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A framework for Measurable Value Propositions - for Business and Service Improvement and Innovation (MVAP)

Master Thesis

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Acknowledgments

I would specially like to thank three persons, whose support has brought me as far as I stand today.

As Benjamin Franklin stated,

“*An investment in knowledge always pays the best interest*”

The person whom I honor for telling me the importance of knowledge and encouragement for going as far as possible to acquire it is my late father, Karamat Ali.

Further a quote from William Arthur Ward,

“*The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great teacher inspires.* ”

In my case, this great teacher is my supervisor Arne Jørgen Berre, who has been inspiring, supportive and a great personality with a lot of wisdom and kindness.

The last quote is from Groucho Mark,

“*Behind every successful man is a woman*”

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Abstract

Both businesses and non-profit organizations need to ensure that their value propositions meet the needs of their customers and stakeholders. In order to ensure this it is proposed to introduce an approach for measurable value propositions.

Businesses have experienced more changes in the last decade than ever before. New markets as well as new technology have been some of the factors behind changes in the markets.

Those who can adapt to the changes have an opportunity to do well in constantly evolving markets and those who fail to adapt will lose to the competition. To address the problem of continuous improvement, a framework is developed that will focus on several issues concerning design. How to develop an innovative solution to the specific problem? How to measure a business performance and acceptance of the proposed solution in the market?

All the above questions are taken into consideration in this thesis. The thesis is divided into 4 parts. The first part describes motivation and method of work in chapter 1. The second chapter aims at defining the problem, which is being analyzed based on two examples, Concierge and CITI-SENSE with some well-known frameworks such as Business Model Canvas, Value Proposition Canvas and ServiceMIF. The problem highlighted is the missing capability of measuring value proposition in implemented frameworks. The third chapter describes the requirements for addressing the identified problem and a further chapter evaluates how existing frameworks fulfill these requirements

The main thesis contribution put forward is a framework for Measurable Value Propositions - for Business and Service Improvement and Innovation, MVAP, which is introduced in part two of the thesis. First the concept of MVAP is introduced and then it is described how MVAP is designed and implemented as a framework. Then the technical details of MVAP is further described and finally validated on the same test examples from the introduction.

In Part III MVAP is evaluated and compared with the existing frameworks, together with suggestions for future work.

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INTRODUCTION

1. Introduction and method of work

Both businesses and non-profit organizations need to ensure that their value propositions meet the needs of their customers and stakeholders. In order to ensure this it is proposed to introduce an approach for measurable value propositions. It is proposed to do this as an extension to existing frameworks for business development.

Frameworks for business development have gained a lot of popularity in recent years. Among the most recent frameworks to appear are Osterwalder Canvas[2], Value Proposition canvas [3] and ServiceMIF [4].

The frameworks mentioned above lay the fundamental basis for this thesis. Two examples are implemented with these tools to give the business context and define the current state. Shortcomings between current state and envisioned state are studied and requirements for reaching envisioned state are defined. The overall goal is to make a framework that allows users to generate innovative business designs and measure the value proposition it has in relation to targeted customer segment..

This thesis will present a framework called: '**A framework for Measurable Value Propositions - for Business and Service Improvement and Innovation (MVAP)'**. This framework will focus on implementing the existing frameworks mentioned above on two examples and lay the fundamentals for the problem analysis with respect to identifying requirements.

The coming sections give an overview for structure of this thesis - Motivation and Method of work.

1.1 Structure of the thesis

The thesis is divided into five parts, each part is described in the following section.

1.1.1 Part I

This part describes the method of work followed by an example for the problem definition, requirement to solutions and finally an evaluation of existing solutions.

1.1.2 Part II

In this part, the concept of MVAP is introduced and then analyzed on performance level and technical level. In the final section MVAP is validated on two examples to test how it performs.

1.1.3 Part III

In this part MVAP is evaluated against the requirements defined in part I and compared with the results from existing solutions. Finally, a conclusion will be made with regard to the effectiveness of MVAP compared to the existing solutions to address the requirements from part I. At the end of this section, remaining work will be described as input for future work.

1.1.4 Part IV

Many of the figures used in Part III and Part IV are directly linked to the tables in the Appendix A and B. Much of this part contains figures, tables and graphs generated for MVAP during the PDSA-Performance cycle and the PDSA-Satisfaction cycle.

1.1.5 Part V

This part contains the bibliography.

1.2 Motivation

The Value Proposition is the beating heart of any business. Knowingly or unknowingly, all businesses have a value proposition. Having great but static value proposition is not enough because markets are changing and technology is evolving. As stated by Heraclitus, "*There is nothing permanent except Change*". In the context of this thesis, change means changes in the business environment. A constantly changing business environment cannot have a static value proposition. To thrive in a constantly changing business environment, a framework is needed that allows innovative business design and a measurable value proposition. The value proposition has to be measurable to enable the business to seamlessly adapt to its local environment.

How can a framework deliver both innovative business design and measurable value propositions?

The answers to the questions above require a further analysis. Addressing issues such as; what is the customer segment, how is the value proposition related to the customer segment and how do they fit into the business model?

There are many tools and techniques that can help answering these questions to some extent, but close observation reveals a missing element. The missing element is a framework that allows generation of innovative business design that have the capability to measure performance of the value proposition and the customer satisfaction.

By failing to have value proposition that is measurable, businesses are unable to quantify how well their products and services are perceived in the market place. The approach developed in this thesis will allow the possibility to measure performance of the value proposition and customer satisfaction with respect to the market segment. The framework provided in this thesis will allow business-designers to qualify and quantify their value proposition with respect to market demand. Information on whether the value proposition is within acceptable technical parameters or not, is essential for decision-makers to either continue their offering, stop it or correct its path.

The motivation for writing this thesis is to develop an approach that allows strategic management tools such as the Business Model Canvas [2] to have the capability to measure value proposition and customer satisfaction at a technical level and in a continuous loop. This approach will allow both continuous improvements of value proposition and innovative business design.

The first step to define the requirements is developed in chapter 2, *Problem definition*. Two different examples are implemented, Concierge and CITI-SENSE to lay the foundation for the problem analysis.

1.3 Method of work

The research method for development and evaluation of MVAP is based on the approach for *technology research [5]*. Three steps are defined in the method for technology research, to either improve existing artifacts or make new ones. All three steps are implemented during this thesis and consist of

1. Problem analysis.
2. Innovation.
3. Evaluation.

1.3.1 Problem analysis

The previous section described the motivation for this thesis, and described the need for a framework allowing innovative business-design and measurement of value propositions.

To fulfill these goals, it is important to know what the current state is. Current state is described in chapter 2 by implementing existing frameworks based on two examples. This laid the fundamentals for this thesis for the further development of requirements in chapter 3. Requirements are categorized in 7 categories where every category represents a part of the problem. Requirements highlighted are meant to bridge the gap between the current state and the envisioned state. Chapter 4 further elaborates existing solutions to fulfill the requirements and evaluate their usefulness relative to the requirements.

1.3.2 Innovation

The artifact will be developed to address the requirements defined with the objective of improved performance over existing solution. To achieve this goal a framework is conceptually presented in chapter 5 to describe how continuous improvement will work to address the requirements. The Framework is called MVAP. MVAP is designed, analyzed and implemented in chapter 6, 7 and 8.

The thesis hypothesis is:

It is possible to support Business and Service Improvement and Innovation through a framework for Measurable Value Propositions with a continuous improvement process.

1.3.3 Evaluation

Chapter 9 evaluates the results from validation of MVAP in chapter 8. The results are compared with results from existing solutions from chapter 4. Finally in chapter 10 a conclusion is drawn regarding whether MVAP validates or refutes the hypothesis.

2 Problem definition

Two examples are implemented in this chapter with three existing frameworks: the Business model Canvas [2], the Value Proposition Canvas [3] and ServiceMIF [4]. The implemented examples are different with regard to their customer segments and value propositions. The reason for using two different examples is to avoid developing a solution that is specific to one specific problem. Different examples allow a problem definition that is general enough to derive requirements from it and will allow the creation of a framework that represents a general solution.

The implementation of the examples with the selected frameworks has two objectives.

1. To provide contextual information of value proposition in the business model.
2. To state a general problem-definition that provides the foundation to identifying requirements for measurable value propositions.

The two examples to implement with the three frameworks are:

1. Concierge.
2. CITI-SENSE.

These are examples that will be analyzed and studied in the following sections, representing different perspectives from a business and a project community respectively.

2.1 Business Model Canvas

The Business Model Canvas being described in this section is also known as Osterwalder Canvas [2]. The reason this canvas is described is that it includes all the relevant building blocks a business needs to have to be operational. The advantage is an overall understanding of the business environment and where the value is fit in, before a technical approach is described in the coming chapters.

This canvas includes nine building blocks to generate business models, and defines a business model as follows:

A business model describes the rationale of how an organization creates, delivers, and captures value [2, p. 14].

For making the complexity of business models simple and understandable, a canvas was designed for visually representing building blocks. How these building blocks are arranged and what those building blocks are, is illustrated and described below.

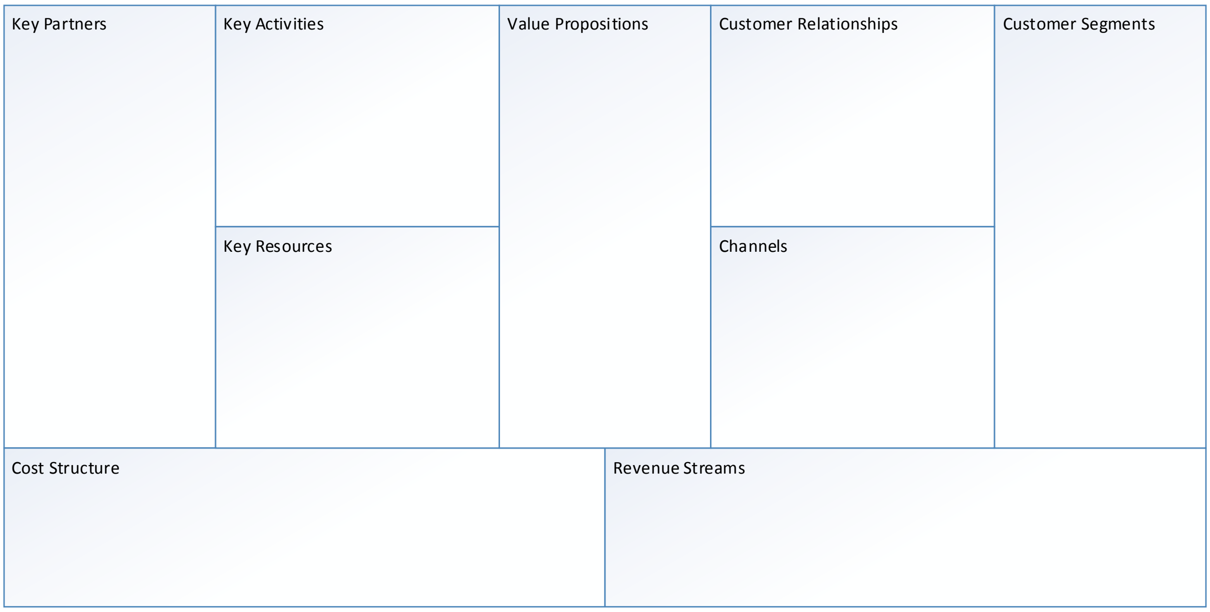

Figure 1: Business Model Canvas [2].

As **Figure 1** illustrates, the building blocks are

1. Customer Segments: Segments in society the organization wants to reach to.
2. Customer relation: This building block describes the type of relation company have with its customers.
3. Channels: This building lock describes what channel the organization uses to reach out to targeted segments to deliver Value Proposition.
4. Value Proposition: A bundle of products and services that are offered to a customer segment.
5. Key Activities: This building block describes the most important activities a company must undertake for the model to work.
6. Key resources: This building block describes the resources needed to make the business model operational.
7. Key partners: Describes necessary relationships a company must have with suppliers and other partners to make a business model work.
8. Cost Structure: Describes the overall cost related to use the model.
9. Revenue Stream: Describes the revenue generated by each customer segment (after costs).

Of the nine building blocks, we will in the context of this work focus on two: 1) Value Proposition and 2) Customer Segments. The reason that only two blocks are highlighted is because they are sufficient to define the problem this chapter is aiming at. Further details for these two building blocks are presented in the section below.

2.2 Value Proposition Canvas

The Value Proposition Canvas is a plugin to the Business Model Canvas, its goal is to achieve a product-market fit [3]. By further segmentation of the two building blocks, namely Value Proposition and Customer Segments into smaller chunks, it is easier to construct a match for the offers and the needs.

The chunks being highlighted are illustrated in **Figure 2**.

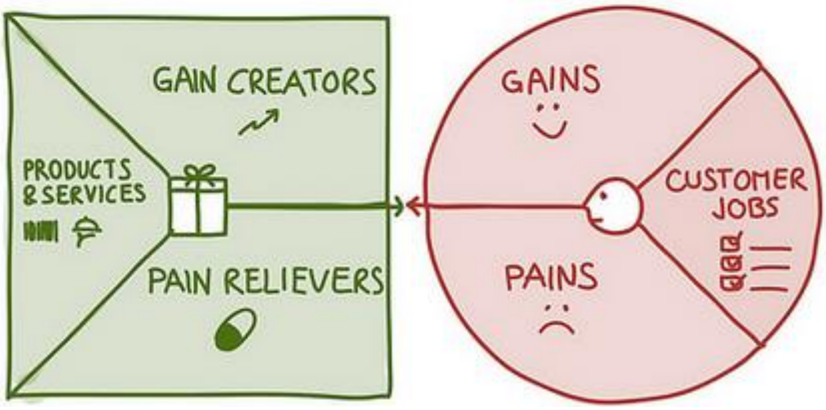

Figure 2: Value Proposition Canvas [3].

Figure 2 illustrates the fit between what jobs the particular Customer Segment wants to get done and what Products and Services can be provided to satisfy this segment. The elements between Customer jobs and Products & Services enable the connection between them on a more granular level. There are four elements in between Customer jobs and Products & Services, namely:

1. Gain Creators: What customer will gain or be surprised by, using certain product or service.
2. Pain Relievers: Describe products & services that solve problems customers have from existing solutions.
3. Customer Gains: What customer would like to achieve by getting certain job done.
4. Customer Pains: What problems customers have with the current way job is being done, like cost, time, and difficulties of getting things done.

Before the frameworks are implemented for the Concierge and CITI-SENSE, it is necessary to describe ServiceMIF.

2.3 ServiceMIF

ServiceMIF is a framework for developing, improving and innovating services [4]. This thesis both incorporates and extends the existing ServiceMIF-framework. Unlike the frameworks described before, this framework has a process. Description of the process in ServiceMIF is in focus here.

The ServiceMIF framework has a process approach called DISSECT. Which describes the development of functional and non-functional Value Benefits [4, p.24]. Besides describing the type of Value benefits, DISSECT also describes how these benefits will be perceived by the customer or how to generate value. The definition of DISSECT is given below.

1 DIS: Discovery. This sub process focuses on discovering the service journey customer undertakes to get the service they need and the provider process that is required to deliver the service.

2 S: Solicitation. This stage involves the solicitation of feedback from the stakeholders to articulate the value benefits for the customers.

3 E: Evaluation. This stage involves the customer feedback after consumption of the service, and how to identify service innovation-opportunities.

4 C: Capture. This stage is meant to capture the experience of the customer by analyzing their level of satisfaction.

5 T: Translation. This stage is meant to use information from the previous stages to identify the opportunities for fulfilling goal of ServiceMIF, either to improve service or to innovate new services.

Figure 3 illustrates the process of DISSECT and alongside every stage, there is a supporting service model. Every service model is a supporting tool to process customer value from one stage to the next.

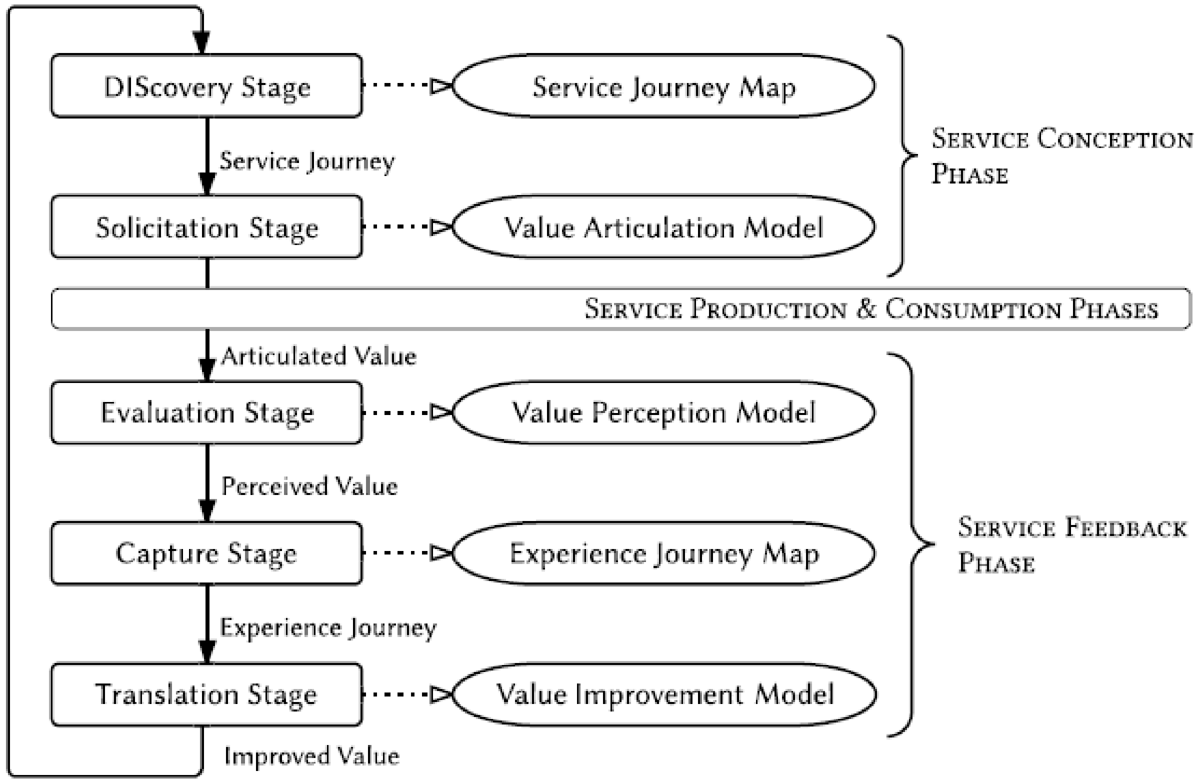

Figure 3: DISSECT process [4].

The last stage is a conclusive point, where information from previous states is decided upon. The translation stage offers three alternatives for improving or innovating services. These three points are:

1. *Value benefit improvement: the value benefit improvement objective consists in identifying opportunities for proposing improved value benefits in the next version of the service [4, p. 8].*
2. *Touch-points Improvement objectives: This objective involves having an overview of value perceived at each touch point and identifying touch point modification opportunities in terms of making additional changes to value benefits [4, p. 8].*
3. *Service Improvement Objective: this stage focuses on the improvement of customer service experience across the touch points for the entire service journey or part of it [4, p. 9].*

Feedback from customer will decide which one of the options will take effect. Either the overall service will be improved, touch points will be improved or Value Benefits will be created. With regard to ServiceMIF, only two of the first stages are relevant with respect to a focus on value proposition, namely DIScovery and Solicitation. The prime focus for value proposition measurements will be related to the DIScovery and solicitation stage. The first stage provides the overall context, similar to the Business Model Canvas described in section 2.1. Second stage will describe the Value Benefits, Value Proposition and Quality of those Value Benefits.

These stages have relevance for the value proposition measurement because they begin from a larger context and narrow down to fundamental elements of the value being offered. These values are to be measured in the focus of this thesis, therefore the first two stages are sufficient. Other stages have no value for the problem being addressed in this thesis, and are therefore left unimplemented for the examples in the coming sections. All relevant frameworks have been described with ServiceMIF being the last one. The next section describes the company and project used as examples, beginning first with Concierge.

2.4 Concierge

To define the problem this thesis is trying to address, existing frameworks described in previous sections are tested. An example implementation in this section is done on a fictional online event booking company called Concierge. Concierge provides personalized services ranging from weather-forecast, travel-information, concert- information and information about movies of interest to the customers. Concierge is not involved in arranging the events, but only provides event information and booking based on customer preferences. The only interaction with this company takes place over the internet with devices such as pc, desktop, smartphones and tablets.

The following presents an implementation of Concierge with the Business Model Canvas, Value Proposition and ServiceMIF.

2.4.1 Business Model Canvas for Concierge

Implementation of Concierge as illustrated in **Figure 4**, is designed with a web based modeling tool called Strategyzer supporting the Business Model Canvas approach [6].

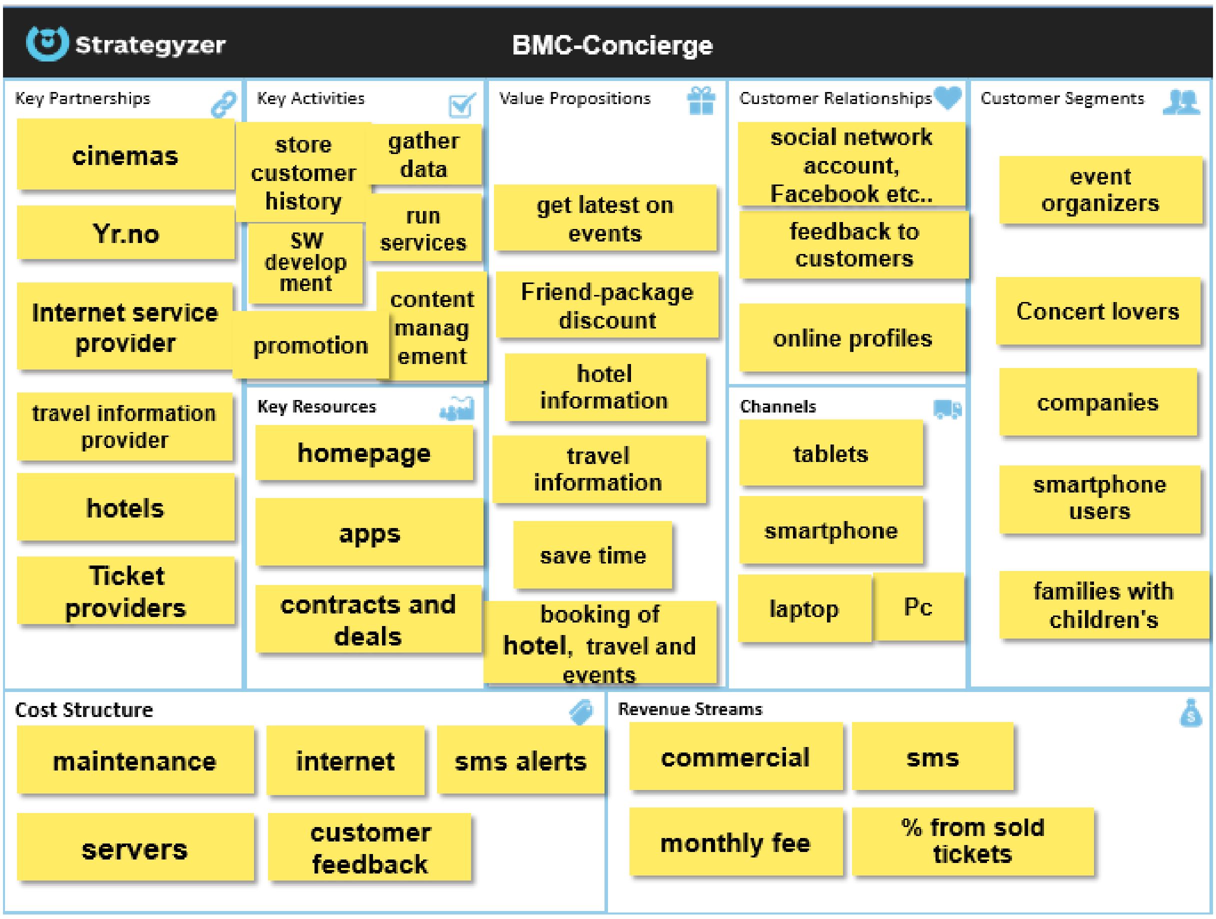

Figure 4: Business Model for Concierge.

An overall business model context is provided, as the basis for further focus on measurements. By implementing an example, the context is created and the definition of Value Proposition and Customer Segments is also created.

Figure 4 illustrates a Business Model Canvas implemented for Concierge. The importance of this implementation is that all the relevant building blocks are defined in relation to each other and in relation to Concierge. The most important building block defined in relation to Concierge, are Value Proposition and Customer Segments. The acquired contextual information by implementation of Business Model Canvas on Concierge, leads to the next step which is a description of Customer Segments and Value Proposition in isolation. Isolation of value proposition and Customer Segments from Business Model Canvas allows an examination at a more detailed level. This purpose is further served by the Value Proposition Canvas and the next section looks at this canvas in more details.

2.4.2 Value Proposition Canvas for Concierge

In section 2.2, the Value Proposition Canvas was described as a plugin to the Business Model Canvas. The building blocks for this plugin are Value Propositions and Customer Segments. These blocks were defined in the previous section during implementation of the Business Model Canvas for Concierge. In this example, the details of Value Proposition and Customer Segments from the Business Model Canvas are granularly defined and relations between them are visualized. Figure 5 illustrate the Value Proposition on the left side and only one of the segments from Customer Segments is highlighted on the right side, which is Concert-lovers. This Canvas gives an easy understating of the relatively complex interaction between the offers and the needs that otherwise would have been hidden under the hood.

The relation between the Value Proposition and one of the customer segment taken from the Business Model Canvas from the previous section, are visualized in Figure 5.

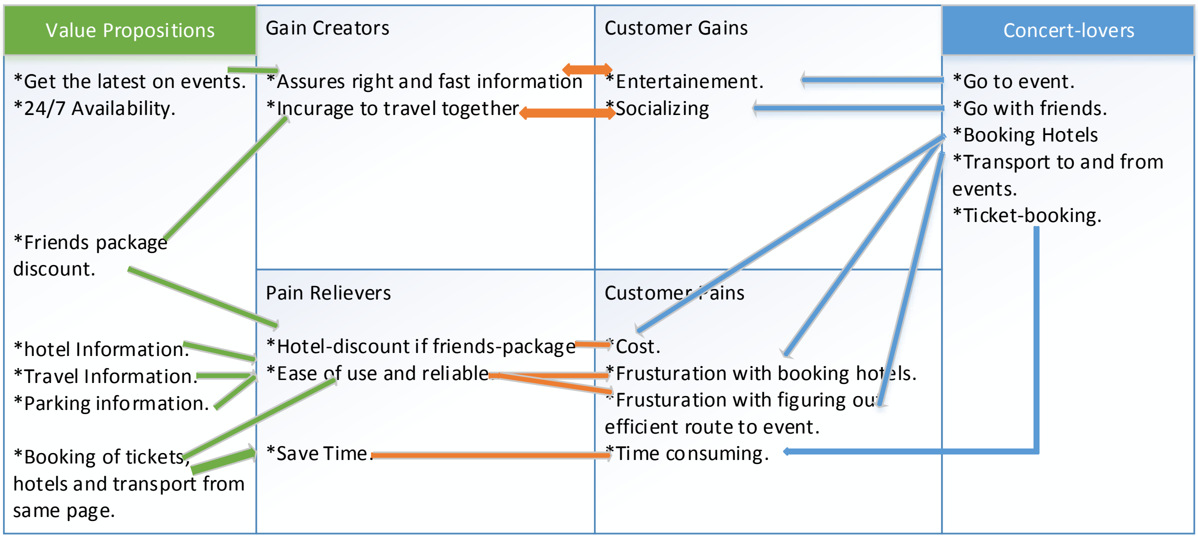

Figure 5: Product-Market fit for Concierge.

Figure 5 shows the fitting between the Value Proposition and the customer segment called Concert-lovers. This canvas illustrates that a product market fit has been achieved. This canvas allows designers to make a model that has more chances to survive in the market because every Value Proposition being offered has a fitting demand. The illustration of how Value Proposition and Customer Segment are fit together on a deeper level allows designers to see the underlying relations between the offerings and the needs. This allows a more detailed and planned approach.

2.4.3 ServiceMIF for Concierge

This section aims to implement the first two stages of ServiceMIF for Concierge. The implementation shall highlight the processes referred to in chapter 2.3 alongside with the supporting service models.

2.4.1.1 DIScovery

This stage highlights two aspects.

1. The customer journey.
2. The provider process.

The points where customer and the provider interact is illustrated in **Figure 6**.

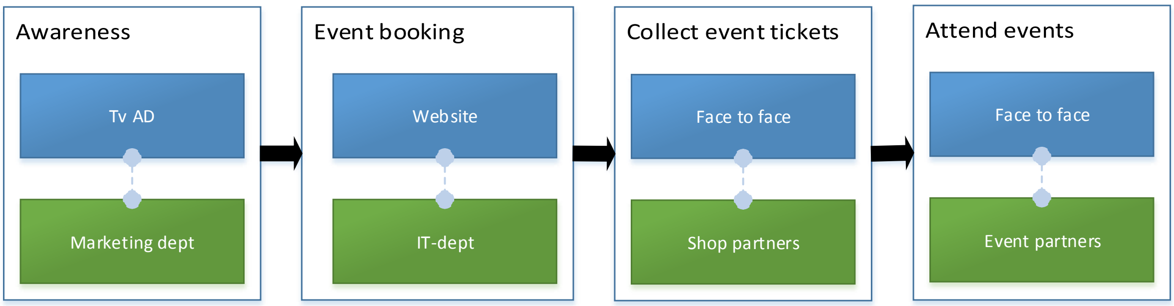

Figure 6: Implementation of DISSECT stage 1 on Concierge.

The touch points [4, p. 19] in blue illustrate the points of view of the customer and the touch points in green represents the provider. These four touch points map the journey the customer will make from becoming aware of Concierge to the moment the customer has attended the events. On the other hand, green blocks represent the provider process which makes it possible to deliver value to the customer at every touch point.

2.4.1.2 Solicitation

This section highlights only one of the touch points from the previous section, **Event booking**. The service model tool in this section is called Value Articulation Model. This model maps the Value Benefits, customer gains from using this service. Value Benefits are either functional or non-functional, **Figure 7** provide the image of the template that describes the Value Benefit and relate them to value proposition and their quality attribute. Illustrated Quality attribute have only a textual value.

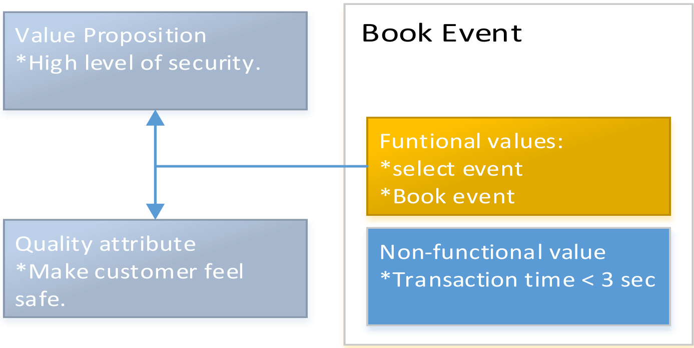

Figure 7: Implementation of DISSECT stage 2 on Concierge.

This section completed the last framework of the three on concierge. The next section introduces the CITI-SENSE project and later sections describe implementation of the same three frameworks on this project.

2.5 CITI-SENSE

The CITI-SENSE project is a project partially funded by the EU in collaboration with countries in Europe, Asia and Australia[7]. The project is meant to be driven by citizens of the respective countries, meaning that citizens will provide feedback from mobile and static sensors to make an overall environmental picture of their surroundings. Their role is to provide data from sensors they carry to give a real-time data about environment. This data ranges from air-quality, UV-radiation, pollen, indoor air-quality to noise pollution. Beside the aim of improving quality of life, the project also aims to;

1) Raise environment awareness of the citizen, 2) raise user participation in societal environmental decisions, 3)provide feedback on the impact that citizen had on decisions [7].

The CITI-SENSE project is an example of a situation where it is important to have a clear definition of the value propositions that the results of the project will offer, and support also after the end of the project. It is thus used as a representative example for the analysis of the requirements for descriptions of measurable value propositions.

A Business Model Canvas is implemented for CITI-SENSE in the next section with a focus on the description of Value Proposition and Customer Segments.

2.5.1 Business Model Canvas for CITI-SENSE

A business model for the CITI-SENSE project is presented in **Figure 8**. The model presents all the relevant building blocks for presenting the business context, defining the Value Proposition and the Customer Segments.

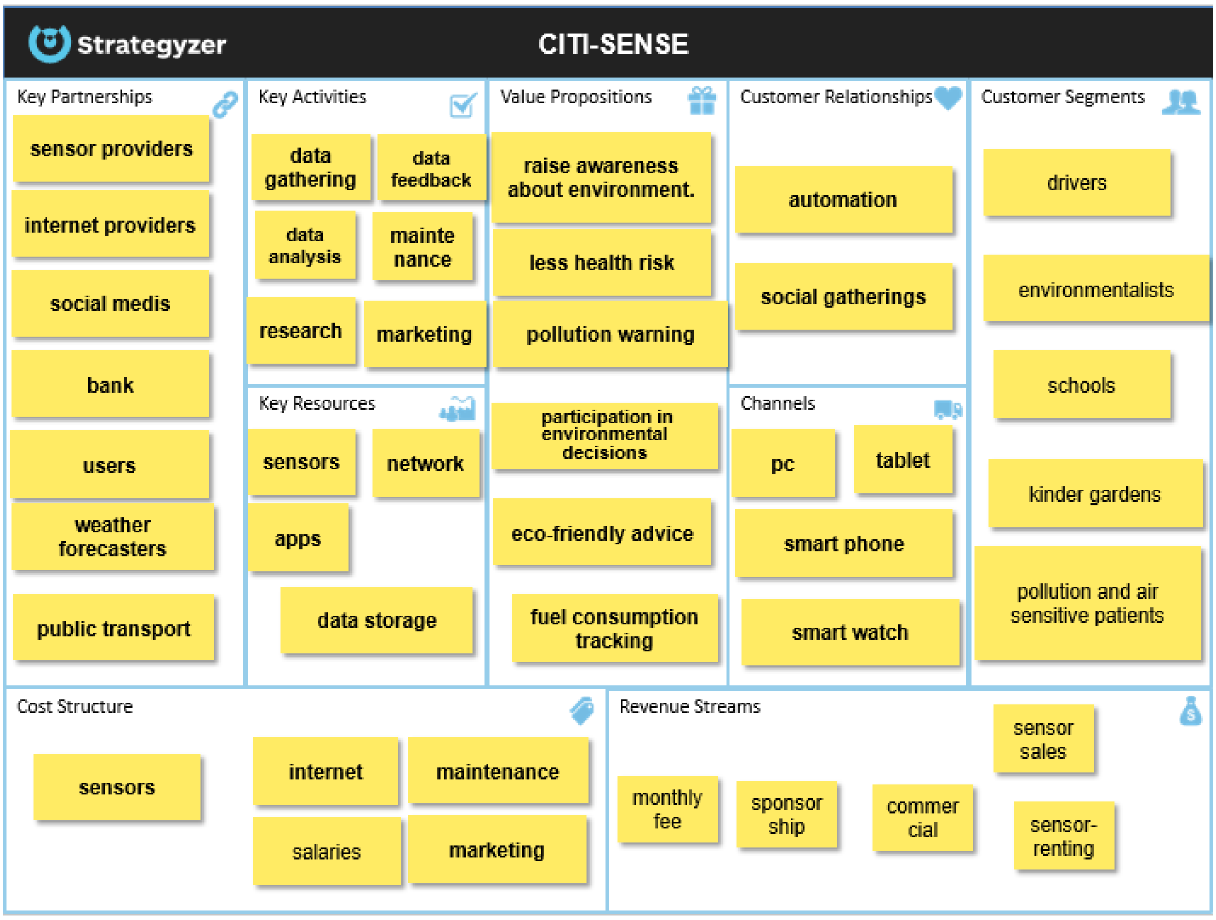

Figure 8: Business Model of CITI-SENSE.

Value Propositions and Customer Segments are defined and can be further elaborated in the Value Proposition Canvas to map the relations between the offerings and the needs.

2.5.2 Value Proposition Canvas for CITI-SENSE

The Value Propositions and the Customer Segments defined in the building-blocks from the previous section are further segmented in this section. The segmentation is illustrated in **Figure 9** below. Beside segmentations, figure 9 also illustrates that one Service/Product can point to multiple elements in the boxes for Pain Relievers and Gain Creators**.** Similarly, point from **Customer Jobs (right side box)** can point to multiple elements in the boxes for **Customer Pains** and **Customer Gain**.

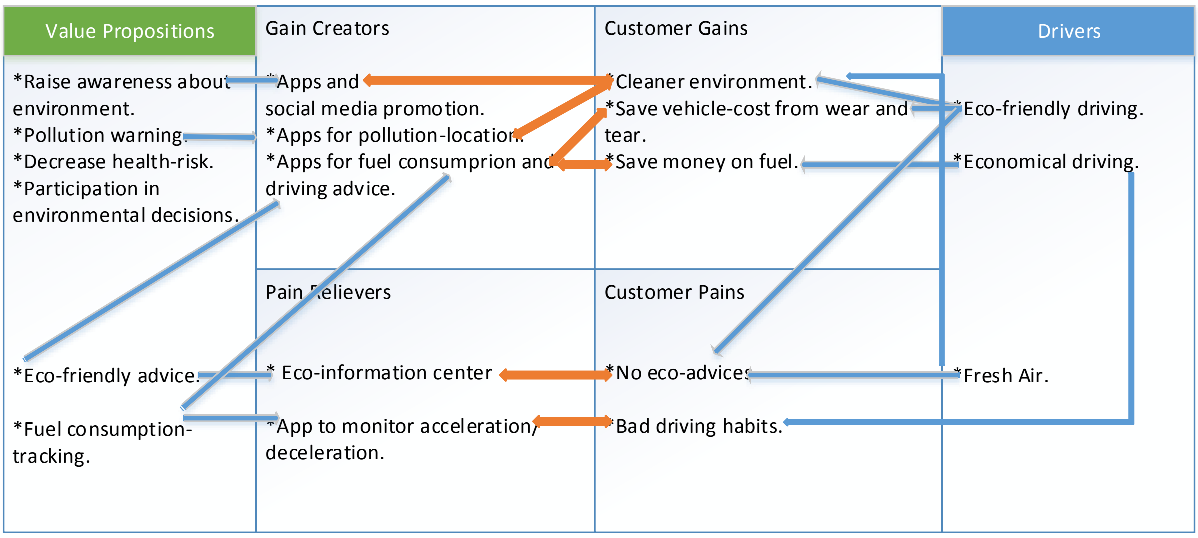

Figure 9: Product-Market fit for CITI-SENSE.

Figure 9 puts the necessary elements together to finish the product market fit. This model allows to visualize the demand and the offerings with higher granularity.

2.5.3 ServiceMIF for CITI-SENSE

This section implements the first two stages of ServiceMIF on the CITI-SENSE.

2.5.3.1 DIScovery

Figure 10 highlights customer journey and provide a process needed to propose the value benefits from the provider to the customer. The process involves a stage from where the customer becomes aware of the service to the stage where the customer contributes with data for a greener environment.

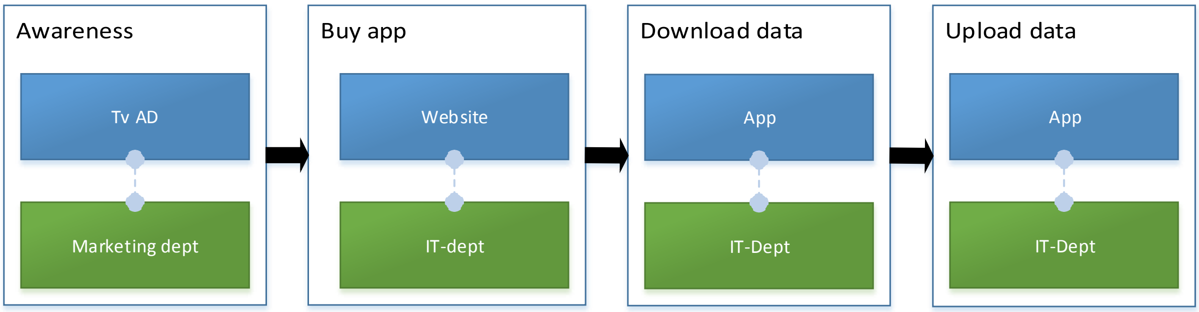

Figure 10: Implementation of DISSECT stage 1 on CITI-SENSE.

2.5.3.2 Solicitation

This stage highlights one of the touch points illustrated in the previous section. The touch point in question is **Buy App.**

This stage describes the fundamental elements in the touch point mentioned above and how they describe the Value Benefits for CITI-SENSE. The elements in this touch point are functional Value Benefits (Orange color), non-functional Value Benefits (Blue color), value proposition and quality attribute. **Figure 11** illustrates this touch-point.

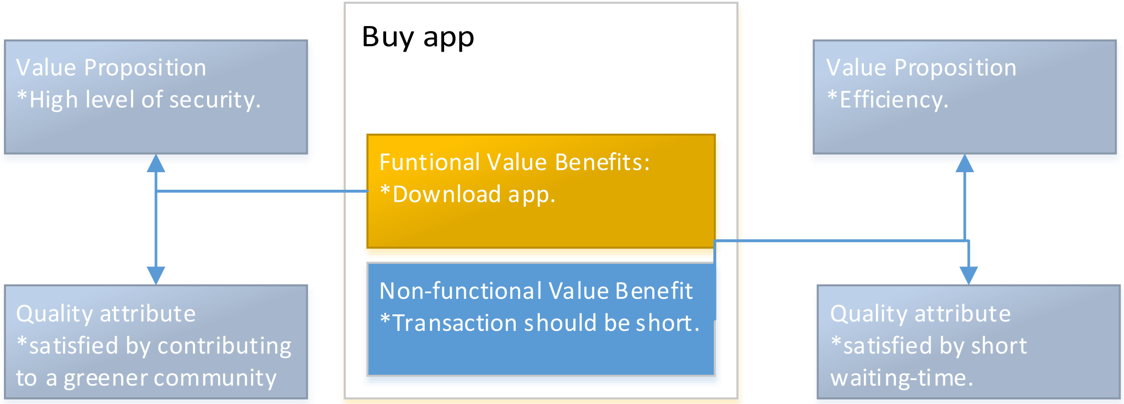

Figure 11: Implementation of DISSECT stage 2 on CITI-SENSE.

Both the functional and non-functional Value Benefits point to their Value Proposition and their quality attributes.

What this example illustrates is the breakdown of the interaction between the provider and the customer. It further categorizes the Value Benefit as functional and non-functional. The gray boxes describe the Value Propositions this Value Benefit is subsets of, and the type of Quality Attribute presented by the Value Benefit to the customer at this interaction point. All the defined frameworks have been implemented on Concierge and CITI-SENSE. The next section of this paper will look at implemented frameworks and defines the problem this thesis will address in next part of this thesis.

2.6 Evaluation and problem definition

The frameworks described in the previous sections served different purposes. The Business Model Canvas in section 2.1 described all the building blocks needed for a business model and defined the Value Proposition and the Customer Segment for Concierge and CITI-SENSE.

The Value Proposition Canvas in section 2.2 was built on the building blocks defined in the Business Model Canvas, and described the product market fit in more detail between the value proposition and a the customer segment.

Section 2.3 described ServiceMIF to explore the opportunities to develop or improve services.

The use of frameworks on Concierge and CITI-SENSE as examples served the following purposes.

1. Use of frameworks on examples provided operational details of the frameworks in use and the context of the value propositions.
2. With different company and project, there were different points of view like partners, customer and value proposition. This approach helps generalizing the problem to derive requirements from in the next chapter.

What can be observed from the examples above is that none of the frameworks had any approach which includes measurements for either to measure performance or efficiency of their products or services. Besides lacking measurements on internal performance, also measurements of customer satisfaction are missing from these frameworks.

The next section describes problems or shortcomings with the models above and defines the problem this thesis will address in the coming chapters.

2.6.1 Problem definition

The challenge is that the business environment is continuously changing. To know how this change will affect the value proposition, a framework is needed that allows monitoring changes and assuring that changes in the business environment are also taken into account while designing or redesigning the value proposition.

An observation from the example analysis of Concierge and CITI-SENSE is that the frameworks in use can implement innovative business design, but lack the capability to measure value proposition.

The problem this leads to is that business designers are unaware of the position of their offerings in the market, this adds an extra layer of uncertainty to their businesses resulting in design of products or services that no one would like to purchase.

Observation from the examples above reveals the following for the frameworks:

1. They do not aim to measure performance of their Value Proposition.
2. They do not aim to measure acceptance in the market, for example how satisfied customers are with the offered Value Proposition.

A combined statement on the two issues above, leads to the problem definition stated as:

How to be sure that the business model with its value proposition will meet the needs of the customers in a continuously changing business environment.

The defined problem tells what is missing from exiting frameworks. To address the defined problem, it needs to be analyzed further into requirements. The purpose of the next chapter is to define those requirements.

3 Requirement to solution

The previous chapter defined the problem. This chapter highlights the requirements needed to be fulfilled to address the defined problem.

The requirements in this chapter are divided in to 7 categories. Every category addresses a part of the problem defined in the previous chapter.

The name of every sub-chapter below is described as an acronym to identify the requirements it represents. As an example, sub-chapter for Business Model has BM-1, BM-2 etc. as acronyms for its requirements.

The 7 categories the requirements have been divided into are:

1. Business Model (BM).
2. Product Market Fit (PM).
3. Technical Requirements (TR).
4. Measurements (M).
5. Customer Satisfaction (CS).
6. Process (P).
7. Visualization (V).

3.1 Business Model (BM)

Even if the focus of this thesis is mainly on measurements of value proposition, it will not make any sense if the context of the value proposition is left out. Context in this case is set by a business model that includes both Value Proposition and Customer Segments. Another reason for having a business model is to allow an innovative business-design for addressing the challenges of a continuously changing business environment.

Requirements for business model are as follows:

BM-1: Business model visualization: This requirement is meant to give a bird's eye view of building blocks in a business model, making it easier to see the relationship between different blocks and how these blocks depend on each other.

BM-2: Customer Segments: Customers are the center of attention of all businesses, in this case there is no exception. Just as much as defining a product or service, a customer needs to be defined also.

BM-3: Value Proposition: Value Proposition is the heart of a business model, achieving measurements of value proposition cannot be done without having a value proposition to refer to. A well-defined building block for value proposition is required and should give an overall organizational context.

BM-4: Ease of use: Business modeling tool must be simple enough to be implemented by non-technical staff.

3.2 Product Market Fit (PM)

To address the problem defined in chapter 2, the relation between customer and provider is required. To make this fit possible, a granular approach is needed to break down customer needs and offers. This leads to the detailing of building blocks defined in the business model, namely Value Proposition and Customer Segment. The requirements below highlights the needs for product market fit.

PM-1: Granular definition of Value Proposition: The components of Value Propositions are broken down to their fundamental parts.

PM-2: Granular definition of Customer Segment: Describe what customer needs are for a certain customer segment and break them down to their fundamental parts.

PM-3: Visualize offers and needs: Visualize the fit between offering being made by provider and the needs that customers have.

PM-4: Functional Value Benefits: This categorizes offerings in Value Proposition as being functional. This means that the value benefit being offered cover a functional need. To realize customer satisfaction, it is important to know what type of values-benefit the customer is satisfied with. This adds another level of segmentation by breaking down the Customer Segment and the Value Proposition to understand them on a more granular level.

PM-5: Non-functional Value Benefits: This is in contrast to the functional requirement above. This allows to describe offerings in the Value Proposition as being non-functional. This means that the benefit being offered will satisfy the customer emotionally and from various quality perspectives.

3.3 Technical Requirements (TR)

To make it possible to measure Value Propositions, it is essential to convert requirements from business requirements to technical requirements. This section puts emphasis on such requirements and requirements to make this tool interoperable.

TR-1: Convert Value Proposition to technical requirement: Product market fit described in previous section should be refined down to technical requirements to make measurements possible.

TR-2: Exchangeable data format: Framework must be able to export data in interchangeable forms, such as CSV (Comma Separated Values), XML or similar. This allows data from models to be processed by other systems, allowing capabilities beyond a single framework.

3.4 Measurements (M)

The technique for measurement is the very focus for measurable value propositions. To make it possible to measure technical requirements, certain values have to be defined. Requirements to make measurement possible are listed below.

M-1: Measurable attributes: Technical requirements must have attributes to measure their performance.

M-2: Goal defined in measurable value: This will define what measurable values have to be achieved to reach the target.

M-3: Scales and meters: Must have scale to set the reference value, and a respective unit to tell where on the scale a certain attribute is.

M-4: Interoperable Measurement Template: Proposed template as solution should be operable with ServiceMIF framework.

M-5: Time for task: Framework must include time for achieving the set goals.

M-6: Benchmark: To have an understanding of relative position of offerings being made, a benchmark-value is needed. Every element in the value proposition has to be converted to a technical requirement and every technical requirement must have a measurable value. This value alone does not make any sense, therefore it has to be compared to a benchmark-value to highlight the state of performance of the offering.

M-7: Multi-Valued Measurement: Must be able to have different sets of values to operate with. For example good or bad, or different kinds of numerical values.

3.5 Customer Satisfaction (CS)

Customers are the core that businesses evolve around. Having measurement of the customer satisfaction with offerings that are being made, can provide important information to check if a customer is going to return or not. This information can be essential to decide future directions of the business or non-profit organizations.

CS-1: Customer Satisfaction Measurement: A reliable and simple method to measure customer satisfaction is important.

CS-2: Measuring User Experience: How the users interaction with the system is, should be measurable.

3.6 Process (P)

To know what elements to work with is one thing, but how to work with the elements, is another matter. To implement anything, a process is needed to describe step by step actions for achieving the goal. Thus, the implementation of the business process is not an exception.

Besides having to describe a process for implementation, a need for continuous improvement is also there. This need can be addressed by having a process-design that allows either iterative implementation of new business designs or an iterative improvements of existing business designs.

P-1: Business Modeling Process: It must be able to give a clear indication of what to do and in which sequence.

P-2: Iterative design: Design implementation in iterative fashion to allow business designers to measure their attributes in one iteration at a time, which in turn produces before and after results that can be compared.

3.7 Visualization (V)

Presenting data in a visual form can be easier to understand than a presentation of values in a matrix with numbers. This allows data to be viewed and decided upon much faster, by adopting this approach, a more efficient process of decision-making can take place.

V-1: Statistical Visualization: Processed data must be presented as a graph.

V-2: Regression model: Should visualize relation between customer satisfaction and provided offers.

4 Evaluation of existing solutions

This chapter will evaluate existing solutions, and describe them in relation to the requirements described in previous chapter. Every requirement for existing solution will be classified as being

0- Not fulfilled.
1- Partially fulfilled.
2- Is fulfilled.

The relevance of exiting framework depends on how well they fulfill the defined requirements. The framework in question is somehow related to business model innovation, business improvement or measurements. Three frameworks has been identified and selected as suitable candidates that can potentially meet the stated requirements, they are:

1. Value Delivery Modeling Language (VDML) [8].
2. PLanguage [12].
3. Quality Function Deployment (QFD) [14].

The frameworks of the Value Delivery Modeling Language and Quality Function Deployment are referred to by their acronyms of VDML and QFD. The frameworks mentioned above are described in coming sections.

4.1 Value Delivery Modeling Language

The Value Delivery Modeling Language (VDML) is a language developed for analysis and design with a focus on value-creation and exchange [8]. What makes this language unique is its ability to show value-flows through all building blocks involved. A Business model framework of VDML is built on seven dimensions, these dimensions are again based on the Business Model Innovation Cube (BMI-Cube) [9]. Dimensions mentioned can be viewed as building blocks in Business Model Canvas, described in chapter 2.1. Every building block in BMI-Cube has a diagram. **Figure 12** below illustrates the idea of these building blocks, and their diagrams.

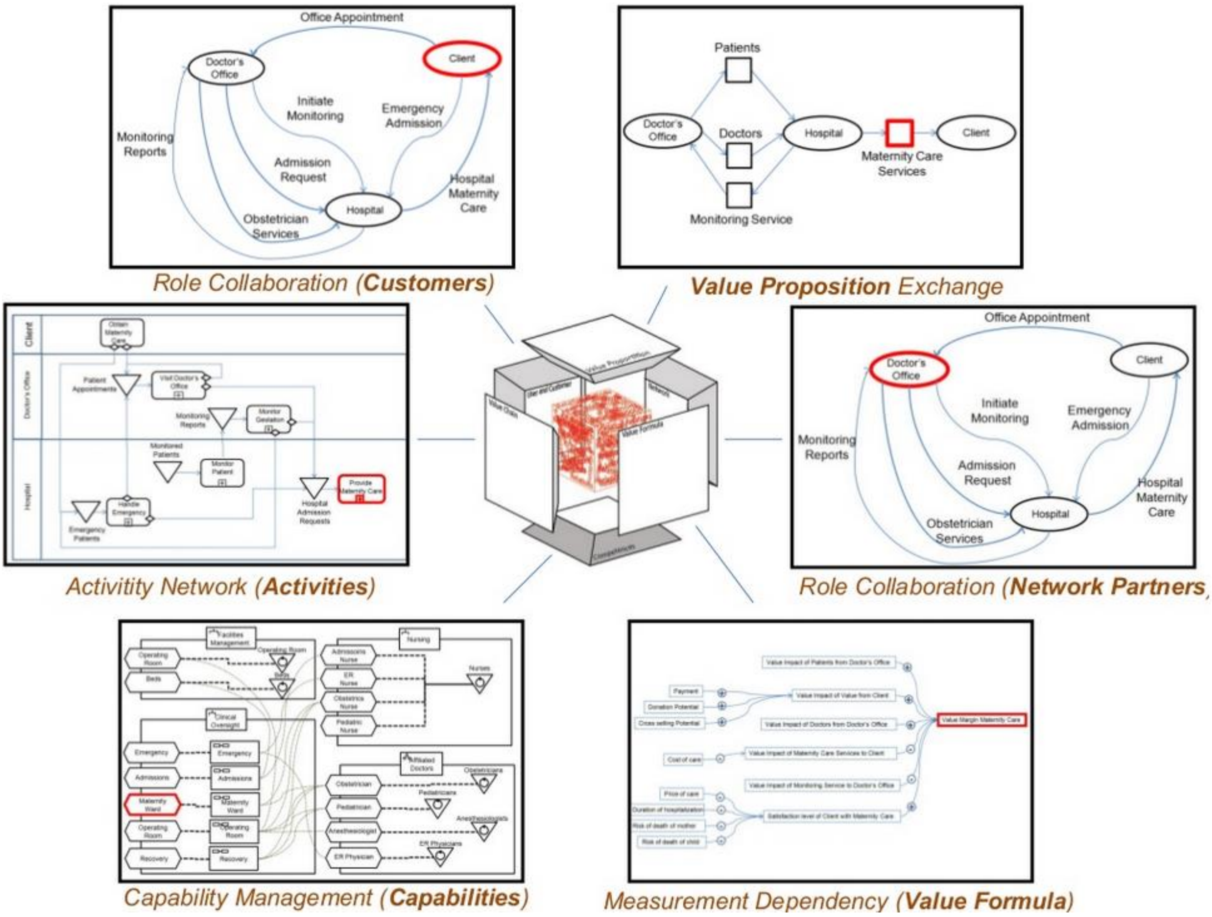

Figure 12: Conceptual Model of VDML.

The building blocks describe the basic elements in a business model. Unlike the building blocks from chapter 2.1, the building blocks in BMI-Cube allow business designers to go a step further down by working on diagrams representing every building block. The building blocks highlighted here are Customer, Value Proposition, Activities, Capabilities, Network Partners, Value Formula, and Relation between the blocks. A short description of these blocks diagram is given below as an extended explanation of **Figure 12** above.

Customers: Defined as someone who is party in a business network [10]. Diagram to model relation between customers and other stakeholders in VDML is called Role Collaboration Diagram.

Value Proposition: Value Proposition is not much different for VDML than Value Proposition in chapter 2.1. The only difference is that *"VDML expands the concept to Value Propositions offered between roles in a collaboration. [10]"*. **Figure 12** describes the value proposition as a unit of value being exchanged between the roles. Diagram used for mapping Value Proposition is called "Value Proposition Diagram".

Activity: Defined as Capabilities library in VDML [10], they describe the most important things a company must do. Diagram used for mapping activities is called "Activities Network Diagram".

Capabilities: Include resources and activities needed for capabilities to produce value. Diagram for this building block is "Capability Management Diagram".

Network Partners: Defines a range of business relationships. Diagram in VDML for modeling these relations is "Role Collaboration Diagram".

Value Formula: A measure that combines certain factors in a model to provide monetary profit or non-monetary positive values. The model for this measurement in VDML is called "Measurement Dependency".

Relation between building blocks: Relations between building blocks is the main characteristic that makes VDML unique. This relation is viewed as seventh dimension of the BMI-Cube [9]. Benefit of this relation is that all the inter-relations can be traced. Action on one building block can give away what consequences it will have on other building blocks.

4.2 PLanguage

In a continuously changing business environment, adaptability is essential to survive. Adaptation is defined as

Something that is changed or changes so as to become suitable to a new or special application or situation [11].

To be suitable to a new or special situation, feedback from environment is crucial. This feedback determines the direction a company should evolve toward.

To address the challenge of adaptation of a business in a changing business environment, Planguage [12] was developed. Planguage is described by a specification language and a process description.

PLanguage Specification language *is used to specify requirements, designs and project plans [12, p. 9].* Specification Language is further divided in three subsections

1. **A set of defined concepts:** meaning goals, functions and objectives to reach.
2. **A set of defined parameters and grammars:** defining parameters with scale and meters and other grammar to have clear understanding of terms in use and to avoid ambiguity.

Process description *provide recommended best practice for carrying out certain tasks [12, p. 4].* Process description provided by PLanguage consists of following processes:

1. **Requirement Specification:** Describes what stakeholders want system to do.
2. **Design Engineering:** To provide a design that is fit for purpose and fulfills requirements.
3. **Specification Quality Control:** Specifies rules to detect errors while communicating technical requirements and error detection or preventions.
4. **Impact Estimation:** Provides views from different implementations of design to give best possible estimation of impact by certain design on defined goals and budget.
5. **Evolutionary Project Management:** used to deliver best possible value in iterations.

PLanguage provide tools and techniques that assures best possible quality on feedback, impact estimation certain decisions will have, and a process to continuously adapt to changes.

4.3 Quality Function Deployment

Traditionally in western companies, the focus has been on improvements and efficiency at product and service levels. This has led to various departments dealing with specific types of problems during production and after. Since certain departments were given the task to assure quality control, it inherently caused a drawback of not having a sufficient structure that gave Company Wide Quality Control (CWQC) [13]. Quality Function Deployment - also known as QFD - on the other hand is based on CWQC [14]. What makes QDF special is that it operationalizes CWQC. QFD is well known for connecting dots between customer requirements and operational requirements, but in fact it is much more than that. Beside mapping customer requirements to technical requirements, it also provides a product development process from customer needs to manufacturing operations [14].

Since QFD is a process, it will continue to build on output information from one stage as input to next. The stages QFD have are illustrated in **Figure 13**.

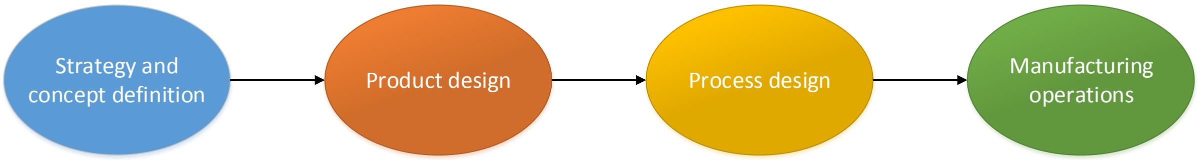

Figure 13: Quality Function Deployment Process [15].

Strategy and concept definition: In this stage, customer requirement are gathered and translated to technical requirements. This is done by using House of Quality matrix. Output from this stage will be used as input to **Product Design** stage.

Product Design: This stage is driven by engineers as output from previous stage was converted to technical requirements. This stage will identify parts and assemblies needed to meet requirements. When the necessary items for meeting requirements are defined, this information will be passed on to next stage, namely **Process Design**.

Process Design: Items defined in previous stage are not enough to complete the tasks; a process is needed to define sequence of events to achieve objectives derived from customer needs.

Manufacturing operations: This stage covers the organizational role, meaning that it will cover everything needed for implementing the plan. Typical activities will be training, production planning, maintenance etc. [15].

The next section covers the first stage in QFD methodology; first stage will cover all the steps in House of Quality (HOQ). Since all four stages are repeated on HOQ type template, it leaves out the necessity of repeating all stages to make almost similar point. How the overall process is, will be described last, focus next is on description of HOQ and an implementation of it in later sections.

4.3.1 House of Quality (HOQ)

House of Quality maps the first step of customer requirements to technical requirements. **Figure 14** illustrates the overall design of HOQ alongside with description of every one of the six blocks it is composed of.

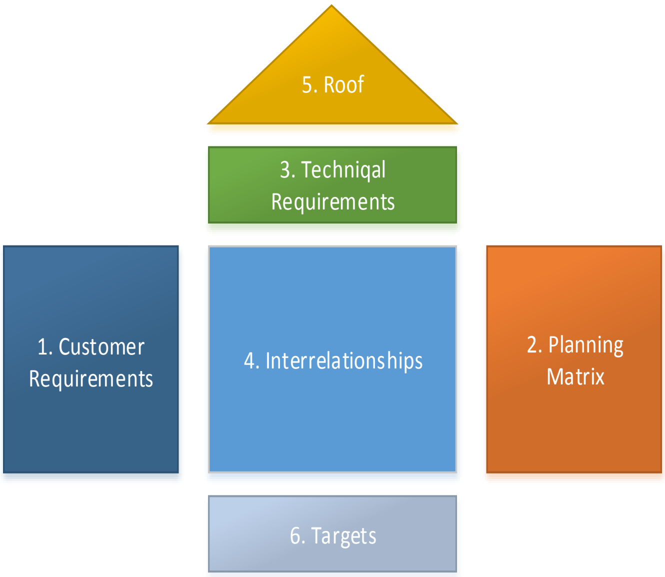

Figure 14: Components of House of Quality.

1. Describes requirements from customer segment. If a car-design is taken as an example, a question that can be asked is **"what kind of car would customer in a particular segment like to have?"** Requirements can be safe, fast, light, economical etc.
2. The planning Matrix has two functions, quantify customer requirement and priorities perception they have of already existing solutions. Data in this matrix is filled by customers using survey.
3. In this step, customer requirements are made to technical requirements. This is the phase where language of the marketing department is modified to allow engineers to understand it.
4. This is a two dimensional matrix, one dimension represent customer requirements and the

   other represents technical requirements. The relation between customer requirements and technical requirements are mapped in this matrix. This highlights which technical requirement belongs to which customer requirement.
5. Function of the roof is to highlight correlation between technical requirements.
   - Positive correlation means that improvement of one technical requirement will improve another it correlates positively with. This relation is indicated by a symbol of +.
   - Negative correlation means, improvement of one technical requirement will deteriorate another. This relation is indicated with a symbol of -.
   - Neutral correlation means, no impact at all between the requirements being compared. There is no symbol for this, therefore the box is kept empty.
6. This is the last block in QFD, it sums information from all the previous points. It focuses on
   - Technical priorities: Refers to, which technical solutions will be chosen as best suited to address customer requirements.
   - Competitive benchmark: Chosen technical requirements are compared to what the company provides and what the competitors are providing.
   - Targets: New information gained by House of Quality defines the targets, and provides a benchmark objective for the new products.

Mapping the HOQ is just the beginning, this provides the necessary steps to extract relevant information.

Certain signs of HOQ are missing in explanation above, to fully grasp the idea of QFD, an example is implemented in coming section.

4.3.2 Quality Function Deployment Example

This section implements a simple example using QFD, implementation describes the first stage for a car manufacturing process using House of Quality.

Symbols in HOQ are described before implementation of the model.

- Doughnut shape represents a strong association and has a value of 9.
- Filled circle describes association of medium strength and have value of 3.
- A filled triangle represents a weak association, and has a value of 1.

Symbols representing strength are used to characterize relation between customer requirements and technical requirements. These symbols belong to step 4 in HOQ.

Symbols highlighted in this paragraph represent correlation between technical requirements. These symbols are used in step 5 of HOQ. Symbols are described on the left side below.

- This symbol represents a strong positive relation between the technical requirements.
- \+ Represents a weak positive relation.
- − Represents negative relation.
- Represents a strong negative relation.

Description of HOQ is complete at this stage, **Figure 15** illustrates the implementation of HOQ from stage one of a car manufacturing process.

Every step in **Figure 15** is numbered in accordance to **Figure 14** in section 4.3.1, the implementation will highlight the strengths and weaknesses of this methodology for the next section.

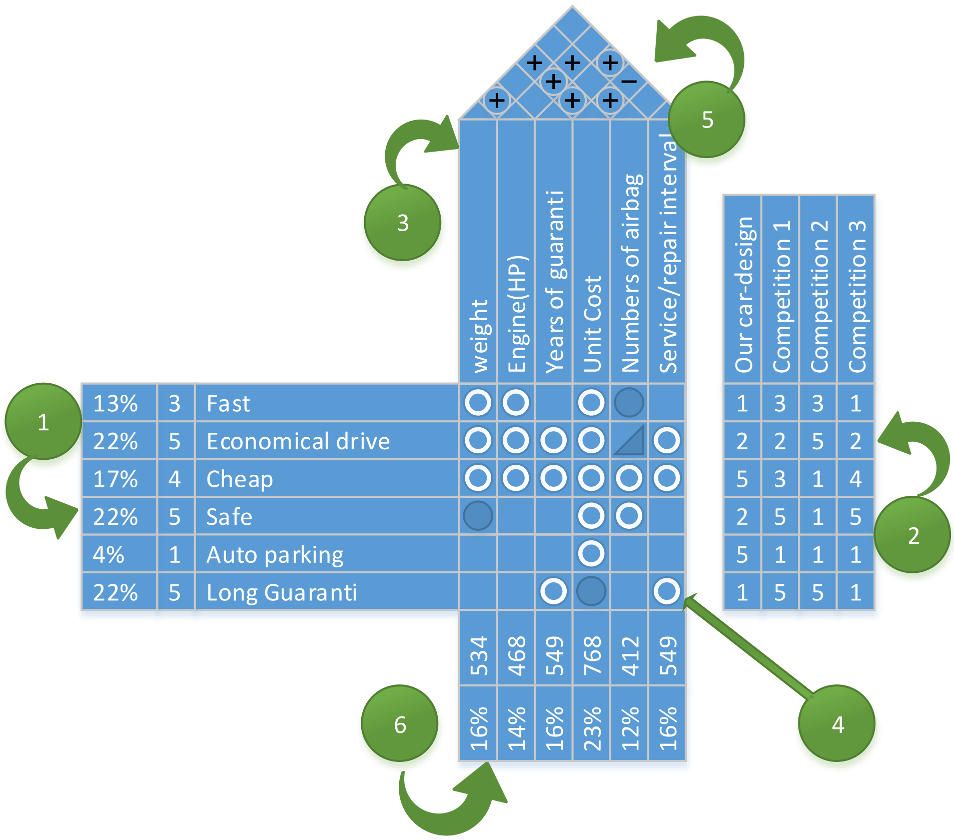

Figure 15: Example implementation of House of Quality on a car design.

Figure 15 is explained step by step, ranging from step 1 to step 6.

1. This step has three columns, starting from right side with customer requirements. Relevant requirements from customers are present in this column, and these requirements will set the guidelines for development process. Mid-column describes the priorities customer attaches to these requirements, 1 representing low priority and 5 as high priority. Last column represents value from mid-column as a percentage.
2. This step highlights performance of company's already existing car (If there is one) and their competition; this matrix is also filled with customers. Benefit of this matrix is that it allows designers to see their products compared to their competitors, through the eyes of their customers. Equipped with this information, designers can see where to make improvements to satisfy customer needs. Matrix in step 2 allows comparing values of customer needs from step 1 with values of offerings by respective company as well as competition. This matrix highlights weakness in exiting offerings and improvement based on this information can satisfy customers as well as strengthen position of product compared to competition.
3. Six technical requirements are defined in this step. These requirements must give technical interpretation to customer requirements defined in step 1. These requirements can be more, but are kept low for sake of simplicity. The point to observe is that all technical requirements are quantifiable.
4. Bits and pieces in this step, start giving meaning. This section maps relation between requirements of step 1 and 3. Relation between them can be strong, medium or weak as described in the beginning of this section. **Figure 15** illustrates that for every improvement made to customer requirement; there will be increase in production cost of every unit, also for those with a medium strength.

5. This step highlights the correlation between technical requirements. Two examples are highlighted.
   1. The correlation between the **Weight** and the **Engine** is symbolized as strong positive, meaning that an increase in weight will also require an increase in engine-power.
   2. Correlation between **Cost of unit** and **Service Interval** is symbolized with a weak negative relation, meaning that an increase in a cost of unit will decrease the intervals for service or repair. A possible explanation can be that an expensive car will have better materials and therefore require less repair or service.

   The benefit of these correlations is that designers easily can see which requirements work together and which works against each other. This information helps them to choose technical requirements to work with, based on performance enhancement and helps avoid pitfall of improving one requirement on expense of another.

6. This matrix is filled with values that reflect a combination of values from step 1, 3 and 4. Earlier definition of symbols in beginning of this section described, doughnut, circle and triangle with values of 9, 3 and 1. Every column in step 4 has either one of these symbols or none. These values are multiplied by percentage value on the left from step 1, and vertically summed to give the final sum in target matrix. Example, starting from four customer requirements fast (13%), economical drive (22%), cheap (17%) and safe (22%). These requirements have their percentage point calculated and will be multiplied with values of symbol they represent in the same row, and finally they are added together vertically for final sum. The sum for four example-values from first column looks like this
   Fast (13 * 9) + economical drive (22 * 9) + cheap (17 * 9) + safe (22 * 3) = 534. These values determine importance and prioritization of each requirement. Reason why only four of the six requirements are illustrated in the example is that the other two customer requirements do not have any relation to technical requirement being compared to, i.e. weight. The higher the sum is, the greater the importance of this requirement for the customer.

After the initial stage of QFD is completed, information from this stage is used in next step of the process which is Product Design. How process in QFD works, is described in next section.

4.3.3 Quality Function Deployment Process

The previous section described that output from first stage is used as input to next stage. These phases are not implemented because the process for doing so is not much different than the HOQ. What this section highlights is the concept of how information flows from start to end. **Figure 16** illustrates flow from requirements to development and quality control.

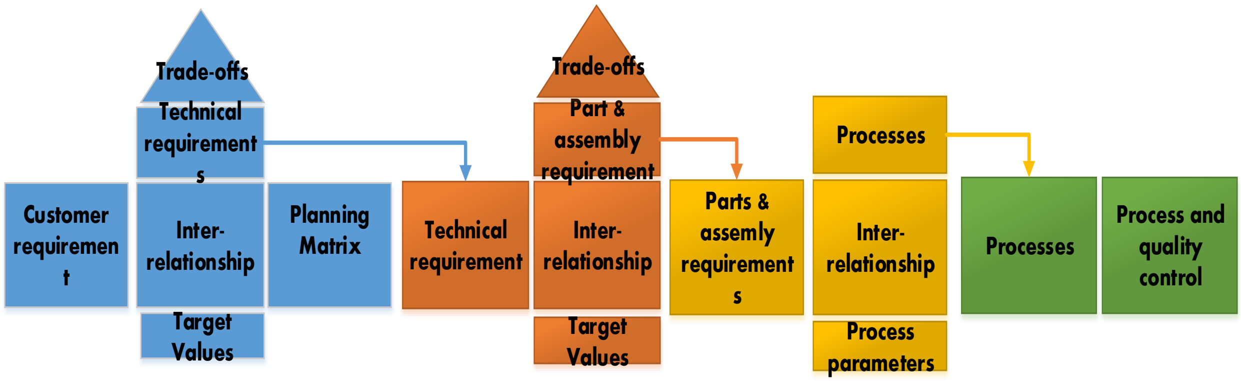

Figure 16: Quality Function Deployment process.

Figure 16 represents each process highlighted in the beginning of the previous section with the same sequence and color. Arrows in Figure 16 above describe how technical requirements used in HOQ are forwarded to the second stage. The second stage transforms technical requirements to parts and assemblies needed to fulfill customer requirements, and this information in passed on to the third stage where process are figured out on how to assemble parts together for a required product. In the last step, information is passed to the fourth stage where quality of process is established to assure that defined process delivers the quality required.

4.4 Evaluation

This section will describe existing solutions by rankings defined in the beginning of this chapter. The values for rankings are highlighted again as:

0- Not Fulfilled.
1- Partially fulfilled.
2- Is fulfilled.

The previous section describes three frameworks as alternative solutions. These frameworks will be ranked relative to requirements defined in chapter 3. The existing solutions are VDML, PLanguage and QFD.

Every requirement in this chapter is ranked according to the values above. The final sum of these values will determine which one of the frameworks that partially or fully satisfy the requirements. In case these frameworks do not score well on addressing the requirements, a new framework will be proposed.

Chapter 3 categorized requirements, and rankings on requirements are done according to those categories.

4.4.1 Business Model Requirements

The idea of having a business model is that it makes it easy to understand or develop business concepts. The requirements below have to be fulfilled by the frameworks in question to be properly qualified to address the defined problem from chapter 2. The table below describes requirements in the left column and existing solutions on the right side.

	BM Requirements	VDML	PL	QDF
BM-1	Business Model Visualization	2	0	0
BM-2	Customer Segment	2	1	2
BM-3	Value Proposition	2	1	1
BM-4	Ease of use	0	2	1
	Sum	6	4	4

Table 1: Business Model Requirements for existing solutions.

BM-1: Business Model Visualization: Is fulfilled by VDML, because this is the only language of existing solutions that have a canvas allowing a bird's eye view on all the necessary building blocks.

BM-2: Customer Segment: Definition of Customer Segment holds great importance to all business designs. All frameworks of existing solutions satisfy this requirement, either fully or partially. PLanguage falls behind a little because it does not define Customer Segments specifically; rather cover them under common name of, stakeholders.

BM-3: Value Proposition: Value Proposition is the heart of all businesses, but only VDML has a required Value Proposition block, which has the ease of visualizing and defining Value Proposition and connecting it to other building blocks. Value proposition can be defined in other solutions as well, but lacks overall organizational context it is being presented in. This is the reason why VDML outperforms other solutions with regard to BM-3.

BM-4: Ease of use: This requirement is not fully met by VDML because there are too many technical details to take into account. It has a canvas, six diagrams for all six building blocks that need to be connected to make sense, and on top of that, the process of adding values to elements in Value Proposition is a demanding one. The PLanguage top on this requirement because it can be used without much training and need of technical staff is not a necessity. The reason that QFD is in middle is that a full implementation of this framework will require technical staff as well as experts from different departments, making it a more complex operation.

4.4.2 Requirements for Product Market Fit

None of the existing solutions fulfill all the requirements for fitting product and market. PM-1 and PM-2 are covered slightly or fully, but most of the requirements are not satisfied.

	PM Requirements	VDML	PL	QFD
PM-1	Granular definition of Value Proposition	2	2	1
PM-2	Granular definition of Customer needs	0	1	2
PM-3	Visualize fit for offers and needs	0	0	0
PM-4	Functional Value Benefits	0	0	0
PM-5	Non-Functional Value Benefits	0	0	0
	Sum	2	3	3

Table 2: Product Market Fit for existing solutions.

PM-1: Granular definition of Value Proposition: Is well covered by VDML and PLanguage because they describe the value proposition early on in the design process and then breaks this down to its fundamental parts. QFD do not start with designing a value proposition, but rather build the value proposition from customer requirements later on in the process.

PM-2: Granular definition of Customer needs: The customer needs are well defined by QFD because this methodology is customers-oriented [14], everything developed in the QFD process is derived from Customer Requirements. Extra customer focus assures high ranking to QFD. PLanguage also have a method of breaking down customer needs to basic jobs. But it does not have a customer specific process; it treats everyone as stakeholders and therefore gets value of 1 for ranking. VDML does not have a clearly defined process for a detailed breakdown of Customer Segments to attributed that define them, therefore gets the lowest score in table above.

4.4.3 Technical Requirements

	Technical Requirements	VDML	PL	QFD
TR-1	Convert Value Benefits to technical requirements	1	2	2
TR-2	Exchangeable data format	2	0	0
	Sum	3	2	2

Table 3: Requirements for conversion from business to technical requirements.

TR-1: Convert Value Benefits to technical requirements: Is an essential component in any effort to measure. Rating for existing models depends on whether they have precisely defined methods to convert Customer Requirements to Technical Requirements. These methods are integral part of PLanguage and QFD, VDML on the other hand have the possibility to convert to technical requirement but lack a clearly defined process for that as PLanguage and QFD. For this requirement, VDML falls behind with value 1.

TR-2: Exchangeable data format: Is only covered by VDML, other tools cannot export data to be used in other system. This requirement is well covered by VDML.

4.4.4 Measurement Requirements

These requirements are fundamental to address for the stated problem in chapter 2; failing to meet these requirements will cause existing solutions to fail as alternatives to address the defined problem. First glance give away VDML as the weakest modeling tool among existing solutions. The only existing solution that covers all the requirements partially and fully is PLanguage or PL. The reason that PLanguage achieved the highest score is that it is made to quantify everything to make it measurable.

	Measurements Requirements	VDML	PL	QFD
M-1	Measurable attributes	1	2	2
M-2	Goal defined in measurable values	0	2	2
M-3	Scale and meters	2	2	2
M-4	Interoperable measurement template	0	2	1
M-5	Time for task	0	2	0
M-6	Benchmark	0	2	2
M-7	Multi-Valued Measurement	2	2	2
	Sum	5	14	11

Table 4: Requirement table for measurements.

M-1: Measurable attributes: All alternatives in question do cover this requirement, reason VDML is lacking is that there is no method or process that simplifies extraction of attributes from requirements.

M-2: Goal defined in measurable values: VDML can have attributes that can be measured, but does not define goals to reach, on the other two alternatives the situation is the opposite. QFD and PLanguage set clear goals to reach by organizations in question.

M-3: Scale and meters: Capabilities of adding scale and meters for purpose of measurement is present in all three alternatives.

M-4: Interoperable measurement template: By having a template that requires a minimum change in order to fit a different model increased efficiency can be attained. This capability is missing in VDML because every measurement process defined in VDML is comprehensive and hard to modify. QFD have templates that can be used over and over again, but this applies to the entire process, meaning that designers must complete the process they have started on before reusing templates. PLanguage has a single template that can be used both platform independent and project independent. This quality gives PLanguage an edge over other alternatives, therefore it has the highest value.

M-5: Time for Task: There is only one framework that allows time present tasks in a time related framework.

M-6: Benchmark: QFD and PLanguage have frameworks that define benchmarks.

M-7: Multi-valued Measurement: All three frameworks mentioned above have capability to use different units for measuring attributes.

4.4.5 Requirement for Customer Satisfaction Measurement

These are only two requirements, but some of the most important one.

	CS Requirements	VDML	PL	QFD
CS-1	Customer Satisfaction measurement	0	1	2
CS-2	Measuring User Experience	0	0	0
	Sum	0	1	2

Table 5: Requirements table for Customer Satisfaction.

CS-1: Customer Satisfaction measurement: VDML have no effective method to measure Customer Satisfaction. This causes it to be ranked lower than the alternatives. PLanguage has an evolutionary development-cycle; it continuously takes feedback and makes necessary changes to adapt to the environment. Feedback can be from customer, system or other goals designers want to achieve. This makes PLanguage a language for overall measurement, not particularly specific for Customer Satisfaction; this is why it has 1 as value. Customer Satisfaction is at center of QFD [16], it begins by collecting data from customer, also called voice of customer and focus all their effort on delivering best possible quality to meet those needs. This makes QFD superior with regard to this requirement.

CS-2: Measuring the User Experience: There is no clear guide for measuring User Experience for any of the alternatives.

4.4.6 Process Requirements

	Process Requirements	VDML	PL	QFD
P-1	Business modeling process	0	2	2
P-2	Iterative design	0	2	0
	Sum	0	4	2

Table 6: Table for Process Requirements.

P-1: VDML lacks a clear process of how to get from start to finish. It is arbitrary where a designer can start for making a business model, user can start from Value Proposition diagram or any other diagram belonging to the building blocks. Clearly defined process in VDML is missing. PLanguage and QFD have process to follow, therefore keeps the lead over VDML for this requirement.

P-2: Iterative development is only possible with PLanguage and solely keeps the highest score.

4.4.7 Requirements for Visualization

	Requirements for Visualization	VDML	PL	QFD
V-1	Statistical Visualization	0	0	0
V-2	Regression Model	0	0	0

Table 7: Requirement table for visualizing data.

None of the existing solutions has any capability to visualize statistical data or implement any statistical method like regression model.

4.5 Conclusion of Evaluation

Alternative Solutions	VDML	PL	QDF	Maximum
Sum points for ranking	16	28	24	48
Percentage value	33 %	58 %	50 %	100%

Table 8: Conclusion of existing solutions.

The table above illustrates how successful alternative solutions have been evaluated to satisfy requirements defined in chapter 3. The most successful alternative has been the PLanguage with 58% success rate.

Next part introduces a new concept of MVAP and checks it against the same set of requirements as above. PLanguage have set a benchmark of 58% on fulfilment of defined requirements, this becomes the target-value for MVAP to achieve. MVAP can only prove its relevance by having higher value than 58%.

II

CONCEPT, DESIGN & IMPLEMENTATION

5 Concept of MVAP

Part one covered all the requirements this thesis is trying to address and implemented some existing solutions for two examples, Concierge and CITI-SENSE. Efficiency of existing solutions was highlighted in table of chapter 4.5. As ranking of existing solutions suggested, PLanguage was best suited, but still there was a potential for improvement of 42%. This part of the thesis will cover an alternative solution as improvement over those solutions implemented in previous chapters. Benchmark value to target is set by PLanguage with 58% rate of covering requirements of chapter 3.

This part introduces the concept of a new proposal by this thesis work with **"A framework for Measurable Value Propositions - for Business and Service Improvement and Innovation"**, in short called for MVAP along with the design of MVAP, then considers the tooling support that is implemented and finally an example implementation on Concierge and CITI-SENSE with MVAP framework.

5.1 Introduction to MVAP

MVAP outlines technique and tool-support to easily breakdown and measure Value Propositions, this technique is further fit into a process that allows continuous improvement of value proposition. The process is based on **Plan Do Study Act** (PDSA) cycle [17]. PDSA describes four steps to continuously improve processes, therefore PDSA-cycle is fundamental to MVAP.

By having process that allows measurements and continuous improvement, the main requirements defined in chapter 3 are fulfilled. There are still many other requirements to be fulfilled, but this chapter will only describe the overall concept of MVAP. Other details are described in the following chapters.

Description of the overall concept is based on three elements.

1. A clear definition of value proposition.
2. Measurements of value proposition elements that deliver value to customer segment. This is a process and is called PDSA-Performance.
3. Measurement of customer satisfaction. This is also a process and is called PDSA-Satisfaction.

Every one of the three elements above are described in the sections below, end of this chapter describes how these elements are put together as a process finalizing the overall concept of MVAP.

5.2 Value Proposition in MVAP

The word Value Proposition has been extensively used in this thesis but still a clear definition is missing. Value proposition is the center-piece and therefore this section has been dedicated to elaborate it.

Value proposition has many definitions, but the one that is used in this thesis is from the book "Business Model Generation", that defines Value Proposition as:

“The bundle of products and services that create value for a specific Customer Segment [2, p. 22].”

The Value proposition bridges world of supplier and buyer, and therefore an approach from consumer and supplier points of views is important to understand the relation between what is being proposed and what the consumer wants.

The word “relation” is not fully understood at this moment, and it only recently that measurements are introduced for MVAP. Before any measurements are done, it is important that bundle of products and services representing Value Proposition are broken down to technical requirements from customer requirements.

Measurements have two categories as defined in step 2 and 3 in the previous section. Step 2 measures value proposition from supplier side relative to customer requirements and step 3 measures customer satisfaction relative to the value proposition that is being offered. Step 2 and 3 are further elaborated in the following sections.

5.3 Measurement of performance requirements

Measurement of performance attributes is done within the organization to check if the products or services do fulfill technical requirements derived from customer requirements. How this is done on deeper level is described in chapter 6. To make the actual measurement only once is one thing but to continuously adapt to changes in the business environment requires a process. This process is described by using PDSA. The point of using PDSA is to have a process allowing continuous adoption to technical requirements defining customer needs in measurable terms. **Figure 17** below illustrates concept of using PDSA with regard to continuous improvement for performance requirement. PDSA in this sub-chapter is called PDSA-Performance to distinguish it from similar cycle in the next sub-chapter, where this cycle is called PDSA-Satisfaction. Every step in this cycle is described in the next section.

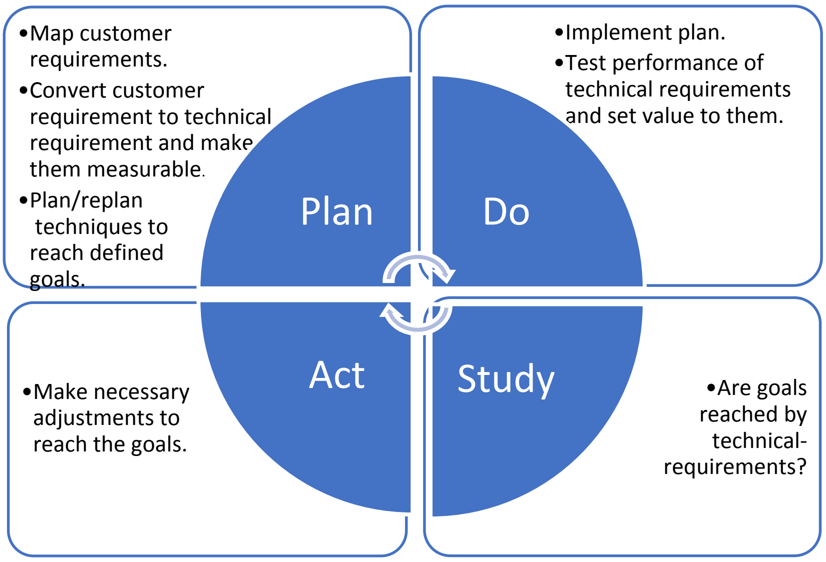

Figure 17: Illustrating internal process for continuous improvement.

Plan

This phase defines customer requirements and converts customer requirements to technical requirements with measurable values. If the process iteration is 0, then a planning is required on how to implement the process, in which case a target value for customer requirements are set in collaboration with the customer. This allows the value proposition to be tested to see if the target value can be achieved. If all technical requirements achieve their intended goals, then they are ready to be offered as value propositions. Otherwise, the cycle for improvements of requirements making up the value proposition should continue. If the iteration number is above 1, meaning that multiple iterations have taken place, then a re-adjustment is needed relative to the previous iteration to ensure that process is aligned with direction of the goal.

Do

Goals to reach have been defined during definition of customer requirements, this step implements the technical requirements that make up value the proposition. After the implementation, a measurable value is given to technical requirements that describe their performance relative to the measurable goals defined by the customers. This step can be termed as "performance measurement" in the coming chapters.

Study

Value given to technical requirements in the previous step is checked against the values set for customer requirements. Gap or similarity between values will decide necessary steps to be taken.

Act

If the values from technical requirements are below the values of customer requirements, it means that goal is not reached. This will require actions to be taken in order to straighten the path. If the values are equal or above the customer requirements then the goal is reached and no further iteration is needed. It is important to understand that customer requirements can be broken down to multiple technical requirements, this will again be explained in chapter 6.

5.4 Measurements of Customer Satisfaction

The previous sections described measurement loop for customer requirements at a technical level, which was within the company for checking performance of the value proposition being offered in comparison to what the customer segment wanted.

Breaking down the value proposition to its basic elements and achieving an acceptable performance, doesn't necessarily mean that customer will be satisfied with the value proposition being offered. To make sure that the customer will be satisfied, yet another implementation is needed based on PDSA, this time by continuously checking the customer segment. **Figure 18** illustrates this with another cycle called PDSA-Satisfaction.

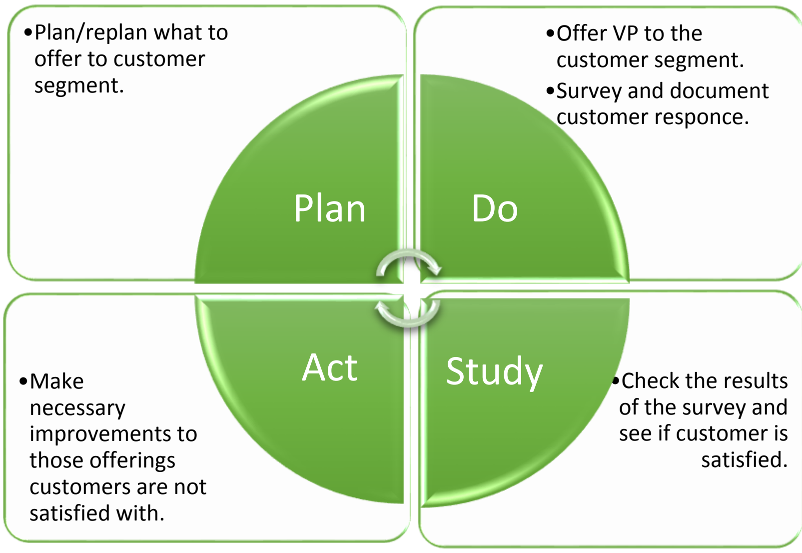

Figure 18: Illustrating the process to continuously measure Customer Satisfaction.

Plan

The Value Propositions that can give satisfactory performance in the previous section are ready to be offered. If this is the first iteration, the process will continue in the defined steps. If the iterations are above 0, then adjustments should be made in relation to the defined customer-satisfaction goals, which require some re-planning during every iteration.

Do

Present the Value Propositions (VP) to the customer and document their response with a customer survey. Responses are documented through the use of Net Promoter Scores [18].

Study

Study the results of Net Promoter Score (NPS) and check the level of customer satisfaction against sub-components of the value proposition that has been offered.

Act

Feedback from the previous steps can tell about which components in the value proposition are causing dissatisfaction among the customers. Actions should be taken to modify or discard those sub-components from value proposition that caused dissatisfaction. In either case of modification or elimination of sub-component from value proposition, modifications have to be made in PDSA-Performance. When the inner process of PDSA-Performance is done to either remove or modify the sub-components, then a re-planning will take place and the cycle of PDSA-Satisfaction starts all over again.

Next subchapter puts together all components described above to give an overall concept of MVAP.

5.5 Process Design of MVAP

Previous sub-chapters described PDSA-Performance and PDSA-Satisfaction for continuous improvement as isolated elements. This sub-chapter will put together those processes as a single process to highlight the overall concept of MVAP. **Figure 19** below illustrates the fusion of PDSA-Performance and PDSA-Satisfaction.

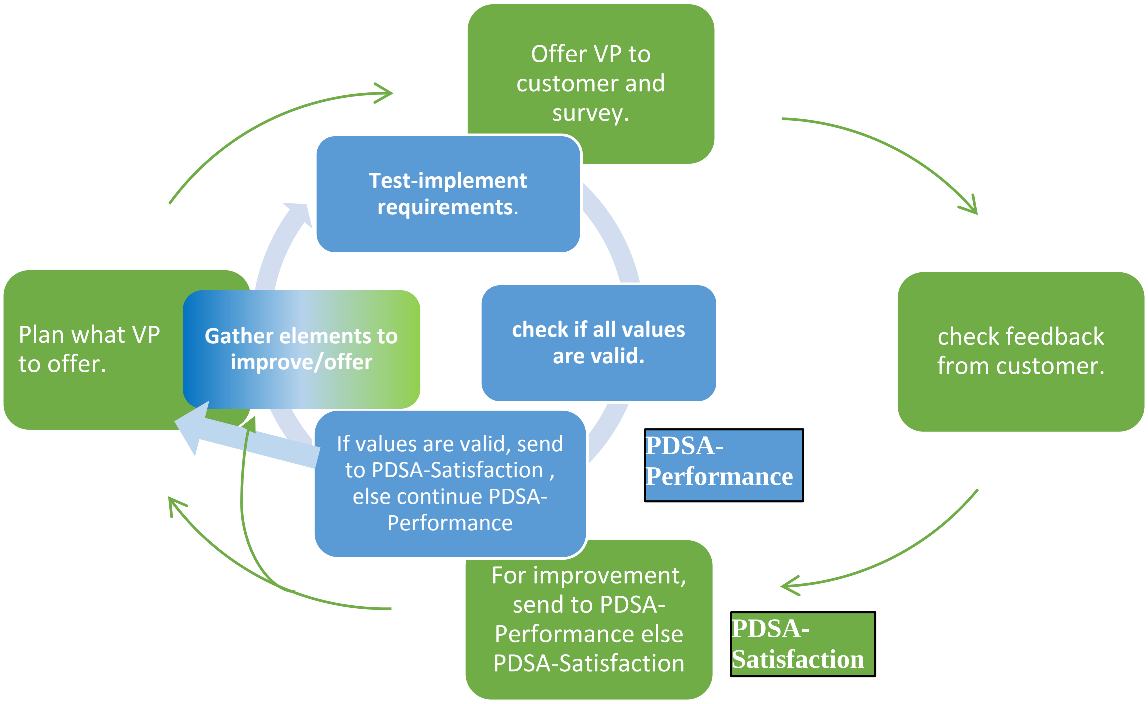

Figure 19: Conceptual process of MVAP.

Figure 19 describes the inner process and the outer process, the most interesting part here is the interaction point between the inner and outer process (Green and blue box on the left). What goes on in this process can be described by looking at the logic inside these boxes. Positive or negative feedback from customers decides if the elements in the value proposition are to be improved. If customers are not satisfied with certain element in the value proposition, then send the element to PDSA-Performance to make the improvements or discard the elements from the value proposition. If the customer is satisfied with all elements of the value proposition then continue the offerings and keep on surveying to capture any changes as soon as they appear.

Chapter 3 categorizes requirements in seven categories, this chapter gives a conceptual understanding of how continuous improvements will be implemented, and by doing so, it touches upon four of the seven requirement categories. These are:

1. Technical requirements.
2. Measurements.
3. Customer satisfaction
4. Process description.

The reason for not having all the categories is that they are represented on a deeper level of the MVAP process. These categories will be covered in the next chapter.

6 Design and Analysis for MVAP

The previous chapter described the process of MVAP, and this chapter will describe details of all the steps in the process to address the requirements from chapter 3.

The structure of this chapter is similar to the last one, meaning that it will go through previously defined PDSA-cycles as PDSA-Performance and PDSA-Satisfaction. What is different in this chapter is that all the technical details are included in the PDSA-cycles that are previously defined.

A detailed description of the PDSA-cycle has two functions:

1. Describe what components every one of the steps in PDSA is composed of.
2. Describe which requirement-category is being addressed by a certain function in every step of the PDSA-cycle.

The requirement categories of chapter 3 were

1. Business Model Requirement.
2. Requirement for Product Market fit.
3. Requirement for converting business requirement to technical requirement.
4. Measurement requirement.
5. Customer satisfaction.
6. Process for implementation.
7. Visualization of results.

Within these categories are many other requirements, and how well the proposed solutions cover all the requirements will be analyzed in chapter 9. The next sub-chapters begin highlighting details of described PDSA-cycles, beginning with PDSA-Performance. **Figure 20** illustrates the relations between value proposition, sub-components and technical requirements. Blue color describes the technical requirements contained in PDSA-Performance and the sub-components in green represent the offering to the customers during the PDSA-Satisfaction cycle.

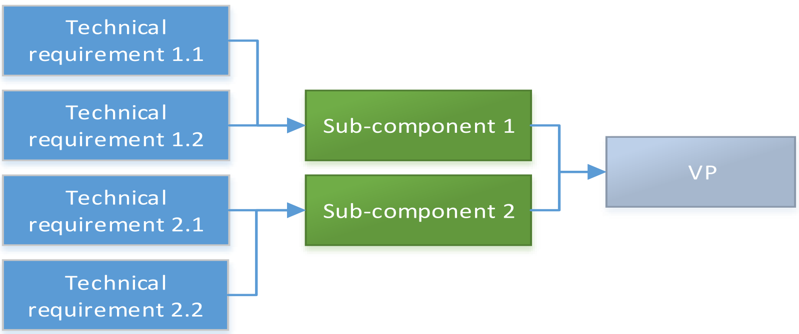

Figure 20: illustration of relations in value proposition.

6.1 PDSA-Performance

This sub-chapter includes the Plan, Do, Study and Act process, but also gives an in-depth view of the components making each stage of PDSA-Performance.

An overall view of building blocks of PDSA-Performance is illustrated in the **Figure 21** below.

The acronyms in the first stage are:

- BMC: Business Model Canvas.
- VPC: Value Proposition Canvas.
- QFD: Quality Function Deployment.
- VPMT: Value Proposition Measurement Template.

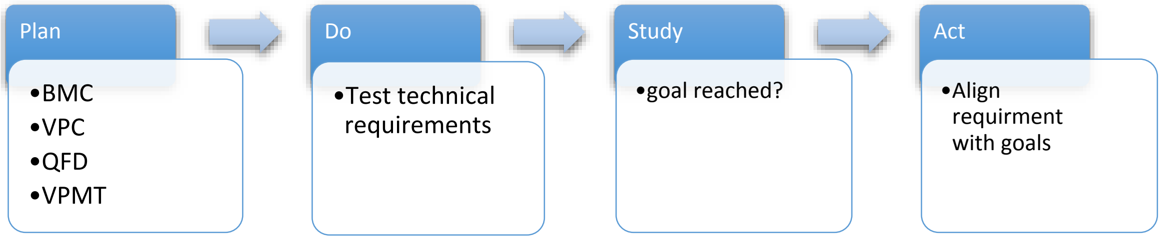

Figure 21: PDSA-Performance Cycle with building blocks for each step.

6.2 Plan

This part of the cycle puts together all the material needed to execute MVAP. Three of the four tools and techniques mentioned in this step have been covered in part 1, but the reason for bringing them in MVAP again is that they are sufficient to cover requirements for MVAP. Most part of MVAP is composed of existing solutions that have been described earlier, but what makes MVAP unique is the way existing solutions are combined to make a new tool. Since most of the theoretical background for Business Model Canvas, Value Proposition and QFD is described in part 1, this chapter will focus on functions that they provide for MVAP.

6.2.1 Business Model Canvas for MVAP

The Business Model Canvas in chapter 2.1 was used to give an overall business context and to specify the Value Propositions alongside the Customer Segments. Since the fundamental part of MVAP is to measure value propositions, it is important to have a business model that have Value Proposition and Customer Segment as a part of their concept. In the case of MVAP both the Value Proposition and the Customer Segments need to be defined by the business model that is being used. This allows to measure both the performance of the requirements that have been derived from the business requirements and to check the customer satisfaction.

By the use of the Business Model Canvas represented in the **Figure 1**, two advantages are gained

1. The overall business context is provided and an entire business model can be generated from a tested platform.
2. The Value Propositions and The Customer Segments are defined along with support structure and cost structure. Also other types of canvases can be used, like the one provided by VDML [9,p 2], the condition being that they have Value Propositions and Customer Segments defined separately as their building-blocks.

After the creation of a business model, both blocks for the Value Proposition and the Customer Segments are separated and sent to the next stage of MVAP. The next stage allows the relations to be visualized between the Customer Segment and the Value Proposition on a more granular level. This happens in the Value Proposition Canvas, described in the next section.

6.2.2 Value Proposition Canvas for MVAP

Similar to the previous section, the Value Proposition is also described earlier in chapter 2.2. This canvas is an add-on to the Business Model Canvas, but can also be used as an add-on for any business model that has Customer Segments and Value Proposition as a part of its building blocks.

However in the case of MVAP a modification has been made to make the Value Proposition a bit more informative. **Figure 22** below shows the extra modifications made to the Value Proposition Canvas.

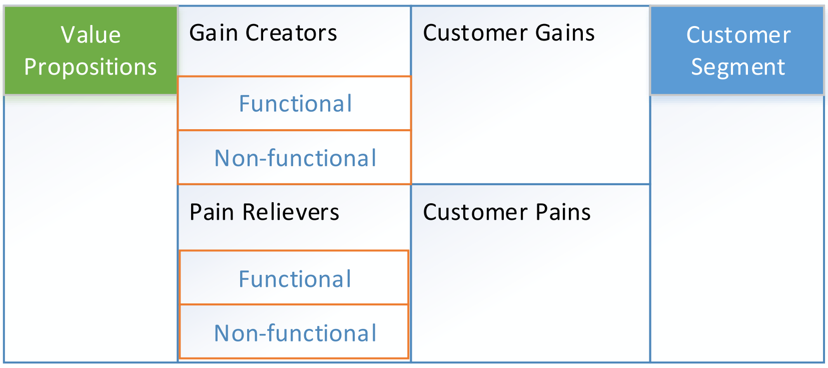

Figure 22: Modified Value Proposition.

The boxes with the red outer line in **Figure 22** show extra segmentations of the Value Propositions. The modification allows the sub-components of the Value Propositions to be split into functional and non-functional parts. The Functional values provide a value to the customer to help in solving their problems [4], while the Non-functional values are those which satisfying customers quality needs and emotional needs [4]. These new categories make it possible to interoperate this framework with ServiceMIF, highlighted in chapter 2.3. Having the functional and non-functional sub-components or Value Benefits as described in ServiceMIF, makes it possible to incorporate the canvas above with solicitation stage of ServiceMIF. The sub-components mentioned above are interchangeable with value benefits because both of them are subsets of the overall Value Propositions and can therefore be used interchangeably. The term sub-components is used in MVAP rather than value-benefits in the coming chapters.

What makes this canvas special is that it has all the basic elements from the Solicitation stage in ServiceMIF, and also allows sub-components (Value Benefits) to be measured unlike in ServiceMIF. The second advantage is that conversion from business requirements to technical requirements is made easier by separating functional and non-functional sub-components. The functional sub-components tells what the system does and the non-functional sub-components describes how good the functions will be performed [19]. This information allows one to plan ahead because if the sub-components being dealt with are functional, then what needs to be done is more obvious, but if the values are non-functional then the situation becomes a little unclear. The example below illustrates the differences.

A customer wants to travel from point A to point B in an airplane. This is a functional value that a customer wants. But if onboard the plane, the customer also wants to have more comfortable seats and to minimum delays, then these are non-functional values that are being added to the functional value. These values are those that deal with the quality aspect of the service being offered.

The non-functional values determine the quality of a product or service. To know that the customer wants to travel from the point A to B is one thing, but what makes the customer satisfied is a complex task, because the quality that the customer asks for can be different in nature and poorly defined. Knowing which sub-components are non-functional shows business designers where to further break down the sub-components, define them properly and measuring them. By doing that they are better equipped to fulfill the requirements to satisfy customer's needs.

This canvas is relevant to MVAP because it allows users to break down the customer needs as well as the Value Proposition being offered. By doing so, three things can be achieved:

1. A direct map between what is being offered and what is demanded, as illustrated in ***Product-Market fit for Concierge*** in chapter 2.4.2.
2. Partial breakdown of sub-components that will make it easier to convert to technical requirements for next step in the process.
3. Have an understanding of what functions are and what customer wants as quality or non-functional values.

6.2.3 Quality Function Deployment for MVAP

Quality Function Deployment or QFD has been included in the Plan-step of PDSA-Performance because it makes it easier to convert and prioritize the requirements from customer requirements to technical requirements. QFD is a process, but for the purpose of MVAP only the part of the process called House of Quality is used and is illustrated by **Figure 14**.

The purpose of the planning step in PDSA-Performance is to use a business model that gives the business context and defines what Value Propositions are and what the Customer Segment is. The two building blocks defined are brought to the Value Proposition Canvas where mapping between offerings and demand takes place. When Value Propositions are broken down to sub-components, then they are ready to be converted into technical requirements. Conversion to technical requirements from business requirements is done by using House of Quality, which was illustrated earlier in **Figure 15**.

<u>The important point that should be underlined is that the entire Plan-step described above is refined with customer's collaboration.</u>

Figure 23 visually illustrates the first step in PDSA-Performance that has 4 underlying processes.

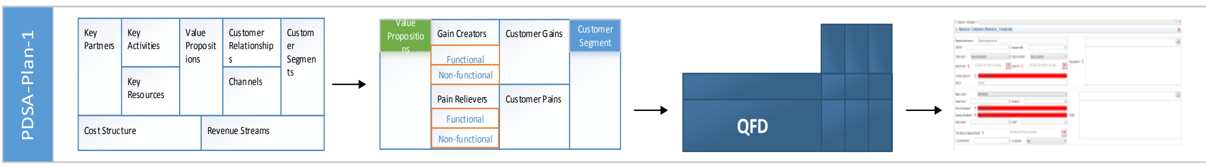

Figure 23: Sub-processes in first step of PDSA-Performance.

Figure 23 illustrates 4 sub-processes from which 3 have been described in their own nature in part 1. The fourth element in the process is the Value Proposition Measurement Template. Since this element is the most significant in MVAP, a partial chapter has been dedicated to.

The total steps in the planning phase of PDSA-Performance are based on implementation of:

1. Business Model Canvas.
2. Value Proposition Canvas.
3. Quality Function Deployment (QFD).
4. Value Proposition Measurement Template (described in next chapter).

The next sub-chapter describes the last element of the Plan-step of PDSA-Performance process.

6.2.4 Value Proposition Measurement Template (VPMT)

The sub-processes covered until now are from existing solutions. The Value Proposition Measurement Template (VPMT) which is being presented in this sub-chapter is new with respect to MVAP.

The template for measurement is the heartbeat of MVAP, since without this all previously described processes would be useless. This section covers VPMT for its relevance to MVAP, and its technical design and development have been discussed in chapter 7.

The VPMT is made of 4 components

1. Meta-data for technical requirement, like its number, name, type of value and so on.
2. Description for textually describing the requirement in question.
3. Measurable values of requirement, like what scale is being used, where on the scale values of a certain requirements are.
4. Notes for relevant information.

Each of the components are described and illustrated in the sections below.

6.2.4.1 Meta-data for VPMT

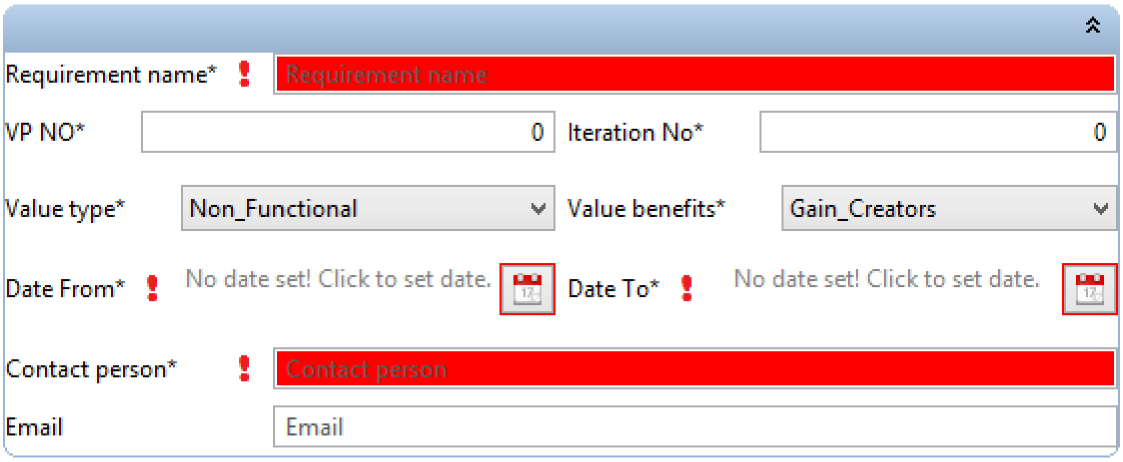

Figure 24: One part of the VPMT that describes the requirement.

The reason for including meta-information for requirements in the template is for recognizing the requirements. Even though it sounds simple to implement, it is often ignored, resulting in a chaos when the requirements starts to pile up.

Kai Gilb states

Imagine having a meeting in some town without a name, find an address there without a name, and find a meeting room there without a name, and have a meeting there with people without names. Somebody have to describe to everyone going there where the town is etc. etc. Crazy as this sound, this is how many treat their requirements, with no names [19, p. 23].

Figure 24 illustrates 9 fields that describe what type of requirements is being measured. Before any detail of the fields, it is important to know that all the field-names that have a * as a prefix are important to fill. Besides that, every field that is required to be non-empty by the system also has red background. Details of each field are given below.

1. **Requirement name:** Reason is simple, to know which requirement is being described, a name has to be given to identify the requirement.
2. **Value Proposition Number:** This number tells which Value Proposition this particular requirement belongs to.
3. **Iteration Number:** The aim of MVAP is to measure the value proposition and set the path straight on the basis of measured data, thus improving the value proposition. This process is done one iteration at a time and for every iteration, the current iteration has to be compared to the previous iteration to hold the track of the direction requirement is moving toward. It can either be betterment, worsening or neutral. Keeping historical data and numeration of iterations allows before and after comparison.
4. **Value Type:** This field allows two options to be chosen, Functional or Non-Functional value type. Chapter 2.3 describes the theory behind these two value-types.
5. **Value Benefit:** Options for this field are either Gain Creator or Pain Relievers. This tells what kind of benefit customers are getting from certain product or service being provided.
6. **Date from/to:** Tells about the timeframe for improving requirement, in meantime can multiple iterations have taken place.
7. **Contact Person:** Stakeholder who can be contacted by business designers in case of a question or anything else related to the project.
8. **Email:** Give the possibility to keep in touch with stakeholder by e-mail.

6.2.4.2 Requirement Description for VPMT

Figure 25 shows image for the field that is meant to allow user to have flexibility to describe other aspects of a certain requirement that have not been covered by meta-data.

Figure 25: Description field for requirements.

6.2.4.3 Measurement description fields for VPMT

If the VPMT is the heartbeat of MVAP described earlier, then this part of the template is the core to the VPMT. It is here the values are defined for requirement and measurements are done. Before description of the fields in **Figure 26** , it is important to know what exactly a measurement is.

The book “How to Measure Anything.” defines a measurement as follows**:**

A quantitatively expressed reduction of uncertainty based on one or more observations [20, p. 23].

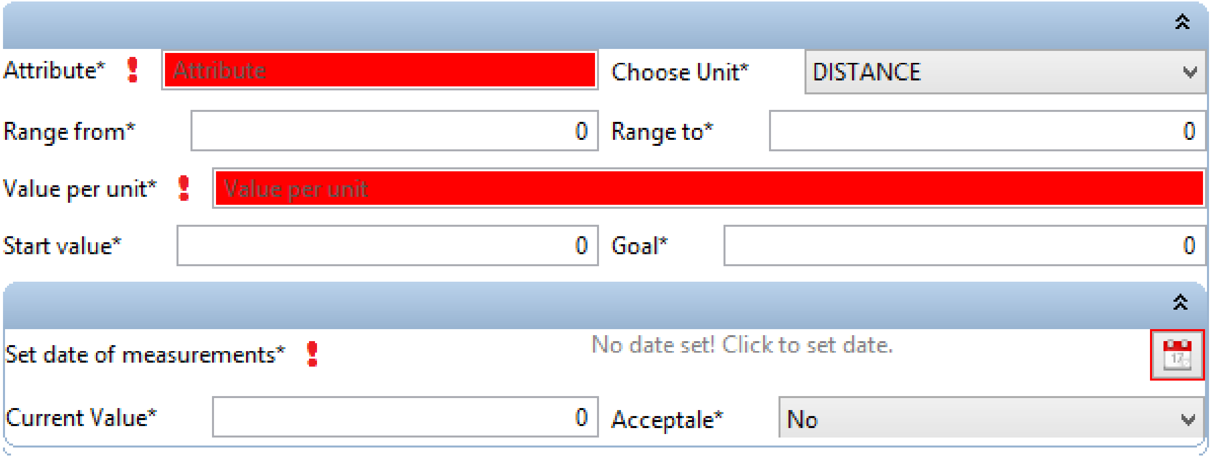

Figure 26: Values for measurement.

Figure 26 illustrates 10 fields that measurably describe requirements in question. By using this part of the template, a scale can be defined and values of current performance relative to scale can be expressed. When these values are added then a clear picture emerges of how well this requirement is performed by an organization relative to the technical parameters defined by the customers. All the 10 fields are defined in the following section.

1. **Attribute:** This is the unit being improved. Either being hotel booking, time-efficiency of a delivery or defects in a system. Whatever attribute being targeted for improvement, is meant to be read from this field.
2. **Choose Units:** This field allows choices between 7 categories to quantitatively express attributes and goals, being DISTANCE, AREA, SPEED, TIME, ACCELERATION, VOLUME, and MASS. Possibilities to change them are there, but for the sake of this thesis only relevant Units have been added to the template. Just enough to prove the concept. Units being used are a mix of **“base units and derived units [21]”.**
3. **Range from/to:** This defines the range from and to a quantified value can be within.
4. **Value per unit:** This field holds huge importance because this field adds the context to the measurements. This field is meant to hold the values this template is trying to measure against certain accurate values as NOK/hour, cost/hour and so on. It is also possible that the values and the units can be changed to the opposite, which again allows flexibility. Example NOK/hour can also be written as hour/NOK, template allows the users to choose the setting as they see fit.
   Attribute tells about a certain property of interest, the Unit describes type of values being used and finally putting them together in this field will describe the relation between them.
5. **Start Value:** This is the first value being recorded. This value stays as it is from the beginning until the end. This value allows seeing if there has been any movement from initial value or not.
6. **Goal:** The value being pursued.
7. **Date of measurement:** This date is set when the measurements are taken. Every measurement in every iteration has the date set. This makes it possible to track the progress over time.
8. **Current Value:** Unlike start value, this value changes with the measurements. This value just tells what the value certain requirement is giving at the moment. This value

with “Date of measurement” can later on be used to see the development, whether it is improving or not.
9. **Acceptable:** This field has Boolean value, either Yes or No. If the goal is reached, then the value is set to Yes otherwise No.

6.2.4.4 Other relevant information

This text-box is meant to allow extra information to be added to the template, information that is not directly concerned with the measurement, but rather to the overall operational context.

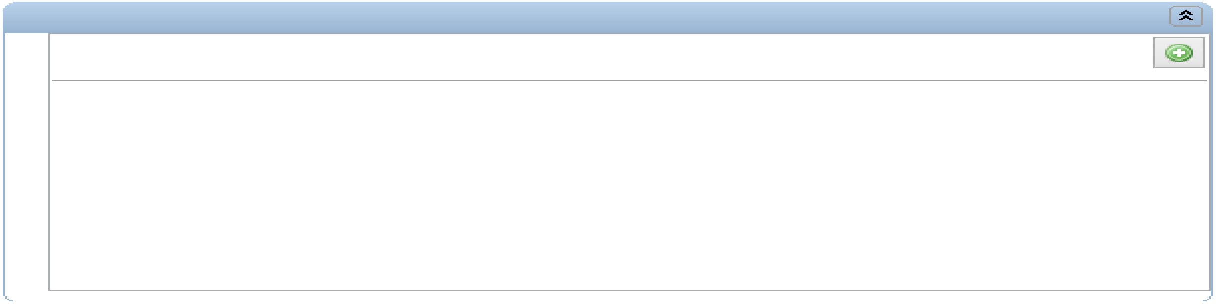

Figure 27: Text-box for adding notes related to project.

Figure 27 shows the textbox, having + sign in upper right corner which allows it to add fields to the box that can be filled with text.

6.3 Do

This step in PDSA-Performance is meant for one thing only, test the performance of the organization relative to the technical parameters defined by the customers. The values from the feedback are added into the templates. This step brings together information needed to compare technical requirements defined by the customer and values from performance measurement.

6.3.1 Test of technical requirements

The testing allows seeing the relative position of the provider compared to the technical parameters defined by the customers. This is done by having a numerical value for the technical parameter, and a numerical value generated in this step for performance measurement.

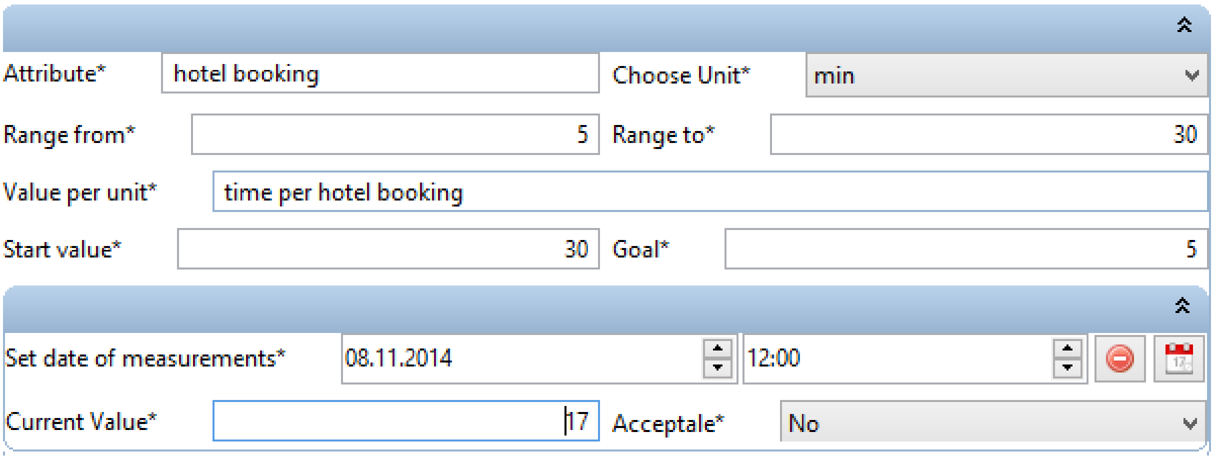

Figure 28: Fields containing technical values related to technical requirement.

Figure 28 illustrates an example by taking only ¼ of the template described in chapter 6.2.4. The attribute being measured is for booking of a room in a hotel, unit for this to be measured by is minutes. Range in minutes is from 5 to 30 minutes and the time taken to book on average at the start state is 30 minutes as described in field for “Start Value”. “Goal” is to get the time efficiency down to 5 minutes.

Date for testing this requirement is 08.11.2014 at 12.00 o’clock and the resulted value is 17 which is not acceptable compared to the goal. After the testing is done and the generated values are added to the template, the data is studied.

6.4 Study

Study of the result from the previous step has to be done to answer the question, how good do we deliver relative to what customers want or wish?

6.4.1 Analysis of results

Results from the previous step are meant to populate the templates with values for the attributes of interest. In the example implemented in the previous sub-chapter, the value did not achieve the goal set for the requirement. There are a number of options from this stage that can be considered, following section will highlight these options.

There are two possible outcome from the values presented in the template.

1. In case of reaching the defined targets for all the sub-components composing the value proposition, offering of value proposition can be made to the targeted customer segment.
2. In case of failing to achieve the target, there are again two options.
    a. Continue the PDSA-Performance cycle and try to improve the values.
    b. Abandon this requirement as not achievable or too costly to achieve.

In case of 2.a, by continuous process there is some valuable data that can be acquired from historical data of the iterations. How this data can be extracted and used on a technical level, is described below.

6.4.1.1 Data storage for VPMT

All data in the templates can be shared and stored by using the EMFStore[22]. Figures below show data for a template that have a requirement to “**improve booking time for rooms**”.

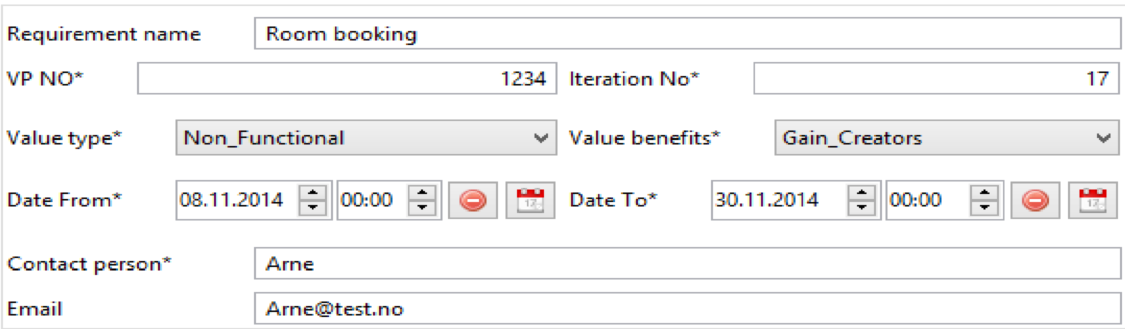

Figure 29: Fields containing example information.

Figure 29 shows meta-information for the requirement, and also sets the iteration number to 17. This means that this requirement have been modified 17 times for getting to set target. **Figure 30** shows an example with numerical values achieved over the 17 iterations.

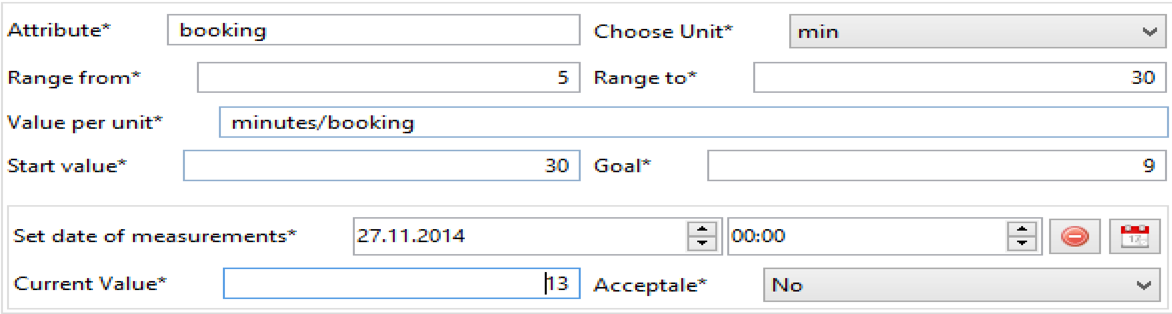

Figure 30: Dummy-values illustrating the example.

By looking at the conclusion from **Figure 30**, it still seems like the value is not reachable even after 17 attempts. It is here the stored information become useful and gives some insight that is not considered when only looking at the "Current Value" in the template.

The EMFStore allows having a repository, this repository have data from every modification made to the template. The data of the repository is not stored as structured data, therefore some readymade tools and scripts are used to extract relevant data. How this is done, is descried in the next section.

6.4.1.2 Steps for data extraction

1. Make sure to commit every time valid values are generated.
2. Iterations have to be multiple to give any meaningful interpretation.
3. Go to the .emfstore folder and to the folder where every commit is stored as *.ups files.
4. Add this folder to the tool called "xml2csv"[23], result shall be converted and delivered to a new file as .csv values.
5. Historical data can now be imported and viewed in Excel, and operation of choice can be performed on those values.

6.4.1.3 Data visualization

The data has been delivered to an Excel-sheet from previous section, the example below will illustrate how to use this historical data.

The data being used is imported to excel during steps above, two tables below will illustrate the usefulness of the dummy-information gathered for the requirements in the template represented in **Figure 30**.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Room booking	1234	17	30,00	10	9	27.11.2014
Room booking	1234	16	30,00	12	9	26.11.2014
Room booking	1234	15	30,00	13	9	25.11.2014
Room booking	1234	14	30,00	14	9	24.11.2014
Room booking	1234	13	30,00	12	9	23.11.2014
Room booking	1234	12	30,00	16	9	22.11.2014
Room booking	1234	11	30,00	19	9	21.11.2014
Room booking	1234	10	30,00	18	9	20.11.2014
Room booking	1234	9	30,00	19	9	19.11.2014
Room booking	1234	8	30,00	19	9	18.11.2014
Room booking	1234	7	30,00	19	9	17.11.2014
Room booking	1234	6	30,00	19	9	16.11.2014
Room booking	1234	5	30,00	20	9	15.11.2014
Room booking	1234	4	30,00	23	9	14.11.2014
Room booking	1234	3	30,00	29	9	13.11.2014
Room booking	1234	2	30,00	28	9	12.11.2014
Room booking	1234	1	30,00	30	9	08.11.2014

Table 9: Values in Excel from EMFStore.

Values in **Table 9** above give following diagram.

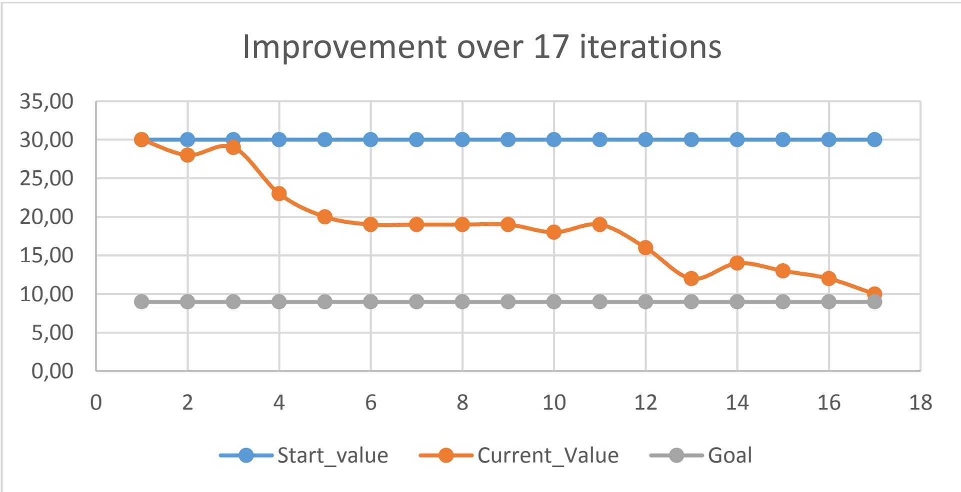

Table 10: Table highlights improvement of booking from Figure 29.

Information highlighted in **Table 10** shows a clear improvement over time on this particular requirement, meaning that it is worth putting effort to improve this requirement when the goal is so close.

Starting point was 30, goal is 9, and after 17 iterations the achieved value is 10.

By having this information visualized this way, give some extra information like

1. Direction of the development, improving, worsening or stable.
2. If it is worth continuing or not.
3. If the improvement is much better than the required goal. This will give away that too much efforts is being put into addressing certain requirement, meaning that improvements being made are beyond the need of the customer. This leads to the conclusion that time and money is being wasted.

6.5 Act

Having all the information gathered in previous section, leads to the final step of the PDSA-Performance cycle. This step is to act on information from the previous step. Decisions have to be made on whether to continue to improve, or discard the requirements from the value proposition being offered to the customers.

6.5.1 Corrective measures

All necessary information and decision making tools have been highlighted. Decision to make in this step is straight forward. Continue if the targeted values are reached, if not, improve or discard. If all the goals are reached, then the value proposition is ready to be offered. If values are not improved, then PDSA-Performance cycle continues until the values are reached or discarded as not worthy of perusing.

This part of the chapter has described the internal process of improving performance relative to the technical parameters defined by the customers. Next part of the chapter describes how the customer will perceive the value proposition, and how can customer satisfaction be measured to understand the success of the value proposition being offered.

6.6 Requirements in PDSA-Performance

Majority of the requirement-categories defined in chapter 3 are fully or partially covered in the PDSA-Performance. This sub-chapter will map the MVAP process to the requirement categories, not each and every requirement from chapter 3. Detailed analysis will take place in chapter 9.

The categories being touched upon in this chapter are:

1. Business Model Requirement, covered in Plan phase of PDSA-Performance.
2. Requirement for Product Market fit, covered in Plan phase of PDSA-Performance.
3. Requirement for converting business requirement to technical requirement, covered in Plan phase of PDSA-Performance.
4. Measurement requirement, defined in **Plan-phase** and values added in **Do-phase** of PDSA-Performance.
5. Customer satisfaction, not covered as yet.
6. Process for implementation process is defined in Figure 19, chapter 5.5.
7. Visualization of results, this requirement is partially touched upon on in chapter 6.4.

The only category not being mentioned is Customer Satisfaction. This category is the main subject for the next sub-chapter, PDSA-Satisfaction.

6.7 PDSA-Satisfaction

As descried in chapter 5, the PDSA-Satisfaction cycle is the outer cycle for continuous improvement. This cycle continuously check the customer satisfaction with the value proposition being offered and statistically visualizes which one of the sub-components of the value proposition is contributing most or least. This information allows modification in the value proposition being offered by excluding those elements in the value proposition that do not matter, to the customer. Alternatively can these elements be modified in accordance to the customer demands. Every sub-process in every step of the PDSA-Satisfaction is illustrated in **Figure 31** and described in the following sections.

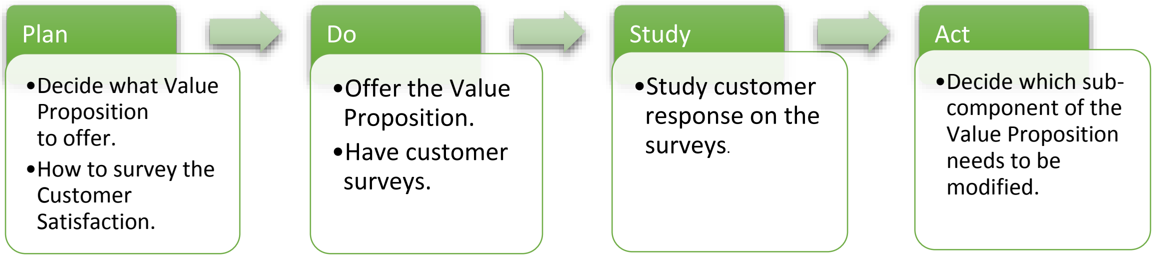

Figure 31: Sub-components for every step in PDSA-Satisfaction.

6.8 Plan

Figure 19 illustrated the conceptual design of MVAP, and an interaction-point between the PDSA-Performance and the PDSA-Satisfaction. The interaction-point from both processes fills each other out.

At this stage must all the technical requirements have acceptable values from the PDSA-Performance cycle. After this achievement will value proposition be passed on to the PDSA-Satisfaction cycle, this is done at the interaction-point between the two processes. If only some of the technical requirements representing the value proposition get valid results during the PDSA-Performance, then the PDSA-Performance cycle continuous for either to improve or discard some of the sub-components or technical requirements composing the value proposition. What decision to make, depends on the management.

After having valid results for all the technical requirements for the sub-components composing value proposition, offer to the customer segment have to be made and surveys have to be conducted. The survey is done to check customer satisfaction, and is done with Net Promoter Score (NPS) [18]. Surveys have to be a part of the planning because it is meant to continuously check the customer satisfaction with the value proposition and every sub-component the value proposition is composed of. Next sub-chapters will shed some light on the NPS and how to measure the customer satisfaction.

6.8.1 NPS for MVAP

This section will briefly explain the NPS and how this score works.

The book "The Ultimate Question 2.0" describes NPS as

"NPS Ultimately is a business philosophy, a system of operational practices, and a leadership commitment, not just another way to measure customer satisfaction" [18, location. 268].

Furthermore have the NPS been linked to the Customer Satisfaction by **Erin Bradner** by stating that

"**Net Promoter is a measure of customer satisfaction that grew out of the Customer Loyalty research by Frederick Reichheld (2003) [24, p. 238].**"

What's most important for MVAP is the simplicity of the test to measure company's relation to the customer.

The NPS operates with a scale from 0-11 and this scale is divided in 3 categories.

1. **Detractors:** Those who are not satisfied and will not recommend company in question to his or her associates. Situation can be even worse if customer is negatively referring to the company.
2. **Passives:** These customers will not be saying anything good about the company, but not bad either.
3. **Promoters:** These customers are the most relevant to the company because they will recommend this company to family and other associates.

By knowing that customers are promoters, it can be deduced that customers are satisfied with a particular company or its products/services and by recommending it to others will give growth over time [18]. Therefore this becomes a strategic indicator and therefore should be taken seriously.

Figure 32 illustrates the scale used for the NPS and how the three categories above are represented on the scale.

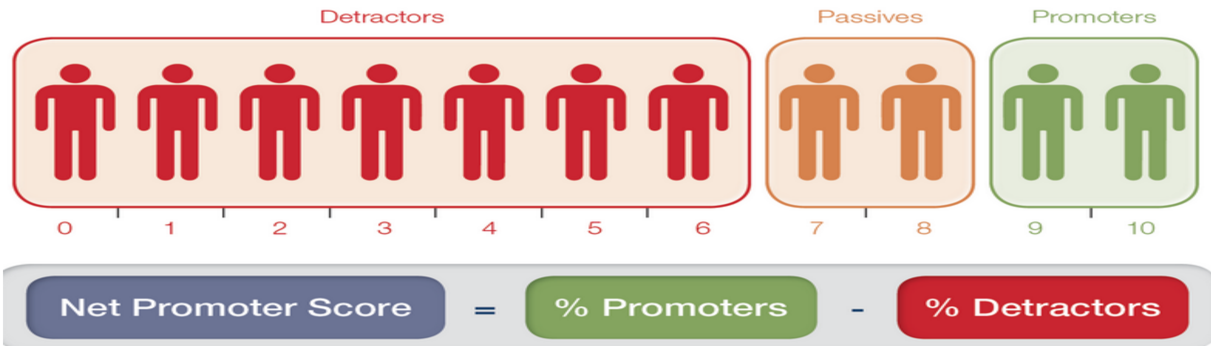

Figure 32: Three categories from NPS with their values [1].

To know how the customers perceive the value proposition for the company in question, a simple question is asked as described below.

Fred Reichheld describes the ultimate question in his book "The Ultimate Question 2.0"

"**How likely is it that you would recommend this company, or this product or service, to a friend or colleague? [18]**".

To respond this question, a scale is presented to the customer where he/she gives a value between 0-10, 0 is the worst and 10 is the best score.

1. If responded value is 0 to 6, then the customer is a **Detractor**.
2. If value is 7 or 8, then they are **Passive**.
3. If value is 9 or 10, then they are **Promoters**.

If the customers are willing to recommend the value proposition or the company to others, will that indicate that the customer is satisfied with what the customer is getting.

To have an overall understanding of what the customer says about the company, a simple calculation is done.

%Promoter - % Detractors = %NPS

If the score has negative value, it means that most of the customers are detractors, if the value is positive, it means that most of the customers are promoters.

There is industry benchmark to the NPS which is about 21% for the consumer software industry [25]. This means that everything above 21% in the consumer software industry is good, but this is limited to the consumer software industry and is not representative for everything else. This value just point in a certain direction and therefore should not be used as a benchmark in the case of Concierge or CITI-SENSE. Reason for using the benchmark for the consumer software industry is because having some value to compare with is better than no value at all.

To know the customers relation to the company or its value proposition still do not tell what part of the delivered value proposition they are satisfied with or not. The NPS at this moment cannot be used for the purpose of addressing issues MVAP is trying to solve, The NPS gives the score for the overall customer satisfaction, not of the sub-components of the value proposition. It is important to know which one of the sub-components of the value proposition is good for the customer and others that are not. Lack of this information will make it unclear of which sub-components of the value proposition to improve or not.

To know what components of the value proposition the customer is satisfied with, a statistical method is used, known as Multiple Regression Analysis. This method is elaborated in the next sub-chapter.

6.8.2 Multiple Regression Analysis for MVAP

In a Multiple Regression Analysis, a dependent variable is tested against the independent variables.
This measures how much the dependent variable move in a positive or a negative direction when the independent variables moves in a positive or a negative direction [26].

By knowing how much impact the independent variables have on the dependent variable, makes it possible to see which independent variable is contributing the most or least to the dependent variable. The formula for the Multiple Regression Analysis is

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3\ldots.. + \varepsilon \text{ [26]}$$

Equation 1: Calculation formula for Multiple Regression Test.

Y = dependent Variable.
β = coefficients, describes numerically how much Y depends on every β.
X = represent independent variables.

ε = represent any arbitrary value.

In case of MVAP, the Y will be the value represented by the NPS as the dependent variable. The independent variables will be represented by the sub-components of the value proposition being offered. For sake of simplicity, value proposition is represented below in similar fashion as the formula for the Multiple Regression Analysis. The sub-components of the value proposition are described as sc.

Value Proposition = sc1 + sc2 + sc3.

Value Proposition: the dependent variable is gained by asking the ultimate question **"How likely is it that you would recommend this company, or this product or service, to a friend or colleague?"**

sc: is gained by using any reliable customer survey for the customer satisfaction.

Both of the elements above can be measured by using the same survey, one question for dependent variable and one for every independent variable.

For both of the cases above, a scale is used as defined in Figure 32, the questions are asked and the values are kept in range of 0 to 10.

The NPS for the value proposition and the survey with the scale of 0-10 for measuring customer satisfaction of the sub-components, will only provide values without explaining the relation between them. If these values are to give any important information, then a multiple regression analysis has to be implemented on these values. The NPS on the value proposition will provide the overall customer satisfaction score. The customer satisfaction survey for every sub-component will provide the customer satisfaction score for the sub-components. The Multiple Regression Analysis will bind the customer satisfaction for the overall value proposition and the customer satisfaction for sub-components together. By doing that a relation can be visualized and an observation can be made on which one of the sub-components are contributing to the overall customer satisfaction and which one is not. This will allow targeted improvements on exactly those components that are disproved by the customers and by doing that both time and efforts are saved.

6.9 Do

In this step of the PDSA-Satisfaction, the value proposition is offered to the customers and the survey is done. The survey being conducted is the one covered in the previous sub-chapter. To conduct the survey, two questions needs to be answered.

1. What kind of survey will be used?
2. What is the sample size needed for the surveys to be representative?

Both steps are described in the sub-chapters below.

6.9.1 Survey for MVAP

The survey for the overall value proposition can be done by using the NPS. For every sub-component, a customer satisfaction survey has to be used that has similar scale to the NPS. How the customer survey is done is out of scope of this thesis, but values for sake of the demonstration are dummy values. Example in **Table 11** illustrates dummy-values in use.

VP	sc-1	sc-2	sc-3	sc-4
5	7	3	8	9
10	1	4	1	9
6	4	3	7	1
6	1	3	9	7
6	7	3	2	7
9	2	7	2	6
5	8	7	4	4
8	7	2	10	5
9	5	4	2	8

Table 11: This table simulates values gathered from a dummy-survey.

There are 4 sub-components as independent variables and value proposition as the dependent variable, all the values have a range from 0-10.

6.9.2 Sample size for PDSA-Satisfaction

The sample-size for any survey is important to know because this tells what the needed numbers of the respondents have to be for a representative survey.

There are 4 steps to complete before a survey [27], these are listed below

1. How large is the population in the targeted segment?
2. Margin of error or confidence interval: Scott M Smith defines this as

   "The confidence interval determines how much higher or lower than the population mean you are willing to let your sample mean fall [27, p. 2]".

3. Confidence level: Which confidence does a survey-team want for mean of a surveyed values to fall within defined confidence interval? The confidence interval is represented by a z-score [27] and the mostly used confidence intervals are
   90% - Z-score value = 1.645
   95% - Z-score value = 1.96
   99% - Z-score value = 2.326
4. How much variance [26] is expected in responses. Meaning how spread out the numbers can be, like 1, 3, 5, 7 have a spread, and relative to this is spread even greater for 1, 5, 9, and 13.

After all the data above is acquired, will the sample-size be calculated by using the following formula: [27].

$$\text{Sample size} = \frac{(Z{-}score)^2 * std{-}deviation * (1 - std{-}deviation)}{(margin\ of\ error)^2}$$

Equation 2: Equation for calculating sample-size.

6.10 Study

As values have been gathered in the previous step, they need to be processed. Processing of the values that have been gathered will take place in this step and decision will be made on the basis of this information.

6.10.1 Processing of sample-data

Since there is no real data to process, an example implementation of regression analysis can be made on dummy-table from **Table 11**. Multiple Regression Analysis can be implemented with multiple platforms, but in this case Microsoft Excel is sufficient. Values plotted in Excel gave the results in **Table 12**

regression statistics			*Coefficients*
Multiple R	0,695820832	Intersection	0,07470732
R/square	0,484166631	sc-1	0,291857258
adjusted R/square	-0,031666739	sc-2	0,707339261
standard error	1,930145907	sc-3	0,366588165
observations	9	sc-4	0,845014343

Table 12: Results from Multiple regression Analysis.

The grey color on the left show value of R/square as 0, 48. This means that this model describe 48% of the variation of the dependent variable through the independent variables.

All the sc-values are presented on the right side, under **The Coefficients**, they tell how much they contribute to the dependent variable. Value of sc-1 is the highest of 0.30, meaning that if a dependent variable moves one unit forward, then the sub-component-1 will move by 0.3 or 30%.

Graph below shows which one of the sub-components has the most or least relation to the dependent variable which is meant to be the value proposition. It is easily visualized which one of the sub-components are contributing most or least. In this case, sc-1 has most impact on the dependent variable and sc-4 has least. Meaning that sc-4 is not satisfying the customers.

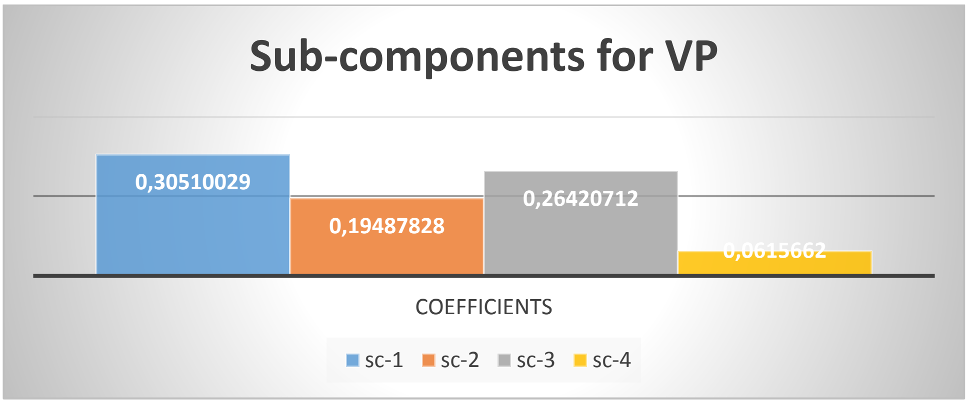

Table 13: Diagram representing sub-components.

6.11 Act

Equipped with the information from the previous step, allows to easily making a decision on what to do next. Options to consider are.

1. Sc-4 is the problem element here, it can be discarded.
2. Sc-4 can be improved. If this is the case, then the PDSA-Performance cycle begins again and when the technical requirements are passed, will the PDSA-Satisfaction cycle begin again.

Chapter 5 in Part 3 has described the process of MVAP and chapter 6 described the technical components within MVAP. The PDSA-Performance process covered all the requirement categories with exception of the Customer Satisfaction. This category has been addressed by PDSA-Satisfaction. Beside the processes of MVAP, a template was also introduced in chapter 6.2.4. The entire process of MVAP is constructed around this template. The Value Proposition Measurement Template has a technical dimension to it, which is the subject of the next chapter.

7 Technical Implementation of MVAP

Earlier chapters covered the process and elements within the process of MVAP. The most important part of the contribution besides the process of MVAP was the Value Proposition Measurement Template or VPMT.

This chapter focuses on describing technicalities of VPMT and components related to it. The technical description involves design of templates, types of templates, arranging fields in templates, data storage, conversion of values to comma separated values (CSV) and data processing.

7.1 Design of VPMT

VPMT was designed using the Eclipse Modeling Framework [28]. This is a modeling framework that allows the generation of code from structured data models. The underlying design of VPMT is illustrated in the EMF metamodel shown below.

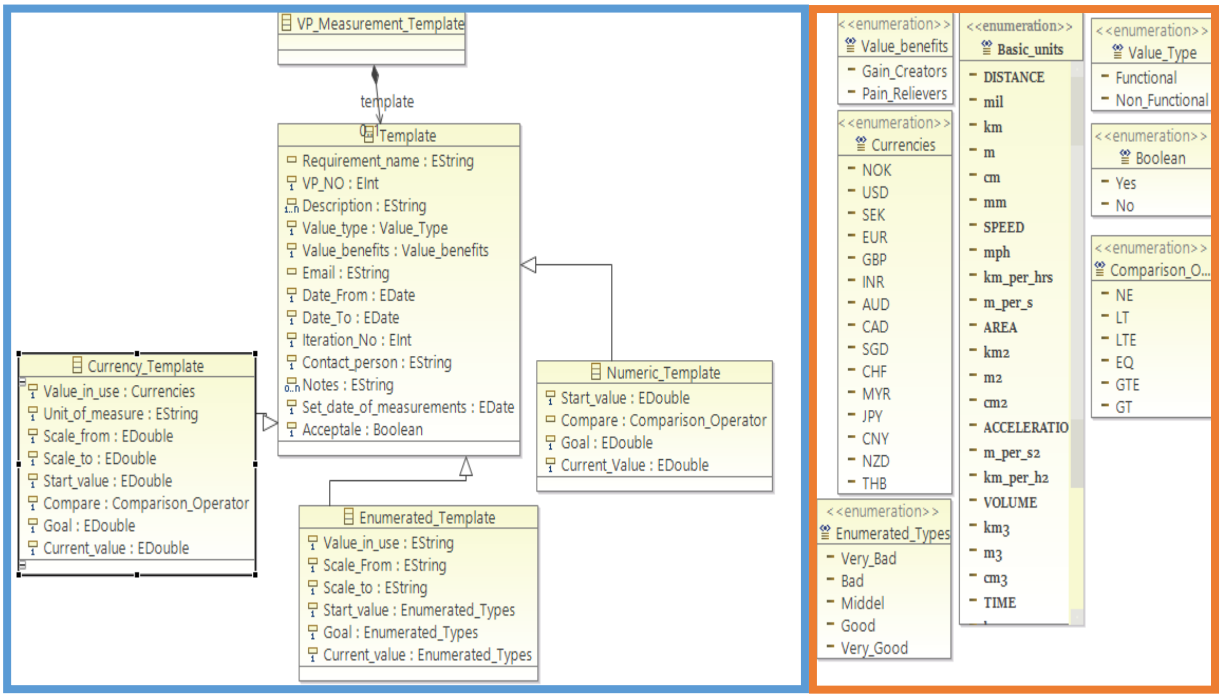

Figure 33: Metamodel design for VPMT.

There are two types of components used for making VPMT. One type is marked within red rectangle and the second in blue.

Elements in red rectangle are basic elements for the template. These will contain values to choose from in the dropdown menu. Example can be illustrated with one element in the **Figure 33** above to make the point. Figure chosen is both illustrated and described below.

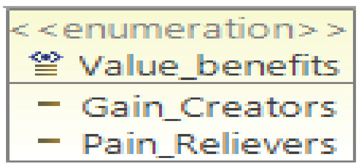

Figure 34: Model for Value Benefits.

Figure 34 illustrates a class from the model illustrated in **Figure 33**. This class is an

“Enumeration class” meaning that self-defined values can be defined here as types and these types can be chosen from, when the model is implemented. In case of Value_benfit in VPMT two options can be chosen, these are “Gain_creators” or “Pain_relievers”. This field is also depicted in **Figure 24**.

There are also more classes like this in **Figure 33**, they are

1. Currencies
2. Enumerated Types (Describing Likert-scale [29]).
3. Basic Units.
4. Value Type.
5. Boolean.
6. Comparison Operators [30, p. 19].

All these classes represent types that can be chosen from to make specialized classes for special purposes.

The second component which is in the blue rectangle represents classes their attributes and relation between them. This part of the model is illustrated in the **Figure 35** below.

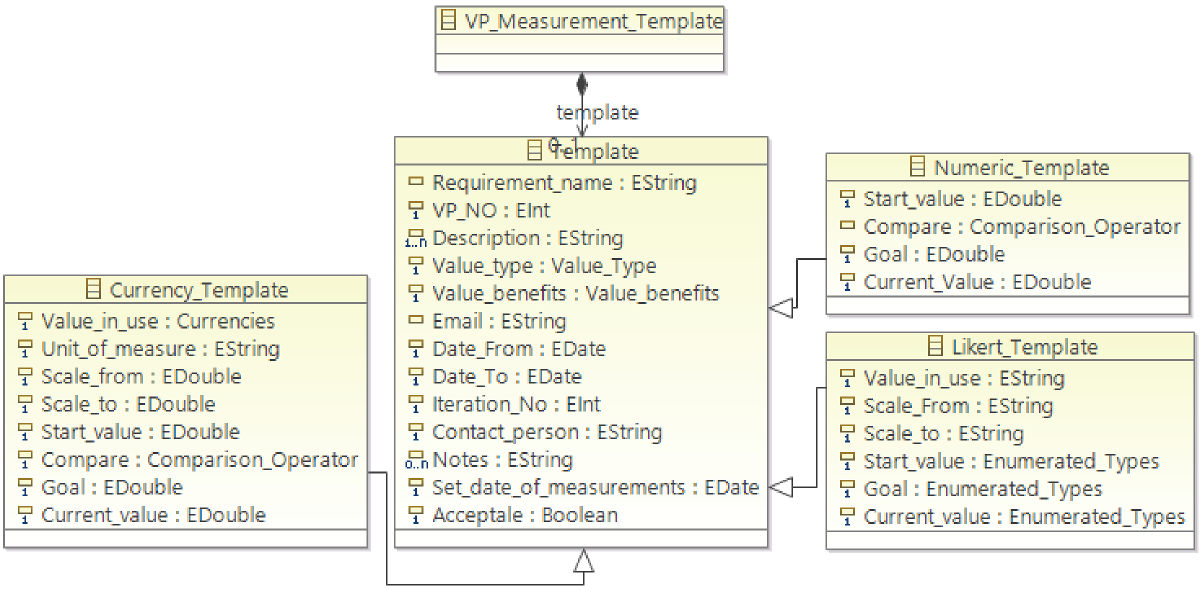

Figure 35: Model for VPMT.

The model above shows the main root container containing class for a Template and 3 other classes that inherit from Template-class. Chapter 6 highlighted only 1 of 3 templates that can be chosen from, reason is that chapter 6 was meant to describe the processes and how their components were put together. Only example from one type of template was enough to prove the concept.

The template-class is the core class that has the basic elements in it, ranging from value proposition number to date of measurement.

What makes every template unique is “**types of values**” defined in the beginning of the chapter. Every template has unique values, in case of VPMT, there are three main categories.

1. Numerical scale.
2. Likert scale [29].
3. Currencies scale.

Every category is briefly described in coming sections. But detail description is only given of Numerical-template because this is the most relevant and the other two templates shares same principles as Numerical-template.

7.1.1 Numerical scale

This template is the main template because it covers most of the values intended to be measured. This template does not contain any enumeration-class, rather defined with an “EDouble” value which gives it the flexibility to define whole numbers as well as decimals.

7.1.2 Likert scale

This template contains a Likert-scale for measurements with values that are not meant to be numerical. The types of measurement element this contains are to be seen in **Figure 36**.

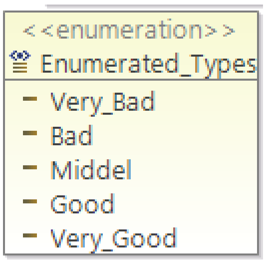

Figure 36: Elements of Likert scale.

7.1.3 Currency scale

This is the last template containing some known currencies, the defined currencies are graphically displayed in Figure 33. The total number of currencies is 15, but can easily expand into more. The Currency template also defines trough Enumeration class for defining different currencies.

The reason behind having three templates and not a single one is because of constraints on the system that was being used to make the template. This system is described in the next part of this chapter.

7.2 Fields for VPMT

The previous chapter defined the design for the Templates. This chapter will describe the tools for making the design and how the look of the templates is set.

The platform used for making EMF design operational is called EMF-forms [31] , which is a sub-component of the EMF client Platform. EMF-forms allow the creation of form-based designs without coding every needed element, therefore makes it an easier and timesaving alternative to creating the form by using code.

7.2.1 Migration to EMF-forms

The beginning of this chapter described an EMF-metamodel, but how is the process from going from EMF-metamodel to EMF-forms?

The metamodel in Figure 33, illustrates the metamodel for VPMT. This model is built upon an *.encore file. All the values defined in the model are store in *.ecore file. The reason for using a graphical editor as seen in Figure 34 is that it makes it easier to create the metamodel. Alternatively a direct approach could also be used to define values inside the *.ecore file, but this would be time consuming and prone to errors. **Figure 37** illustrates the alternative way of making the metamodel.

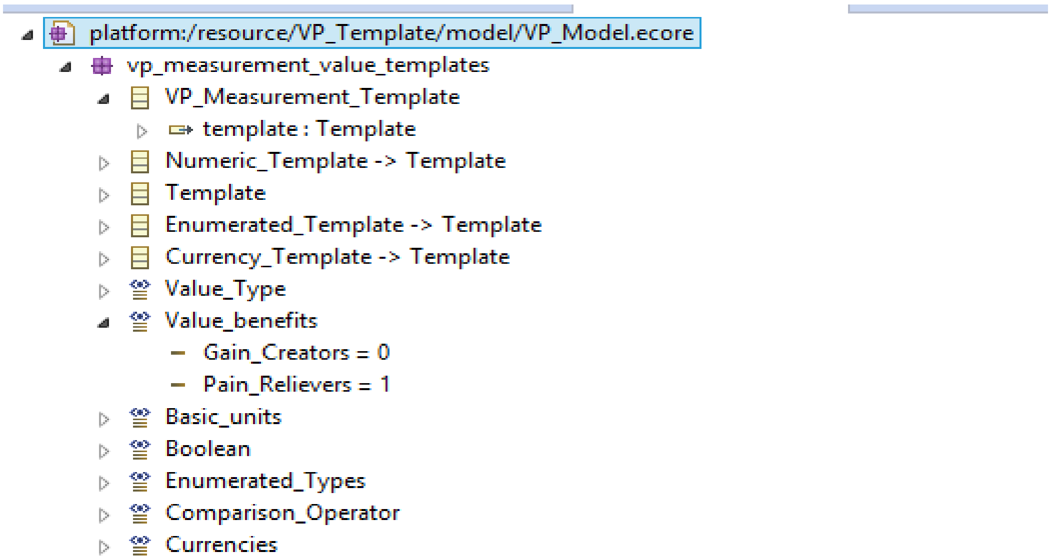

Figure 37: Metamodel without editor.

Comparing this to the graphical editor in **Figure 33** makes it clear that a graphical editor is much more informative and easier to use.

As mentioned all the values were stored inside the *.ecore file. This can also be seen in **Figure 37** where all the defined classes are within a purple package. This is the main ecore-file that laid the fundament of VPMT.

One of the purposes of EMF is to generate code from models. This is done by generating codes from an *.ecore file, result is Java code for classes defined with graphical editor. Beside this will also another file be generated ending with *.edit. This file have reusable classes for building EMF-editors [31].

After generating the model code and *.edit file, all elements are on place to generate EMF-forms on top of generated files.

7.2.2 EMF-forms

Before generating the forms, there are some prerequisites. Some software has to be downloaded from Eclipse Market Place, which is EMF Client Platform "**ECP SDK 3.0**".

By having all the necessary software, models and code in place, phase of generating the forms is started. Generation of forms is located in a file with suffix *.viewyamodel and steps for generating this file is as follows.

A. Right-click on *.ecore file and go to EMF forms, choose "**Create view model project**".
B. **Figure 38** illustrates all the classes that were defined in *.ecore model.

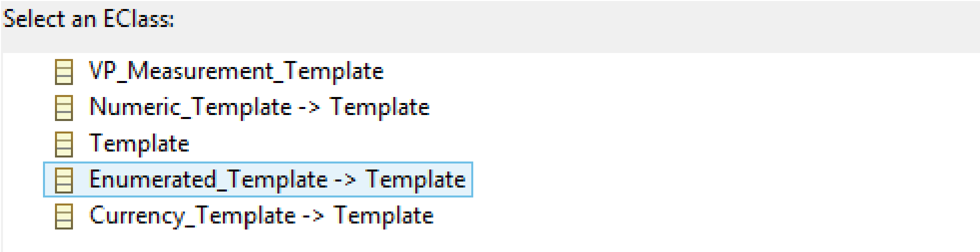

Figure 38: Classes to load into view model.

Those classes that are meant to be modified as forms, can be chosen from this diagram after fulfilling step 2.

The result is a form that has all the fields for every attribute from **Figure 35**. This job is automatically done by the ECP and the only thing remaining is to sensibly arrange the fields in the form.

7.2.3 Forms Layout

The last step for making the forms is to arrange the fields. This process is illustrated below by placing both the "Layout hierarchy" and the actual form-layout.

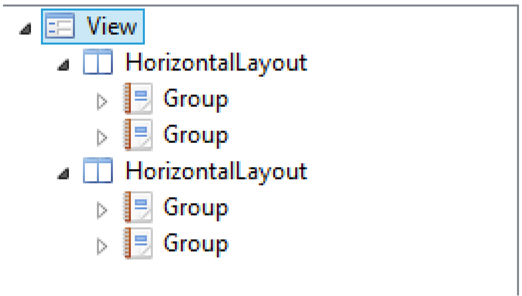

Figure 39: Layout design.

For the layout design, 4 groups are defined. Every group is like a segment for its own purpose. Within the view model are two "**horizontal layout**", this means that arrangement of the first two Groups in first horizontal layout will appear horizontally on the upper part of the screen and the lower Groups will appear horizontally on the lower part of the screen. Every group has fields defined in them, these groups will be elaborated further in coming sub-chapters, from above as Group 1, Group 2, Group 3 and Group 4. Their overall placement on the screen will be like a simple matrix as illustrated in table 14.

Group 1	Group 2
Group 3	Group 4

Table 14: Group locations.

7.2.3.1 Group 1

This group contains meta-data about the requirement. This field was well covered in chapter 6.2.4.1. **Figure 24** is repeated below to see its relation with the Layout Hierarchy.

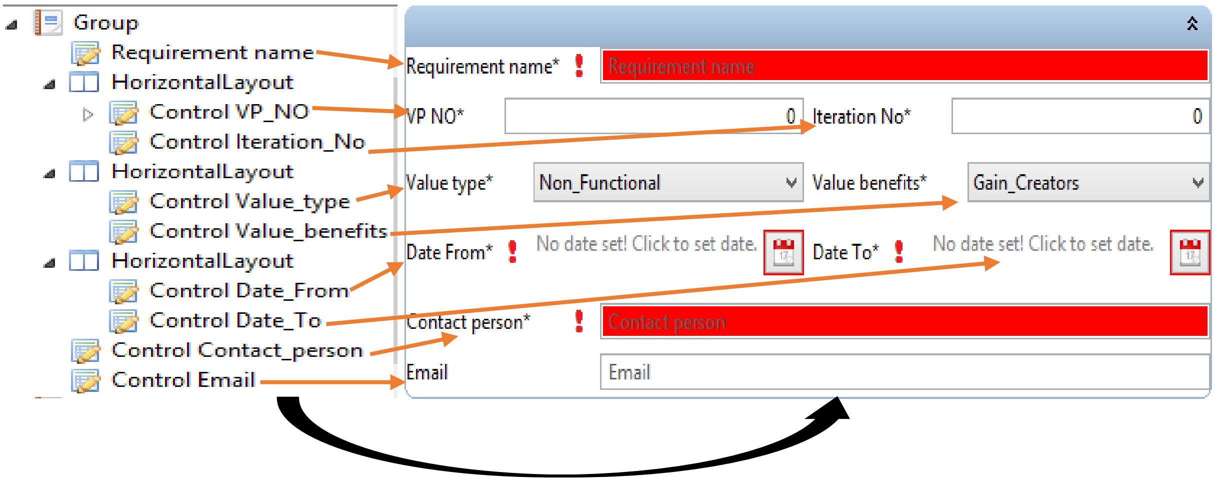

Figure 40: Relation between Layout and appearance in Group 1.

The left side shows the layout Hierarchy and the right side shows how this will appear on the screen as a template. There are multiple "HorizontalLayout" elements in the group, meaning that elements within them are arranged in a horizontal fashion.

7.2.3.2 Group 2

This group is no different in principle than one above, but its content is lesser. The reason is that this group is only meant to add a text-box to the template to add text relevant to the technical requirement so detail beyond fields can be added to it.

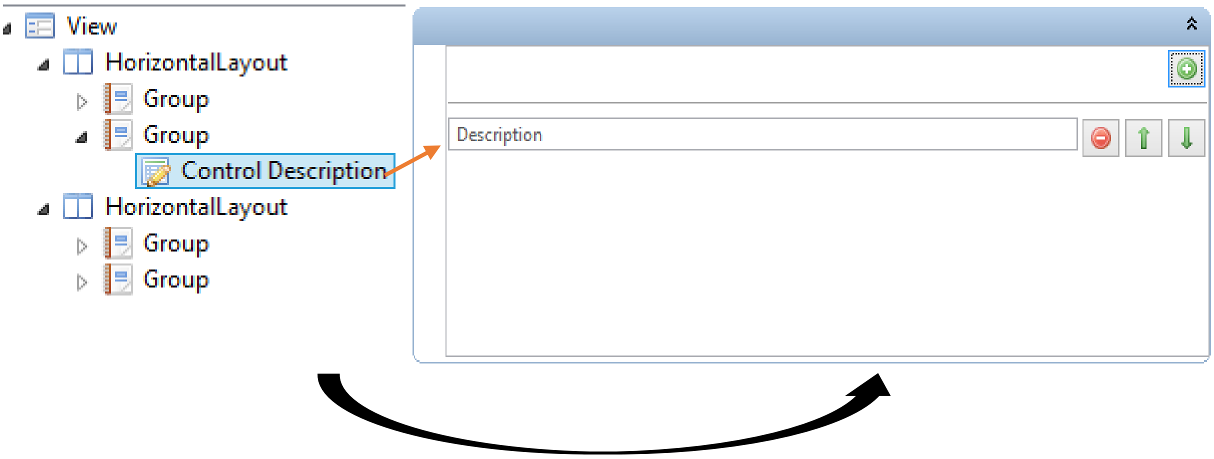

Figure 41: Relation between layout of Group 2 and projection on template.

7.2.3.3 Group 3

This group holds information about the technical details of the requirement and is placed on the lower horizontal line on the screen. **Figure 42** below follows same pattern as above.

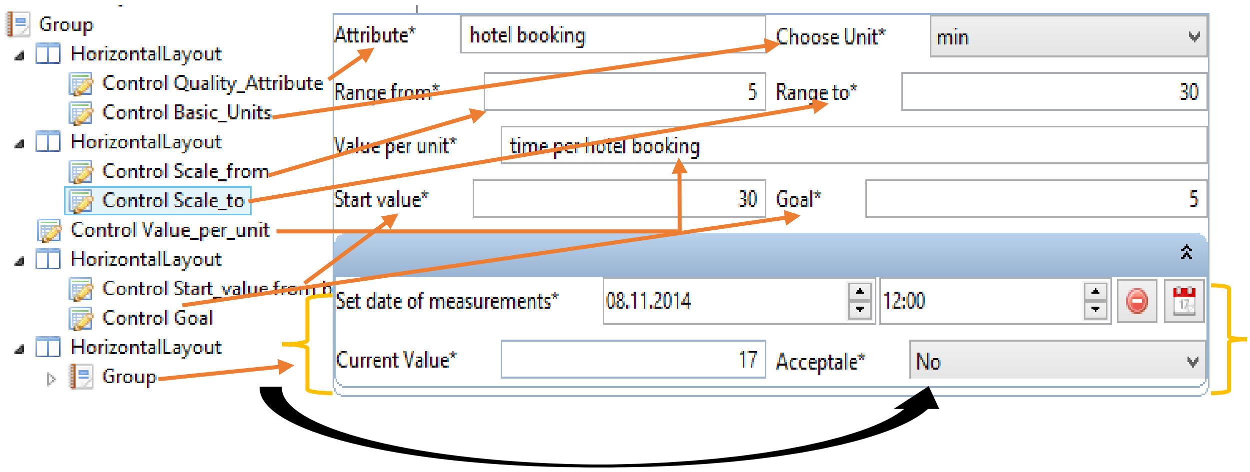

Figure 42: Layout and fields arrangement for Group 3.

The values in angular bracket are defined in sub-group of Group 3.

7.2.3.4 Group 4

This is the last group in the template and the reason to have it here is for adding additional information that is not directly technical but is somehow related to the process of MVAP, and the requirement in question.

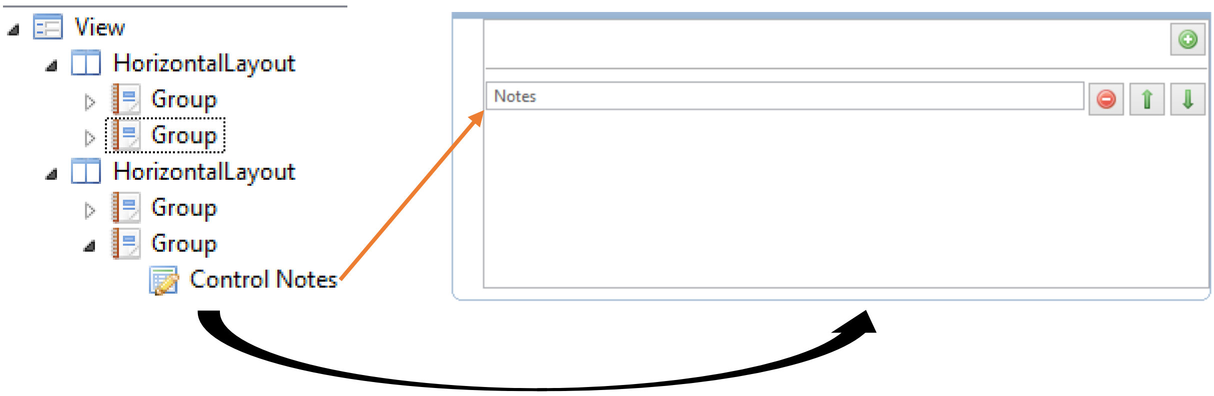

Figure 43: Show layout hierarchy of Group 4 and how it's projected in VPMT.

Forms are the main part of the contribution in thesis, but their advantage is limited if the values cannot be stored for later use or converted for use in different systems. The following part of this chapter will cover how the values are stored and converted.

7.2.3.5 Value storage and value conversion in MVAP

As described in chapter 6, values can be stored to a repository and besides storing latest values, also history can be tracked and earlier versions can be restored.

Even if the storage was there and history was saved onto the repository, a problem was that historical values could not be obtained from the system in a structured manner because the output file for EMFStore only stored values in .ups format. This placed a limitation to the system because structured data was lacking and therefore the requirement **"TR-2: Exchangeable data format"** from chapter 3 would go unaddressed. A solution had to be made to extract only needed data, label it, and write it out as in a CSV form.

7.2.3.5.1 Value extraction and CSV conversion

Values to work from were in .ups format. For extracting the values, a .batch file was made.

.batch file contained a premade software called xml2csv [23], this software could do 2 thing

1. Read .ups values as XML.
2. Extract only defined labels and convert to CSV.

The only problem was that this could not happen as a process, this only read a file at a time and not all the files from the history folder to convert all data about the requirement.

A simple .batch program was written to make a loop that will bring inn .ups values and for every file imported, it would run xml2csv on it and export values in a single file as CSV.

Parts of the code for the .batch file are presented below with a simple explanation on the left.

- Path to .emfstore
- Copy all .ups files in the .emfstore-folder
- For-loop for every .ups file
- Use of xml2csv on every file.
- Output-file.
- Delete *.ups files

```
@ECHO OFF
SET pathName="shada\.emfstore\project-_4HgoQWbxEeS1L"

ECHO.
ECHO The default database folder is %pathName%.
ECHO.

ECHO Copying all database (.ups) files...
XCOPY %pathName%\*.ups /Y
ECHO.

ECHO Creating .csv file now...
FOR %%F IN (*.ups) DO (
xml2csv %%F result.csv "Requirement_name,VP_NO" -X )

REM Remove .ups files
DEL *.ups
ECHO.
```

Figure 44: Code of .batch file.

This chapter has covered the technical aspects of VPMT and how historical values are stored in the repository, retrieved with .batch code, and converted to CSV. By doing that, all the technicality has been described and the only missing thing is an example based validation.

The next chapter covers the validation of MVAP on both Concierge and CITI-SENCE and compare results in chapter thereafter.

8 Example based validation of MVAP

In chapter 2, three frameworks were introduced and implemented on Concierge and CITI-SENSE as examples. This chapter uses the same two examples from chapter 2 and realizes these with MVAP.

Chapter 6 described two intertwined processes of PDSA in MVAP, both processes will be implemented in this chapter for later comparison between MVAP and the existing solutions covered earlier.

8.1 Validation of MVAP for Concierge

This part of the chapter will validate the PDSA-Performance cycle for Concierge, beginning with the Plan-step. When the technical requirements are developed and their goals are reached, only then will the PDSA-Satisfaction cycle start.

8.1.1 Measurements for Concierge

MVAP is a framework developed onto the Business Model Canvas. Both the Canvas from VDML and the Business Model Canvas from chapter 2 are good options. This example is initiated with Business Model Canvas from chapter 2.1 because of familiarity with the framework from earlier chapters.

Figure 45 below represents only two primary building blocks from the already implemented Business Model Canvas from Chapter 2.4.1. This gives the overall business context and defines the building-blocks for the Value Proposition and the Customer Segments.

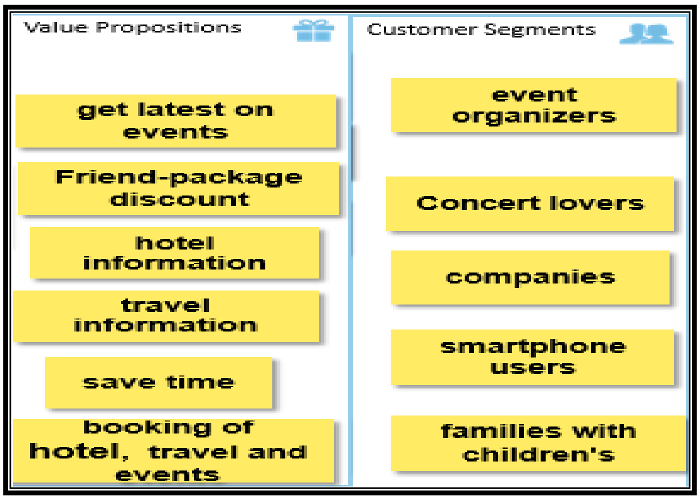

Figure 45: Two building blocks from Figure 1.

The next step in the process is to achieve a product market fit. This fit has been achieved in the example for Concierge in chapter 2.4.2.

The canvas illustrating the product market fit in this section is slightly different because it also categorizes the sub-components into functional and non-functional sub-components. Figure 46 illustrates these differences.

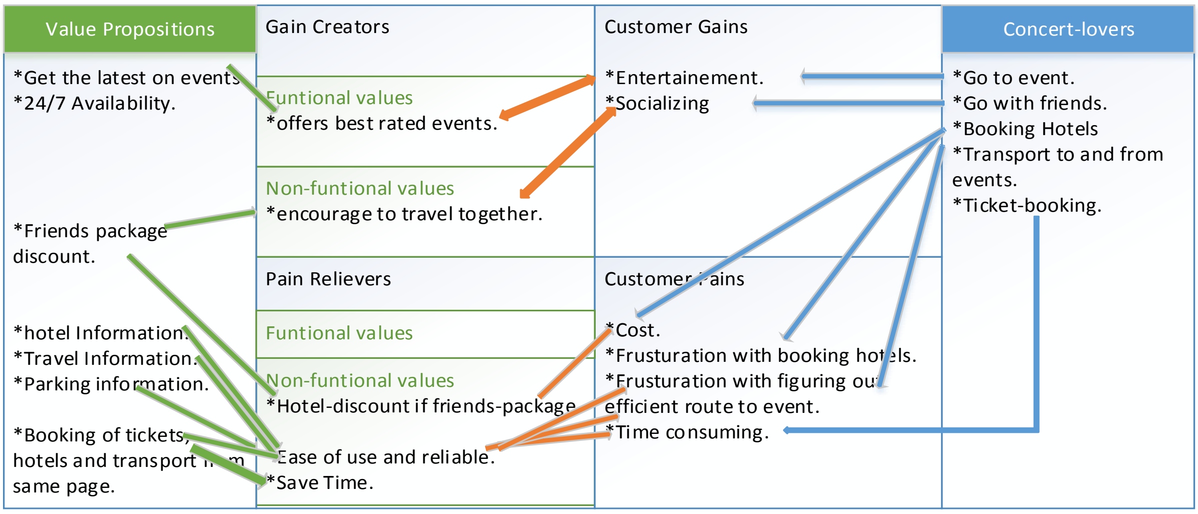

Figure 46: Modified Value Proposition Canvas.

The Figure 46 above illustrates functional and non-functional values on top of the Value Proposition Canvas from chapter 2. Two new categories make it possible to interoperate this framework with ServiceMIF, highlighted in chapter 2.3. By having the functional and non-functional sub-components or Value Benefits as described in ServiceMIF, makes it possible to incorporate canvas above with Solicitation stage of ServiceMIF. Reason for having equivalence between Value Benefits and sub-components, is that both are subset of the overall value proposition they represent.

The Value Proposition Canvas in Figure 46 takes a step further by breaking down the customer needs and the Value Proposition. This helps to design the requirements at a granular level and by having a defined customer need to refer to, increases the chances of a product market fit. The next stage converts business requirements to technical requirements. This is done by using similar techniques as in HOQ matrix [15].

Since requirements are fundamental for the entire process, it is important to validate and prioritize Value Proposition and technical requirement-parameters with the customers.

Certain steps are taken to fill the matrix, these are:

1. Write business requirements from Value Proposition in the left row.
2. Prioritize elements the customers want in the Value Proposition block.

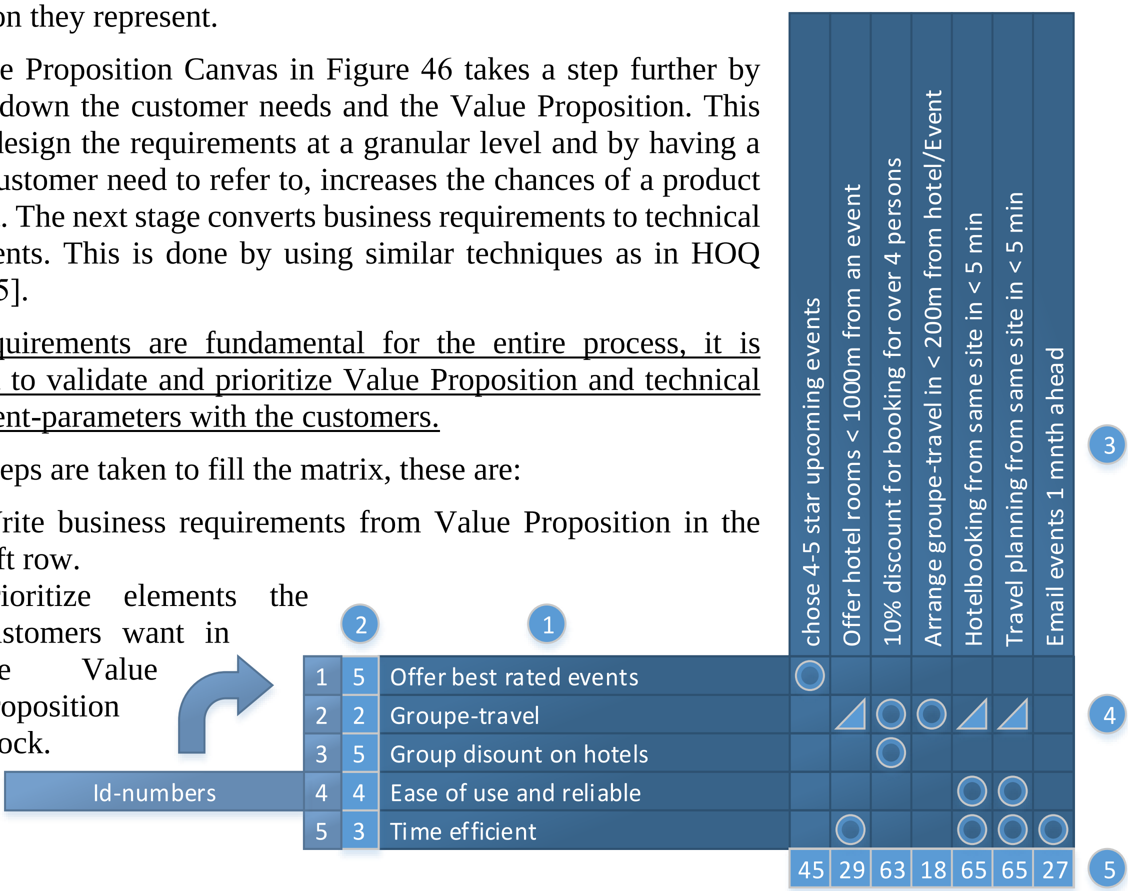

Figure 47: Conversion of sub-components of value proposition to technical requirements.

3. A value ranges from 1-5, 1 means less priority and 5 means high priority.
4. For every business requirement from either Pain Relievers or Gain Creators, there are one or more technical requirements. Every requirement must have a measurable value.
5. Fill matrix with relationship values defined in chapter 4.3.2.
    a. Doughnut = 9.
    b. Circle = 3
    c. Triangle = 1.
6. Calculate values for prioritizing requirements. This is done by multiplying priority (point 2), with relationship values (1-9 in point 4) and add all columns where there are values. Example, technical requirement No.2 from left **“offer hotel rooms < 1000m from an event”,** have triangle and a doughnut. These symbols represent value of 1 and 9. On the left side, there are priorities valued 2 and 3. This give total value of (1*2 + 9*3) = 29.

Important thing highlighted in **Figure 47** is that some of the business requirements have multiple technical requirements.

As values for the requirements have been set, the next step would be to use Value Proposition Measurement Template or VPMT defined in chapter 7.1. This technique changed the entire field setting because all communication have been market related, and after the use of matrix in **Figure 47**, all the requirements have become measurable and can therefore be worked on technically. The matrix in **Figure 47** illustrates conversion from Business to technical requirements. The ratings in point 5, shows the priority to the requirements, the highest value being 65 and the lowest being 27.

Figure 48 arranges the technical requirements according to the points gained in the matrix depicted in **Figure 47**.

1	Travel planning from same site in < 5 min
2	Hotelbooking from same site in < 5 min
3	10% discount for booking for over 4 persons
4	Chose 4-5 star upcoming events
5	Offer hotel rooms < 1000m from an event
6	Email events 1 mnth ahead.
7	Arrange groupe-travel in < 200m from hotel/Event

Figure 48: Prioritized sequence of technical requirements.

Until now, a business model has been made for Concierge, and breakdown of Value Proposition and Customer Segments have been done. Further the business requirements have been converted to technical requirements. With knowledge of technical parameters, one last task in planning step of PDSA-Performance is to set up the template for measuring the performance relative to the defined technical parameters. Next part of the chapter describes use of the VPMT for this purpose.

8.1.2 VPMT for Concierge

VPMT for every one of the technical requirements is made, and only the values relevant for the demonstrations are described here. Detailed figures are to be found in Appendix A. Every objective to be reached is written as acronym OC-1, OC-2 etc. for Objective for Concierge 1, Objective for Concierge 2 and so on.

8.1.2.1 OC-1: Time efficiency for travel planning

Before any test is conducted to measure performance, technical parameters have to be defined. These parameters are of two types.

1. Metadata, like start date, end date, goal etc.
2. The real values achieved.

Being part of the Plan-step in PDSA-Performance, means that the only values from type 1 can be added, other values are added in the next step of the PDSA-Performance cycle. **Table 15** shows the relevant values in VPMT that defines the technical parameters and other relevant information.

Requirement name	Time efficiency for travel planning.	Value type	Non functional
VP No	1	Value benefit	Pain relievers
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Travel planning
Choose unit	min (minutes)	Range from	1
Value per unit	min per planning	Range to	30
Goal	5 min		

Table 15: Values defining frame for OC-1.

The requirement is to have the travel-planning time below 5 minutes. The rest of the information is to identify the requirement and add relevant information. Another thing needed to be highlighted is that all the objectives have a VP NO, this number tells which value proposition the requirement is measuring for. In this case, all the requirements belong to the same value proposition and therefore all of them will have the same VP NO.

8.1.2.2 OC-2: Time efficiency for booking

Requirement name	Efficiency of booking-time	Value type	Non functional
VP No	1	Value benefit	Pain relievers
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Hotel-booking
Choose unit	min (minutes)	Range from	1
Value per unit	min per booking	Range to	30
Goal	5 min		

Table 16: Values defining frame for OC-2.

This objective is relatively the same as the objective 1, the only difference here is that it is meant to measure time for booking from Concierge as described in the field for **Value per unit** in **Table 16**.

8.1.2.3 OC-3: Group discount

Requirement name	Group discount	Value type	Non functional
VP No	1	Value benefit	Pain relievers
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Group-discount
Choose unit	Pct.	Range from	0
Value per unit	Pct. per group-booking	Range to	20
Goal	10 pct.		

Table 17: Values defining frame for OC-3.

Goal here is to keep the discount at 10% when there is a group-booking.

8.1.2.4 OC-4: Offer of events

Requirement name	Offer best events	Value type	Functional
VP No	1	Value benefit	Gain Creators
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Event
Choose unit	Distance	Range from	1
Value per unit	Stars per event	Range to	5
Goal	Show 4-5 star event		

Table 18: Values defining frame for OC-4.

Unlike the objectives above, this one has self-defined values. On the field of "**Choose Unit",** there is a default value "**Distance**" meaning that nothing has been defined as unit from this dropdown window. The alternative being used here is from field of "**Attributes**" and "**Value per unit**". By doing that, a relation is improvised in the field of "**Value per unit**", for this objective it is "**Stars per event**". Those events with certain stars will be offered, not the rest. Point illustrated here is that there is flexibility to improvise the template and use it for other values than the default values in VPMT.

8.1.2.5 OC-5: Hotel offers close to events

Requirement name	Hotel close to event	Value type	Non functional
VP No	1	Value benefit	Pain relievers
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Proximity to event
Choose unit	m	Range from	50
Value per unit	Hotel-event distance	Range to	2500
Goal	Less than 1000m		

Table 19: Values defining frame for OC-5.

The goal for this objective is to keep as close to the event as possible, defined as a minimum of 50 meters and a maximum of 1000 meters.

8.1.2.6 OC-6: Pre notice of events

Requirement name	Pre notice of events	Value type	Non functional
VP No	1	Value benefit	Pain relievers
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Event notification
Choose unit	days	Range from	1
Value per unit	Days before event	Range to	60
Goal	30 days		

Table 20: Values defining frame for OC-6.

The objective here is to simply be able to send and remind with information about the events one month ahead.

8.1.2.7 OC-7: Special hotel offer for groups

Requirement name	Close proximity for groups	Value type	Non functional
VP No	1	Value benefit	Pain relievers
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@concierge.no
Date to	30.11.2014	Attributes	Proximity to hotel
Choose unit	m	Range from	50
Value per unit	Distance per event	Range to	1000
Goal	< 200 m		

Table 21: Values defining frame for OC-7.

This requirement is similar to the OC-5: the difference is that the hotel being offered to the group is 200 m from the event, unlike the OC-5 where the distance can be up to 1000 m.

What vividly can be observed from the examples above is the limitation of the actual templates that represents these tables in the Appendix A. Values less than, above and other comparison operators cannot be applied because the system does not allow the numerical fields to have any symbol that represent the comparison operators.

This part of the chapter has laid the fundament for the measurement by adding measurable values from technical requirements into the template. Next step in the PDSA-Performance is to see how Concierge performs relative to the technical requirements above.

8.1.3 Implementation of performance test for Concierge

This step has the same function as the "**Do**" step in the PDSA-Performance. This stage will mainly test the performance of sub-components of the Value Proposition, and gather data to see how they perform relative to the goals set for the different objectives. Every objective is tested in separation and the values are recorded. Fields representing values that matter in this step are:

1. Start value: this would be the first value recorded, and will stay static until the end.
2. Set date of measurement: date the measurement is done.
3. Current value: this is the specific value recorded on date from step 2.
4. Acceptable: tells if the recorded value reached the goal or not.

After implementing this step, all the fields above should be populated in the VPMT. Depiction of completed templates for all the objectives from previous part of the chapter can be viewed in the Appendix A.

All the generated values are recorded in the repository after every checkout, and with some simple coding will values be fetched from the repository and into an excel sheet. This process is thoroughly described in chapter 7.2.3.5.

8.1.4 Study performance

The objective that has been fulfilled will not require any new round in the PDSA-Performance cycle, they are set aside until all the objectives are met. The failed objectives will be set for another round of the PDSA-Performance cycle until all objectives are met. Since this is a process, there are supposed to be multiple rounds that show the progress. Graph over the progress in the PDSA-Performance cycle is also available in the Appendix A.

8.1.5 Act

This is the last step of the cycle before it can begin all over again, if need be. The task here is to act to those objectives that have not reached their goals. Either they are improved and sent for another round of the PDSA-Performance cycle or simply discarded. This decision will rely on the management.

8.1.6 Results

All the tables from chapter 8.1.2 will be identified by their Requirement name, and for the sake of simplicity only relevant values will be displayed in the final result table.

In **Table 22**, there are some assumptions made because the values being used to illustrate performance are actually dummy-values. Assumptions made are that all requirements have met their goals in 10 iterations. Another assumption is that the date all goals were achieved, is 30.11.2014. **Table 22** below show end-result for the 7 objectives from chapter 8.1.1, and present graphs for every value (dummy) generated from start to end over process of 10 iterations.

Graphs for every objective can be seen through links on the right side of **Table 22**, acronym for every objective is OC-1, OC-2 etc.

Requirement name	Iteration No	Start value	Current Value	Goal	Measurement-date	Acceptable?	Link to graphs
Time efficiency for travel planning	10	23	4	5	30.11.2014	Yes	OC-1
Hotel-booking	10	20	2	5	30.11.2014	Yes	OC-2
Group discount	10	0	10	10	30.11.2014	Yes	OC-3
offer best events	10	2	4-5	4-5	30.11.2014	Yes	OC-4
Hotel close to event	10	0	750	1000	30.11.2014	Yes	OC-5
Pre notice of events	10	0	30	30	30.11.2014	Yes	OC-6
Close proximity for groups	10	1000	200	200	30.11.2014	Yes	OC-7

Table 22: Summary of values reached after 10 iterations in PDSA-Performance cycle.

The column for “Start value” shows how good Concierge was at performing the task at the starting point and values to reach were those displayed in the “Goal” column. There are some rows that contain 0 as value, meaning that this sub-component was absent to begin with and is newly added to the value proposition. The first value generated for these rows was after the first iteration of PDSA-Performance.

8.1.7 Customer Satisfaction for Concierge

The objective of PDSA-Performance was to visualize, improve and test in a continuous loop until all goals are either reached or some of them discarded to remake the Value Proposition. PDSA-Satisfaction takes over as soon as PDSA-Performance has validated its values.

In this phase PDSA-Satisfaction uses validated value proposition and offer it to the customer segment, and feedback trough survey will be used to see if the customers are satisfied or not.

Values for the customer satisfaction survey are also dummy values for PDSA-Performance. In this case, any customer satisfaction survey can be used with the condition that it has 11 point scale as described in chapter 6.8.2. Before presenting a table with variables, a sample-size is calculated because accuracy of the survey depends on the sample-size.

Since this factor is important, sample-size is calculated for making the point that it have been taken into account.

Formula for sample-size is described in chapter 6.9.2 as:

$$\text{Sample size} = \frac{(Z-score)^2 * std-deviation * (1-std-deviation)}{(margin\ of\ error)^2}$$

Further values needed to calculate a sample size are Z-score, in this case the confidence level is arbitrarily chosen to be 90% corresponding to Z-score value = 1.645. Standard deviation is 0.5 and margin of error is kept at 0.05. This gives

Sample size = $1.645^2 * 0.5 * \frac{1-0.5}{0.05^2}$ = 270 respondents are needed.

Table presented with values for dependent variable and independent variable is simplified to contain fewer values than what the actual size should be.

CS	best rated events	group travel	group discount	Ease of use and reliable	Save time
10	8	10	2	10	7
9	6	8	3	9	7
10	8	9	4	8	6
6	3	5	6	9	9
7	4	5	5	7	9
8	7	7	4	7	7
6	4	5	7	7	9
7	7	8	5	8	5
9	9	10	5	6	8
5	2	4	4	10	9

Table 23: Dummy values for concierge.

Table 23 shows dependent values as Customer Satisfaction (CS), all others are independent variables. Before moving on to multiple regression analysis, a simple calculation is needed to calculate the NPS, formula for this was presented in Figure 32 as NPS = Promoters – Detractors. This value for **Table 23** is 27% which is better than benchmark presented in chapter 6.8.1. Information missing is: which independent variable contributed most or least for satisfaction of the customer. The answer to this comes from the multiple regression model.

The result from the multiple regression model is present in **Table 24** below.

regression statistics		*sub-components*	*Coefficients*
Multiple R	0,938659351	best rated events	0,96128383
R/square	0,881081377	group travel	0,61713579
adjusted R/square	0,732433098	group discount	0,34425906
standard error	0,914004009	Ease of use and reliable	0,775906
observations	10	Save time	0,79610777

Table 24: Values for multiple regression analysis for table 22.

The most significant values from multiple regression analysis are presented in **Table 24**. The most telling of them all is R/square value, telling that 88% of the variation in CS can be explained by the 5 independent variables in **Table 23**. The next significant piece of information is **coefficient** for every independent variable. The graph below illustrates this.

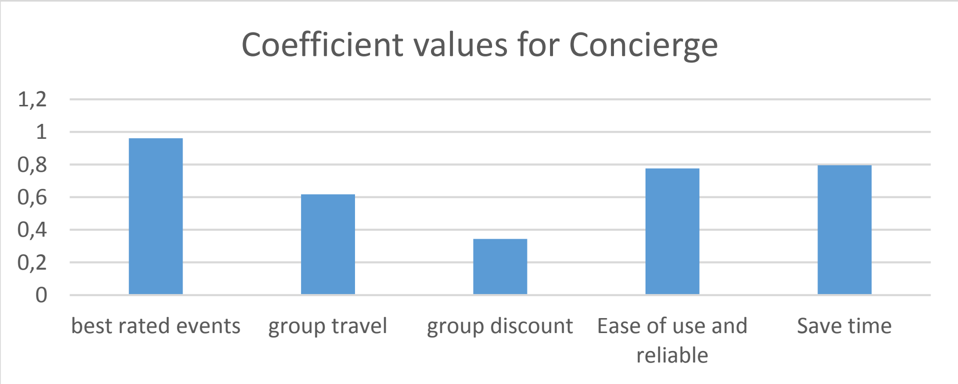

Figure 49: Multiple regression model for Concierge.

This graph shows that most of the offers made are well received by the customers because they score close to 1. The service that contributes the most is "Best rated events" and the offer that contributes least is "Group travel". By removing the offer least accepted can have an impact on the overall customer satisfaction negatively, but if it does not negatively impact the R/square value, then there should be no reason to improve this offer, it is better to remove it from value proposition. To see what happens to R/square by removing it, is depicted in another multiple regression test below.

regression statistics			*Coefficients*
Multiple R	0,93401036		
R/square	0,87237535	best rated events	0,67911076
adjusted R/square	0,77027562	group discount	-0,3641193
standard error	0,84690646	Ease of use and reliable	0,09735911
observations	10	Save time	0,2486948

Table 25: regression after removing one element from value proposition.

Observation from **Table 25** is that R/square has fallen since previous model. Difference between the R/square from **Table 24** and **Table 25** is:

0.881081377 - 0.87237535 = 0.00870603.

Converting this to percentage will give 0, 87%.

This means that removing "Group travel" from value proposition will decrease customer loyalty by less than 1%, therefore concludes that Concierge can safely remove this offer from value proposition during the next iteration and put money and effort to something else.

8.2 Validation of MVAP for CITI-SENSE

Much of the process of PDSA-Performance and PDSA-Satisfaction has been well covered theoretically and implemented with one example also, therefore will this example be implemented with less explanatory details than Concierge.

8.2.1 Measurements for CITI-SENSE

Starting-point is also PDSA-Performance as before and the Plan-phase contains 4 sub-processes. Two of them are already implemented in early chapters, being the Business Model Canvas from chapter 2.5.1 and the Value Proposition Canvas from chapter 2.5.2. Business requirements extracted in these canvases will be directly converted to technical requirements. Figure 50 illustrates the conversion of the requirements from customer requirement to technical requirement that can be measured.

Besides converting values from customer requirements to technical requirements, also priority have been given to every technical requirement.

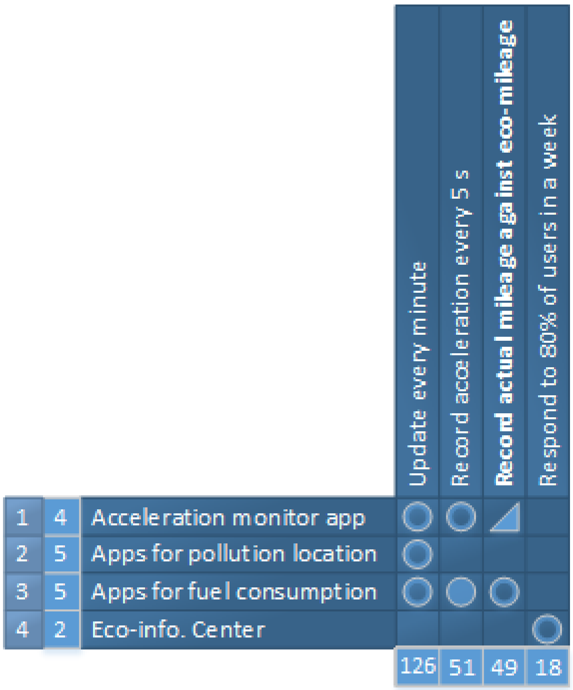

Figure 50: Requirement conversion for CITI-SENSE.

If arranged in accordance to priorities, new arrangement is:

1. Update every minute.
2. Record acceleration every 5 s.
3. Record actual mileage against eco-mileage.
4. Respond to 80% of user-request in a week.

There was a fifth requirement in the Value Proposition Canvas in chapter 2.5.2, this requirement was removed to illustrate that all requirements don't have to make it to conversion stage. Some of the requirements can be rejected by the customers as not being valid for them.

Customer validates which requirement to validate and which one not to before conversion of requirements starts. A fictional validation-process with customers, filtered out this fifth requirement. An assumption here is that the modified Value Proposition Canvas illustrated in **Figure 46** is already implemented. The reason for it not to be included is that it is relatively same as the Value Proposition Canvas illustrated in chapter 2.5.2.

Until now have the technical parameters been set, and the values defining technical parameters loaded into the VPMT.

8.2.2 VPMT for CITI-SENSE

The technical parameters and the metadata are added to the VPMT, performance data is added in the DO-phase of the PDSA-Performance cycle. This process is done similar as for Concierge, and tables in use are also as for the Concierge example.

Compared to the previous template, this is second value proposition being measured, and therefore has VP NO as 2. Dates, name, contact person and email stay the same as before. Process of reaching the goal is called Objectives for CITI-SENSE, and their acronyms are OCS-1, OCS-2 etc. Actual template is available in the appendix from here.

8.2.2.1 OCS-1: Update-frequency of the site

Requirement name	Update site	Value type	Non-functional
VP No	2	Value benefit	Pain Reliever
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@citisense.no
Date to	30.11.2014	Attributes	updates
Choose unit	min	Range from	1
Value per unit	min per update	Range to	10
Goal	1		

Table 26: Values defining technical parameters for OCS-1.

This step will populate the template with all the needed information about the goals to reach. Relation of values being used is defined by “Value per unit”. The relation in this particular case is number of minutes it takes before any update takes place.

8.2.2.2 OCS-2: Data-storage for acceleration

Requirement name	Record Acceleration	Value type	Non-functional
VP No	2	Value benefit	Pain Reliever
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@citisense.no
Date to	30.11.2014	Attributes	recording
Choose unit	s	Range from	1
Value per unit	s per recording	Range to	30
Goal	5		

Table 27: Values defining technical parameters for OCS-2.

Template for table 27 represents the frequency for recording acceleration, goal here is to make a recording every 5 seconds.

8.2.2.3 OCS-3: Compare mileage

Requirement name	Compare mileage	Value type	Non-functional
VP No	2	Value benefit	Pain Reliever
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@citisense.no
Date to	30.11.2014	Attributes	distance
Choose unit	km	Range from	200
Value per unit	km per refueling	Range to	900
Goal	500		

Table 28: Values defining technical parameters for OCS-3.

Goal for this requirement is to have a 500 km range for every refueling.

8.2.2.4 OCS-4: Customer response

Requirement name	Customer response	Value type	Non-functional
VP No	2	Value benefit	Pain Reliever
Iteration No	1	Contact person	ole
Date from	03.11.2014	Email	ole@citisense.no
Date to	30.11.2014	Attributes	response
Choose unit	days	Range from	1
Value per unit	80% per week	Range to	7
Goal	80%		

Table 29: Values defining technical parameters for OCS-4.

This requirement has a goal of having a response rate of 80% to the customer inquiries per week.

8.2.3 Implement performance test for CITI-SENSE

Second step in the PDSA-Performance cycle is to test to see how CITI-SENSE is performing relative to the requirements parameters defined earlier. This step will allow remaining fields to be filled with the values that measure performance.

8.2.4 Study values of VPMT

The objectives that reached their goals are kept unchanged, but those objectives that missed their goal will be set aside for improvement.

8.2.5 Act

The objectives with unacceptable values will be improved and sent for another iteration to check if latest improvement did yield acceptable results. The decision of discarding the requirement or improving it, is up to the management.

The moment all sub-components of value proposition have positive results, then the PDSA-Satisfaction cycle is triggered to offer these values to the customer segment.

8.2.6 Results

The only results that will be displayed in the **Table 30** below are final result with similar assumption as in case of Concierge. Assumption then was that

a. All the objectives are met.
b. They start on same date and end on same date.
c. The objectives are met after 10 iterations.

The final results are presented in **Table 30** below, and links from right side points to the graph that show improvements from start to the end over 10 iterations.

Requirement name	VP_NO	Iteration No	Start value	Current Value	Goal	Set date of measurements	Links to graphs
Update site	2	10	30	1	1	30.11.2014	OCS-1
Record Acceleration	2	10	20	4	5	30.11.2014	OCS-2
Compare mileage	2	10	200	580	500	30.11.2014	OCS-3
Customer response	2	10	13	88	80	30.11.2014	OCS-4

Table 30: Final output of all 4 objectives.

8.2.7 Customer Satisfaction for CITI-SENSE

The sample-size in this case is no different from the one in chapter 8.1.7. The sample-size then was 270, but values used were only 10. Similar approach is made here. **Table 31** below illustrates dummy values as if they were gathered from a surveys.

CS	pollution location	Acceleration monitor	fuel consumption	Eco-info center
10	10	2	7	7
9	7	3	6	7
10	9	4	7	6
6	6	6	5	9
7	5	5	6	9
8	7	4	6	7
6	5	7	5	9
7	7	5	6	5
9	9	5	8	8
5	8	4	4	9

Table 31: Values from a fictional survey.

Before a regression test is conducted, the NPS for the Customer Satisfaction represented in the left row in **Table 31** will be calculated and after that will regression test be used to see which one of the 4 independent variables contributed most or least.

NPS = % of promoters - % of detractors, this give following score for Customer Satisfaction.

49% promoters – 22% detractors = 27% Customer Satisfaction. This value is above the 21% benchmark presented in chapter 6.8.1.

The multiple regression test is conducted to see which one of the sub-components is contributing the most or least. Those sub-components that contribute least are removed and another multiple regression test is conducted to see how much the customer satisfaction will drop by removing this sub-component, will the customer satisfaction still remain the same, improve or worsen?

The first test conducted, presents the values in the **Table 32** and the **Figure 51** below.

regression statistics			*Coefficients*
Multiple R	0.949140027		
R/square	0.90086679	Pollution location	0.719782759
adjusted R/square	0.821560222	Acceleration monitor	0.103403645
standard error	0.746410503	Fuel consumption	0.009605272
observations	10	Eco-info.center	0.602268439

Table 32: Statistical values for 4 sub-components in value proposition of CITI-SENSE.

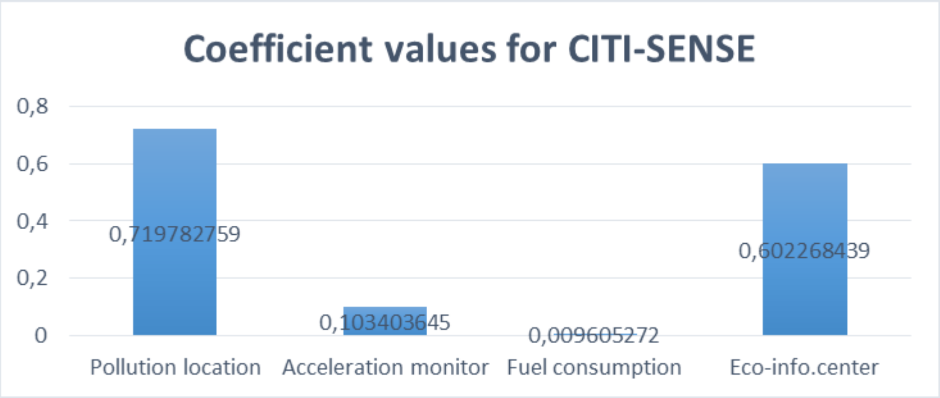

Figure 51: Graphical representation of Coefficient values from CITI-SENSE

It is obvious from **Figure 51** that "**Pollution location**" and "**Eco-info center**" are contributing the most with values as 0.719 and 0.6. The least contributing component in the value proposition is "**fuel consumption**". The remaining task is to see how much the customer satisfaction will fall if this component is taken away from the value proposition. **Table 33** below shows the results after removing the "**fuel consumption**" component from the value proposition.

regression statistics			*Coefficients*
Multiple R	0.756273934		
R/square	0.571950263		
adjusted R/square	0.357925394	pollution location	0.421325606
standard error	1.415874148	Acceleration monitor	0.518211019
observations	10	Eco-info center	0.336761817

Table 33: Statistical values of 3 sub-components in value proposition of CITI-SENSE.

By removing "**fuel consumption**" from the offer made by CITI-SENSE, a drop has taken place from the R/square in **Table 32** to the R/square in **Table 33**. The drop is 0.3289 or close to 33% drop in the customer satisfaction.

For Act-phase in the PDSA-Satisfaction cycle, this information will mean that it is not a good decision to remove the "**fuel consumption**" component from the value proposition. This component can be improved and therefore can be sent back to PDSA-Performance for the improvement. After the inner loop is done with improving this task, the offering again appears in the PDSA-Satisfaction cycle. It will again be tested against the customer segment it is meant for. The improvement goes on this way as a continuous process.

III
EVALUATION

9 Evaluation of MVAP

The existing solutions VDML, QFD and PLanguage were evaluated in chapter 4 in order to see if they fulfilled requirements defined in chapter 3. MVAP will be compared to the same set of requirements in this chapter to see if it is a better alternative to the existing solutions. Requirements categorized the same way as in chapter 4.

9.1.1 Business Model Requirements

	BM Requirements	MVAP	VDML	PL	QDF
BM-1	Business Model Visualization	2	2	0	0
BM-2	Customer Segment	2	2	1	2
BM-3	Value Proposition	2	2	1	1
BM-4	Ease of use	2	0	2	1
	Sum	8	6	4	4

Table 34: Results of MVAP in Business Modeling.

BM-1: Business Model Visualization: Creating a business model is the first task in MVAP. The overall business model allows having an overview of all relevant building blocks and their setting relative to each other. MVAP uses a tested and proven Business Model Canvas, described in chapter 2.1. This describes the building blocks and gives a bird's-eye view to see the relation between the building blocks. By doing that, the requirement of BM-1 would be covered.

BM-2: Customer Segment: Since MVAP is a framework for improving value proposition in relation to customer requirements, it is essential that the business model being used has a block that defines customer segments. The Business Model Canvas used for MVAP in chapter 8 allows MVAP to define customer segments as part of the business model, thereby fulfills requirement of BM-2:

BM-3: Value Proposition: Similarly as previous requirement the block defining value proposition is important for MVAP, also this requirement is covered by using Business Model Canvas described earlier.

BM-4: Ease of use: The Business Model Canvas in use puts all building blocks on a single page and by doing that it gives an easy understanding of the big picture. Limited business knowledge is enough to start using this Business Model Canvas.

9.1.2 Requirements for Product Market Fit

	PM Requirements	MVAP	VDML	PL	QFD
PM-1	Granular definition of Value Proposition	2	2	2	1
PM-2	Granular definition of Customer needs	2	0	1	2
PM-3	Visualize fit for offers and needs	2	0	0	0
PM-4	Functional Value Benefits	2	0	0	0
PM-5	Non-Functional Value Benefits	2	0	0	0
	Sum	10	2	3	3

Table 35: Results of MVAP for Product Market Fit.

PM-1: Granular definition of Value Proposition: A breakdown of value proposition was achieved by using Value Proposition Canvas in chapter 8 therefore fulfilling this requirement too.

PM-2: Granular definition of Customer needs: The Canvas in the previous requirement also covered Customer needs.

PM-3: Visualize fit for offers and needs: The Value Proposition used for MVAP puts together building blocks to visualize relation between blocks for offers and needs.

PM-4: Functional Value Benefits: A definition for Functional value benefits was added to Value Proposition in chapter 6.

PM-5: Non-Functional Value Benefits: As above, this definition of value was also added in the modified Value Proposition.

9.1.3 Technical Requirements

	Technical Requirements	MVAP	VDML	PL	QFD
TR-1	Convert Value Benefits to technical requirements	2	1	2	2
TR-2	Exchangeable data format	1	2	0	0
	Sum	3	3	2	2

Table 36: Technical Requirements fulfilled by MVAP.

TR-1: Convert Value Benefits to technical requirements: Conversion phase from customer requirements to technical requirements was fulfilled in chapter 6.2.3.

TR-2: Exchangeable data format: To make values generated by MVAP to be used compatible with other systems, .usp to CSV conversion was done in chapter 7.2.3.5. The process of conversion was too cumbersome which affected interoperability which resulted in 1 as value for this requirement.

9.1.4 Measurement Requirements

Many of the basic values needed to make the template versatile are left out because of time constraints. This is the reason for value 1 given to measurement M-2, M-3, M-4, M-6 and M-7.

	Measurements Requirements	MVAP	VDML	PL	QFD
M-1	Measurable attributes	2	1	2	2
M-2	Goal defined in measurable values	1	0	2	2
M-3	Scale and meters	1	2	2	2
M-4	Interoperable measurement template	1	0	2	1
M-5	Time for task	2	0	2	0
M-6	Benchmark	1	0	2	2
M-7	Multi-Valued Measurement	1	2	2	2
	Sum	9	5	14	11

Table 37: Measurements Requirement table comparing MVAP to existing solutions.

M-1: Measurable attributes: To measure something, it is important to know what attributes are being targeted and there has to be some arranged values to observe the direction of the progress. This has been done in VPMT in chapter 6.2.4.3.

M-2: Goal defined in measurable values: Field for goals to achieve is defined in the same part of the template as the previous requirement; the problem here is that all values that ideally can be included are not there.

M-3: Scale and Meter: Scale is defined in chapter 6.2.4.3, these are fields for “Range from” and “Range to”. Meter is chosen from the “Choose Unit” field, where choice can be made from a dropdown window to define what type of value that is being operated with.

M-4: Interoperable measurement template: VPMT is not an embedded template into any system; it can therefore be used independent of any framework. One element missing from ServiceMIF was its inability to measure, by having VPMT that includes functional and non-functional values besides defining value benefits, makes VPMT easily adaptable and to be used in ServiceMIF for taking measurements.

M-5: Time for task: The time frame for getting the task done is defined in the fields for “Date from” and “Date to”.

M-6: Benchmark: How the system is currently performing is important to know. Upper value to achieve is set by the Goal requirement; lower value being set is done during the first iteration. This value is the benchmark, and is added into the field of “Start value” and remains the same throughout the improvement process of PDSA-Performance.

M-7: Multi-valued Measurement: All examples implemented with VPMT were with numerical values. Description of the templates containing Likert-scale and Currency was described in chapter 7.1.2 and 7.1.3. Since there was no use of these templates in Concierge and CITI-SENSE, they were left out, despite being defined, implemented and ready to use. Problem is that there are three templates and not 1 as conceptually thought.

9.1.5 Requirement for Customer Satisfaction Measurement

	CS Requirements	MVAP	VDML	PL	QFD
CS-1	Customer Satisfaction measurement	2	0	1	2
CS-2	Measuring User Experience	0	0	0	0
	Sum	2	0	1	2

Table 38: Comparison of MVAP and existing solutions.

CS-1: Customer Satisfaction measurement: The entire PDSA-Satisfaction cycle is about measuring Customer Satisfaction.

CS-2: Measuring User Experience: There was no direct technique to measure User Experience. Alternatively can PDSA-Satisfaction be modified from measuring Customer Satisfaction to measuring User Experience. But since this requirement is not addressed, the score for this requirement will be 0.

9.1.6 Process Requirements

	Process Requirements	MVAP	VDML	PL	QFD
P-1	Business modeling process	1	0	2	2
P-2	Iterative design	2	0	2	0
	Sum	3	0	4	2

Table 39: Describing Process Requirements of MVAP relative to existing solutions.

P-1: Business modeling process: The entire process of PDSA-Performance and PDSA-Satisfaction can be implemented step-by step. The steps needed for the implementation are from so many different platforms that it can be confusing while implementing those steps. This drawback is the reasons to give 1 as value for this requirement.

P-2: Iterative design: Both PDSA-Performance and PDSA-Satisfaction have an iterative design, which allows measurement against earlier iterations.

9.1.7 Requirements for Visualization

	Requirements for Visualization	MVAP	VDML	PL	QFD
V-1	Statistical Visualization	2	0	0	0
V-2	Regression Model	2	0	0	0
	Sum	4	0	0	0

Table 40: Requirements for Visualization to presented frameworks.

V-1: Statistical Visualization: PDSA-Performance gives a graphical output to illustrate the progress of improvement over a test period of 10 iterations. It similarly gives PDSA-Satisfaction a graphical output for values generated by multiple regression tests.

V-2: Regression modeling: Measurement for Customer Satisfaction takes place with a Regression test during PDSA-Satisfaction cycle.

9.1.8 Comparison between MVAP and existing solutions

Alternative Solutions	MVAP	VDML	PL	QDF	Maximum
Sum points for ranking	39	16	28	24	48
Percentage value	81%	33 %	58 %	50 %	100%

Table 41: Comparison of existing solutions and MVAP.

Comparing MVAP to the existing solutions shows that MVAP is a better alternative than the others. The best challenging framework is PLanguage which underperformed by 40% relative to MVAP for addressing the requirements.

10 Conclusion and further work

This chapter will conclude the work done for MVAP from the problem definition to the contribution made in order to solve the stated problem. Finally, a section for Future work will describe the improvements that were part of MVAP concept but could not be implemented or were only partially implemented.

10.1 Problem and objective of the thesis

Three existing frameworks were introduced and implemented in chapter 2. The frameworks were:

1. Business Model Canvas
2. Value Proposition Canvas
3. ServiceMIF

These frameworks were used for two examples, namely Concierge and CITI-SENSE. By having the frameworks used we saw shortcomings to be studied relative to what the contribution of this thesis was going to be.

The concept of this thesis is to present a framework that allow innovative business-design and continuously measure value propositions with relation to customer satisfaction.

The problem with the frameworks introduced initially was that they either did not have a development process, or any measurements, or neither of them. To address the problem, a set of requirements were presented in chapter 3. These requirements were essential to be fulfilled to solve the defined problem.

Three frameworks of existing solutions were presented in chapter 4 and analyzed to see if they could fulfill requirements from chapter 3. The analyzed frameworks were:

1. PLanguage.
2. Value Delivery Modeling Language (VDML).
3. Quality Function Deployment (QDF).

The solution with the highest score of addressing the defined requirements was PLanguage with 58% rate of fulfilling requirements. This is, however, not enough to solve the problems defined in chapter 2, therefore a new framework, MVAP, was needed to be developed so that the requirements from chapter 3 could be addressed.

10.2 Contribution

To address the requirements defined in chapter 3, a new framework was developed, called

MVAP: A framework for Measurable Value Propositions - for Business and Service Improvement and Innovation.

The purpose of the framework is to allow innovative business-design and measure Value Proposition in a continuously changing business environment.

The idea is to combine existing solutions in such a way that requirements are addressed, rather than reinventing the wheel by starting from scratch. The starting point was with the Business Model Canvas defined in chapter 2.1. This is important to MVAP because the proposed framework is also meant to have an element of innovation in it. Business Model Canvas allows generation of innovative business design for addressing complex business environments. The MVAP is therefore developed on top of the Business Model Canvas.

The focus of MVAP is to break down value proposition and customer segments defined in the Business Model Canvas, for this purpose Value Proposition Canvas is used, as defined in chapter 2.2. Finally the step that converts business requirements to technical requirements is achieved in chapter 6.2.3, where steps from QFD are used for the purpose of conversion from business requirement to technical requirements. Technical parameters are then added to the VPMT, described in chapter 6.2.4. Technical values are compared between current values achieved during performance measurement and the goal that the requirement is meant to achieve. Until the goal is achieved the comparison of values in VPMT will continue in the PDSA-Performance cycle, this cycle is described in chapter 6.1.

When all technical parameters are achieved the value proposition is offered to the customer segment and their satisfaction with the value proposition is measured. This is a process on its own and is called PDSA-Satisfaction, described in chapter 6.7. The parts of the value proposition that the customers are satisfied with, will remain part of the value proposition. Those parts that do not contribute to the customer satisfaction will again be sent back to PDSA-Performance for review, reinvention or elimination. By doing this, the process of continuous improvement is achieved.

The hypothesis in chapter 1.3 stated

It is possible to support Business and Service Improvement and Innovation through a framework for Measurable Value Propositions with a continuous improvement process.

All the requirements of the 7 categories, have been fully or partially addressed by the PDSA-Performance and the PDSA-Satisfaction cycles of MVAP. This was illustrated during the evaluation in chapter 9, which implies that the hypothesis stated above is therefore validated.

10.3 Future work

Even if the main hypothesis has been validated, there are some issues that need more attention and effort to be considered for future work. The improvements left for future work are defined according to the categories for requirements used in chapters 3 and 9.

Technical requirements: The requirement for "*Exchangeable data format*" is not fully satisfied because an exchange representation has not been fully implemented. Improvement to this can therefore be a task for future work.

Measurement requirements: The Value Proposition Measurement Template (VPMT) in this thesis had some basic values just enough for validation of Concierge and CITI-SENSE. These values can be extended further to make the template applicable on a larger scale of technical requirements. In this thesis, only the most basic units have been added, like DISTANCE, VOLUME, MASS and etc. All of these can be extended and should be extended to match the conceptual design which requires a flexible template that can be used to measure everything.

Another weakness worth addressing is that there are three templates, Numerical-template, Enumerated/Likert-scale template and Currency-template. All of these templates should be embedded into one single template for ease of use.

Comparison operators are not operational in this version of the Value Proposition Measurement Template; this capability should be added to the template because these operators have a significant role in measurements.

Customer Satisfaction: Net Promoter Score (NPS) has been used to measure customer satisfaction and multiple regression tests are used to find out factors that contribute to customer satisfaction. Besides these tests, there are other tests that can be included to process recorded data for the purpose of being accurate and efficient in decision making. Some of the relevant tests are cohort analysis and retention-rate testing. The requirement for measuring "*User Experience*" went unaddressed. This is significant because good user experience is a contributing element to customer satisfaction; this requirement is therefore left for future work.

Process requirement: Requirement for having a process is fulfilled, but the efficiency and flow between every step within the process is not as good as it should be. Technical description of MVAP is described in chapter 7. Steps from conversion to technical requirements, measuring, storing data and then processing it in excel is a cumbersome process. This process can definitely be made more efficient and automated.

The process of PDSA-Performance and PDSA-Satisfaction is a process that only limits itself to value proposition and customer segment, not the overall framework of Business Model Canvas. How the improvement process would impact the entire organization is not addressed in this thesis, but it is an important factor worthy of including in future work.

Ease of use: use of Business Model Canvas to develop a business model was not a major issue, and MVAP had a full score on this requirement. But ease of use of the overall system is not as easy as the implementation of Business Model Canvas. As mentioned before a system should be built around the MVAP framework to allow easy implementation of MVAP.

It is assumed that some of the topics for a future work would be addressed in the context of further use and evaluation of MVAP.

IV
APPENDICES

11 Appendix A - Objectives from Concierge example

11.1 OC-1

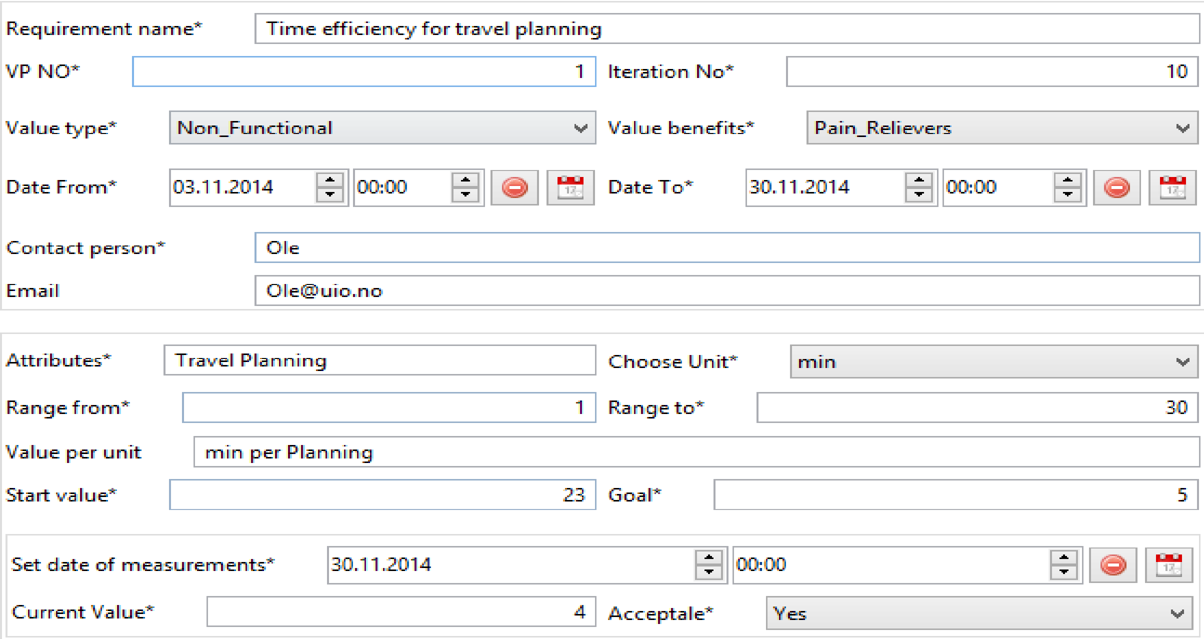

Figure 52: Full depiction of requirement 1 with all values set after a performance test.

This requirement has all the parameters set before internal testing. Two fields are left out, Description and Notes, because they provide no extra information for this requirement. Next table and graph describe the values generated during 10 iterations of improvements.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Time efficiency for travel planning	1	1	23	23	5	03.11.2014
Time efficiency for travel planning	1	2	23	22	5	06.11.2014
Time efficiency for travel planning	1	3	23	20	5	09.11.2014
Time efficiency for travel planning	1	4	23	17	5	12.11.2014
Time efficiency for travel planning	1	5	23	16	5	15.11.2014
Time efficiency for travel planning	1	6	23	15	5	18.11.2014
Time efficiency for travel planning	1	7	23	14	5	21.11.2014
Time efficiency for travel planning	1	8	23	11	5	24.11.2014
Time efficiency for travel planning	1	9	23	10	5	27.11.2014
Time efficiency for travel planning	1	10	23	4	5	30.11.2014

Table 42: Improvement during PDSA-Performance.

Core values that matter for improvement are described in Table 42.

Figure 53 is a graph that illustrates the development over 10 iterations. Point is to visualize values as such that it is easy to understand how development for this particular objective has been over time.

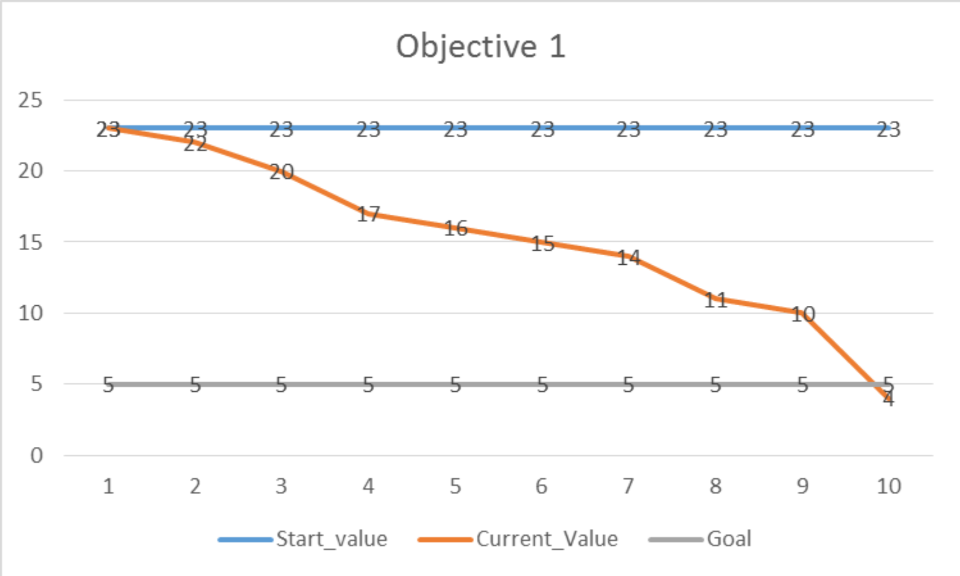

Figure 53: Development of Objective 1 over 10 iterations in Concierge.

11.2 OC-2

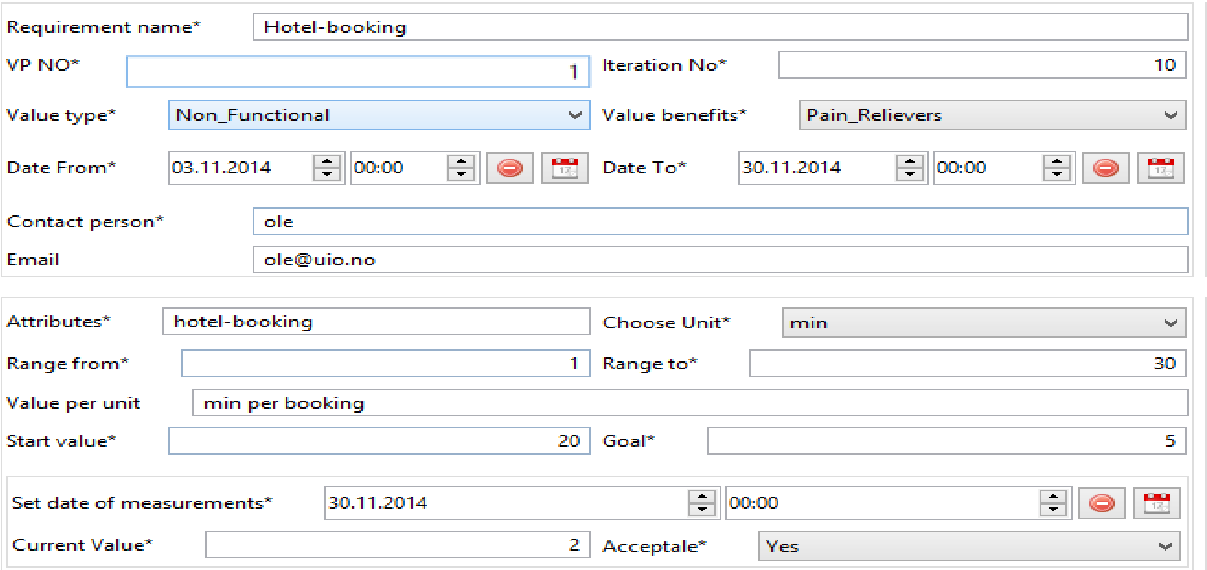

Figure 54: Template fully populated with values for Hotel-booking requirement.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Hotel-booking	1	1	20	19	5	03.11.2014
Hotel-booking	1	2	20	16	5	06.11.2014
Hotel-booking	1	3	20	14	5	09.11.2014
Hotel-booking	1	4	20	13	5	12.11.2014
Hotel-booking	1	5	20	12	5	15.11.2014
Hotel-booking	1	6	20	11	5	18.11.2014
Hotel-booking	1	7	20	10	5	21.11.2014
Hotel-booking	1	8	20	8	5	24.11.2014
Hotel-booking	1	9	20	6	5	27.11.2014
Hotel-booking	1	10	20	2	5	30.11.2014

Table 43: Improvement over 10 iterations.

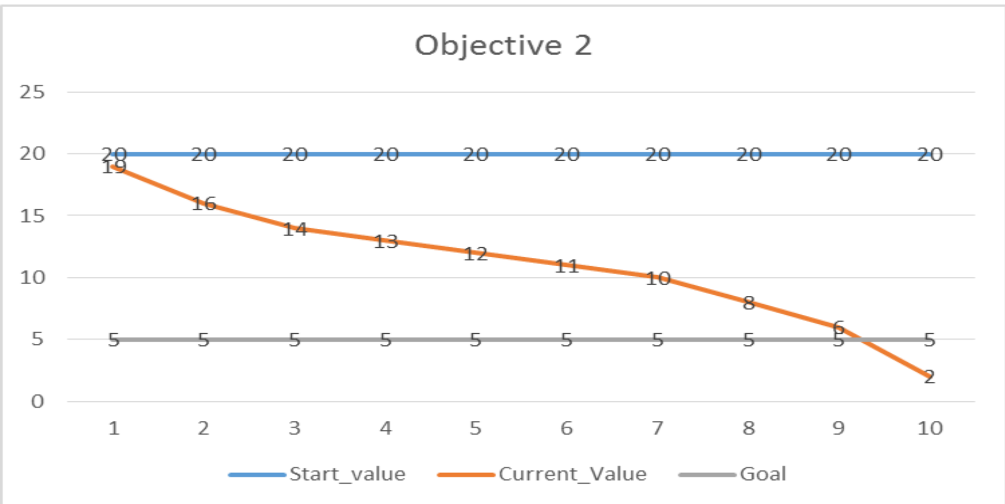

Figure 55: Graph of improvement for objective 2 in Concierge.

11.3 OC-3

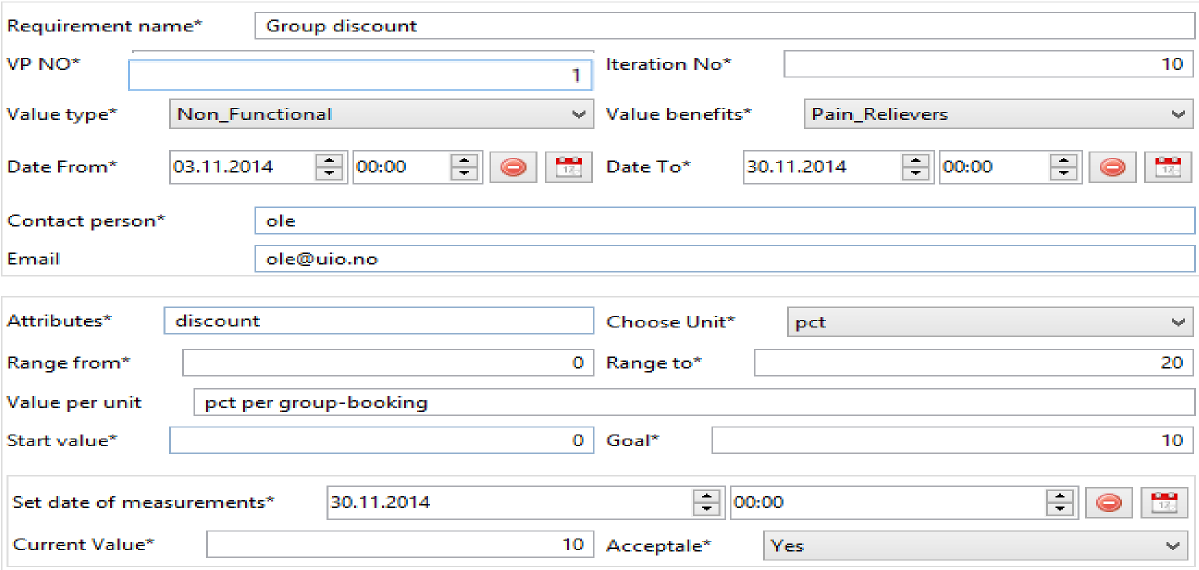

Figure 56: View of template after reaching goal.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Group discount	1	1	0	1	10	03.11.2014
Group discount	1	2	0	2	10	06.11.2014
Group discount	1	3	0	3	10	09.11.2014
Group discount	1	4	0	3	10	12.11.2014
Group discount	1	5	0	4	10	15.11.2014
Group discount	1	6	0	5	10	18.11.2014
Group discount	1	7	0	7	10	21.11.2014
Group discount	1	8	0	8	10	24.11.2014
Group discount	1	9	0	9	10	27.11.2014
Group discount	1	10	0	10	10	30.11.2014

Table 44:Improvement data for OC-3.

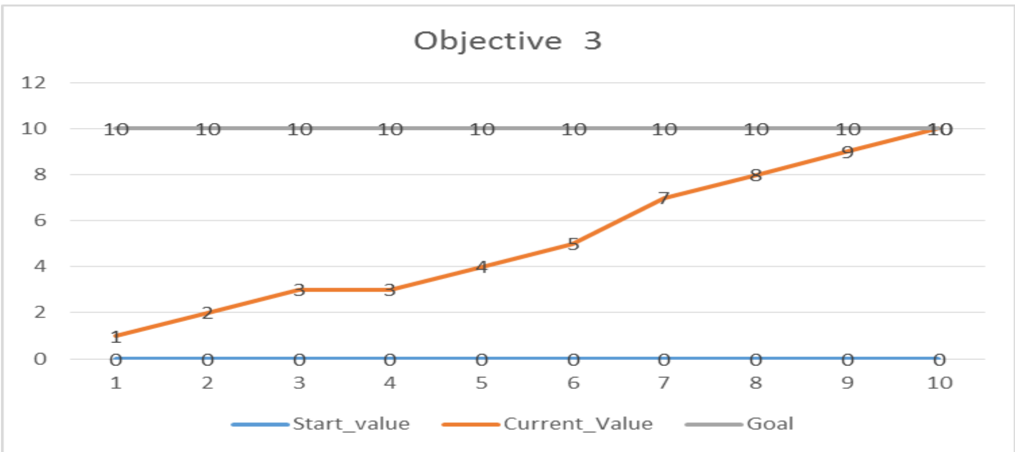

Figure 57: Graphical visualization of improvement for objective 3 in Concierge.

11.4 OC-4

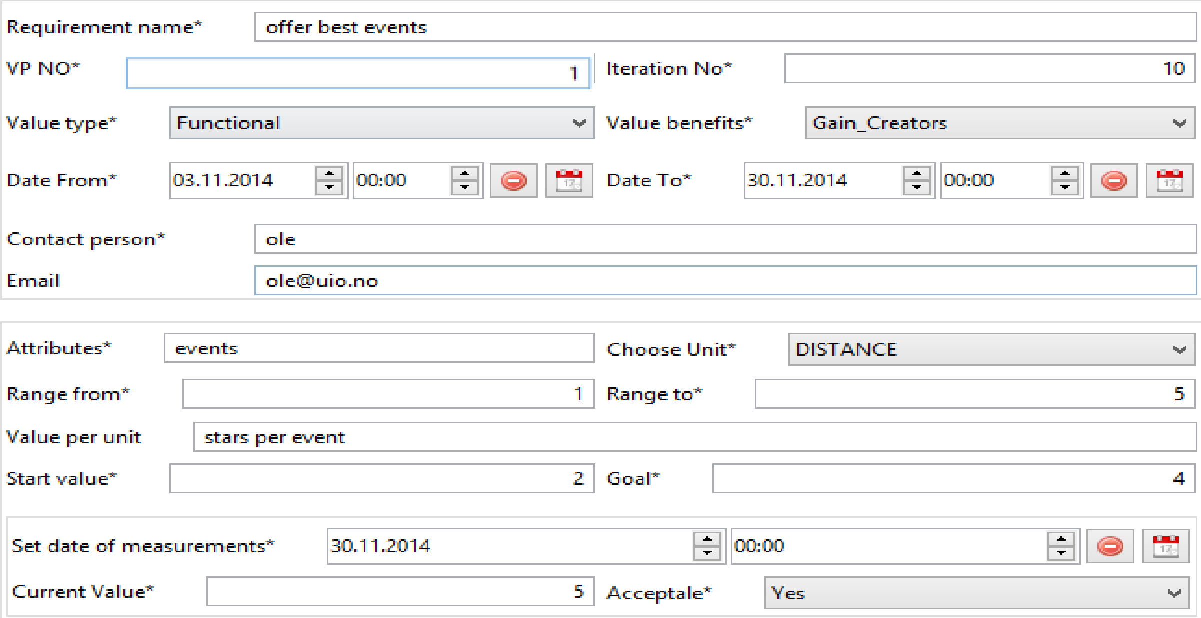

Figure 58: Example template for OC-4.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
offer best events	1	1	2	3	4	03.11.2014
offer best events	1	2	2	2	4	06.11.2014
offer best events	1	3	2	2	4	09.11.2014
offer best events	1	4	2	3	4	12.11.2014
offer best events	1	5	2	2	4	15.11.2014
offer best events	1	6	2	3	4	18.11.2014
offer best events	1	7	2	2	4	21.11.2014
offer best events	1	8	2	3	4	24.11.2014
offer best events	1	9	2	3	4	27.11.2014
offer best events	1	10	2	5	4	30.11.2014

Table 45: Improvements over 10 iterations for OC-4.

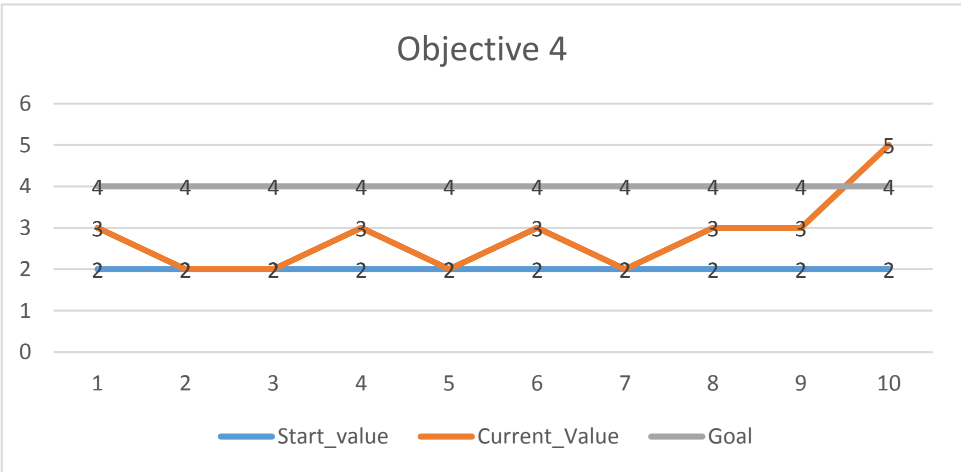

Figure 59: Graphical visualization of improvement for objective 4 in Concierge.

11.5 OC-5

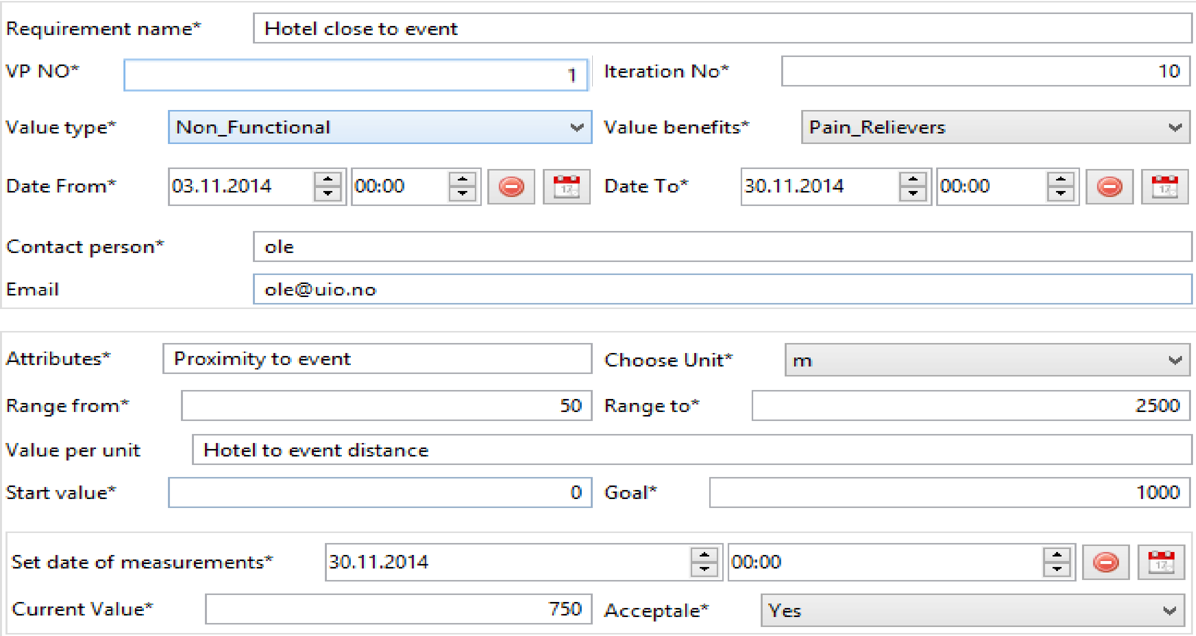
Requirement name* Hotel close to event
VP NO* 1
Iteration No* 10
Value type* Non_Functional
Value benefits* Pain_Relievers
Date From* 03.11.2014 00:00
Date To* 30.11.2014 00:00
Contact person* ole
Email ole@uio.no
Attributes* Proximity to event
Choose Unit* m
Range from* 50
Range to* 2500
Value per unit Hotel to event distance
Start value* 0
Goal* 1000
Set date of measurements* 30.11.2014 00:00
Current Value* 750
Acceptale* Yes

Figure 60: Template for OC-5.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Hotel close to event	1	1	0	2403	1000	03.11.2014
Hotel close to event	1	2	0	2360	1000	06.11.2014
Hotel close to event	1	3	0	1851	1000	09.11.2014
Hotel close to event	1	4	0	1780	1000	12.11.2014
Hotel close to event	1	5	0	1615	1000	15.11.2014
Hotel close to event	1	6	0	1359	1000	18.11.2014
Hotel close to event	1	7	0	1260	1000	21.11.2014
Hotel close to event	1	8	0	1066	1000	24.11.2014
Hotel close to event	1	9	0	1065	1000	27.11.2014
Hotel close to event	1	10	0	922	1000	30.11.2014

Table 46: Improvements over 10 iterations for OC-5.

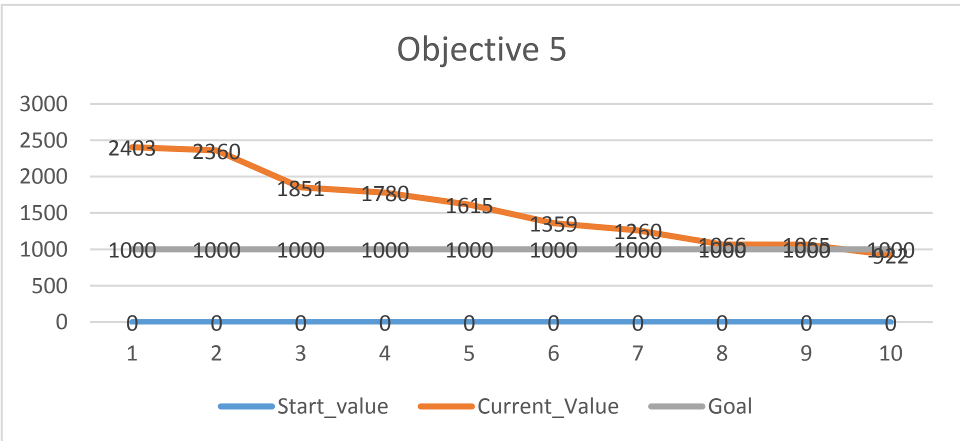

Figure 61: Graphical visualization of improvement for objective 5 in Concierge.

11.6 OC-6

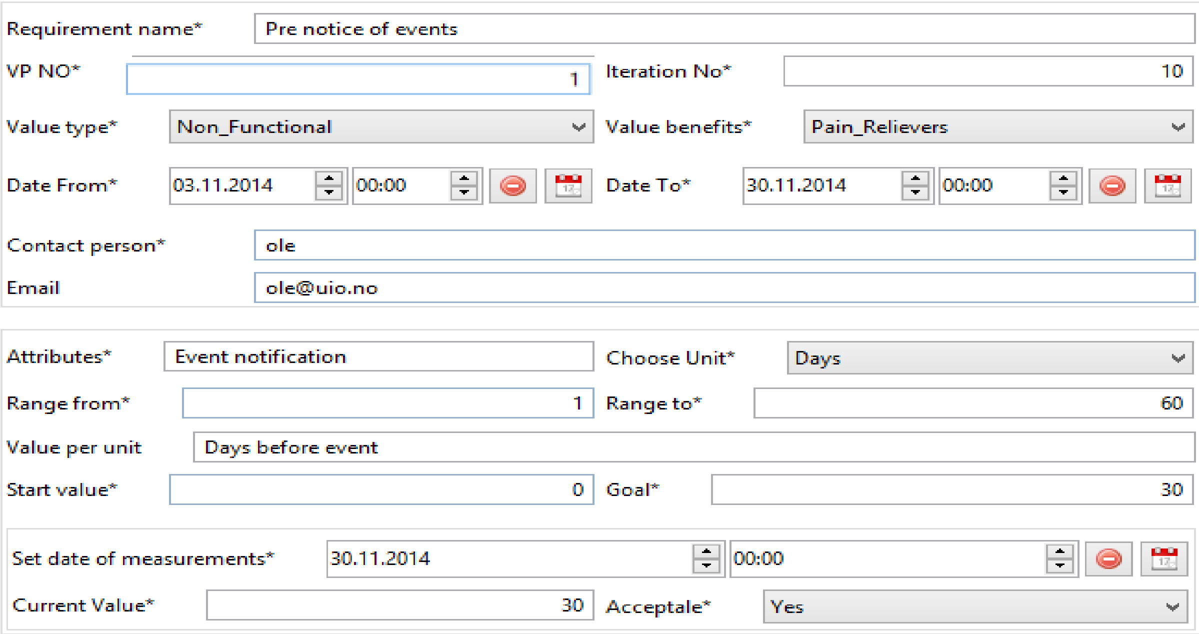

Figure 62: Template for OC-6.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Pre notice of events	1	1	0	11	30	03.11.2014
Pre notice of events	1	2	0	12	30	06.11.2014
Pre notice of events	1	3	0	16	30	09.11.2014
Pre notice of events	1	4	0	17	30	12.11.2014
Pre notice of events	1	5	0	21	30	15.11.2014
Pre notice of events	1	6	0	23	30	18.11.2014
Pre notice of events	1	7	0	26	30	21.11.2014
Pre notice of events	1	8	0	28	30	24.11.2014
Pre notice of events	1	9	0	26	30	27.11.2014
Pre notice of events	1	10	0	30	30	30.11.2014

Table 47: Evolution over 10 iterations.

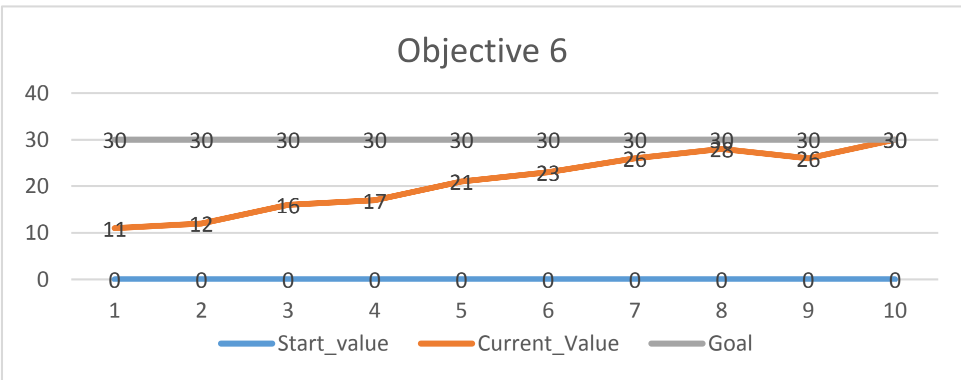

Figure 63: Sixth objective of OC-6 and its improvement.

11.7 OC-7

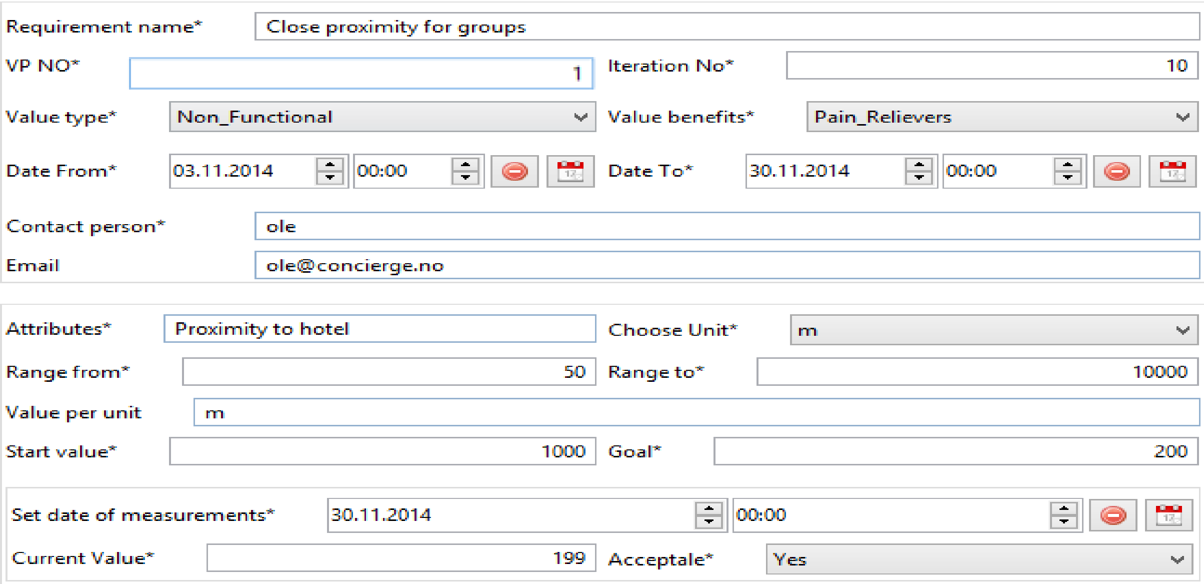

Figure 64: Template for OC-7, displayed at iteration 10.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Date measurements
Close proximity for groups	1	1	1000	958	200	03.11.2014
Close proximity for groups	1	2	1000	852	200	06.11.2014
Close proximity for groups	1	3	1000	844	200	09.11.2014
Close proximity for groups	1	4	1000	788	200	12.11.2014
Close proximity for groups	1	5	1000	746	200	15.11.2014
Close proximity for groups	1	6	1000	396	200	18.11.2014
Close proximity for groups	1	7	1000	307	200	21.11.2014
Close proximity for groups	1	8	1000	292	200	24.11.2014
Close proximity for groups	1	9	1000	290	200	27.11.2014
Close proximity for groups	1	10	1000	199	200	30.11.2014

Table 48: Development of values over 10 iterations.

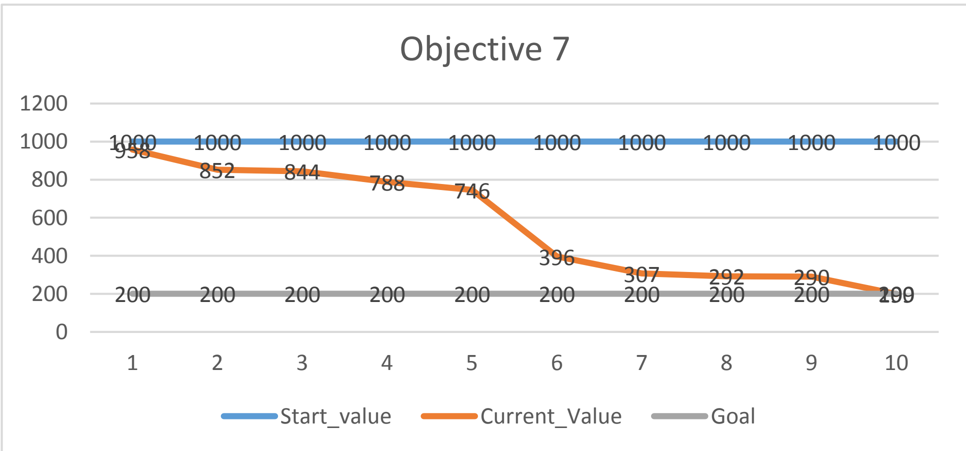

Figure 65: Graphical view over iterations.

12 Appendix B - Objectives from CITI-SENSE Example

12.1 OCS-1

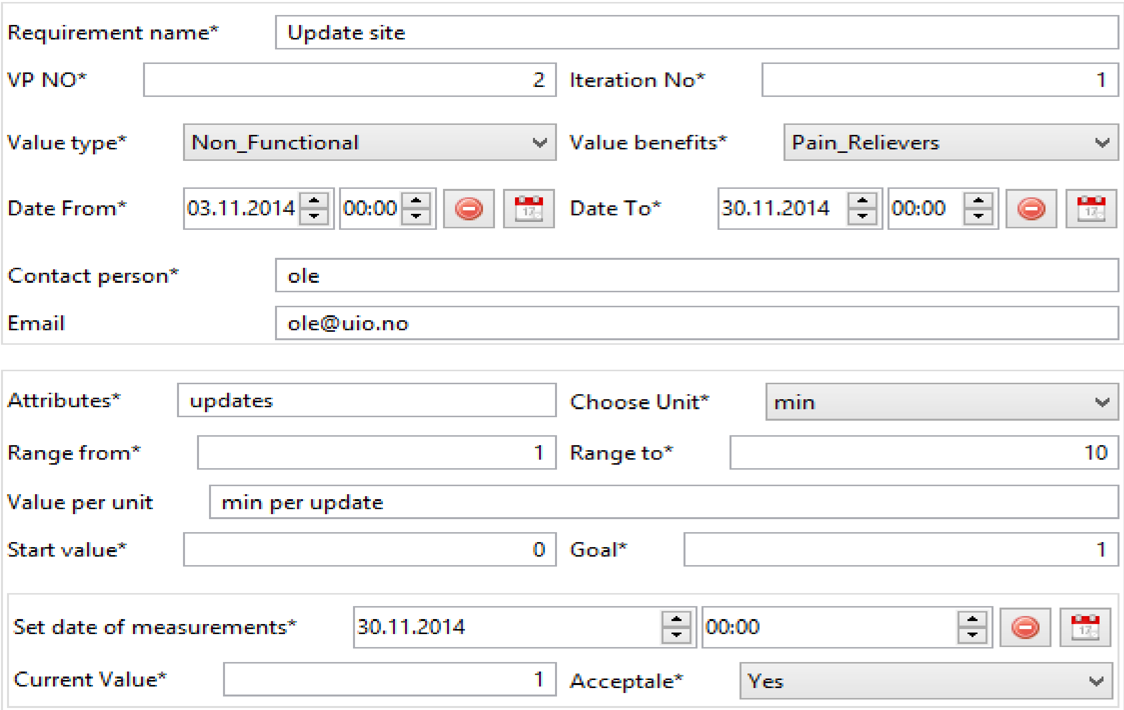

Figure 66: Illustrates the achieved goal.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Update site	2	1	30	30	1	03.11.2014
Update site	2	2	30	26	1	06.11.2014
Update site	2	3	30	25	1	09.11.2014
Update site	2	4	30	22	1	12.11.2014
Update site	2	5	30	15	1	15.11.2014
Update site	2	6	30	13	1	18.11.2014
Update site	2	7	30	13	1	21.11.2014
Update site	2	8	30	12	1	24.11.2014
Update site	2	9	30	5	1	27.11.2014
Update site	2	10	30	1	1	30.11.2014

Table 49: Improvements of OCS-1 over 10 iterations.

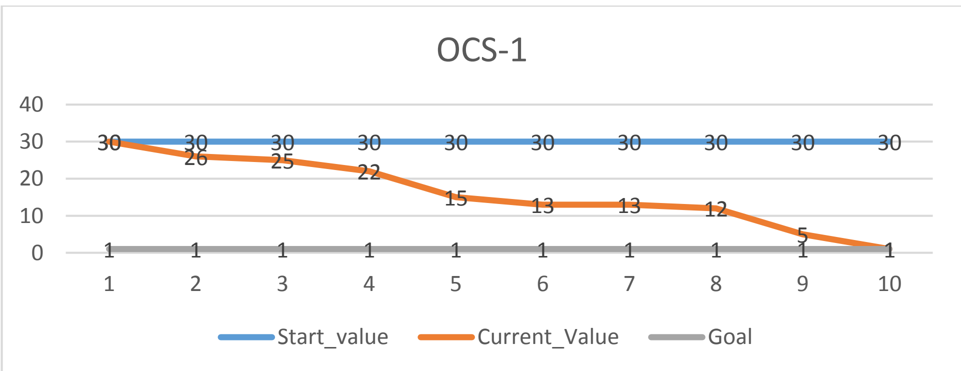

Figure 67: Improvement graph for OCS-1 over 10 iterations.

12.2 OCS-2

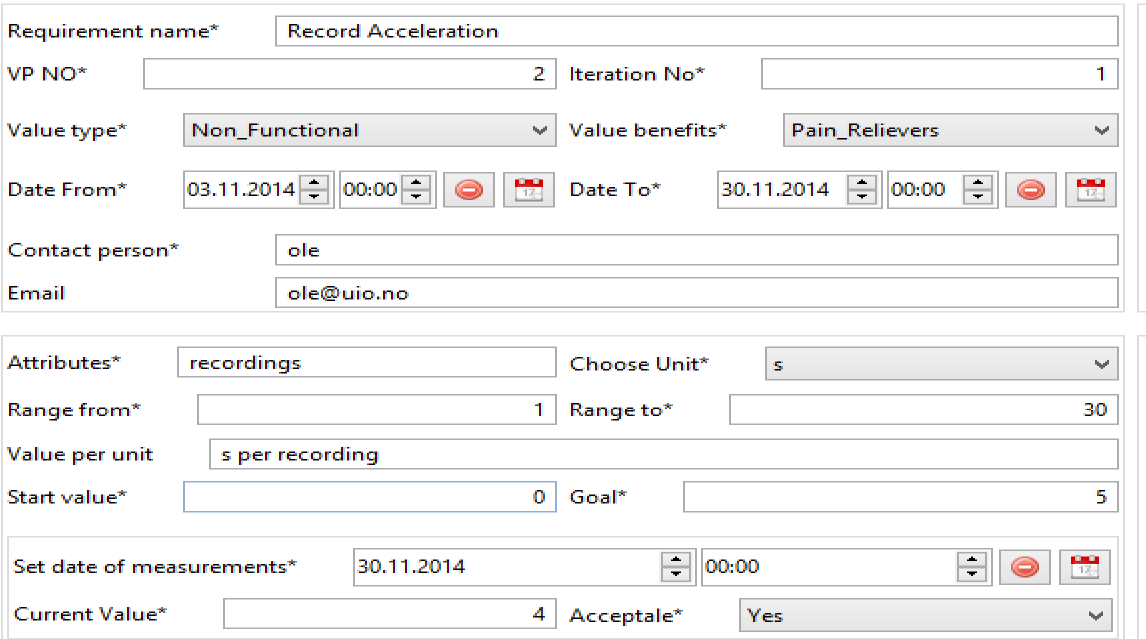

Figure 68: Template for OCS-2 illustrates the achieved goal.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Record Acceleration	2	1	20	20	5	03.11.2014
Record Acceleration	2	2	20	18	5	06.11.2014
Record Acceleration	2	3	20	17	5	09.11.2014
Record Acceleration	2	4	20	14	5	12.11.2014
Record Acceleration	2	5	20	10	5	15.11.2014
Record Acceleration	2	6	20	9	5	18.11.2014
Record Acceleration	2	7	20	8	5	21.11.2014
Record Acceleration	2	8	20	5	5	24.11.2014
Record Acceleration	2	9	20	5	5	27.11.2014
Record Acceleration	2	10	20	4	5	30.11.2014

Table 50: Improvements of OCS-2 over 10 iterations.

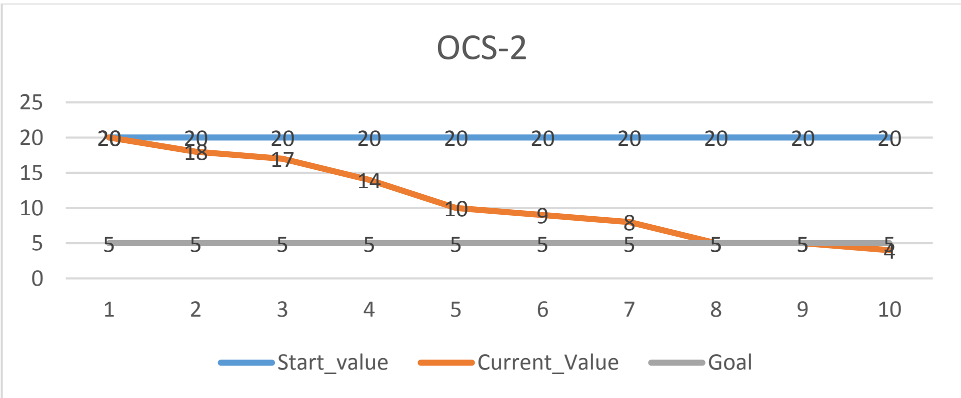

Figure 69: Improvement graph for OCS-2 over 10 iterations.

12.3 OCS-3

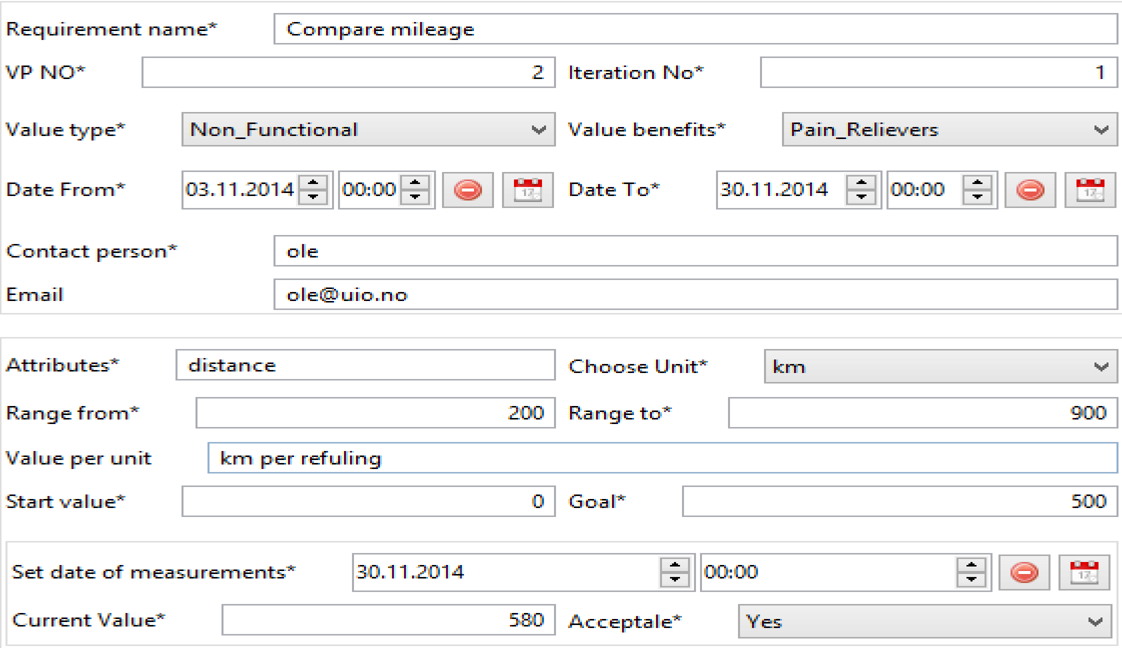

Figure 70: Template for OCS-3 illustrates the achieved goal.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Compare mileage	2	1	200	200	500	03.11.2014
Compare mileage	2	2	200	203	500	06.11.2014
Compare mileage	2	3	200	285	500	09.11.2014
Compare mileage	2	4	200	302	500	12.11.2014
Compare mileage	2	5	200	305	500	15.11.2014
Compare mileage	2	6	200	308	500	18.11.2014
Compare mileage	2	7	200	401	500	21.11.2014
Compare mileage	2	8	200	407	500	24.11.2014
Compare mileage	2	9	200	471	500	27.11.2014
Compare mileage	2	10	200	580	500	30.11.2014

Table 51: Improvements of OCS-3 over 10 iterations.

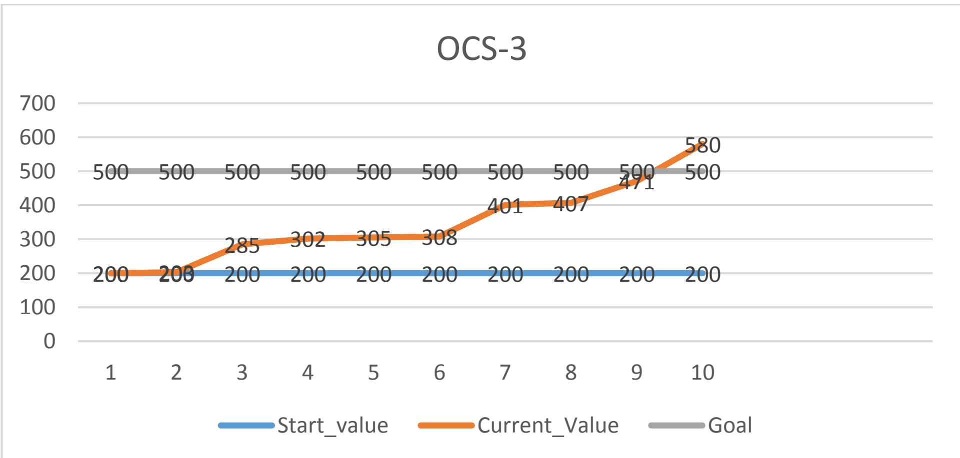

Figure 71: Improvement graph for OCS-3 over 10 iterations.

12.4 OCS-4

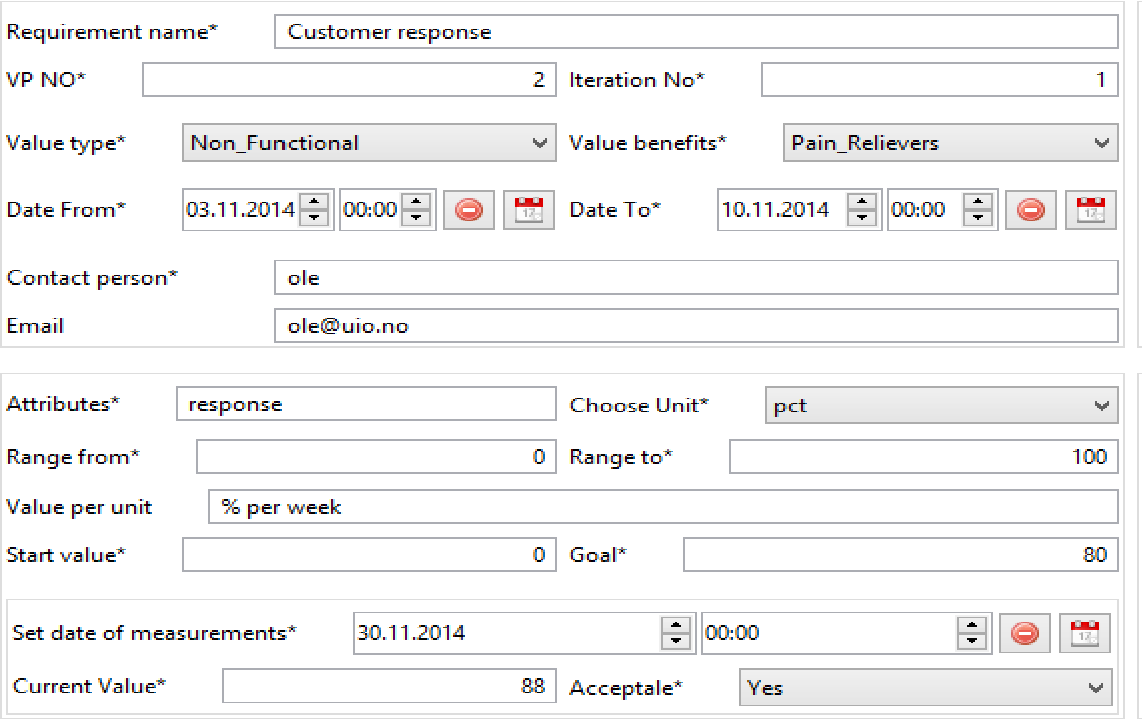

Figure 72: Template for OCS-4 illustrates the achieved goal.

Requirement_name	VP_NO	Iteration_No	Start_value	Current_Value	Goal	Set_date_of_measurements
Customer response	2	1	13	13	80	03.11.2014
Customer response	2	2	13	20	80	06.11.2014
Customer response	2	3	13	28	80	09.11.2014
Customer response	2	4	13	33	80	12.11.2014
Customer response	2	5	13	36	80	15.11.2014
Customer response	2	6	13	70	80	18.11.2014
Customer response	2	7	13	72	80	21.11.2014
Customer response	2	8	13	77	80	24.11.2014
Customer response	2	9	13	83	80	27.11.2014
Customer response	2	10	13	88	80	30.11.2014

Table 52: Improvements of OCS-4 over 10 iterations.

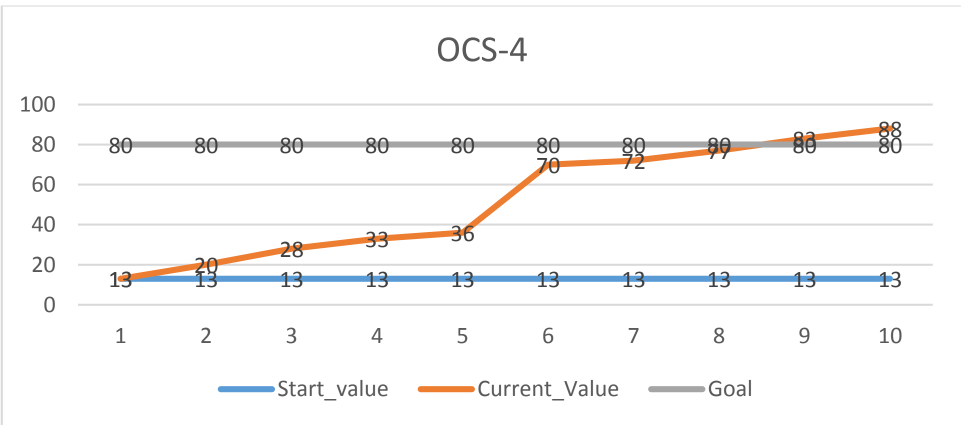

Figure 73: Improvement graph for OCS-4 over 10 iterations.

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