionnaire is not somewhat intimidating to me.	5	0,00	5/5
Behavioural intention to use the system, will I use it?			
I intend to use the questionnaire in the next 3 months.	4	1,53	2/5
I predict I would use the questionnaire in the next 3 months.	4	1,53	2/5
I plan to use the questionnaire in the next 3 months.	4	1,53	2/5

Each category will be discussed individually.

Performance expectancy, how well does the product work?

The overall result was quite positive. The main thing to take away was that the amateur mechanic didn't think it would increase productivity as much as the other respondents. This can be understandable, since they have not actually worked with the software systems.

Effort expectancy, how much effort does it take to use?

In general, respondents found the questionnaire easy to operate, but a bit harder to understand. This is understandable, since the questionnaire requires one to imagine the mock-up design while looking at the excel questions.

Attitude towards technology, is this a good use of technology?

Everyone thought this was a very good use of technology. Nothing more to add.

Facilitating conditions, am I able to make use of the questionnaire?

The consensus, was that it was overall quite doable and usable, but the conditions could have been better. For example, organising a workshop where everyone could attend and get a general instruction with the ability to answer questions could have alleviated much of this.

Self-efficacy, how much help do I need to use the questionnaire?

This question shows more or less the same results as the previous one. The one exception is that, again, the amateur mechanic found it harder to complete. This could be because they lack information that the others have.

Anxiety, how do I feel about using the questionnaire?

Respondents were not anxious at all about using the questionnaire.

Behavioural intention to use the system, will I use it?

Everyone had a very clear intention of using it, with the exception of one Novulo employee. Asking about it afterwards, they had the understanding of relating it to them personally, making it a misunderstanding. All the others scored very positive.

The few misunderstandings and issues that will be resolved in the final product left aside the results look very positive.

5.8.4 ADDITIONAL FEEDBACK

Some additional feedback, and things to consider were mentioned by a few people when filling in the validation questionnaire.

One found the explanations at the requirements page lacking, which is understandable as it is very limited.

Some found the options given (basic, recommended, full), to be lacking. They wanted more choice when selecting these. This was a deliberate design choice, as the details page was designed for people who wanted to go more in depth. However, this could have been explained better.

Something that might have been underestimated is how ready people are to put quite a bit of time into a project such as shit. None of the respondents skipped the details page, all were interested in what that does. This could be partly because they were interested in the project to begin with, so they wanted to know all the details. The suspicion is that for a project as big and important as replacing the software a company uses, people will put in those ten more minutes.

The ending could have used more explanations as well, with an indication about the price and the time it takes to implement.

5.9 CONCLUSION

The iterations described in the design science and the requirements questionnaire methodology theory mostly come down to researching, interviewing, and testing, in that order. Repeating as often as necessary. This way many different versions were created, but the people that gave feedback would agree that the final version used all their feedback well. The questionnaire also meets all the requirements set at the beginning.

6. CONCLUSIONS AND RECOMMENDATIONS

This chapter aims to explain the conclusions based on the experience creating this product.

6.1 SUMMARY OF THE PROCESS

The process started with the observation that the Novulo web shop was extensive, but not used. This sparked the need to start the process of improving it. After consulting with Novulo employees on why it doesn't get used, the idea of a questionnaire to guide potential customers through the web shop came to be.

Since there was already an implementation project happening at that time at a small garage company, the decision was made to use that sector as a basis for the project. Many iterations of the process were made, together with the garage company and Novulo consultants. The end result is a mock-up of the planned design, combined with a proof of concept made in excel.

6.2 LIMITATIONS AND FURTHER RESEARCH

This thesis is mostly tested on SMEs. This is because Novulo currently does not have any big clients in the industry. They did have them before, meaning that experience from Novulo employees is a valid help in this regard, but it hasn't been tested in the field. Further research can be done here, by testing the solution on different sizes and types of companies. While there is a basis for the hypothesis that the questionnaire is valid and usable for other sectors, it needs to be researched as well.

Another shortcoming is the ability to test the effect of the questionnaire. It is based on theory and proven methods, but applied to a different environment. The ways to test it are available for the long term. There is however no way to know for sure right now if it will be effective. Research after the fact is necessary to ensure the usefulness of the questionnaire.

The literature on questionnaires for user requirements gives very few specific answers. Literature has many answers for questionnaire design and gathering user requirements, but not very many for those two combined. Doing more research on how the two combine can be very valuable for furthering the understanding of this topic.

A possible shortcoming is that customers might be hesitant to use the new system. In the business software sector, something like this has not really been used before. Getting customers to use the new system could be a challenge. This is another topic for further research. Researching how accepting customers in the business software sector are of new technologies is needed to be able to improve the product in the right way.

All the validation and testing were done on a very limited size group of people and companies. This doesn't have to make it bad, but does make sure that more testing has to be done before putting big financial resources into it, or it will be a risk.

Lastly, the validation feedback gathered at the end of the project has not been used to improve the project. Even though this is not the goal of the validation feedback, it could have been very valuable.

6.3 CONCLUSIONS

This chapter aims to answer each research question in short, and gives a conclusion in the end.

HOW TO DESIGN A METHODOLOGY?

To design a methodology, first the purpose must be clearly defined. Having a clear picture of what the end goal might look like is needed to even begin the design. Next the requirements need to be set. Creating the baseline for the rest of the methodology is another essential step to be able to design a method properly. The methodology itself needs an overview of how all the steps relate to one another, with each step explained in detail later on, with a summary at the end.

HOW CAN A QUESTIONNAIRE BE IMPLEMENTED?

The main thing to take away from the implementation process in this thesis is that many things change during the implementation. The idea of implementing the questions in the Novulo CMS was quickly abandoned in favour of excel, combined with a mock-up of the design as a proof of concept. Validation and testing is also very important to do every step of the way.

HOW TO DEFINE BUSINESS PROCESSES?

This thesis defines a business process as a set of related activities, with the boundaries between these activities defined by the person defining the processes for the goal that they have. BPMN is then used to map these processes. The modelling language was chosen because it distinguishes which stakeholder is involved exactly in which process well. There is no formula to define the exact processes. Using the guidelines provided combined with experience and feedback should result in an accurate business process model.

WHAT FACTORS INFLUENCE CUSTOMER SATISFACTION?

There are many factors that influence customer satisfaction, but the factors relating to information and transparency are considered most important. Customers find it important to know what goes on at what time, and that they are being heard. As long as the customer feels important and treated fairly, other factors matter less.

WHAT TOOLS AND THEORIES CAN BE USED TO CREATE A QUESTIONNAIRE FOR GATHERING USER REQUIREMENTS?

Creating a valid and well-designed questionnaire can be quite a challenge. What most models that describe best-practices for the creation of questionnaires have in common is that they agree that minor details can have great effect on the final outcome. Phrasing both the questions and answers in such a way that all of these details are attended to is just as hard as it is essential. Luckily there is a huge amount of literature that researched this to fall back on.

To create a questionnaire that specifically gathers user requirements, user stories have to be incorporated into the questionnaire. For the user to understand what kind of requirements they are setting, contextual information is important. When a user can read a story and then see what applies to them, the information that they give is more accurate than when they just answer simple questions.

In this thesis this means that much attention was paid to the creation of the questions, but also to the explanations and making sure that every type of customer can use and understand everything.

HOW TO MEASURE THE SUCCESS OF A PROJECT?

In general, project success is measured by using key performance indicators. To create a good KPI, *Relevance for enterprise target, Quality of data, Compatibility with hierarchy, Variability, Periodicity, Visualization and*

Effort al have to be taken into account. More than one KPI is always needed to check the performance of the system as a whole.

In this thesis KPIs related to efficiency are most relevant. The goal was to reduce the amount of time spent by a Novulo employee on acquiring new clients without losing them. This means that KPIs that measure both the effectiveness of the questionnaire, but also measure the time spent on acquiring these clients are relevant.

WHAT KIND OF PRIVACY/REGULATION CONCERNS ARE THERE?

While there are privacy issues to keep in mind, none of them are that severe they interfere with this project. Getting consent from interviewed individuals is needed, and the GDPR regulations have to be kept in mind as well. If this is all done correctly, no issues should arise.

CONCLUSION OF THE THEORY

The main research question was as follows: *How do you design a questionnaire in a way that the results contain all the necessary information required to design a business application?*

To answer the question in one sentence: *Using user stories, use cases connected to BPMN Models to turn a questionnaire into accurate business process descriptions and then verifying the information using appropriate KPI's.*

This thesis has attempted to combine theory and practice into a method that essentially tells the customers what they need. Even though more testing and development is needed, it has succeeded in what it attempted to do. Feedback was mostly positive and the project will be used as a basis for a follow-up at Novulo.

CONCLUSION OF WRITING THE THESIS

The expectation when creating the questionnaire was quite a bit different than from reality. Getting an overview of all the possible business processes was quite easy, since Novulo had so much experience working on it already. However, creating the questionnaire was way harder. The Novulo content management system was a lot more complex than expected and after putting, maybe too much, time into it the decision was made to quit and do it another way. The testing and validation were also more complex than expected, but not out of the norm. The planning only didn't account for extra validation at the end. Overall it was a pleasant experience that did take a lot longer than expected but overall has satisfactory results.

6.4 RECOMMENDATIONS

The research in this study has shown that creating a questionnaire for gathering user requirements is entirely possible and can also be very useful. The next step now is to recreate the questionnaire in the Novulo CMS, and then test it more using real clients. Furthermore, once this is done, the steps taken in this thesis can be used to recreate questionnaires for all other sectors Novulo is active in.

In general, the recommendation is to start by implementing this as an option. The method is not fully developed yet, which can make it a risk to use as a full replacement. It is however promising, and should be used when developing a new web shop.

Furthermore, even if the choice is made to not use the questionnaire methodology or any questionnaire even, the methods for data collection, KPI creation, problem identification and evaluation mentioned can all be used still.

6.5 CONTRIBUTIONS

6.5.1 LITERATURE

This thesis has attempted to combine research into questionnaire design with research into gathering user requirements. The methodology used in this thesis can be used and expanded upon for other research.

To summarize, the following contributions to literature can be found in this study:

1. A method for creating a questionnaire for gathering user requirements.
2. A study of the literature available required for the above questionnaire.
3. Validation of the method by testing the prototype.

This is useful for academic researchers because of the following researchers. First, the study can be used as a basis for any other type of questionnaire design. There are many best practice documents out there, but this thesis summarized a lot of relevant information in one place.

The method itself can be re-used and adapted to fit other needs. It is a *generalized* method, which means it can be used in for any type of questionnaire for creating user requirements. Even parts can be used when designing questionnaires with a different goal, the possibilities are endless.

6.5.2 PRACTICE

In practice this thesis can be used well as a baseline for any type of questionnaire, for any type of product. It can help consumers get products that they need, and might not even know they need. It can probably mostly be used for companies that sell complex products, since for simple things, it is probably still too much effort. Any company that currently spends many resources acquiring clients and helping them figure out exactly what they need, can implement this method and save a decent portion of those resources.

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8. APPENDICES

8.1 FINAL LIST OF ALL QUESTIONS (DUTCH)

Below is a list of all the questions available in the questionnaire, including sub questions.

Pagina 1:

Wat voor type bedrijf?

- Dealer
- BOVAG-garage
- Universele garage
- Merkspecialist
- Bandenspecialist
- Overig: vul in

Pagina 2:

Hoeveel personeel heeft uw bedrijf?

- 0-10
- 10-25
- 25-50
- 50-100
- 100+

Hoeveel vestigingen heeft uw bedrijf? (invullen)

Pagina 3:

Wat voor werkzaamheden verricht uw bedrijf?

- Banden wisselen
- Onderhoud uitvoeren
- Onderdelen vervangen
- APK – Keuring
- In/Verkoop voertuigen
- In/Verkoop onderdelen
- Groothandel
- Verschillende soorten service
    - Pech service
    - Glas service
    - Vervangend vervoer

Pagina 4:

Wat voor typen klant help u?

- Particulier

- Bedrijven
- Leasemaatschappijen

Deel 2: (hier is dus de keuze gemaakt de diepte in te gaan)

Pagina 5:

Welke processen moeten ondersteund worden?

- **Zoeken van banden (bij externe leveranciers)**
    - Op basis van bijbehorende eigenschappen
        - Inclusief registratie van heffingen
        - Inclusief registratie van montageprijsen
- **Zoeken in eigen productcatalogus**
    - Op basis van bijbehorende eigenschappen

- **Elektronisch inkopen**
    - Banden
        - Bij leveranciers
        - Bij producenten
        - Op basis van inkoopadvies?
        - Op basis van min/max voorraden?
    - Onderdelen
        - Op basis van inkoopadvies?
        - Op basis van min/max voorraden?
    - Overige producten
        - Zelf in laten vullen wat?
        - Op basis van inkoopadvies?
        - Op basis van min/max voorraden?

- **Facturatie**
    - Aan de balie
        - Contant
        - Pin
        - Factuur
            - Papier
            - E-mail
            - Extra optie?
        - Op rekening
            - Aan/uit zetten per klant
    - Elektronisch
        - Per email
        - Extra optie?
- **Klachten garanties registratie**
    - Per onderdeel
        - Klachten registreren
        - Garanties registreren
- **Automatische updates**
    - Automatisch updaten van
        - Beschikbare banden

        - Bandenprijzen

Pagina 6:

Wat moet er geregistreerd worden?

- **Klanten**
    - Standaard informatie:
        - Naam
        - Telefoonnummer
        - Email
        - Adres
        - Notitie
    - Prijs/kortingsafspraken

- **Leveranciers**
    - Standaard informatie:
        - Naam
        - Telefoonnummer
        - Email
        - Website
        - Adres
        - Notitie
    - Prijs/kortingsafspraken
    - Elektronische bestelinformatie

- **Resources**
    - Medewerkers
        - Standaard informatie:
            - Naam
            - Telefoonnummer
            - Email
            - Adres
            - Notitie
        - Roosters
            - Start en einddata
            - Verschillende roosters per persoon
        - Bevoegdheden
    - Bruggen
        - Roosters
            - Start en einddata
        - Bevoegdheden

        - Eisen
        - Planbaar (ja/nee)
    - Overige resources
    - Rechtenscheiding
        - Medewerkers toegang geven tot verschillende informatie o.b.v. functie en informatiebehoefte

- **Voertuigen**
    - Banden (per locatie op de auto)
    - Informatie ophalen van RDW
        - Merk
        - Kleur
        - Vermogen
        - Gewicht
        - Chassisnummer (op basis van de meldcode van een voertuig, via het VWE)
    - Extra informatie
        - Kilometerstand
        - Notitie
        - Omschrijving
        - Lease (ja/nee **check begin**)
    - Eigenaar
    - Berijder

- **Informatie opslaan over uitgevoerde werkzaamheden**
    - Alle benodigdheden
    - Werkzaamheid per uniek onderdeel
        - Inladen van onderdelen vanuit een externe catalogus
    - Bandeneigenschappen
        - Opslaglocatie banden
        - Millimeterstanden banden

Pagina 7:

Wat voor planning moet er komen?

- Plannen van afspraken op basis van beschikbaarheid van resources
    - Medewerkers
    - Bruggen
    - Andere locatie in de werkplaats?
    - Vervangend vervoer services
    - Haal- en breng services

Pagina 8:

Wat voor financiële producten zijn er nodig?

- Grootboekadministratie
    - Basisfuncties die nodig zijn om te kunnen boekhouden

    - Inlezen van bankafschriften
    - Aanschrijven van openstaande debiteuren
    - Bundelen van betalingen in betaalopdrachten
    - Voorbereiden van BTW aangifte
    - Rekening-couranten
    - Real-time inzicht in openstaande posten
    - Rapportagemogelijkheden
- Het opvragen van goedkeuring voor en het factureren van lease werkplaatsafspraken via ROB-Net (**Check lease aangevinkt).**

Pagina 9:

Wat voor overige functionaliteit is er nodig?

- Verwerking van inter-company in- en verkoop
    - Logistieke afhandeling
    - Financiële afhandeling

8.2 VALIDATION QUESTIONNAIRE

Validation questions for the questionnaire

The aim of this questionnaire is to get feedback on the final version of the *User requirements questionnaire*.
Please consider the mock-up layout as the real layout when answering these questions.
This survey should only take about 3 minutes.

Answers range from 1-5
1 means: Strongly Disagree
2 means: Disagree
3 means: Neutral
4 means: Agree
5 means: Strongly Agree

Performance expectancy. How well does the product work? I would find the questionnaire useful for my job.	**Answer**
Using the questionnaire enables me to accomplish tasks more quickly.	
Using the system increases my productivity.	
Effort expectancy. How much effort does it take to use? My interaction with the questionnaire is clear and understandable.	
I find the questionnaire easy to use.	
Learning to operate the questionnaire is easy for me.	
Attitude towards technology. Is this a good use of technology? Using the questionnaire is a good idea.	
Facilitating conditions. Am I able to make use of the questionnaire? I have the resources necessary to use the questionnaire.	
I have the knowledge necessary to use the questionnaire.	
A specific person (or group) is available for assistance with difficulties.	
Self-efficacy. How much help do I need to use the questionnaire? I could complete the questionnaire…	
If there was no one around to tell me what to do as I go.	
If I could call someone for help if I got stuck.	
If I had a lot of time to complete the job for which the software was provided.	
Anxiety. How do I feel about using the questionnaire? I do not feel apprehensive about using the questionnaire.	
It does not scare me to think that I could lose a lot of the information using the questionnaire by hitting the wrong key.	
The questionnaire is not somewhat intimidating to me.	
Behavioural intention to use the system. Will I use it? I intend to use the questionnaire in the next 3 months.	
I predict I would use the questionnaire in the next 3 months.	
I plan to use the questionnaire in the next 3 months.	