Abstract Organizational Values in IT Requirements
Developing a framework

Master thesis
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EXECUTIVE SUMMARY

IT technology is considered by business leaders as a crucial factor to achieve competitive advantage nowadays. The last decade the IT demand within organizations has significantly increased. This entails a variety of IT demands for IT providers. At the beginning of an IT project an agreement is made between the IT providers and IT demanders. The agreement contains all the IT requirement of the IT project. The IT requirements in the contract includes implicitly values of the organization; because the values are not explicitly considered it could miss important values of the organization.

This research paper is concerned with providing the reader with a framework to facilitate the transformation of norms and values of an enterprise into IT requirements necessary for the construction of an IT project. Values refer to what a person or an organization regards as important in life. Within the literature there are many studies whose purpose is to appropriate the reader with an understanding of how to effectively and efficiently extract IT requirements from a particular source in order to properly execute an IT project. Even though there is also emphasis on the importance of values within IT requirements there is no method to include values in ICT-design.

Within the scope of this research paper we have focused mainly on the research domains and related papers concerning Value Sensitive Design, IT Alignment and Requirements Engineering. This lead to the following research objective: to design a framework that is rooted in the design for values theory and can be used to include values and norms of an organization within the requirements of an IT service/product.

The research methodology used to achieve the objective of this thesis is an adjusted approach of Verschuren and Hartog’s (2005) design cycle. In Verschuren and Hartog’s (2005) approach we find the following phases: First hunch, Requirements and assumptions, structural specifications, prototype, implementation, and evaluation. The adjustment concerns the final two phases (i.e. the implementation and evaluation phase) of Verschuren and Hartog’s (2005) design cycle. The implementation and evaluation phase have been omitted and are replaced with the verification and illustration phase.

![Figure 1: Research methodology](image-url)
Figure 1 depicts the coherence of the adjusted approach of Verschuren and Hartog with regard to the chapters of this thesis. The first hunch is described within the first two chapters of the thesis. Chapter one and chapter two are describing the goals and expectations of the framework. The second phase, the requirements and assumptions phase, include the literature review and interview with experts. The literature review and interviews with experts contained requirements and assumptions. These requirements and assumptions are structured in the structural specification in chapter five. Furthermore, chapter five contains the prototype of the framework. The prototype is derived from the structural requirements and assumptions. Finally, we verified and illustrated the prototype in chapter six.

**Results**

The result of this study is a framework that allows organizations to identify norms and values within their organization and include them in the IT requirements. Figure 2 contains the derived framework with all necessary steps to include values and norms within IT projects. The framework consists of five steps and six building blocks. The organization block is derived from the IT alignment literature research and provides in-depth insight into the relationship between IT and business. The Value Sensitive Design research domains provides insight in how to abstract values from an organization and translate them into design requirements. The Requirements Engineering domain provides methods to include design requirements into IT requirements, which is called Service Specifications in our framework. The last step of the framework is the actual implementation of the IT requirements. The overlap of the three research domains provides a new method to include values in ICT-design. In addition, the framework includes valuable insights and considerations that are found important by experts in the field.

![Diagram](image-url)
Verification and validation
The framework has been verified through an interview with an expert. With the expert we investigated the completeness of the framework and whether the derived requirements are adequate. Furthermore, we discussed the applicability of the framework. Finally, we also illustrated the framework to a case. This allows the user to see the details of each step in practice.

Conclusions
We were not able to find methods that allow to include values and norms of an organization into the process of Requirement Engineering for an IT project. The framework that has been constructed in this thesis provides organizations steps that need to be considered to include values within IT requirement (from extracting the necessary and required values into translating them into IT requirements). A limitation of the constructed framework is that it has not been used in practice. However, we expect that we reduced this limitation by including the expertise of our interviewees. Value tensions issues that could arise during an IT project is such an example of practical insight of an expert. The final framework does not provide a blueprint of how to include values within IT requirements, but provides organizations a good overview of what needs to be considered.
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1) INTRODUCTION

1.1. PROBLEM CONTEXT

Business leaders consider IT a pivotal factor for achieving competitive advantage (Fitzgerald et al., 2013). The organizations wherein information technology (IT) is used to realize goals and perform certain business activities can be described as information systems. Business leaders expect that in the future the role of IT within information systems will only increase. Customer demands for IT services vary significantly. The large amount of variance does not make it possible for IT providers to meet all consumers demands (Patel et al., 2009); therefore IT providers and consumers need to make tradeoffs via a negotiation process. At the end of the negotiation process an agreement is reached between the provider and consumer. The result is a contract that includes requirements which need to be translated into an IT product/service.

Ideally, the requirements that are included in the contract should cover all the demands of the consumer. Subsequently, IT providers need to understand the requirements in accordance with the expectation of the consumer. However, in practice it turns out that this ideal situation is difficult to achieve. A parliamentary inquiry committee – under direction of parliamentarian Ton Elias - investigated IT projects within the Dutch government. The parliamentary inquiry committee concluded that organizations are not able to develop clear and complete requirements. Their conclusions implied that an IT provider manages to successfully develop what is promised in the contract, but the IT product/service does not (fully) fit the organization.

IT that is developed for an organization needs to be aligned with the organization. Within an organization many rules may not be defined explicitly and formally but do affect employees; all these informal and formal rules can be called values and norms (Van den Hoven, 2007). The IT requirements of an IT project needs to be aligned with the values and norms of an organization. Research in both private and public sector has proven that excluding values and norms within IT solutions can lead to resistance to its introduction. The resistance to IT could result in an IT failure. We can find many examples of IT projects that failed, due to missing norms and values in the IT requirements (Aldewereld et al., 2014, Van den Hoven, 2007, Peppard and Thorp, 2014). Besides resistance to the introduction of an IT project, values and norms play an essential role in an information system to act in an organized and co-ordinated manner (Liu et al., 2001).

Even though missing values and norms of an organization could lead to failure of an IT project it often occurs that they are not considered in the IT requirements. The impact of the values and norms on the organization becomes apparent after the IT system has been put to use; it is at this point that the negative or positive effects of the values of the organization on the IT project become visible. However, the impact of IT on the values and norms of an organization should not become apparent.

1 http://fd.nl/ondernemen/898484/commissie-elias-veegt-vloer-aan-met-ict-sector
2 http://www.nrc.nl/handelsblad/van/2014/oktober/16/commissie-biedt-ict-rapport-aan-even-goolen-wat-1428965
after the system is built and in use; more preferably would be to consider the relevant values and norms of the organization during the process of defining and documenting the IT requirements.

Furthermore, the changing environment adds to the existing problem, because we now have to consider that information systems are operating in an open and dynamic environment, where new IT tools can be added and removed instantaneously, and where some of these IT tools can autonomously move from one part of the system to another (Zambonelli and Van Dyke Parunak, 2003, Op’t Land et al., 2008). The current dynamic environment could lead to changing requirements over the years. When a customer has to wait two years before an IT system is delivered it could occur that the consumer changes the way they think about the expectations of the IT project. The consumer could have seen certain IT features in their environment that they would like to include in their own IT project.

This section elaborated the problem of organizations misaligning IT with their business. In order to find a solution for the problem it is pivotal to identify the root cause of the misalignment. When re-examining the discussed examples we can notice that many organizations do not know what they actually find important and when this is the case they often do not know how to translate it into their own IT project.

1.2. RESEARCH BACKGROUND

In the previous section we described the identified problem with current IT requirements in IT projects. In this section we will discuss the three research domains that we ought to investigate: Requirements Engineering, Value Sensitive Design, and IT alignment.

The current method to obtain IT requirements can be found in the Requirements Engineering. Requirements Engineering is defined as the research domain that deals with composing IT requirements for a project (Scheithauer and Hardegen, 2011). We will discuss existing software development methods for IT projects. Furthermore, we will go in-depth into all the phases that can be distinguished in Requirements Engineering. It is expected that the most interesting phases are the specification of IT requirements. There are several elicitation techniques to determine IT requirements in the Requirements Engineering. However, these techniques lack the ability to deal with value identification and elicitation.

Techniques for value identification and elicitation can be found within the Value Sensitive Design research domain. The Value Sensitive Design research domain is concerned with adding values into the design phase of a project. The research field of value sensitive design is an emerging one; therefore we expect that still much scientific research will be published. Aldewereld et al. (2014) introduced the Value-Sensitive Software Development (VSSD) framework as a design for values approach to the development of IT systems. Within the VSSD framework the relationships between values, business domain and the software product are more explicit. Van de Poel (2013) developed conceptual tools that can be used to translate values into more specific system requirements. We
will also discuss how values can be identified and discovered in an organization. However, in contrary to the Requirements Engineering domain the Value Sensitive Design does not consider the elicitation of IT requirements.

Figure 1: Venn diagram of the research domains

IT alignment is a research domain that is concerned with the interaction of IT and business (Campbell, 2005). This interaction concerns the alignment of IT strategy with the business goals, strategy and needs. In this research we want to establish that the problem lies in connecting values and norms of an organization to the IT requirements. The contextual environment of the connection between the organization and IT is therefore an interesting starting point. IT alignment which focuses on this connection between IT and business is a study that already exists a couple of decades and could provide us valuable insights of the IT and business environment.

In conclusion, the expectation is that none of the research domains are able to resolve the identified problems in the thesis. However, the overlap of the chosen three research domains could provide a solution, because they are expected to complement each other; therefore we will look into all three research domains (see figure 1).

1.3. RESEARCH OBJECTIVE

Based on the problem context and research background we derived the following research objective for this thesis: to design a framework that is rooted in the design for values theory and can be used to include values and norms of an organization within the requirements of an IT service/product.

The framework can be seen as a tool to help companies/government to include values and norms within the requirements of an IT project. Before the values and norms are included in the requirements they need to be made explicit first. A customer of IT services that manages to include values and norm within the IT requirements will be less inclined to changing IT requirements in the
future. The framework will contain aspects of existing Requirements Engineering methods, Value Sensitive Design theory and IT alignment.

The objective of this framework is not to give companies a blueprint of how to include values within IT requirements, but to give them an overview of what needs to be considered. Firms are operating in all kinds of business environments and the industry’s role is an important contextual factor in developing IT impacts (Dale Stoel and Muhanna, 2009). We can therefore not expect one single best framework for all companies, because the performance of the companies is impacted by both the external environment and the IT capabilities.

### 1.4. RESEARCH QUESTIONS

From the research objective we derived the research questions. In this thesis the objective is to design a framework that is rooted in the design for values theory and can be used to include values and norms of an organization within the requirement of an IT service/product. This leads to the following main research question:

[RQ]: How can we include values and norms of an organization into the process of Requirements Engineering for an IT project?

In order to answer this main research question we first need some sub-questions answered. The first three sub-questions pertained to the literature research.

**SQ1.** What can we learn from existing literature about IT alignment?

To understand the underlying reasons for IT usage within an organization we will start this thesis by researching IT alignment. Within the IT alignment research we seek to get a better understanding of the relationship between business and IT.

**SQ2.** What can we learn from existing literature about design for values?

Research needs to be done to find out what literature is available and what we can learn from the literature to develop the framework.

**SQ3.** What can we learn from existing literature about Requirements Engineering?

Existing Requirements Engineering literature will be explored on how they cope with values and norms in organizations. This should give a better overview what is already covered in the literature. Furthermore, we want to derive requirements for the framework.

**SQ4.** What can we learn from the field experts?

Based on the answers to SQ 1, SQ2, and SQ3 an interview will be drafted for the experts. We want to derive requirements from practical insights for the framework. Finally, we would like to confirm whether the experts also face the aforementioned problems.

**SQ5.** What requirements can we derive for the framework from both the literature and the experts?
By answering SQ1, SQ2, SQ3 and SQ4 an answer will follow for SQ5, using the literature and experts we can derive the requirements and building blocks the framework should include.

SQ6. Is the framework useful to include organizational values and norms within requirements?

After the framework is constructed we would like to verify it. This will be done by an expert. Finally, we will apply the framework to a scenario.

1.5. RESEARCH APPROACH

The research approach should provide the method to answers all the research questions. We will use the research design approach of Verschuren and Hartog (2005). This design cycle encompasses six different stages. In this report we will exclude the last two stages (i.e. implementation and evaluation) due to the limited time. Instead of implementation and evaluation we will provide a verification and illustration (see figure 2). In chapter two we will elaborate on each stage.

![Figure 2: Research Approach](image)

1.6. RESEARCH SCOPE

Determining a scope and limitation for this thesis is essential due to the limited resources and time. When the scope is not considered appropriately, this could have effect on the quality of the work. In this thesis we mentioned that we would like to research problems that cause IT projects to fail. Several decisions, considerations, and actions could negatively influence the outcome of an IT project. We narrow the focus in this thesis to the realisation of IT requirements. The thesis should
not deliver a framework that replaces existing Requirements Engineering methods, but to complement them by providing a framework that focuses on expressing missing values in the IT requirements.

Terms like value sensitive design, IT alignment, and Requirements Engineering are broad concepts. We will elaborate on these concepts to get a better understanding of the scope of this thesis. Before we will elaborate these concepts, bear in mind that the objective of this thesis is to design a framework that allows an organization to include values and norms in their IT requirements; therefore the research domains should result in a framework that addresses the research objective.

The framework will be based on literature review and interviews. Due to the limitations in the scope and time of this thesis extensive validation is not possible (i.e. testing the framework in a business environment). Verification will take place through evaluation with an expert. Finally, we will also provide how the framework could be illustrated in practice.

1.7. THESIS OUTLINE

In this chapter we introduced the problem, research background, research objective, and research approach of this thesis. In the next chapter we will elaborate on the research approach. Chapter 3 contains our literature research. In chapter 4 we will discuss what we have learned from the experts. In chapter 5 the results of the literature research and experts is assembled in a framework. This framework will be verified and illustrated in chapter 6. Finally, we will end in chapter 7 with the conclusions, limitations and academic contributions.
2) RESEARCH METHODOLOGY

In the research approach (section 1.5) we shortly described the adjusted approach of Verschuren and Hartog (2005). This adjusted approach is the research methodology of this thesis and encompasses the whole process of the thesis; therefore each phase of the adjusted approach of Verschuren and Hartog (2005) will be elaborated in this chapter. The design cycle of Verschuren and Hartog (2005) is the following:

1. First hunch: develop a small set of goals for the framework.
2. Requirements and assumptions: generate the requirements and assumptions that need to satisfy the goals of the framework.
3. Structural specifications: from the design requirements and assumptions the structure of the framework can be made. Furthermore, the first shapes of a framework need to appear in this stage.
4. Prototype: the realization of a first version of the framework will be developed. In this phase it will also become clear whether all structural specifications are included in the framework.
5. Implementation: Out of scope.

The implementation and evaluation phase are considered out of scope. The implementation and evaluation of the framework would require us to use the framework in practice. We do not have the time and resources to apply the framework in practice. Furthermore, one could assume that applying such a framework to a large IT project alone can be considered too complex for one person. Instead of the implementation and evaluation phases we introduced verification and illustration.

2.1. FIRST HUNCH

Within the first hunch phase, a set of goals are described for the framework that will be constructed. The research objective of this thesis is the following: to design a framework that is rooted in the design for values theory and can be used to include values and norms of an organization within the requirement of an IT service/product. The research objective was derived from the research background and problem context. We identified that the current methods within Requirements Engineering lack the ability to include values and norms within IT requirements. Through looking into Value Sensitive Design, IT alignment and Requirements Engineering we expect to be able to include values and norms within IT requirements. The current way of setting up IT requirements within Requirements Engineering is depicted on the left side of figure 3. The right side of figure 3 depicts the first hunch of our thesis.
In the second phase, we will derive requirements and assumptions of the framework from the first hunch. The requirements and assumption can be considered as the building blocks of the framework. Verschuren and Hartog (2005) defined three types of requirements and assumptions: functional, user and conceptual. The functional requirements contain all the functions the framework should fulfil. These functional requirements will be derived from the extensive literature of the following domains: value sensitive design, Requirements Engineering, and IT alignment. Secondly, we have user requirements which are focused on the future users of the framework. The third and last types of requirements are the contextual ones; these requirements are set by the political, economical, juridical and or social environment. These types of requirements will not be explicitly included in the framework because they are less important for this thesis.

All the requirements and assumptions will be listed in chapter five and are based on chapter three and four. The third chapter contains all the requirements and assumptions gathered from the literature research. Chapter four contains the requirements and assumptions from the field experts. The following two sub-sections describe the methodology used in chapter three and four.

2.2. REQUIREMENTS AND ASSUMPTIONS FROM LITERATURE RESEARCH

The literature research is limited to primary and secondary literature sources. The sources include papers, company reports, books, journals and conference reports. In order to obtain these sources we used the following databases:

- Google Scholar
- Scopus
- TU Delft library
- The ACM digital library

In these databases we used the following keywords:

- IT alignment
- Strategic Alignment Model
- Value Sensitive Design
The keywords also included titles and authors of publications found in the references of other publications.

The literature research should answer the following research questions: SQ1 (i.e. what can we learn from existing literature about IT alignment?), SQ2 (i.e. what can we learn from existing literature about design for values?) and SQ3 (i.e. what can we learn from existing literature about Requirements Engineering?). The answers contain requirements and assumptions that will be used to develop the framework. Based on these three research question we have three objectives for the literature research. The first objective of the literature is to better understand the relationship between IT and business. Secondly we will have the objective to provide an overview of what has already been researched in the value sensitive design. We will start by reading into taxonomy of values and norms and then we will focus on the earlier mentioned Value-Sensitive Software Development (Aldewereld et al., 2014) and its references. Finally, from the Requirements Engineering literature we will focus on the most famous software development processes and techniques to obtain IT requirements.

### 2.2.2. REQUIREMENTS AND ASSUMPTIONS FROM FIELD EXPERTS

In this section we described the method (i.e. interviews) we used to collect data of the experts. Within this section we will first describe in more detail why we used this research method. Finally, we provide the goals of the interviews and the interview protocol.

#### 2.2.2.1. RESEARCH METHOD

According to Verschuren et al. (2010) different decisions need to be made when creating a research approach. An exploratory research is conducted because investigating the overlap of the three research domains could be considered as a new field. The results of an exploratory research are in general not applicable for decision making, but can provide significant insight. A qualitative research is conducted because this research cannot be measured. An interview is used as a data gathering method to get more in-depth and practical information. The main advantage for an interview is that it can lead to the production of rich data, including observational data (Bjornholt and Farstad, 2012). A semi structured interview will be used because they allow going in-depth into the elements of the research.

#### 2.2.2.2. GOALS OF THE INTERVIEW
The main goal of the interviews is to answer the research question SQ4 (i.e. what can we learn from the field experts?). The interviews with the experts are held after the literature research is conducted. Based on research question SQ4 and the literature research we have the following interview goals:

1) Investigate whether the research problem really exist in practice and add more problems if they are mentioned.
2) Find out to what extent IT values need to be aligned with business values.
3) Investigate how values are included in IT systems.
4) Investigate what values are important within the company

The first goal has as purpose to compare the identified problems in the literature with practice. The existence of the problems in the literature can then be confirmed in practice. Furthermore, questions related to the problems could, besides the identification of the problems, lead to insights of other problems. The second goal is to determine the added value of the framework that we want to develop. The final goals should provide us insight into the whole process from value discovery to IT requirements.

2.2.2.3. INTERVIEW PROTOCOL

Based on the goals of the interview, interview question can be deduced. We have four types of questions: personal, identification problem, values within IT and business, and including values in IT systems.

Personal: We have questions concerning the role of the professional within the organization.

Identification problem: In the problem context in the first chapter we identified different problems. These type of questions can confirm the aforementioned problems in practice.

Values within IT and business: we strive to know the importance of aligning IT values to business values.

Including values in IT systems: These type of questions provides us with insight into what extent values contribute to existing IT system in practice. Furthermore, it answers the third and fourth goal of the interview.

2.3. STRUCTURAL SPECIFICATIONS AND PROTOTYPE

In this section we combined the structural specification and prototype into one section. The gathered data from the requirements and assumptions phase will be combined and analyzed to derive structural specifications. The structural specifications will be the elements that the framework should possess. This stage is also considered the most complex one because the designs will get its first forms (Verschuren and Hartog, 2005). The structural specifications are listed in the first section of chapter 5. After the structural specifications are derived we can start realizing a mock-up of the framework. We will decide and make clear in this phase which structural specifications will be retained in the mock-up after its realization. In this phase we should also revise whether all the goals and requirements and assumptions have been fulfilled from the first hunch (requirements and assumptions). The prototype is described in the second section of chapter 5.
2.4. ILLUSTRATION AND VERIFICATION

The verification and illustration phase are the last phases within this thesis and is not included in Verschuren and Hartog’s six stages (2005). The illustration phase will take place by applying the framework to a case to get a better understanding of how the framework should work in practice. The verification phase has as purpose to test whether the framework is constructed correctly. We illustrated and verified the framework based on the following the criteria:

1) **The understandability of the framework**: is the framework clear? Are the used terminology explained?

2) **Relevance requirement**: are the defined requirements of the organizations easy to understand? Are they understandable? Are they used in practice? Does the framework cope with trade-offs between requirements?

3) **Completeness framework**: does the framework cover all the identified requirements? Can we include new requirement for the framework?

4) **Applicability**: Is the framework interesting to use for in practice?

The first criteria will be explained through an illustration. Criteria 2, 3, and 4 will be tested through verification.

**Illustration**

In order to illustrate the understandability of the framework we will apply the framework to a case. The framework will be applied to an IT project that was conducted by Capgemini for the Dutch government³. We selected this case because of the following two reasons:

1) We expect that there will be enough information available online, due to its attention it received from the Dutch government and media.

2) Even though Capgemini stated that the new IT system would fit the requirements, the government decided to cancel the project⁴. The final conclusion of the Dutch government was that the introduction of the IT system would be very problematic.

**Interview with expert**

The verification of the developed framework will be conducted by an expert. We can divide the interview in two different components. The first component verifies the completeness of the framework. We need to know whether we are missing requirements and whether the included requirements are adequate. The second component verifies whether all the requirements are present within the framework. The expert will verify whether the established requirements are fulfilled. Each individual requirement needs to be covered by at least one activity within the framework. If all the requirements are fulfilled by at least one activity we can conclude that the requirements are verified within the framework.

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⁴ Ibid.
2.5. CONCLUSIONS

In conclusion we will summarize the content of this chapter to clarify the purpose of this thesis. We started off by stating that this thesis will follow an adjusted approach of the Verschuren and Hartog’s framework. In their framework, they make use of the implementation and evaluation phases, these two phases will be omitted in this thesis and supplemented by the illustration and verification phase. As stated previously, this decision is based on the time and resource constraints, which will make the usage of the implementation and evaluation phase infeasible.

![Research Methodology Diagram]

Figure 4, as can be seen above, depicts the methodology used in this thesis. The following is a short description of the figure.

The first and second chapter of this thesis contains the *first hunch phase*; herein the goal is to establish the groundwork for the resulting framework. The assumption on which we are basing our framework is that within the current Requirements Engineering domain, the ability to include the values and norms of an organization into the IT requirements are lacking. By combining this domain with the Value Sensitive Design domain and the IT Alignment domain, we expect to construct a framework wherein we are able to extract the values and norms of an organization and have them properly represented in IT Requirements.

The third and fourth chapters are dedicated to extracting the *requirements and assumptions* necessary for the construction of the framework from the literature review and the field expert interviews. The fifth chapter deals with all the elements of the framework and the actual construction of the framework in the *structural specifications phase* and the *prototype phase*.
Finally, the sixth chapter will discuss the verification and illustration phase, wherein the purpose is to establish whether the constructed framework is the correct framework for our purposes and whether the framework itself is built correctly.
3) LITERATURE REVIEW

This chapter presents the lessons learned from literature about IT alignment, value sensitive design, and Requirements Engineering. This chapter will be broadly divided into the three research domains. The objective of the literature review is first to analyze the three aforementioned research domains to derive requirements for the framework. The second objective is to learn from the literature to develop the framework. Within in each research domain we focused on sources that combine insight from theory with proven practical application.

From each research domain we sought for requirements that can be used as requirement for a framework that allows including values of an organization in the IT requirements. We expect that several steps should be included in the framework. These steps need to be discovered and identified within the literature. Finally, the literature review should confirm that a certain framework to include values from an organization in IT requirements does not exist.

3.1. IT ALIGNMENT

IT alignment is the domain that is concerned with the interaction between IT and business. This research domain is seen among managers as an important factor and driver to optimize business performance (Fitzgerald et al., 2013, Silvius, 2014). Over the years many definitions for IT alignment have been conceptualized. Reich and Benbasat (1996) defined IT alignment as the degree to which the IT strategy is supported by the business mission, objectives and plans. Henderson and Venkatraman (1993) defined IT alignment as the degree of fit and integration among the following four concepts: business strategy, organizational infrastructure, IT strategy, and IT infrastructure. Good IT alignment occurs when proper IT solutions are used in given situations and these actions are in concurrence with the business strategy, goals and needs (Luftman et al., 1999). Wieringa et al. (2005) stated that IT alignment is the problem of matching IT services with the requirements of the business. Over the years different definitions have been conceptualized for IT alignment. The main distinction we notice in IT alignment definitions of researchers is that certain researchers define IT alignment merely as IT supporting business, while other researchers state that IT alignment is about business supporting IT and vice versa. Beside the usage of the term IT alignment we can find many publications that use equivalent terms (Chan and Reich, 2007). The literature includes the following equivalent terms: fit (Chan, 1992, Venkatraman et al., 1993), integration (Venkatraman et al., 1993), linkage (Reich, 1993), harmony (Luftman and Brier, 1999), and fusion (Smaczny, 2001). Chan and Reich (2007) state that all these equivalent terms possess in general the same meaning (the integration of strategies between IT and business).

3.1.1. STRATEGIC ALIGNMENT MODEL

In this section we will discuss the Strategic Alignment Model. We will start by explaining what the model implies. Subsequently we will elaborate how the model can be used and why this model is relevant for this thesis.

What is the model used for?
In the nineties the role of Information Technology was changing from a back office role to a more strategic role. Venkatraman et al. (1993) discussed the analytical and administrative approaches for conceptualizing and managing strategic management and information technology. A Strategic Alignment Model (SAM) was developed to provide managers and researchers practical ways to attain IT alignment. Venkatraman et al. (1993) were influenced by a research conducted by Morton (1991) at the Massachusetts Institute Technology (MIT). SAM is built on four basic concepts: business strategy, information technology strategy, organization infrastructure and processes, and information technology infrastructure and processes.

**How can the model be used?**

The concepts within SAM are based on two axes of dimensions: strategic fit and functional integration. The former building block recognizes the need for strategy within the external and internal domain. The external domain is seen as the business environment wherein a company operates. The external domain includes differentiation from competition and strategic decisions concerning the alliances and partnerships. The internal domain is concerned, in contrast to the external domain, to the business processes, administrative structures, and the acquisition and development of human resource skills within the company. Venkatraman et al. (1993) state that IT strategy should be determined by an external domain (positioning of the firm within the IT environment) and an internal domain (configuration of the information system). However, managers seem to have more experience within the external domain with positioning their products and less with positioning within the IT market (Venkatraman et al., 1993). This can be partly explained due to the fact that managers are applying strategy to output market and because IT strategy has been often used as an internal response to business strategy.

Venkatraman et al. (1993) distinguish three sets of decisions for an organization within the external IT market (see figure 5).

1. Information technology scope – the information technology scope contains technology that support current business strategy or could shape new business strategy initiatives for a firm. This information technology scope is analogous with the business scope that deals with decisions concerning the product market offerings in the output market.

2. Systemic competencies – attributes of IT strategy that could lead to new business strategies or improve the support of existing business strategies. Systemic competencies are analogous to business distinctive competencies, which deals with those attributes (pricing, quality, value added service, and superior distribution channels) of strategy that should lead to a competitive advantage.

3. IT governance – usage and selection of mechanisms to obtain required IT competencies. IT governance is analogous to business governance which involves make-versus-buy decisions in business strategy.

Furthermore, Venkatraman et al. (1993) distinguished three types of components for the internal IT domain (see figure 5).

1. Information system architecture – the information system architecture is related to the technical infrastructure of a firm and includes a portfolio of applications,
hardware, software etc. The information system architecture is analogous to the internal business strategy environment to develop the administrative structure of the firm. This structure of a firm includes dealing with roles, responsibilities, and authority structures.

2. Information system processes – decisions of a firm to define the work processes that are central around the operations of the information system architecture. These work processes include systems development, maintenance, and monitoring and control systems. Information system processes are analogous to the development of business processes to support and shape the ability of a firm to execute business strategies.

3. Information systems skills – information system skills encompasses acquisition, training and development of the knowledge and capabilities of individuals to manage and operate the information system infrastructure (Venkatraman et al., 1993). Information systems skills are analogous to the skills that are needed in the business domain to execute a strategy of a firm.

Venkatraman et al. (1993) stated that a firm should not prefer the external domain over the internal domain or vice versa. Research has shown that an inadequate fit between the external and internal domain is an important cause for failure of IT projects (Venkatraman et al., 1993).

SAM contains besides strategic fit (the alignment of internal and external domains) a functional integration dimension. The functional integration dimension encompasses the need to integrate IT strategy with the business strategy and considers how decisions that are made in the IT domain impacts business strategy and vice versa. Venkatraman et al. (1993) distinguishes two types of
functional integrations: strategic integration and operational integration. Strategic integration is about linking the external domains and deals with the capability of IT strategy to both shape and support business strategy. Operational integration is about linking the internal domains (information system infrastructure and processes, and organization infrastructure and processes) and highlights the significance of reaching internal coherence between organizational requirements and the expected capabilities of IT.

**Why is the model relevant for this thesis?**

Venkatraman et al. (1993) are one of the pioneers in the field of IT alignment and their paper about SAM is one of the most widely cited IT alignment model (Chan and Reich, 2007). SAM contains a holistic overview of IT alignment and insights into IT and business domains. Traditionally managers see IT as external tools that can be selected at any moment and will easily fit the organization. For an organization it is necessary to incorporate the ‘functional integration’ and ‘strategic fit’ to reach IT alignment.

The research objective of this thesis includes a framework design that includes values and norms of an organization within the requirements of an IT service/product. Venkatraman et al. (1993) provides with SAM a renewing perspective to view the research objective. Applying the obtained knowledge used in SAM to the research objective of this thesis leads to the identification of a relationship between the research objective and above mentioned four domains. The research objective of this thesis is to design a framework that is rooted in the design for values theory and can be used to include values and norms of an organization within the requirement of an IT service/product. This research objective contains overlap with all domains of SAM but fits mostly with the internal domains, because we seek to include values and norms of the organization within the requirements of an IT service/product. Venkatraman et al. (1993) provide a more in-depth understanding of IT usage within the organization by elaborating the aforementioned set of decisions and components (skills, architecture and processes).

### 3.1.2. OTHER RELEVANT WORK:

A various amount of models have been proposed in the literature. The two key models in the IT alignment research that have attracted most attentions by researchers are the aforementioned SAM and MIT model (Avison et al., 2004). Venkatraman et al. (1993) was influenced by the MIT model and therefore SAM contains many similarities with it. However, in contrary to the MIT model SAM draws a distinction between the external perspective of IT (IT Strategy) and the internal perspective of IT (IT infrastructure and processes). This identifies the capabilities of IT to both support and shape business strategy.

These two key models have been extended and evaluated over the years. SAM has received empirical support and contains practical value (Avison et al., 2004). Several scholars have extended or were influenced by the SAM and/or MIT model (Luftman et al., 1993, Avison et al., 2004, Maes, 1999, Baets, 1992). Luftman et al. (1993) researched what the consequences are of an organization that merely focus on one of the four domains (i.e. business strategy, IT strategy, organization infrastructure and processes, and information system infrastructure and processes) could. Too much focus on one domain affect the organization negatively. In one of their cases they found an organization that focused too much on technology, which lead to reduced exploitation of the
technology. Luftman et al. (1993) stated that the attention paid to the linkage of IT and business can significantly affect the competitiveness and efficiency of an organization. An organization needs to find how IT can enable the achievement of competitive and strategic advantage. Figure 6 depicts the IT alignment model developed by Baets (1992) and includes like SAM the aforementioned four domains. In addition to SAM, Baets (1992) stated that alignment takes place in a broader context and included other factors such as competition, and Global IT domain. The model of Baets (1992) is not considered in the IT framework, because it does not contain sufficient relevant contributions over SAM. For this same reason other extensions of SAM and/or MIT are not expected to contribute to the thesis objective.

Figure 6: The Baets model

### 3.1.3. REFLECTION IT ALIGNMENT

Some scholars argue that alignment is not always desirable. Ciborra (1997) for example suggests that IT alignment is too theoretical (e.g. there is no observable alignment, nor measurable fit) and that it does not capture real life. Furthermore, researchers argue that alignment will not work because business strategy is not a clear concept due to the dynamic environment which entails unpredictable and turbulent circumstances (Vitale et al., 1986). In other words the alignment for the existing business strategy could not be adapted to the business strategy that continuously needs to be changed because of the dynamic environment. Another argument used by scholars is that IT should challenge business and not follow it (Chan and Huff, 1993). However, Kearns and Lederer (2000) revealed that alignment of IT could lead to competitive advantage, while the opposite – aligning business to IT – lead to competitive disadvantage. The question we could ask: is whether we should still use IT alignment in this thesis? Although these arguments suggest that IT alignment is not always a suitable goal, the last two decades the community ranks it as top priority in...
Furthermore, IT alignment provides in concurrence with the objective of the thesis valuable insights between the relationship of IT and business.

3.2. VALUE SENSITIVE DESIGN

To include values and norms in the framework we will seek in the literature for some answers in the value sensitive design domain. We start the chapter by giving a definition of value sensitive design and discuss some values. Furthermore, we will discuss literature that provides us the discovery and identification of values within an organization. Subsequently, we will discuss how we can translate values into norms and software requirements.

What is value sensitive design?

In contrary to the IT alignment domain there are fewer definitions available for value sensitive design. Before we will discuss Value sensitive design we will first elaborate on values. In general the word value refers simply to the economic worth of an object. For example, the value of a house is €150,000. However, in this thesis we use a broader meaning of value, wherein value refers to what a person or an organization regards as important in life. In a company many rules are defined and these rules need to be followed. Many rules may not be defined explicitly and formally but do affect employees of an organization; all these informal and formal rules can be called values and norms (Van den Hoven, 2007). In The handbook of information and computer ethics of Himma and Tavani (2008), Friedman et al. suggest “twelve values with ethical import” (i.e. human welfare, ownership and property, privacy, freedom, freedom from bias, universal usability, trust, autonomy, informed consent, accountability, courtesy, identity, calmness, and environmental sustainability) that are frequently involved in system design. Table 1 contains some of these values, their definition and references to literature. These values could appear in two types of forms: implicit and explicit values. In this thesis we refer implicit “to the phenomenon that are non-conscious and proceed without deliberate intention” and explicit as “phenomenon that are accessible to conscious thought” (Dinh et al., 2012).

Table 1: Frequently used values in system designs.

<table>
<thead>
<tr>
<th>Human value</th>
<th>Definition</th>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy</td>
<td>Privacy refers to a claim, entitlement or right of an individual to determine what information about him or her can be exposed or/and communicated to others.</td>
<td>(Schoeman, 1984, Friedman et al., 2006, Agre and Rotenberg, 1998, Boyle et al., 2000, Palen and Dourish, 2003)</td>
</tr>
<tr>
<td>Trust</td>
<td>Trust refers to expectations that exist between people who can experience good will, extend good will toward others, feel vulnerable, and experience betrayal.</td>
<td>(Friedman et al., 2006, Olson and Olson, 2000, Nissenbaum, 2001, Dieberger et al., 2001)</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Autonomy refers to peoples’ ability to decide plans, and act in ways that they believe will help them to achieve their goals.</td>
<td>(Friedman et al., 2006, Friedman and Nissenbaum, 1997, Isaacs et al., 1996)</td>
</tr>
<tr>
<td>Informed consent</td>
<td>Informed consent refers to garnering peoples’ agreement, encompassing criteria of disclosure and</td>
<td>(Friedman et al., 2006, Faden et al., 1986, Friedman et al., 2000)</td>
</tr>
<tr>
<td>Human welfare</td>
<td>Human welfare refers to peoples’ physical, material, and psychological well-being.</td>
<td>(Leveson, 1991, Friedman et al., 2003, Neumann, 1994, Friedman et al., 2006)</td>
</tr>
</tbody>
</table>

Value sensitive design (VSD) is about including values in the technological design of IT (Van den Hoven, 2007). Including values in the technological design implies that human values, norms and moral considerations are explicitly taken into account in the design of an IT project from the beginning. Value sensitive design was initially proposed in the nineties only for the IT domain, but more recently it also attracts researchers from other disciplines (Van de Poel, 2013, Van den Hoven, 2007). Even though the implementation of a new IT innovation could lead to many advantages for a company, it became apparent that organizations show resistance against these IT innovations resulting in failure of the IT project. The resistance can be partially be explained by missing (or not sufficiently present) values and norms within the IT design. Friedman et al. (2006) define VSD as “a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process”. According to Friedman et al. (2006) VSD employs an integrative and iterative tripartite methodology that consists of conceptual, empirical and technical investigations. These three investigations will be discussed into more detail in the next section.

### 3.2.1. TRIPARTITE METHODOLOGY

According to Friedman et al. (2006) VSD is built on an iterative methodology that integrates conceptual, empirical and technical investigations.

**Conceptual Investigations**

During the conceptual investigation the following types of questions are formulated (Friedman et al., 2006). Which direct and indirect stakeholders are affected by the design? How are these stakeholders involved? What values are involved? How should we cope trade-offs among competing values in the design, implementation and use of information systems (e.g. autonomy vs. security)? Should moral values (e.g. privacy) have a greater weight than non-moral values (e.g. aesthetic preferences)? Subsequently, these questions are answered based on philosophically informed analyses (Friedman et al., 2006). Friedman et al. (2006) stated that a good starting point for the conceptual investigation is the aforementioned twelve values with ethical import in *The handbook of information and computer ethics* of Himma and Tavani (2008).

**Empirical Investigations**

The empirical investigation encompasses the understanding of the relationship between values and technology in practice. The empirical investigation can be applied to any human activity that can be observed, measured or documented (Friedman et al., 2006). The applicability of empirical investigations include the entire range of quantitative and qualitative methods used in social science, including observation, interviews, surveys, experimental manipulation, and collection of relevant
documents. The empirical investigation could for example reveal how stakeholders apprehend individual values of an organization or how do stakeholders prioritize values in design trade-offs (Friedman et al., 2006). In addition, empirical investigation could also be interesting to explore what people say they would do and what people actually do.

**Technical Investigations**

Technical investigation can be divided into two forms (Friedman et al., 2006). The focus within the first form is on how existing technological properties and underlying mechanism support or hinder human values. The focus within the second form is on how to involve the proactive design of systems to support values in the conceptual investigation. It may be the case that at times technical investigations, in particular of the first form, may look similar to empirical investigation. However, their unit of analysis differs. Empirical investigations focus on individuals or groups that are affected by the technology, while technical investigations focus only on the technology.

**Why is this model relevant for this thesis?**

In order to include values within IT requirements one needs to discover and identify these values first. The tripartite methodology allows organizations to discover and identify these values that are not clearly visible. Subsequently, pursuing the three investigations allows an organization to find more specific and contextual values. Finally, the tripartite methodology identifies whether human values hamper or foster technology.

**3.2.2. TRANSLATING VALUES INTO DESIGN REQUIREMENTS**

After an organization has discovered and identified their values an essential step in Value sensitive design is to translate values into design requirements. The abstract values need to be translated into the more specific design requirements. These design requirements can then be used within the IT project.

**How can we translate values into design requirements?**

In order to have a better understanding of how this translation can be done Van de Poel (2013) introduced the values hierarchy. The values hierarchy is defined as a hierarchical structure of values (e.g. human welfare, privacy), general norms (e.g. improved working circumstances) and more specific design requirements (e.g. an hour break when working 9 hours) (see figure 7) (Van de Poel, 2013). Norms are the intermediate layer below values and above design requirements. Norms may have different meanings. Norms are described by van de Poel (2013) as all kind of prescriptions for, and restrictions on, action. One kind of norms is the end-norms, which is a norm that is referring to an end to be achieved. End-norms are important in designs and may refer to the designs’ properties, attributes, or capabilities. Furthermore, such an end-norm may include objectives (e.g. maximize safety), goals (e.g. maximum speed of a car), and constraints (e.g. boundary conditions). Note that the relations between the different layers are not deductive. One reason for this is that the lower levels are more concrete or specific than the upper layers. Formulating a lower layer from an upper layer requires taking into account the specific context or designing project for which the hierarchical value is created.
The value hierarchy is a coherence structure that is held together by the *specifications* and *for the sake of relations*. Specifications occur when higher level elements are translated into element of lower levels (e.g. norms to design requirements). Specifications contain contextual content. For the sake of relations are used for connecting lower level elements with higher levels. Notice that higher levels cannot be deducted from lower levels, because lower levels are more specific. However, when the reasoning behind the specification is present you could have a correct for the sake of relation. Therefore, the degree of justification for the sake of relation depends on the adequacy or plausibility of the specification made.

**Why is translating values into design requirements relevant for this thesis?**

In the cases Van de Poel (2013) researched it became apparent that translating values, especially new values (e.g. animal welfare), into specific design requirements can be a lengthy and cumbersome process. Within a translation it could be necessary to require specific expertise from outside engineering (e.g. physical analysis may help to better understand privacy and trust). Furthermore, the actual translation from values to norms happens often outside the design process (e.g. legislation, or codes and standards by standardization committees). Furthermore, it is important to mention that translating values into requirements is value laden and that requirements can be obtained in different ways (Van de Poel, 2013). Each (sub-) disciplines can specify a value differently. In addition, some specifications of values are dependent on the feasibility of existing technology; therefore it could be decided to not include certain specifications in the requirements because of technological limitations. Figure 8 depicts an example of a value hierarchy with the design of a chicken husbandry system. This model allows organization to translate value into design requirements which should ensure that values are not misinterpreted into the design requirements.
3.2.3. VALUE-SENSITIVE SOFTWARE DEVELOPMENT FRAMEWORK

Aldewereld et al. (2014) introduced the Value Sensitive Software Development (VSSD) framework to make the links between values, the business domain and the resulting IT. The VSSD framework considers how abstract values can be translated into more concrete elements and can be seen as the first step to include values in the design and implementations of systems.

How can we use the Value Sensitive Development Framework?

VSSD framework can be considered from three complementary views: values view, modeling view, and the business view. The values view encompasses the values, norms, rules, considerations, and procedures of an organization. The values view contains much overlap with the aforementioned value hierarchy of Van de Poel (2013). A difference is that Aldewereld et al. (2014) makes use of procedures (i.e. choice of action to maintain norms), while Van de Poel (2013) describes design requirements. Second, the modeling view describes the system’s architectural design based on value decisions and domain characteristics. This view contains much overlap with SOA. The Service Oriented Architecture (SOA) is an IT architecture design pattern that supports the vision of information systems as a set of linked services that can be reused via the internet or network for different purposes (Erl, 2008). Third, the business view describes the domain’s contextual aspects based on the existing systems and services. The three views are considered at three different levels (see figure 9).
Aldewereld et al. (2014) made the following three different levels: abstract level, concrete level, and implementation level. The abstract level contains a high level of abstraction and can be seen as the first step in the requirements analysis. The definitions of terms are in this level of such an extent that they are not contextual and therefore could be used for any system organization. The concrete level contains specified model components based on the domain analysis and value design process. Unlike the abstraction level the concrete level does take into account the contextual environment and describes the norms and rules. The implementation level encompasses the execution of the implementation of the IT project. This level includes procedures for role enactment and norm enforcement.

**Why is the Value Sensitive Development Framework relevant for this thesis?**

We discussed all the levels and views, but how is this all related to each other? Aldewereld et al. (2014) explains that the value view describes “why things are as they are”. The values, norms, and procedures elaborate the incentives for the way software is. Aldewereld et al. (2014) acknowledges that the business view contains elements that explains why certain elements are incorporated within the IT requirements. The role of the business view within the VSSD is to elaborate ‘what’ the driving forces are from business and domain perspectives (e.g. existing infrastructure, and available services). The modeling view describes the “how of the software” (Aldewereld et al., 2014). Within the modeling view these two forces (i.e. why of the value view and what of the business view) are brought together within a software design. Note that the value and business view are based on the existing IT system while the model view should be describing the new IT system.
In this chapter we explained how we can discover and identify contextual values from an organization, translating values into design requirements and the Value-Sensitive Development Framework. The used theories are important contributions to the literature of Value sensitive design, but could be considered to be too theoretical.

Le Dantec et al. (2009) identified three limitations within the tripartite methodology. First, by providing the twelve values for ethical import as starting point for values, the results of the conceptualization investigation may result in values aligned with these twelve values instead of values that are expressed in the context of the design. Second, Friedman et al. (2006) does not provide any guidance on which empirical instrument is appropriate for a particular context. Third, Le Dantec et al. (2009) argued that, when focusing on the ethical import values in the conceptual investigation, proceeding from the conceptual investigation to the empirical investigation brings along known values over value discovery.

To resolve the first and third limitation Le Dantec et al. (2009) suggested to conduct the empirical investigation before the conceptual investigation. This leads to less prescription in the kind of values considered and more sensitivity for local values. A local value is classified in most cases as one of the twelve values, but contains more specific information. Le Dantec et al. (2009) stated that to overcome the second limitation the ‘photo elicitation technique’ could be applied. An example of the photo elicitation technique can be found in the Technology & Homelessness case wherein the researchers shifted the power from interviewer to the interviewee by allowing the interviewee to shape the direction of the conversation (Le Dantec et al., 2009). The interviewee was allowed to bring their own taken pictures to the interview, which reduced a possible bias of the interviewer.

Even though Le Dantec (2009) provided some good arguments against the tripartite methodology some researchers still prefer to use the methodology developed by Friedman et al. (2006). Both theories are founded on philosophical reasoning and are hampered by a lack of empirical support. The lack of practical support permits space for philosophical discussion concerning the preference of theory.

The values hierarchy model created by Van de Poel (2013) was designed based off a case commissioned by the European Union. This case encompassed a period of more than 25 years. In current IT business projects, where time is always of the essence, such a lengthy time would be too impractical to consider. Furthermore, the entire model is based on a single case and therefore its applicability to other cases should be considerably questioned. There are also no known cases where this particular model has been used to transform values into IT requirements, notwithstanding its ability to do so. Furthermore, this model is mainly concerned with theory and practical applications are therefore less pronounced.

With regard to the VSSD framework by Aldewereld et al. (2014), similar critique can be assigned to it. Particularly its theoretical nature and lack of practical application are cause for concern to anyone wishing to use it on their own case. This is partly due to the fact that the value view within the VSSD framework is derived from the aforementioned values hierarchy model created by Van de Poel (2013). Next, to the specifications a lack of practical understanding is also present for the relationships within an abstraction level.
Though these models possess their limitations, as has been discussed briefly, this does not entail the models are without merit. The models are certainly worth consideration when tackling on an IT project from scratch, because they allow one to construct a framework from which to expand upon and ultimately reach the desired objective.

3.3. REQUIREMENTS ENGINEERING

Requirements Engineering refers to the research domain that deals with the process of eliciting, defining, documenting and maintaining demands from stakeholders into software requirements that are compatible with existing IT systems (Scheithauer and Hardegen, 2011).

Requirements Engineering is a mature discipline where we can find publications more than a decade old. In the “problem context” of this report (see section 1.1) we identified and described different problems and shortcomings in the current use of IT requirements. Antón et al. (2001) stated already more than a decade ago that developers of IT should be aware of how values (e.g. security, privacy) affects IT and that these values should be included in the requirements.

However, in this section we will not focus on how requirements cooperate with including values but how IT requirements can be determined. We will discuss the different phases one can go through in the Requirements Engineering. Before we do that we will give some background information about the software development method of the Waterfall model and the Agile Software methodology to gain a better understanding of the context. The Waterfall model is one of the most famous software developing models in the world. Requirements Engineering is presented in the Waterfall model as the first phase of the software developing process. We will discuss in the next section the role of Requirements Engineering within the waterfall model and its counterpart, the Agile Software development. Subsequently, we will discuss different phases in Requirements Engineering.

3.3.1. SOFTWARE DEVELOPMENT PROCESSES.

The Waterfall model and Agile Software development methods provide project managers guidance in which order the major tasks of a project should be executed (see figure 10). The Waterfall model is a sequential design process in which progress is going through different phases. The waterfall models in general contain the following type of phases: Requirements Engineering, design, construction, integration, testing, production/implementation and maintenance. The Agile Software Development is a group of software development methods in which requirements evolve through collaboration between stakeholders/teams. In contrary to the waterfall model the Agile Software Development methods are using an iterative process. The Agile Software Development originally first underlying concepts were based on twelve principles in the Agile Manifesto (Beck et al., 2001). Agile Software promotes adaptive planning, evolutionary development, early delivery, continuous improvement, and strives to have rapid and flexible response to change. Advocates of Agile Software Development tools argue that the Waterfall models do not include changing requirement and has less focus on customers within a project, because Requirements Engineer is only done in the first phases of the project (Barlow et al., 2011). Advocates of Waterfall models argue that Agile Software Development tools can be inefficient in large companies and certain types of projects, because of the iterative character of Agile methods. Finally, Barlow et al. (2011) argue that within Agile projects there is a
lack of documentation, not well defined requirements, and does not promote formal communication.

Figure 10: Waterfall and Agile methodology

3.3.2. PHASES WITHIN REQUIREMENTS ENGINEERING

Within the Requirements Engineering there are several stages that can be identified (Royce, 1970, Nuseibeh and Easterbrook, 2000, Chemuturi, 2012). In Requirements Engineering the first phase is to elicit the requirements of the customers, users and other stakeholders. Solely asking a stakeholder for their requirements is not sufficient (Alexander and Beus-Dukic, 2009). Gathering requirement practices from software engineers includes questionnaires, interviews, brainstorming, prototyping and role playing. After the elicited requirements are documented the requirement analysis will take place. In the requirement analysis phase the software engineer starts by determining all the conditions that need to be met for a new or changing IT product (Nuseibeh and Easterbrook, 2000). Based on the conditions and needs the software engineer analyses the feasibility of the requirements and needs to resolve any conflicts with its stakeholders. Subsequently, the requirements have to be specified in the requirement specifications phase. The functional (e.g. calculations) and non-functional (e.g. criteria concerning the privacy and reliability) requirements of the products will be determined in the specification phase (Leffingwell and Widrig, 2003). Furthermore, this phase includes in some cases also a Use Case Diagram. The Use Case Diagram contains a list of steps the stakeholder (e.g. customer, provider) is expected to undertake to achieve a goal within the system. The next phase is system modeling. In this phase the system is being modeled and this is often visualized in the Unified Modeling Language (UML). UML allows software engineers to develop the system’s architectural blueprints in a diagram (Dobing and Parsons, 2006). Such a diagram includes: activities, external interface, individual system components, interaction of system components, and how the systems will run. The validations phase takes place after the UML diagrams are designed. Within this phase the software engineer needs to validate their documented requirements and models with the needs of the stakeholders (Royce, 1970, Nuseibeh and Easterbrook, 2000, Chemuturi, 2012). Finally, the last phase we will discuss is the requirement management phase. The requirement managing phase is continuously present during the Requirements Engineering and encompasses dealing with changes in the system as the system is developed (Hood et al., 2007).
The project does not necessarily have to follow the above described sequential order of phases or pass through every phase separately.

### 3.3.3. EVALUATION REQUIREMENTS ENGINEERING

Within the software engineering model there exist six distinct phases that should be executed sequentially in order to arrive at the desired outcome. However, with regard to my own thesis only two of these phases fall within the necessary scope. These are the engineering specification phase and the system modeling phase. These phases encompass the usage of the Use Case Diagram and the Unified Modeling Language models. The remainder of the phases discussed in the software engineering model will therefore not be considered heavily within this thesis. The reason for not including the first two phases of the system engineering model: ‘eliciting the requirements’ phase and ‘requirement analysis’ phase, has to do with the fact that these phases are similar to the methods employed in the value sensitive design where one can translate organizational values into design requirements. After having obtained the design requirements, the specification phase and the system modeling phase used in the software engineering model will allow one to translate the design requirements into IT requirements. After having obtained the IT requirements, the validation and management phases are no longer required and they thus fall outside the scope of this thesis.

Concerning the two phases in the software engineering model that will be used in this thesis, the most important aspects are the Use Case Diagram method and the UML method. These methods are very useful in transitioning from design requirements to IT requirements; however there are some improvements that can be made with respect to these two methods, namely the fact that they lack the availability to include non-functional requirements into their framework. This requires one to separate the functional and non-functional requirements when constructing the IT requirements.

### 3.4. CONCLUSIONS

The main goal of the literature review was to learn from the research domains: IT alignment, value sensitive design and Requirements Engineering. The literature review provides insight into prior research and gives a better understanding of definitions, models and processes. We will start this section by answering the first three research sub-questions of the first chapter.

SQ1. What did we learn from existing literature about IT alignment?

- The IT alignment section provides a more in-depth understanding of IT usage within the organization by highlighting key elements in business and IT.
- The second thing we learned is that an inadequate fit between the external and internal domain is an important cause for failure of IT projects. Therefore, an organization needs to find a right balance between these domains.
- Thirdly, a balance needs to be created between IT and business; this is described as the functional integration in the literature. Organizations that spend too much attention on IT could negatively affect the competitiveness and efficiency of its organization.
SQ2. What can we learn from existing literature about design for values?

- We learned how we can discover and identify contextual values from an organization and whether these values will hamper or support technology (e.g. applying the tripartite methodology).
- Secondly, we learned how values are related to norms and design requirements and how you could cope with problems that arise during the translation from values to design requirements.
- Thirdly, the VSSD framework was introduced to make the relations between values, business domain and the software explicit.

SQ3. What can we learn from existing literature about Requirements Engineering?

- We learned that the phase wherein Requirements Engineering takes place can differ depending on whether an organization is using the Waterfall or Agile methodology. This brings along different approaches of how requirements are drafted initially.
- Finally, we’ve learned how requirements are specified into IT requirements. This could be done by using Use Case Diagrams and UML.

In conclusion, there are several points that are worth mentioning. First, the three separate domains that have been discussed lack a coherent approach in the literature that we have come across. We expect that the multi-disciplinary domains combined could enrich IT projects. The second point that should be noted is that the models concerning IT alignment and value sensitive design are too theoretical in nature; this will frustrate any attempts to use the models in practice. Adding concrete steps that can be used by practitioners of the models will therefore certainly add to the usefulness of these models. Finally, the Requirements Engineering domain lacks the availability of models that incorporate non-functional requirements. Ideally, one would be able to incorporate both functional and non-functional requirements into the same model to prevent duplication of effort. The reason why we advocate for a holistic combination of these three domains is because we expect this will lead to a comprehensive method that will limit each individual domain’s shortcoming and strengthen their advantages. Benefitting any researcher or manager looking to increase the chance of success for their own particular IT project.
4) INTERVIEW RESULTS

This section of the thesis is concerned with deriving the assumptions and requirements necessary for the construction of the framework from the information provided by the field experts that were gained through the interviews that were conducted. It is divided into four sub-sections:

1) Problem Identification.
2) Find out to what extent IT values need to be aligned with business values.
3) Investigate how values are included in IT systems.
4) How to determine which values are important within the company

These sub-sections are retrieved from section 2.2.2.2. ‘Goals of the interview’. Before we will go in-depth into these four sub-sections we will shortly describe our preliminary inquiry.

4.1. PRELIMINARY INQUIRY

To increase efficiency of the time spent with the expert we conducted a preliminary inquiry. We started by searching more information about the organization and explore what values the organization finds important. Furthermore, a diagram was constructed of the expected flow of values within the organization. This was mainly based on a short interview with my first supervisor and complemented with information from the internet. The final flow of the values – including some adjustments of the experts - within their organization is depicted in figure 11.
4.2. PROBLEM IDENTIFICATION

The probability of a project failing increases as the size of the project increases. The experts estimated that a couple of hundred projects fail each year within their organization. The experts stated that we live in a dynamic environment which does not ensure the future; therefore IT companies strive to avoid large IT projects and divide large projects into multiple small projects. Problems that could occur during such a big IT project are the following:

1) A customer that has to wait two years before he sees the first version of an IT service is expected to have changed his expectations of the wanted IT. In the current dynamic environment the customer could change the way they think about the needed IT service and therefore prefer to have something different than at the start of the IT project. Moreover, a customer could see other requirements in these two years that he also would like to have.

2) An IT provider is not always able to understand the requirements of the customer.

3) Certain requirements are not feasible for the IT provider.

4) Customers cannot clearly visualize and thus describe which requirement should be included in the IT requirements. IT providers cannot provide on short term a model/prototype which implies that the customer cannot see the product until it is almost finished.
5) It is often difficult to find the correct balance for certain IT requirements. For example there exists according the experts a difficult trade-off between ease of use and security of any particular IT project.

Dividing the execution of a large IT project into multiple small projects leads to increased flexibility and allows an organization to better cope with changing requirements.

4.3. TO WHAT EXTENT IT VALUES NEED TO BE AlIGNED WITH BUSINESS VALUES.

According to the experts, the need for a tight fit between the values of the business and the values of the IT department are really important. An inadequate fit between IT and business values could lead to many misunderstandings and therefore should be prevented as much as possible.

The method by which this can be prevented as much as possible is to ensure that the managerial structure of the company is less hierarchical and instead possesses a flat structure. This enables the flow of information from different departments to permeate through the company in a more readily and easily fashion. If done correctly, this structure should ensure that the different departments have a tighter fit with one another. One example provided by the experts is the realization of ‘DevOps’ teams within the company. These teams include individuals from both the developing and operational departments, and therefore allow a clearer insight into the workings and goals of both departments.

Furthermore, another method employed by the experts is the usage of ISO standards. According to the experts, if these standards are adhered to strictly the fitness between two disparate departments will tighten considerably, and thus prevent the complications that arrive when there is a lack of fitness.

4.4. INVESTIGATE HOW VALUES ARE INCLUDED IN IT SYSTEMS

By thoroughly examining the needs and values of the stakeholders that want the service, it is possible to extract the values that are required for the IT project. The experts stated that the usage of the Agile/Lean approach allows them to include the values of an organization into the IT systems. This method entails a continuous flow of change within the development of the system, wherein short iterations are built sequentially to allow a proper feedback loop to occur, which serves as purpose to quickly determine where a potential issue might arise. Another method to include values from an organization into their IT project is by the usage of workshops, wherein the IT provider tries to exactly determine which values are necessary to incorporate into the IT project for each respective customer.

4.5. HOW TO DETERMINE WHICH VALUES ARE IMPORTANT WITHIN THE COMPANY

One of the experts tried to determine which values are important within the company through the usage of a Business Impact Analysis (BIA). The BIA contains a list of 700 questions, which provides a score to different criteria such as reliability, availability and accuracy of a particular IT system. On the basis of these scores the IT provider can then prioritize which values are the most critical for the customer, and therefore allow both parties to have a clear view of how to achieve the satisfaction of the customer for any particular project. This BIA is filled in by the staff members of the customer.
organization. A high score for particular criteria implies that a lot of measures have to be undertaken to ensure the proper implementation of that criteria. For example payment systems usually have a score of 99.9, which means that in any given year the system is at most allowed to not function once a year.

Another method to ensure you can guarantee the values from the stakeholders is by conducting an audit. Similarly to the BIA, the audit functions by allowing the customer to attach a particular value of importance to different criteria of a project. This then results in a formal contract, wherein the IT provider pledges that they will ensure the proper implementation of the criteria. Afterwards, the customer is provided with a review form, wherein the customer can clarify to what extent the deliverance of promises has been achieved.

Furthermore, the experts stated that collaboration between different groups is difficult and miscommunication between them can easily happen. These miscommunications often lead to a different solution than the customer or organization prefers. Multidisciplinary teams reduce the transfer of data between groups, which prevents miscommunication. This should in practice allow an IT provider to more effectively guarantee the values of a company.

This is what we are currently trying to proceed. We did not determine the norms in advance to the project with the consequence that we realized during the test phase that the built system is not sufficient. Then you have to redesign and rebuild the system. Finally, the diagram can only be used for one department and does not take into the whole chain.

**4.6. INTERVIEW RESULT COMPARISON TO THE LITERATURE**

Based on the previous section we can compare the literature to the results of the interview. We will start by the identification of the problems. In the first chapter we described the problem of the thesis. These problems were also identified within in practice. In addition, we realised that in practice a customer of IT is not always capable to have a clear visual representation of their own requirements and the IT provider is not able to deliver a model or prototype.

In the first hunch we described the current way organizations try to include values within IT requirements and how our framework would have to look like. From our literature research we realised how to elicit values and translate them into design requirements. In practice a lack of attention is given to eliciting values and including them into the IT requirements.

Organizations realise that missing values in IT requirements cause several problems within IT projects. Often during the end of the project they realise that not all requirements were fulfilled correctly or that new requirements need to be added. By creating multidisciplinary teams organizations try to improve the IT requirements.

Organizations attempt to set the focus on short iterative IT projects. The idea is that organization will be able to receive rapidly feedback which can be incorporated in the next version. A subject in the feedback with a lot of attention gets a high priority so that it will be released in the next version. This subject is expected to have high value for the organization. A bad first version is not considered to be a problem. An expert referred to the first iPhone that was launched in 2007 and had many defects.
Even though the quality could have been much better it became a large success, because it has been continuously improved.

4.7. CONCLUSIONS:

In this section we will answer the following research question:

**SQ4. What can we learn from the field experts?**

- The experts confirmed that in practice many IT projects fail due to incomplete requirements.
- Values are not necessary complementing each other. Conflicting values (e.g. security versus ease of use) need to be considered. The IT provider needs to find the right balance of the intensity of the values in the IT requirement.
- One of the experts emphasized the need to review the delivered work in large projects. This review should be done by the customer or an external company.
- The experts mentioned different ways to ensure the values of the customer within the IT requirements e.g. multidisciplinary teams, questionnaires, workshops, and interviews.
- The agile methodology is something that the experts prefer above the Waterfall method. Short iterative processes has as main advantage that the time to market significantly decreases and better feedback will be provided after each cycle.
- IT requirements that are derived from design requirements could be implemented by different departments within an organization. This needs to be aligned and managed in advance.

During the interviews the literature gap and need for a framework became more apparent. However, there are certain requirements in practice that are not mentioned in the literature. The missing requirements could be explained due to the lack of empirical research in the discussed research domains.
5) DETAILED DESIGN

In this chapter a detailed design of the framework will be constructed. The framework will be based on our derived requirements from both literature and the interviews. Given the insights of the literature research and interviews different problems are identified. As we mentioned earlier we will address the problem of missing requirements in the IT requirements by focusing on values. The framework should require a procedure to identify values and include them into IT requirements.

Section 5.1 starts this chapter by formulating all the requirements gathered from the literature and interviews for the framework. Next, section 5.2 provides the framework and discusses the steps that are included in the procedure. Finally, we will answer the fifth sub-research question in the conclusions.

5.1. REQUIREMENTS AND ASSUMPTIONS

Based on the literature research in chapter 2 and the results of the interviews in chapter 4 we were able to derive several requirements for this framework. These requirements are the following:

1. **Links between IT and business within an organization**
   Within the IT alignment research domain several links between IT and business are described in-depth. There are several components present within IT and business that are related to each other. This can be used as a starting point for values within a new IT project.
   a. **Functional integration**
      In SAM the authors distinguish between external and internal IT and external and internal business. Functional integration is about the integration of IT and business. The IT solutions given in certain situations need to be in line with the business strategy, goals, and needs.
   b. **Strategic Fit**
      The strategic fit is about seeking the right balance between the external and internal domain. The internal business and IT need to be in balance with the external business and IT. The strategic fit of an organization influences the competitive advantage.
   c. **Avoid focus on one domain within technology or business**
      Organizations that merely focus on one of the four domains described in the SAM model are expected to be negatively affected by this strategy. We know that IT could lead to competitive advantage, but too much focus on IT could make an organization not fully exploit business.

2. **Discover and identify values within an organization**
   Within an organization we can distinguish two types of values: explicit and implicit values. The first types of values are more accessible to conscious thought, while implicit values are values that are non-conscious and proceed without deliberate intention. Implicit values need a different approach than explicit values. While explicit values need to be identified, implicit values need to be discovered first.
3. **Make it possible to prioritize IT requirements**
   All the identified values within an organization need to be prioritized. The organization need to state what they ought important. The prioritization of values facilitates eventually upcoming trade-offs in the IT requirements.

4. **Map the effects of values within the organization on IT**
   A technical investigation allows an organization to better understand the relationship between the values of the organization and its technology. A technical investigation gives insight in how values hamper or foster technology.

5. **Translate values into norms**
   Derived values from an organization appear in an abstract form and need to be specified. In the value sensitive design research we’ve been taught to specify values into norms. Each value can have multiple norms. From literature and the interviews it became clear that skipping this step could bring along problems in the successive phases.

6. **Translate norms into design requirements**
   From norms design requirements can be derived. This translation can be a complicated and long process. This step could require expertise from outside the Requirements Engineering domain. Each determined norm can have multiple design requirements. From literature and the interviews it became clear that skipping this step could bring along problems in the successive phases.

7. **Identify the relationship between values, business and software.**
   The VSSD framework provides a good overview between the relations values, business domain and the software. These relationships should return within the framework.

8. **Compatible for both Agile and Waterfall methodology**
   The phase wherein Requirements Engineering is been applied depends on the software development process: Waterfall or Agile methodology. Agile methodology has multiple cycles which imply that Requirements Engineering needs to be done for each cycle. The framework needs to take into account both of these different approaches.

9. **Translate design requirements to IT requirements**
   The value sensitive design research domain taught us how to specify values into design requirements. Use Case Diagrams and UML diagrams provide insight into the functional and non-functional requirements.

10. **Reduce the amount of missing IT requirements**
    The experts confirmed that in practice many IT projects fail due to incomplete requirements.

11. **Address conflicting values**
Values are not necessary complementing each other. Conflicting values (e.g. security versus ease of use) need to be considered. The IT provider needs to find the right balance of the intensity of the values in the IT requirement.

12. Review moments
   One of the experts emphasized the need to review the delivered work in large projects. This review should be done by the customer or an external company.

13. Existing tools to ensure values of the stakeholder within the IT requirements
   In practice organizations use multiple ways to ensure the values of the stakeholder during the implementation of the project and drafting of the requirements.

14. Dissemination of implementing IT requirements in the organization
   Design requirements that are obtained by the IT provider are specified into IT requirements. It is not always the case that an IT requirement can be executed by one department within an organization. IT requirements that are derived from design requirements could be implemented by different departments within an organization. This needs to be aligned and managed in advance.

5.2. DESCRIBING THE FRAMEWORK

While literature contains several techniques and methods to obtain IT requirements, we noticed that none of these techniques and methods include values within IT requirements. Based on the literature research and the interviews we derived requirements and assumptions in the previous sections. From the requirements and assumptions a framework is constructed. This constructed framework allows IT managers to include values and norms of an organization within the IT requirements. The framework is a generic approach that contains all steps that should be considered to include values in IT requirements for both companies and the government. The framework is a cycle that can be continuously used to set up IT requirements. The reasoning for a cyclic framework is that organizations are operating in a dynamic environment which could require an organization to derive IT requirements more than once (Op't Land et al., 2008). Furthermore, a cyclic framework is more compatible with the Agile software development processes which divide a project into multiple cycles. Even though the framework is presented as succeeding steps the steps may partly overlap and/or be executed in parallel.
The procedure of the constructed framework consists of five distinct steps, as figure 12 illustrates. In the following sections we will discuss the different phases of the framework.

### 5.2.1. ORGANIZATION

In an organization we distinguish between the internal IT and the internal business (Venkatraman et al., 1993). The internal IT includes the following components: information system architecture, information system processes, and information system skills. Similar to the components in the internal IT, Venkatraman et al. (1993) described the following three components for the internal business: internal business strategy, development of business strategy, and business skills. Section 2.1.1 contains a more detailed description of these components within the organization. Within these components within the internal IT and internal business explicit and implicit values can be found. Furthermore, an organization needs to balance the operational integration - fit between the internal business and the internal IT – after the introduction of a new IT solution. Therefore, an organization needs to align the values of the internal IT and internal business.

### 5.2.2. ELICITATION OF VALUES

The first step involves the *elicitation of values*. Values appear in two types of forms: implicit and explicit values. As explained in section 2.1.1 the elicitation of implicit values is expected to be more difficult than the elicitation of explicit values. Examples of frequently used values in information systems are: privacy, trust, informed consent, autonomy, and human welfare. The elicitation of the values includes the discovery and identification of values. The tripartite methodology used by Friedman et al. (2006) provides a systematic method for the discovery and identification of values. The tripartite methodology consists of 1) empirical, 2) technical, and 3) conceptual investigations.
Typical questions that are addressed during the conceptual investigations are: Which direct and indirect stakeholders are affected by the IT solution? How are these stakeholders involved? What values are involved? How should we handle trade-offs among competing values in the design, implementation and use of information systems (e.g. autonomy vs. security)? Should moral values (e.g. privacy) have a greater weight than non-moral values (e.g. aesthetic preferences)?

The most prominent proponents of the empirical investigations include the usage of methods that can be applied to any human activity that can be observed, measured or documented. The applicability of empirical investigations include the entire range of quantitative and qualitative methods used in social science, including observation, interviews, surveys, experimental manipulation, and collection of relevant documents. The questions that arise in the empirical investigation commonly deal with “How do stakeholders prioritize values in design trade-offs? What effect do the values have on technology?”

The technical investigations can be divided into two forms (Friedman et al., 2006). The focus within the first form is on how existing technological properties and underlying mechanism support or hinder human values. The focus within the second form is on how to involve the proactive design of systems to support values in the conceptual investigation. It may be the case that at times technical investigations, in particular of the first form, may look similar to empirical investigation. However, their unit of analysis differs. Empirical investigations focus on individuals or groups that are affected by the technology, while technical investigations focus only on the technology.

### 5.2.3. Value Specifications

The next step in the framework is to consider value specification from the given abstract values of the organization (Van de Poel, 2013). Value specification adds contextual or domain specific content to the elicited values resulting in norms. Examples of norms would be to improve the working circumstances, increase the performance of a system, and ensure privacy of customers. Van de Poel (2013) described norms as all kind of prescriptions for, and restrictions on, action. End-norms – a type of norms that is referring to an end being achieved – may include objectives, goals and constraints. Similar to values a norm is value laden, which implies that norms and values can be interpreted in multiple ways. To find a specification that is suited to the organization the translations of values into norms requires specific contextual information. This specific contextual information is often found outside the organization (e.g. legislation, or codes and standards by standardization committees).

### 5.2.4. Requirement Specifications

Following from the norms we can derive design requirements through the requirement specifications step. Translating norms into design requirements can be a difficult and complex process. It could occur that the translation from norms to design requirements requires expertise from outside the scope of the IT provider (e.g. physical analysis may help to better understand privacy and trust). An example of a design requirement would be that an IT system is not allowed to go offline more than once a year or that the response time for a transaction is two seconds. Based on all the requirement, needs and conditions the IT provider analyses the feasibility.
After all the design requirements are defined by the IT provider they should be reviewed (e.g. through questionnaires or interview) and discussed with the stakeholders. We found out from our interviews that in practice different methods are used to ensure values with IT requirements. Examples of how IT providers are trying to ensure values within IT requirements include holding a workshop with an organization or hiring an external company to measure the presence of a norm/value. This allows the IT provider to anticipate conflicts with the involved stakeholders.

5.2.5. SERVICE SPECIFICATIONS

From the design requirements we can derive IT requirements. The design requirements will be specified in the requirement specification step. In this step functional and non-functional requirements are determined (Leffingwell and Widrig, 2003). Values are mainly contributing to the non-functional requirements of the IT requirements. A Use Case Diagram provides a better overview of how design requirements are placed in a system. The Use Case Diagram contains all the functional steps the stakeholder is expected to undergo to reach a goal. Finally, the system should be modeled. Modeling is often done in the Unified Modeling Language (UML). In our developed framework we depicted multiple IT requirement blocks to illustrate that an IT requirement could be fulfilled by several departments within an organization. For example, taking into account the norm that says we have to finish a transaction within two seconds. This transaction needs to pass department A, B, and C. When A and B are done developing their part of the transaction it could be the case that department C only has 0.1 second to provide their part. To overcome this problem rules need to be developed in advance.

5.2.6. IT IMPLEMENTATION

Now all the IT requirements are identified and the system is modeled in UML the last step can be conducted: the implementation. The implementation is the actual realization of the IT solution based on the IT requirements. We will not go into detail into the actual implementation (and other phases such as testing and deployment) because this is outside the scope of this research. We do want to mention that the deployment of the IT solution affects the current internal business and internal IT. This effect on the internal business and internal IT could lead to a new project wherein the values are changed and different values need to be discovered and identified. In contrast to the Waterfall model the Agile Software methodology promotes short implementation cycles, which entails that our framework needs to be used for every cycle.

5.2.7. REVERSED STEPS

From our framework which is depicted in Figure 12 one could conclude that reversed steps in the cycle are not present. However, this is not the case. When it turns out that the norms or design requirements of an organization are not representing the expectations of the stakeholders through a review or audit it could be ought necessary to reformulate the norms. Even when the IT provider already passes this step and is bus formulating the design requirement it could occur that the IT provider has to go back one step or even two steps (i.e. redefine the norms or values).

5.3. CONCLUSION
In this section we will answer the following research question:

SQ5. What requirements can we derive for the framework from both the literature and the experts?

In chapter two and chapter four we derived requirements from the literature and the experts. These requirements are merged into fourteen requirements. It is remarkable to notice that requirements from the academic literature complement the requirements of the experts and vice versa. Based on the requirements we determined five building blocks for the framework are constructed: 1) organization, 2) values, 3) norms, 4) design requirements 5) and IT requirements. From the organization the values are elicited. These values are specified into norms, subsequently into design requirements and then IT requirements. After the IT requirements derived the IT project can be implemented. The deployment of the IT project influences the current organization, which could influence the existing organization values. All the fourteen derived requirements from literature and interviews need to be presented within the framework.
ILLUSTRATION AND VERIFICATION

In chapter 5 we constructed a framework. In this chapter we will verify and illustrate this framework. The illustration will be take place through applying the framework to a case. The verification will be done through an interview with an expert. Finally, we will answer the following research question in the conclusion:

[SQ6] Is the framework useful to include organizational values and norms within requirements?

6.1. ILLUSTRATION OF THE FRAMEWORK

The case is an IT project that was executed by Capgemini for the Sociale Verzekeringen Bank (SVB). The SVB is the executor of natural insurances within the Netherlands. The SVB activities include implementing policies concerning the child support, pension, survivor benefits and other allowances. In 2006 SVB introduced the change program ‘SVB Tien’. The reason for the start of this change program is to anticipate on social changes such as the increased ageing, globalisation, and emancipation of civilians (Auditdienst Rijk, 2014). These social changes influenced the execution of regulations of the SVB. Furthermore, it was necessary for SVB to improve costs efficiency. Finally, the amount of clients was increasing to such an extent that different demands were made of the services of SVB (Auditdienst Rijk, 2014).

In 2006 SVB stated that the current IT environment could not provide sufficient possibilities to fulfill the aforementioned requirement (HEC, 2010). Therefore the ‘SVB Tien’ was introduced with the following goals (Auditdienst Rijk, 2014):

1. Improved service for civilians: service aimed for civilian needs to be fast and personal; using multiple channels and make civilians the focal point.
2. Lower execution costs for increasing ageing people: simultaneously the process should aim for quality, speed, and consistent with current IT; maximise automation of case treatment; and monitor risk profiles.
3. Flexible interaction between innovations within the government: maximize usage of authentic registrations and a short ‘time to market’ after modifications take place within the law and regulations.

The key of the new service and design concept of the SVB is a combination of so called “High touch and High tech”. Civilians and customers could already arrange many services via the internet (High tech). Services that were not available online are delivered at several locations of the SVB. The format of teams on these locations is transformed from legislation expert teams to integral service providers.

The SVB Tien change program is originally divided into four clusters (see figure 13):

Cluster 1: improvement of the services through integral services team on location.

https://www.svb.nl/int/nl/index.jsp
Cluster 2: innovation of the processes and migration of IT systems. The architecture SVB strives for has been determined and is agreed on in a contract.

Cluster 3: Organize the supply and demand organization.

Cluster 4: Chain integration.

6.1.1. PROBLEMS

The incurred costs of this IT project were more than 50 million Euros. Even though Capgemini stated that the new IT system would fit the requirements the government decided to cancel the project. The final conclusion of the Dutch government was that the introduction of the IT system would be very problematic. Based on the result of the Software Improvement Group (SIG) (2014) SVB decided to stop the project in 2014. SIG received the task to measure the technical quality of the two software version of Capgemini; a version of May 2013 and the version of June 2014. The results of the conducted analysis of SIG (2014) were the following:

- The technical quality of both software versions does not differ much from each other and is considered to be below market average. The ‘SIG rate’ for Trusted Product Maintainability (between 1 and 5 stars, where 3 is the average) was for the May 2013 version 2.3 stars, while the version of June 2014 is 2.4 stars. The size of the IT system belongs to the biggest 5% and the quality to the lowest 35%.

- More than 26 thousand defects in the IT system are registered and it is expected that there will be around 85 thousand defects. Based on the defect analysis it is expected that the system cannot be used the coming year. The low technical quality, large size, and expected defects made SIG conclude that the IT system cannot be used at short notice and SIG expects that at least another year needs to be invested in the system.
Both SVB and Capgemini did not (completely) agree with SIG’s analysis\(^6\). An important counter argument they gave is that SIG analysed only one (i.e. maintainability) of the eight aspects of the ISO/IEC 25010.

### 6.1.2. SCOPE

Cluster 1, 3, and 4 are outside the scope of this thesis. We are only interested in the implementation of the ICT project which is related to cluster 2. We were not able to find the detailed IT requirements of the project; therefore we were forced to illustrate the case based on the available information. Because of the large size of the IT case over the years sixteen external quality reports were published and ten letters were sent to the House of Representatives concerning the progress of the project (see Appendix E). To illustrate the framework we describe all the values and IT requirements into detail. However, we will limit our illustration to merely a couple of examples in each step.

### 6.1.3. IMPLEMENTING THE FRAMEWORK.

In this section we will apply each step of our framework to the SVB case.

#### 6.1.3.1. ORGANIZATION

The conducted IT project was created for SVB and therefore the organization of SVB contains the environment wherein the IT solution should operate. In our framework we distinguish between the internal IT and the internal business. We found the following goals for SVB\(^8\):

- SVB is searching for tasks that fit the core business: conducting personal finance arrangements for the government.
- Guaranteeing the primary processes of the social services: clients receive what they are entitled to.
- Striving to be the best employer within the government
- We live in a dynamic environment; therefore SVB invests in innovation and is involved in social developments.

These goals describe what the organization strives for and what the internal organization should find important.

#### 6.1.3.2. VALUES

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\(^8\) [https://www.svb.nl/int/nl/over_de_svb/onze_prestaties/doelstellingen/](https://www.svb.nl/int/nl/over_de_svb/onze_prestaties/doelstellingen/)
A method to identify and discover values is by using the tripartite methodology of Friedman et al. (2006). The tripartite methodology consists of the empirical, technical, and conceptual investigation. The empirical investigations encompass the understanding of the relationship between the technology and values in practice. As mentioned in the scope we did not use qualitative or quantitative research methods for the case; therefore the empirical investigations is excluded. Important identified stakeholders are Capgemini, SVB, House of Representatives, customers of SVB, and civilians. **Social welfare** is a value that is in line with the goals of SVB and what the government and civilians would expect from SVB. Social welfare includes the values trust and security. We will elaborate on these two values. We assume that SVB finds security more important than, because there was a lot of commotion in the Netherlands due to several security leaks within the government⁹.

Because we did not hold the empirical investigation we did not find any implicit values. In the next step we will therefore not work with implicit values. However, examples of implicit values within SVB could be **integrity** and **environmental awareness**. Integrity is associated with the quality of being honest and possessing strong moral principles. Environmental awareness concerns the reducing of negative impact of the environment by the organization (e.g. reducing CO2 emission) (Isaacs et al., 1996).

### 6.1.3.3. NORMS

Norms can be determined from the values through value specification. Adding contextual content (i.e. SVB improving their services for civilians) to values allows specification to a norm. For SVB we translated security into the following norms: 1.) protection of client information, 2.) Ensure non-repudiation (i.e. confirming executed actions that occurred when executed so this cannot be denied in a later stage) and trust is translated into increased performance, which leads to: 1.) improve the quality of service, 2) faster processing time.

Leakage of data of civilians could lead to large consequences for SVB; therefore protection of client information is necessary. SVB deals with many transactions and requests on a daily basis. Non-repudiation ensures appropriate data that is verified over the years. Finally, when the performance of the system improves it is expected that the trust towards SVB will be increased. We divided trust into quality and processing time. The determined norms for all values need to be discussed with the involved stakeholders. Furthermore, we could use the **for the sake of** relationship to connect reliable storage to trust, because protection of client information influences trust too.

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Figure 14: Values, norms and design requirements derived from the case

6.1.3.4. DESIGN REQUIREMENTS

From the norms the design requirements can be specified. This translation requires additional specific contextual information. In the previous section we determined three norms. The first norm is the protection of client information and can be specified into the following four design requirements: strong password, secure login page, secure communication channel and store personal information safely. A strong password implies that a civilian needs to fulfill minimal criteria before using a password. By securing the login page of the SVB website the sensitive data that is used on that page is protected. Securing communication channels should lead to the prevention of losing data of civilians. Finally, storing personal information safely should prevent intruders to use obtained data. Subsequently, we can translate faster processing time to the following design requirements: two seconds (estimation of a fast request) to process a child support request, and process a registration within a half second. Note that the design requirements a half second to register and store personal information safely could conflict. We mentioned in the value section that we assumed that SVB attaches more values for security than trust. This prioritization for values facilitates prioritizing the design requirements. Finally, the design requirements need to be discussed and need to be aligned with all the involved stakeholders. Figure 14 depicts the derived values, norms and design requirements of the case.

6.1.3.5. IT REQUIREMENTS

The last and most concrete phase is the IT requirements. In this phase from the design requirement we have to derive IT requirements. IT requirement can be divided into functional and non-functional requirements. Based on the design requirements a Use Case Diagram can be derived. A simple version of the requirements needed by SVB is depicted in the Use Case Diagram in figure 15. The
non-functional requirements are covered by the functional requirements and need to be written explicitly so they will be taken into account for the next stage. In large organization such as the SVB it is important that design requirements are managed correctly. Assume that we need two systems – one that contains law and regulations and processing data of civilians - to handle the following design requirement: two seconds to process a child support request. The time that each department gets to process a child support request has to be given in advance.

![Simple UML illustration of the case](image)

6.1.3.6. **IT IMPLEMENTATION**

After all the IT requirements are derived the implementation of the IT project can start. This final step of the IT project is not within the scope of our thesis. However, we would like to mention that after the implementation the organization could have changed their values. For example, SVB could have become an organization that focuses more on security because this is emphasized within these projects. The result would is that it could be necessary for SVB in a new IT project to start at the first step of our framework (i.e. elicitation of values). Furthermore, it is better for an IT project to fail as early as possible when you knew afterwards it would have failed anyway. Therefore, we would suggest starting first with the crucial IT requirements. Based on the prioritization of the design requirements we would recommend starting the IT implementation with the IT requirements concerning the security.

6.1.4. **SUB-CONCLUSION**

We tried to illustrate the model by applying our framework to a case. It became apparent in an early stage that we had to make several assumptions in the illustration. We did not conduct an
empirical investigation and were missing in-depth information concerning the elaborated descriptions of the IT requirements. Secondly, the case already took place, which implies that we already knew the problems that occurred and why the project failed. It would be more practical to use the framework at the start of a real IT project. What we found more important is that the framework demonstrated that it allows including values and norms of an organization within the IT requirements. We described each step and the results for each corresponding step. Next, to the illustration of the transformation from values into IT requirement we provide valuable considerations. For example, the framework considers how to deal with value tensions and facilitates organizations that want to pursue a tradeoff between IT requirements. It is impossible to state that the project would not have failed when SVB would have used this framework. However, we expect that our framework would have emphasized more on security in an early stage, which could have resulted in more comprehensive IT requirements. Finally, our framework also stimulates ‘fail fast’, which indicates that SVB would had focused earlier on the crucial values/IT requirements and therefore would be more likely to stop the IT project faster.

6.2. VERIFICATION

In this section we will discuss the verification of our framework. The verification is threefold which is retrieved from section 2.4. As proposed in section 2.4, the method by which we will verify the validity of the constructed framework is by first determining whether the requirements included in the framework are clear. Secondly, whether the requirements are complete and there no necessary requirements omitted. Finally, we will determine whether the framework is integral i.e. are all the research domains represented in the framework.

6.2.1. ALL DERIVED REQUIREMENTS

Table two contains all the derived requirements from the literature and interviews with the experts. We will start by discussing them.

Table 2: All the requirements included in the framework

<table>
<thead>
<tr>
<th>The framework should include the following requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Links between IT and business within an organization</td>
</tr>
<tr>
<td>1.1. Functional integration</td>
</tr>
<tr>
<td>1.2. Strategic fit</td>
</tr>
<tr>
<td>1.3. Avoid focus on one domain within technology or business</td>
</tr>
<tr>
<td>2. Discover and identify values within an organization</td>
</tr>
<tr>
<td>3. Make it possible to prioritize IT requirements</td>
</tr>
<tr>
<td>4. Map the effects of values within the organizations</td>
</tr>
<tr>
<td>5. Translate values into norms</td>
</tr>
<tr>
<td>6. Translate norms into design requirements</td>
</tr>
<tr>
<td>7. Identify the relationship between values, business and software</td>
</tr>
<tr>
<td>8. Compatible for both agile and waterfall methodology</td>
</tr>
<tr>
<td>9. Translate design requirements into IT requirements</td>
</tr>
<tr>
<td>10. Reduce the amount of missing IT requirements</td>
</tr>
</tbody>
</table>
6.2.2. RELEVANCE OF THE REQUIREMENTS

In this section we have asked the expert to express his opinion about all the derived requirements of the framework. All the requirements of the constructed framework are listed in table X. In this section the focus is set on whether the requirements are clear and unambiguous for the expert. We asked the expert to show that each requirement is clear and unambiguous by trying to provide a practical example for the requirement.

Links between IT and business within an organization

Currently the organization of the expert is undergoing a transition that should strengthen the link between business and IT. The organization will be divided into tribes, squads and chapters. A squad is a team that consists of employees of multiple disciplines (e.g. IT, business, and juridical). A squad is aiming to achieve one business goal. A set of squads are a chapter and a set of chapters are a tribe.

Discover and identify values within an organization

An organization has both implicit and explicit values. The explicit values are clear for most organizations. However, discovering and identifying implicit values is a complex process. The expert gave an example of their director aiming to have less meeting within their organization. Four years later their organization did not manage to achieve this. The meetings are visible, but the underlying reasons for these meetings are implicit. One of the underlying reasons is that employees are taking accountability for their conducted work during these meetings.

Make it possible to prioritize IT requirements

The expert stated that this is an important requirement that is very difficult to realize. Almost everyone in his company experiences that the organization is trying to do too much at the same time. When they communicate this to their directors they get the following respond: What is your biggest problem or obstacle? When we manage to resolve this problem/obstacle can we go on with the project? The answer of their directors does not include prioritization in their solution that a prioritization is made such as skipping a task temporarily.

Map the effects of values within the organizations

The expert stated that this is a very important requirement and that they are still trying to make progress with this requirement. More progress is expected after the introduction of the new structure of the organization that includes squads, chapters and tribes.

Translate values into norms and norms into design requirements
The expert finds these two important requirements but mentions that is also very difficult to realize. An example of a non-functional requirement within their organization is the following demand: “the mobile application needs to be online at all times”. All IT that supports the mobile application is also affected by this demand, because it is required to be intact at all-time too.

**Identify the relationship between values, business and software**

Identifying the relationships between business, values and software is not emphasized within the organization.

**Compatible for both agile and waterfall methodology**

The expert finds this a good requirement to make the framework compatible with both methodologies. Within his organization both methodologies are used.

**Translate design requirements into IT requirements**

Within the organization of the expert they have product managers who develop the design requirements of products/services. For example, customers should be able to use all services/processes only through mobile phone. Starting a bank account is an example of such a process.

To translate design requirements into IT requirements the expert initially sets up a Use Case Diagram. Subsequently a cycle diagram is developed, which includes all functions, parameters, goal and other IT requirements. Next, to the functional requirements the non-function requirements are drafted.

**Reduce the amount of missing IT requirements**

The expert expresses that there are two views that can be used. Firstly, is to focus on reducing missing IT requirements in advance. Secondly, the challenge to ‘fail fast’. The second view is what the expert thinks the organization should be heading to in the future. When an IT project is going to fail, the organization should try to figure this out as fast possible. An organization should prevent going through a long project and fail in the end.

**Address conflicting values**

Values are not always complementing each other. The expert is conducting a migration and then an update. In this case they are complementing each other. However, when two values are not complementing they need to be addressed.

**Review moments**

External companies are used to analyse the quality of developed code of software engineers. The external company judges whether the delivered software is sufficient. The way the organization of the expert is testing also changed over the years. They use to test in an environment that had a laboratory setup. Nowadays, they start testing by allowing a couple of users to use the new service. Subsequently, the friends and family of employees are allowed to use the new service too. The current way of testing consist more of trial and error. Furthermore, the expert distinguished different types of reviews for different stakeholders, which continuously occurs.
Existing tools to ensure values of the stakeholder within the IT requirements

This is an important requirement which is increasing very fast within the organization of the expert. The monitoring tools, deployment tools, fully automated systems, and external companies are tools to ensure these values.

Dissemination of implementing IT requirements in the organization

Non-functional requirements could include that the whole process of a transaction is only allowed to take a certain amount of time. In large organization it often necessary that multiple actors/departments are needed to develop a transaction. It often occurs that when different departments worked subsequently to realize this transaction the final department is not able to realize the transaction with the remaining time; therefore the processing time needs to be divided per actor/department in advance.

6.2.3. IDENTIFICATION REQUIREMENTS WITHIN FRAMEWORK

The expert stated that all the requirements are sufficiently present in the framework. However, the expert did mention that the framework should consider including ‘fail fast’. The framework already takes into account prioritization of IT requirements. In the implementation phase one could start with these (crucial) IT requirements. For example, for the development of a mobile application security was crucial. When you start designing all the screens of the application and then starts to implement these screens and you realize in a later stage that you are not able to ensure security than all the time and money spent on the screens are wasted. The expert mentions that in the history it is often the case that an IT project fails because one or two aspects could not be fulfilled. For example, Google stopped with Google Glass because there is currently no one who wants to walk with these glasses.

6.2.4. APPLICABILITY

The expert mentions that there are multiple cases where he expects this framework could benefit the organization. Within the tribe of the organization analyses needs to be conducted of the delivered IT. A classic performance measurement method for software is: How many lines of codes did you write? How much of these lines are good? How much of these lines are wrong? How long does it take to produce these lines? The framework made the expert realize that it is more interesting to see the positive impact that the external stakeholder experiences of the software. What values does the stakeholder find important? How these values are influenced by the delivered IT? Feedback from the stakeholder concerning the effect of the software is more likely to positively influence the quality of the software.

6.3. CONCLUSION

In this section we will answer the following research question:
SQ6. Is the framework useful to include organizational values and norms within requirements?

The framework was applied to a case from the SVB. This case was mentioned in the section problem context in the first chapter. The IT provider of the SVB tien program used the norms used in the ISO/IEC 25010. This ISO standardization contains many different general quality measurements. The advantage of the framework in comparison to the ISO standardization is that it provides the path from values to IT requirements. All the general norms or values are transferred into IT requirements. Moreover, the values are traceable from the IT requirements. Therefore we can derive more comprehensive IT requirements. Finally, we also stimulate IT projects that are doomed to fail, to fail faster.

The verification of the constructed framework was conducted through an expert. During the interview the focus was on establishing whether the framework contained all the necessary requirements and if all the requirements have practical applicability. With regard to the completeness of the requirements, the expert stated that the requirements that can be found in the table are indeed sufficient and adequate for the purpose of translating values into IT requirements. With respect to the practical applicability of the fourteen requirements listed, the expert purported that only the seventh requirement: ‘Identify the relationship between values, business and software’ has not been encountered in practice. The remainder of the requirements were all in some form necessary in order to successfully complete the objective set forth by the customer. The interviewee did have a suggestion with regard to the tenth requirement ‘Reduce the amount of missing IT requirements’. The addition of a ‘fail fast’ element should complement this requirement, by allowing one to quickly determine whether the lack of a particular set of requirements will be detrimental to the entire project. The expert is concerned with prioritizing the requirements during the implementation in order to discern what the most crucial requirements are. Figuring this out from the outset will prevent a project from continuing when crucial requirements are not feasible.
In this chapter we will discuss the answers to the sub questions and main research question that were described in the first chapter. The answers to the sub questions are the building blocks that are required to provide a comprehensive answer to the main research question. Furthermore, we also include paragraphs pertaining to the academic contribution and our reflection.

7.1. ACADEMIC CONTRIBUTION

Many organizations are not able to express what the organization finds important within IT requirement of an IT project. In many cases the organization discovers that an IT service does not fit the organization after the IT is delivered and introduced within the organization. In this thesis we contribute to the academic literature by developing a framework that allows including values and norms - which are presented as the preferences of an organization – within IT requirements. In this thesis we investigated the following three research domains: Requirements Engineering, Value Sensitive Design, and IT alignment.

IT requirements are currently derived using several Requirements Engineering techniques. We found several good techniques to extract requirements and translate these requirements into IT requirements. However, these elicitation techniques within Requirements Engineering lack the ability to identify and include values and norms within IT requirements.

The Value Sensitive Design research domain is concerned with including values within the design phase. The Tripartite methodology within the Value Sensitive Design research domain allows an organization to recognize its values (i.e. implicit and explicit values). Furthermore, it allows translating the identified values into design requirements. However, this research domain lacks the ability to translate design requirements into IT requirements.

The research domain IT alignment is concerned with the interaction between IT and business. Academic research revealed that it is crucial that the introduction of new IT services need to be aligned with the business and IT of that organization. IT alignment reveals how to identify and divide the IT and business within an organization. Furthermore, it provides valuable insight in what decisions to consider for aligning IT and business.

Within our framework we brought these three domains together. We mentioned that Requirements Engineering lack techniques to identify and include values within IT requirements and that Value Sensitive Design lacks the ability to translate design requirements into IT requirements. However, Value Sensitive Design makes it possible to identify and include values within design requirements and existing Requirements Engineering techniques allow translating design requirements into IT requirements. In our framework we merged the strengths of these two research domains and reduced the aforementioned weaknesses. In addition, we included the IT alignment to get a better understanding of the flow of values and norms within the organization. Next, to bringing the three domains together we included practical considerations and requirements in our framework.

7.2. CONCLUSION

In this section we will answer all the sub research questions and the main research question.
SQ1. What can we learn from existing literature about IT alignment?

The most valuable lesson that can derived from the existing literature concerning IT alignment is the fact that it allows one to gain a significant in-depth understanding of IT usage within an organization by highlighting the key elements in business and IT. The method by which this understanding can be extracted is through the knowledge of IT alignment’s core tenets, which boils down to the fact that an inadequate fit between the external and internal domain is an important cause of failures of IT projects. It is therefore most prudent for any organization wishing to successfully complete an IT project to find the appropriate balance between these domains. Furthermore, there needs to also exist a balance between IT and business; within the literature this is described as the functional integration. The need to find a balance between business and IT is predicated upon the fact that lacking to do so properly, by focusing for example too much on IT could negatively affects the competitiveness and efficiency of the business side of an organization.

SQ2. What can we learn from existing literature about design for values?

A proper understanding of the literature concerning design for values allows one to discover and identify contextual values from an organization and determine whether these values will hamper or support technology (e.g. applying the tripartite methodology). This model also clearly stipulates how to transition from values to norms and then to design requirements and the exact nature of their interrelatedness. Furthermore, it provides a method through which one can cope with any problems that might occur during the translation from values to design requirements. Lastly, an important framework within the design for values domain is the VSSD framework, which was introduced to elucidate the relations between values, business domain and software. The usefulness of this framework lies in the fact that it allows the relations between these disparate domains to become explicit.

SQ3. What can we learn from existing literature about Requirements Engineering?

Requirements Engineering is a methodology that translates business requirements into IT requirements. Pertaining to software Requirements Engineering, the most notable lesson to be gleaned is the fact that the phase wherein Requirements Engineering takes place is conditional upon whether an organization is making use of the Waterfall or the Agile methodology. This results in varying approaches with regard to the manner in which the requirements are drafted initially. Finally, one particular downside of the Requirements Engineering domain is the fact that it lacks the availability of models that incorporate non-functional requirements. Ideally, the Requirements Engineering model should be able to incorporate both functional and non-functional requirements into the same model to prevent unnecessary duplication of effort.

SQ4. What can we learn from the field experts?

The interview with the field expert confirmed the information that we gained through the literature research in some pivotal points. Mainly the fact that the experts concluded that indeed many IT projects fail due to incomplete requirements, which is the point that was made clear in the IT
alignment model that stated that an inadequate fit between the external and internal domain is the cause of many IT project’s failures. Furthermore, the experts determined it is often the case that values are not necessarily complementing one another, quite to the contrary actually, there are often conflicting values. These conflicting values need to be understood beforehand, in order to ensure that appropriate intensity can be assigned to each value so that a proper balance can be maintained when transitioning from values to IT requirements.

One of the experts emphasized the need for reviewing the delivered work in large projects; preferably this review should be performed by the customer or a third party to prevent conflict of interests. Also, another point made was the fact there are different methods to ensure the values of the customer within the IT requirements e.g. multidisciplinary teams, questionnaires, workshops and interviews. With respect to the two methodologies within the software Requirements Engineering domain; the Waterfall and the Agile methods, the experts both agreed that the Agile method has their preference. In their view short iterative processes have as main advantage that it significantly reduces the time to market and allows for better feedback after each cycle. Finally, the experts stated that IT requirements which are derived from design requirements could be implemented by different departments within an organization. In order to successfully orchestrate this task, it is imperative that the needs are aligned and managed in advance.

SQ5. What requirements can we derive for the framework from both the literature and the experts?

In chapter two and chapter four we derived requirements from the literature and the experts. These requirements are merged into fourteen requirements. These requirements are all included in the framework. This framework exists from five different phases, with a similar amount of steps. These steps are the result of the three research domain combined.

SQ6. Is the framework useful to include organizational values and norms within requirements?

The framework that has been constructed in this thesis is illustrated and verified by an expert. The values that have been included in the illustration were derived from the goals of the organization, instead of the internal business, internal IT and functional integration components of the organization. Nevertheless, the illustration of the case showed the benefits of how the framework can be used to translate values into IT requirements. Furthermore, the expert stated that it is useful enough to consider making use of it. He claimed that the common method by which software coding is measured is antiquated and does not provide relevant information with regard to utility that is experienced by the customer of the IT project. The method that has been used tries to quantify the amount of software code that has been written and the proportion of software code that is deemed correct or incorrect. A far more interesting approach is determining the positive impact that is experienced by the external stakeholders of the software and using that information to determine and measure efficiency of the software code. That is where the framework that has been constructed in this thesis provides more relevant information regarding the customer’s satisfaction with the finished IT project, because it is focused a lot more on the whether the initial values of the customer have been properly translated into the IT requirements.

RQ: How can we include values and norms of an organization into the process of Requirements Engineering for an IT project?
In order to include values and norms of an organization into the process of Requirements Engineering for an IT project, one needs to establish a framework that allows one to extract the necessary and required values and norms from an organization and translate these values and norms into design requirements and ultimately IT requirements. The framework that has been constructed in this thesis allows one to do exactly that. The framework starts with the elicitation of values, where the goal is to extract the values from the internal business, internal IT and functional integration components of an organization. As has been discussed previously, this can be done through the usage of questionnaires, interviews, observations and surveys. Afterwards the values specifications starts, which focuses on transforming the previously acquired values in to norms. In this phase the goal is to add contextual or domain specific content to the generally abstract values that are derived from the first phase. The requirement specification phase follows upon the values specification phase and is intended to result into design requirements. This phase can be the most arduous, because it requires one to translate norms into specific and concrete design requirements. It is during this phase that outside expertise is often needed to clearly articulate the necessary design requirements that fully encompasses the intended goal of the norms that have been constructed. At this point, the service requirements phase should be initiated in order to result in the actual IT requirements that are necessary to clarify the scope and nature of the finished product. As has been mentioned previously in this thesis this phase requires the usage of Use Case Diagrams and the Unified Modeling Language to transition from design requirements into IT requirements. Finally, after completing all the previous steps the IT implementation phase will commence, and the framework has come to a full circle. The finished IT project should be employed at this stage and the customer should be able to determine whether the finished product has met all their expectations. The end result of the proper implementation of this framework should ensure that all the initial values and norms that were stipulated should have found their way into the completed IT project.

A problem that occurs when an IT provider wishes to incorporate the different values that an organization might want to see represented in the final IT project, is value tension. What this implies is that it often is the case that a customer desires to conflicting values within the same IT project. A common example of this issue has to do with the ease of use and security of a particular IT project. These two values often conflict, because one impedes on the implementation of the other. The framework that is constructed in this thesis tries to work around this issue by clearly prioritizing which values are more important to the customer before any IT requirements are constructed. By clearly articulating the order of significance of the values from the onset, these value tensions issues can be significantly reduced. Furthermore, if during the course of the IT project a different view is perceived as to the significance of the initially stated priority of the values, this can be easily changed by varying the weights of importance that are assigned to each individual value. For example, if security of your IT project is considered to be the most important aspect, but it turns out that it only encompasses a small part of the IT project, this discrepancy can be retroactively changed by applying different weights of importance to the security value during the different iterations that the IT project will naturally go through.

Some further criticisms that can be levied against the domains that have been used in this thesis to derive my framework are the following. Within for example the Requirements Engineering domain, there exists a possibility of not being able to include all the necessary IT requirements. This mainly
has to do with the fact that the Requirements Engineering methodology tries to extract the IT requirements directly from the organization, whereas our framework first tries to establish which values are perceived as important by the organization before trying to construct the IT requirements. This method allows one to gain a more complete overview of which IT requirements are considered to be of importance to the organization. Another point of criticism that has been discussed previously, concerns the lack of practical applicability that the three domains possess. This criticism is mainly based on the fact that the domains are more concerned with the theoretical underpinnings of their methodology than they are with the practical applicability of their methodology. Therefore all the requirements of our framework include practical applicability. However to test the practical applicability of the framework (coherence of requirements) it is necessary for any framework for it be used in the real work.

7.3. REFLECTION

In the earliest phase of this thesis, a schedule was planned out to outline the different aspects of the thesis and the timeline by which each aspect should be fulfilled. The basis on which these aspects were chosen was derived from an adjusted design approach constructed by Verschuren and Hartog (2005). This adjusted approach provided me with a clear structure and methodology to follow in order to complete my thesis; it functioned as a connecting thread throughout my thesis that clarified what was currently being worked on and what the subsequent parts should entail. Quite early on however, I found myself to be behind schedule due to unforeseen circumstances concerning the schedules of the field experts that were supposed to be interviewed. The fact that I was not meeting my own expectations concerning the timeline troubled me quite a bit in the beginning, I attributed this to the fact that this was the first time that I tried to construct a framework and some hiccups were inevitable. Hindsight, I can also conclude that some delay was built up because of the difficulties I face to scope the thesis. The proposal of the thesis contains a scope which was too broad.

Initially, the goal was to conduct a limited validation of the framework, this was however thwarted due to time and resource constraints that prevented me from achieving the goal that was planned from the onset. Therefore, we chose to illustrate the framework to a case. Advantage of the illustration is that we discussed the results of each step of the framework and how the steps are related to each other.

Concerning the limitations of this research, the following can be said. The first limitation concerns the amount of interviewers that were approached for this thesis. Only two field experts were approached to conduct the semi-structured interviews with. This is quite a small number of interviewees to have, which inevitably will lead to an overrepresentation of the information gained from the literature review in the derivation of the framework. Looking back on this, it might have been more prudent to spend more time on finding appropriate candidates for the interviews, however due to the fact that finding the two respondents and conducting the interview took a lot of time and effort I was dissuaded to try and search out more candidates. Especially, because it is not uncommon for the time and effort to have been spent in vain, due to the certainty of finding an appropriate candidate with the necessary credentials being less than stellar.
Another limitation is the lack of validation. A better validation could take place when the framework is used in practice within an organization in the initial phase of an IT project. Final limitation is the lack of verification. We verified the one expert whether we had all requirements and whether these requirements were sufficiently presented in the model. We would have preferred to have more interviews to have multiple verifications.
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APPENDIX A INTERVIEW QUESTIONS FOR DERIVING REQUIREMENTS

Interview Questions for deriving requirements:
- Introduction of myself
- Ask permission to record.

Personal:
What is your role in the company?
- Thesis context
- Explain identified problems in literature concerning IT failures.

Identification Problem:
Do you face these problems also within your company?
- No -> what do you think your company is doing that other companies are not doing?
- Yes -> when and how does this problem occur? What does your company do to overcome the problem?

Added value of IT alignment with business:
- Explain values

Do you think it is necessary to have a fit between the values the business strives for and the values IT strives for?

How do you make sure this fitness is reached?

Are there any other tools or resources that could replace an IT value framework?

Including values in IT systems:
Where do you get your values from?

How are these values included in the IT requirements?

How do you guarantee the values from the stakeholders?

What are the (dis)advantages of using values explicitly in the software development process?

Do you have any other suggestions or advice for me?

Feedback interview

Discuss results research (Preference for new meeting? Or E-mail?)
APPENDIX B INTERVIEWEE 1 DERIVING REQUIREMENTS OF EXPERT

Role expert

The interviewee works for a company that provides IT services and is considered to be one of the largest consulting and outsourcing company in the world. The expert is a SAPP application controller. His tasks include making sure that within an external company all the applications are executed correctly, adding new features to the system, sell new features, and use the latest technology updates.

Do you face these problems also within your company? If so, how do these problems arise?

Yes, we also face the problems you mentioned. It is important to start an IT project with clear agreements with the customer. This agreement should include a complete list of all the requirements of the project. Furthermore, the requirements need to be defined as specific as possible. It often occurred that we have faced customers providing really bad requirements or that these customers want to add/change requirements in a later stage.

Furthermore, I am not sure whether this happens in our company but it I know certain companies (i.e. IT providers) leave out requirements on purpose in a tender so that the customer to accept their low bid.

How do you overcome these problems?

Sometimes the customer tries to resolve this problem by hiring an external company to take over the first part of the project. The external company will realize all the requirements for the customer and the technical part is then done by us (e.g. implementation, testing etc.). This requires a good collaboration with the external company.

More often it is the case that we have to help the customer to set up the requirements. We have different methods to use this. We are a large company that possesses a lot of knowledge and experience in different branches. This makes us capable to better estimate the IT requirements of a customer. Furthermore, we use other methods such as workshops to obtain IT requirement.

Do you think it is necessary to have a fit between the values business strives and the values IT strives for?

Within IT we strive to have the same values as within business, but it is hard to align the values of business all the time. We have examples of cases that we managed to align the values of IT with business, but there are also cases where this alignment is not reached. Business could for example strive for high security and at the same time they would like to have high ease of use. This is not always feasible because within IT a trade-off needs to be made between security and user friendliness. For example, nowadays every system should have a unique password and the password should include certain characters and needs to be of a certain minimum size. Imagine that you need to use more than sixty different passwords. The passwords increase security but it also decreases the ease of use. A general rule that you can apply is that when you increase security the ease of use decreases.
How do you make sure this fitness between IT and business is reached?

There are different ways to make sure we reach this fitness. In the current case an external audit took place to make sure fitness is reached between IT and business. Furthermore, when a customer is in need for high security we could deliver certain ISO guidelines. The ISO standards are really specific and the system needs to be compliant to them. With our experience and knowledge we are also capable to provide our own guidelines, which allow us to ensure certain fitness between IT and business.

Including values in IT systems:

Within our company we have all these different departments too. The process for a new customer starts with a bid process. The customer wants to execute a project. Different companies are then joining this bid process. Subsequently, a tender will be drafted. The tender includes abstract values. A tender that is been drafted will pass the juridical department. We do this for every contract. The first round in the bid process contains global requirements. Every following round the requirements become more specific. The real detailed requirements will be drafted after the bid is won. Then a workshop could be held to obtain better insight into the requirements. Furthermore, we have a lot of knowledge and experience in many branches which allows us to know which values to use for different customers.

How are these values included in the IT requirements?

The requirements are realized in cooperation with the customer. Suppose the customer attaches a lot of value for privacy then this becomes visible in the requirements.

Within our company we also work very often in multidisciplinary teams. This ensures that all stakeholders involved have their responsibility and at the same time represent their values/interest. The stakeholders include departments of our company, but also external companies and the customer.

How do you guarantee the values from the stakeholders?

One way we guarantee values by conducting an audit. When a customer indicates that he attaches a lot of value for privacy then we will take that into account by setting up the contract. We are then obliged to consider this value. Recently we promised to deliver a customer certain performance. We hired an external company that is specialized in measuring performance. This external company is capable of measuring the performance. This company ensures that the promised service is delivered.

Furthermore, in all many big projects we let the customer review us. The review contains all kind of element such as deliverance of promises.

What are the (dis)advantages of using values explicitly in the software development process?

I think it is really important to write down all the requirements of the customers from the beginning, because this is the foundation of your project. Furthermore, there is a trade-off in the usage of certain values. When one focuses too much on security the ease of use decreases. In the case that employees need a couple of minutes more to log in on their systems the structural costs increase. Sometimes there is even too much security. Recently we were not capable to use certain user
permissions. It took us a lot of time to get these permissions back. This can lead to unnecessary waste of time and costs.
APPENDIX C INTERVIEWEE 2 DERIVING REQUIREMENTS OF EXPERT

Interview with expert:

- Introduction of myself
- Thesis context
- Ask permission to record.

Personal:

What is your role within the company?

The expert graduated as Electrical Engineer in 1993 and started as a software engineer. Subsequently, the expert started working with meta control systems (i.e. stabilizing unstable systems/processes by connecting results to input in a cycle). After that the expert started writing communication protocols. ING invited the expert to write communication protocols for ING. The expert subsequently became a project leader and project manager within ING for several years. Thereafter, the expert took different roles within ING such as the responsibility for all IT automation related to the offices, all IT for business customers, all IT developments for Postbank/ING. The past 4 years the expert focused on increasing the flexibility of IT projects by moving from the rigid “prince 2” to the Agile methodology. A large project the expert is currently focusing on is the migration of the systems of the old banks (e.g. Postbank and NMB Bank) into one system.

- Explain identified problems in literature concerning IT failures.

Identification Problem:

Do you face these problems also within your company?

- No -> what do you think your company is doing that other companies are not doing?
- Yes -> when and how does this problem occur? What does your company do to overcome the problem?

The expert identified these problems also within ING. An average project within ING is expected to last nine months. The probability to fail a project increases as the size of the project increases. The expert estimated that a couple of hundred projects fail every year within the organization. We live in a dynamic environment which leads to an uncertain future; therefore ING strives to avoid large IT projects and divide large projects into multiple small projects. Problems that could occur during such a big IT project are the following:

1) When a customer needs to wait two years for the end result his expectations of the results change. A customer changes the way they think over the years and therefore wants something else two years later. Moreover, a customer could see other requirements in these two years that he also would like to have.
2) As IT provider you are not capable of exactly understanding the requirements of the customer.
3) Certain requirements are not feasible for the IT provider.
4) Customers cannot clearly visualize and thus describe which requirement should be included in the IT requirements. IT providers cannot provide on short term a model/prototype which implies that the customer cannot see the product until it is almost finished.
Dividing the execution of a large IT project into multiple small projects leads to increased flexibility and allows an organization to better cope with changing requirements.

**Values within IT and business:**

*Do you think it is necessary to have a fit between the values the business strives for and the values IT strives for?*

The expert emphasized the importance of aligned values within business and IT. An inadequate fit between IT and business values could lead to many misunderstandings and therefore should be prevented as much as possible.

*How do you make sure this fitness is reached?*

Currently each department within ING has layers of managers (level 1, level 2, level 3, etc.) and the highest managers (i.e. Level 1) of two or more departments are communicating together. Managers of level 2 and lower do not interact with other managers from other departments. The different departments are even located in different buildings. The way the values are interpreted within the organization depends on how the values are interpreted downwards from the managers to the staff.

You do not want to have this as an organization; therefore ING tries to transfer values within the organization via other ways. One way ING include values from operators into an IT project of development is by so called DevOps. DevOps are teams that include team members from both operators and developers. For example: development needs to deliver certain services via mobile phone and then operators set requirements such as the service should be capable to have millions of transactions per day and none of these transactions can go wrong to ensure trust. Or operators demand a robust system which does not contain many malfunctions. Because operators have to use the system that Development is going to develop it can include certain requirements for developers. Besides team members from Development and Operations it is often the case that a product owner from business is included in the teams.

The usage of multidisciplinary teams and the switch from the Waterfall to Agile methodology did not have any measurable positive effects on efficiency, quality or costs the first three years. What they did notice is that the time to market significantly decreased, due to dividing a large project into multiple small projects. Instead of nine months a service/product goes live within three months. ING uses now around four years the multidisciplinary teams and notices now that the labour productivity is slowly increasing. The increased productivity is achieved by demanding more creativity of software engineers, which results in more automation. For example, creative test automations are created now.

**Including values in IT systems:**

- **Explain values**

*Where do you get your values from?*

ING uses the Agile/Lean approach. Lean entails a continuous flow of change within the developments of the system. For example when Business wants to have a mobile application, then it demands certain requirements for the application. The developers will then design and implement this
application. Once the product is live and used by the customers, the feedback that is given will be included in the next delivery. Subjects with a lot of attention in the feedback get a higher priority.

*There is a chance that the first version is really bad. Do you think that is a big risk?*

The expert pointed out that the first iPhone in 2007 was not from high quality. However, Apple managed to present the iPhone in such a way that a market was created for it. The first release allowed Apple to incorporate the feedback of the users and keep improving the phone. Instead of making a phone in a laboratory and hoping that the users will like it.

Next, to short development there are also values that the whole organization find important such as trusts and security.

**How are these values included in the IT requirements?**

For a new IT project we set up new requirements. These requirements can be linked to the values of the organization.

**How do you guarantee the values from the stakeholders?**

For the aforementioned project, to migrate all current systems to one system, the business demands that all current services should not impact the customers. This means that the impact for the customer needs to be minimized. Suppose during the IT project a better solution could be reached, but this will have impact on the customers. Development will then decide in consultation with business what functionalities receive a higher priority.

Before the development of a system a Business Impact Analysis (BIA) needs to be filled. This BIA contains 700 questions, which provides a score that the system should have for reliability, availability and accuracy. BIA is filled in by staff members from business or/and operators. A high score implies that development has to include more measures to guarantee this score. For example payment systems have a score of 99.9 for availability and are thus allowed to not work merely once a year.

**What are the (dis)advantages of using values explicitly in the software development process?**

Making reliability, availability, and accuracy explicit has the advantage for developers that they know what measures should be taken to comply with the IT requirements. For example when the BIA score is level 4 for reliability than it implies that all data needs to be encrypted. ING takes standard into account in every new development the confidentiality, integrity and availability values. Other values that are less used are placed as requirements in the non-function requirements.

The disadvantage of using these values explicitly is that business and operators who will in the BIA are not critically enough and prefer to be on the safe side, which results in higher score and more measures (i.e. more expensive).

**Do you have any other suggestions or advice for me?**

Collaboration between different groups is difficult and miscommunication between them can easily happen. These miscommunications lead often to a different solution than the customer or organization prefers. Multidisciplinary teams reduce the transfer of data between groups, which prevents miscommunication.
APPENDIX D VERIFICATION INTERVIEW QUESTIONS

Interview questions for verification framework:

- Introduction
- Ask permission to record.

Relevance Requirements:

- Show the derived requirements for each domain. For each requirement we have the following question:

  Is it valid to include this requirement from your experience?

  Do you think the requirement could contribute to the framework?

  Are there missing any important requirements?

Identification requirement within framework:

  For each requirement:

  To what extent is this requirement it sufficiently presented in the framework?

  Does the framework cover all the requirements?

Applicability

  Would you consider using this framework or elements of this framework within your organization?
APPENDIX E VERIFICATION INTERVIEW WITH EXPERT

Links between IT and business within an organization

- Functional integration
- Strategic fit
- Avoid focus on one domain within technology or business

Within our organization we are going to start working with tribes, squads and chapters. Staff members from business and IT will be brought together into one team. These teams of multidisciplinary teams are called squads. A squad will try to achieve one business goal. A set of squads are a chapter and a set of chapters are a tribe. Next, to the squads we recently started to continuously monitor the latest technology and we are also trying to provide customers extra services. Focusing on one domain of SAM does indeed bring along problems. The expert referred to a book of Jim Collins called ´Good to Great´. Jim Collins did research to aspects of successful companies. This book describes what we experience in practice that focus on multiple domains is necessary.

Discover and identify values within an organization

This is hard to realize. In practice we speak about culture when we are talking about norms and values. Some are explicit and implicit. The implicit values are hard to find, so it is really difficult to change. In 2011 one of our directors said in an article for a newspaper that he wants to achieve that less meetings take place within the organization and staff lower in the hierarchy take more responsibilities. We did not manager to realise the former change. The meetings are visible, but the reasons for these meetings are not explicit. One reason we hold meetings is to show delivered results and allows employees to be accountable for their work.

Make it possible to prioritize IT requirements

This is an important requirement, but is very difficult to realize. Almost everyone within the company experiences that we are trying to do too much at the same time. When we communicate this to the directors we get the following respond: What is your biggest problem or obstacle? When we manage to resolve this problem/obstacle can we go on with the project? The answer does not provide a solution wherein a prioritization is made such as skipping a task temporarily.

Our organization wants to be innovative and is trying to bring along large changes. Before a new project starts we are inclined to first start investigating the whole process for problems that could occur. The result is that a lot of time passes before we actually start a project. We feel safe with this approach because it gives the suggestion that the project will be under control. A better option would be to just start the project and face the benefits and problems of the project. The project can be stopped when it does not suit the organization.

Recent years we started to use more Agile. We noticed in the constructed small teams that they started with a broad scope. As the project continues they realize that certain elements are not necessary to be included into the scope which results in a project that possesses a continuous flow wherein issues are being resolved. We face difficulties in saying we have the following hundred tasks and let us focus for now on the first five tasks.
In the constructed framework we want to achieve prioritized requirements by prioritizing values. These prioritized values are then specified into prioritized norms and these norms are then specified into prioritized design requirements etc. What do you think of that?

We want to integrate different systems into one system. The integration of these systems is already a big innovation. We decided that we first want to migrate and then decide to upgrade.

What is the reason for not upgrading?

The experience has taught us that when you want to migrate and then upgrade we have to build a new system in a new environment. This will take years and that means that the migration will be delayed with years.

This implies that you find duration more important than innovation for this project? And the prioritization took place in an early stage.

Yes, I agree that we did the prioritization in an early stage. Yes for this project we decided that the duration of a project is more important than innovation. However, we expect that by not being innovative now we will be more innovative in the future.

Map the effects of values within the organizations

I think this is a very important requirement too and that we still have to make some steps in this. I expect that we will make some more steps in the future through the new structure of squads, chapters and tribes.

Translate values into norms

I have the idea that innovation is driven by IT and not business. When we discover a new IT technology we want to include it within our organization. They told me in 2009 that we have to deliver four times as much with the same budget.

Does business not mention what they find important?

They do. We continuously hear from them that the delivered IT is too expensive or too slow etc.

Translate norms into design requirements

We spend a lot of time for this important step. However, it is very difficult to realize this step. We have for example non-functional requirements. An example of such a requirement is that we demand that our mobile application is 24/7 online. Such a demand brings along many requirements for the IT. We for example also have to ensure that the whole backend is 24/7 online. These additional measures lead to all kind of extra costs for maintenance that we cannot spend on the development of new services. This implies that you could say that the stability of current services is more important than certain innovations.

Identify the relationship between values, business and software

Within our organization we are not busy trying to make the relationships between business, values and software explicit.
Compatible for both agile and waterfall methodology

This is a good requirement.

Translate design requirements into IT requirements

We are currently busy with this process. We have product managers who say that products need to be created and should contain the following design requirements. For example we want our customers to be able to do everything through their mobile and that customers do not need to have any form of interaction with us to complete a process. Starting a bank account is an example of such a process.

Within the IT we start first setting up a Use Case Diagram. Then we make a cycle diagram, which includes all functions, parameters, goal and other IT requirements. In addition, we have the non-functional requirements (e.g. the whole process should not take longer than 1 second).

Reduce the amount of missing IT requirements

This is true. But the question that could arise is the following: what are missing requirements? The challenge is going to be to ‘fail fast’. This is the direction we should be heading to in the future. In the case we are failing, we want to know this as fast possible. We want to prevent going through a long project and face a problem in the end.

For the integration of the different systems we also tried to reduce the amount of missing requirements. I mentioned that we wanted to migrate first and then upgrade. By focusing on just migrations first we try to provide a complete set of requirements to finish the migration first.

Address conflicting values

This requirement is right, but can you see conflicting values? I am inclined to say that values are not always complementing each other. In our case we have a migration and then an update which complements each other. However, it could be the case that two values are not complementing. Did you take this into account?

Yes you are right. For example ease of use and security are often not complementing each other. By prioritizing IT requirements in an early stage (values, norms, and design requirements) we try to address conflicting values in the IT requirements.

I think that could resolve many problems.

Review moments

We also use external companies to analyse the quality of developed code of software engineers. The external company judges whether the delivered software is good but we are changing the way we are testing the functionalities. We used to test in an environment that reminds you of a laboratory. Nowadays we start testing by allowing a couple of users to use the new service. Subsequently, the friends and family of employees are allowed to use the new service too. This is a more trial and error way of working for testing the functionality.
Furthermore, it is not like we have one review moment, but we have every two weeks a meeting with all stakeholders wherein all the delivered work is reviewed. So we have different types of reviews and different review moments.

**Existing tools to ensure values of the stakeholder within the IT requirements**

This is an important requirement which is increasing very fast within our organization. The monitoring tools, deployment tools, fully automated systems, and external companies are tools to ensure these values.

**Dissemination of implementing IT requirements in the organization**

This is what I mentioned earlier. The constructed non-functional requirements could include that the whole process of a transaction is only allowed to take a certain amount of time. When you know this you have to divide the time in advance for all the parties involved. In the past the last party involved received the least time for a process.

**Identification requirement within framework:**

For each requirement:

*To what extent is this requirement sufficiently presented in the framework?*

*Does the framework cover all the requirements?*

The requirement that identify the relationship between values, business and software is not clearly visible. Furthermore, I think it would help to add something with the aforementioned ‘fail fast’ in the ‘reduce the amount of missing IT requirements’ requirement. You could for example say when you know the most critical IT requirements of a project that you start within the implementation with these IT requirements. When security is your most crucial value then you should make security your starting point. For example, for the development of our mobile application security was crucial. When you start building screens and all kind of other IT requirements while you are not capable of ensuring security than the effort done for these requirements are wasted. Because security is crucial we started with the security for the mobile application first. After the security is ensured we have the most critical IT requirement(s) covered. In the history it is often the case that an IT project fails because one or two aspects are not fulfilled. For example, Google stopped with Google Glass. The reason therefore is that currently no one wants to walk with these glasses.

**Applicability**

*Would you consider using this framework or elements of this framework within your organization?*

Yes there are multiple things that come in mind. I told you that we want to start with these Tribes. We would like to conduct data analyses of delivered IT within these Tribes. A classic performance measurement method for software is: How many lines of codes did you write? How much of these lines are good? How much of these lines are wrong? How fast are you? Actually that is not interesting. More interesting is to see the positive impact that the external stakeholder experiences of the software. That is where you would like to get your feedback from and how you could actually measure efficiency.
## APPENDIX F SOURCES USED FOR ILLUSTRATION

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