Standardizing Requirements Specification for IT Sourcing

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Abstract

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This thesis considers standardizing service requirement specification for IT sourcing. The potential benefits a standardization of service requirements writing combined with Scania IT's developing strategy have created a need for an investigation about how requirements standardization for IT sourcing could be done. This thesis is built upon three different approaches, requirements engineering, service oriented requirement engineering and best practices. Combined, these different approaches comprise the theory model RSB that will be used in the requirements standardization work. The strategies for collecting data, the authors choose embedded case study. The main problem at Scania IT regarding requirements specification in sourcing is the absence of a standard. The service requirements specifications varies in quality and execution, which causes communication problems. In order to standardize the requirements specification, the authors of this thesis have developed a standardization model consisting of three phases. A template is developed and presented in this thesis, the template is also included in the standardization phases model. The template created in this thesis, based on the RSB-model combined with the empirics, shows how a standard template can be designed. This study also suggests a three-phase model for working with standardization in the future. The standardization model suggest a requirements management software connected to a database.
Populärvetenskaplig sammanfattning
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1. Introduction

One important factor for big organizations and companies are the IT-systems, which facilitates communications and improves efficiency in many areas. At Scania, the organization responsible for the development and maintenance of IT-systems is a subsidiary company named Scania IT. The IT-systems developed by Scania IT is an important part of the efficiency of Scania but they are also a vital part of the competitive advantage. That requires a well-developed process for developing new IT-systems. One part of the process is to buy parts or whole systems as a service from suppliers, instead of developing them in-house. Resources could be saved without risking the competitive advantage. In the overall strategy that Scania IT is working under, sourcing is becoming more important because it is more cost and resource efficient.

Before sourcing contracts, for example a Service Level Agreement (SLA) can be written between Scania and a supplier, an investigation of what is needed from the supplier and from the service should be done, i.e. the service requirements. The service requirements are written down in a document, which serves as a base for the SLA. At Scania IT, a standard way of writing the service requirements has been missing. That has brought difficulties to both the internal and external communication at Scania IT, but also to the work with improving quality of the service requirements writing.

The potential benefits of a standardization of requirements writing combined with Scania IT:s developing strategy have created a need for an investigation about how requirements standardization for IT sourcing could be done.

2. Problem Background and Description

To investigate the possibilities to create a standardization of service requirements, it is important to map how the service requirements are used today. At Scania, the IT purchase department, SAI, handle all contacts with potential suppliers. That originates from their general sourcing strategies, which means that when project groups at Scania IT have written initial service requirements specifications they send it to SAI. At SAI, the specification is used as a base for a request for quotation (RFQ) that is sent out to suppliers on the market. Different suppliers are given the opportunity to answer the RFQ and describe how they would deliver a service according to what is described in the RFQ. When all answers are analyzed, suppliers are chosen and sourcing contracts are written with suppliers, which will deliver services to Scania IT. A simplified overview is shown in figure 1.
The quality of the service requirements specification affects the whole sourcing process. To standardize the service requirements writing is a first step in the work of improving requirements quality. It is also the mission behind this thesis initiated by the Vendor Management Office, VMO, which is a part of Scania IT.

Requirements written in a sourcing specification for IT services consists of three different parts; functional, non-functional and service requirements. Non-functional requirements have been pointed out as a weakness at Scania IT by an internal investigation. The investigation report points out that several percent of a project's budget could be saved if the quality of the requirements were improved. The work with this thesis starts where the earlier report ended and will investigate how a potential standardization of requirements writing could be conducted.

According to the assignment behind this thesis, service requirements should be in focus. The authors have seen that a general structure is missing in the standardization work. Therefore the authors have chosen to extend the study and include functional and non-functional requirements.

2.1 Purpose
The purpose of this thesis is to find a standard way to create specifications for functional, non-functional and service requirements in the procurement of sourcing IT services.

2.2 Research Question
How can the writing of a service requirements specification be standardized?
- How can a standard template be designed?
- How can the template be implemented at Scania IT?
- How can Scania IT work with standardization in the future?
2.3 Limitations

The scope of this thesis is based on that requirements elicitation is done. There are several techniques for collecting and gather requirements in a project and this thesis will not cover that section.
3. Theory

This thesis is built upon three different approaches, requirements engineering, service oriented requirement engineering and best practices. Combined, these different approaches comprise the theory model RSB used in the requirements standardization work.

![Diagram showing the RSB model]

Figure 2: The RSB-model shows approaches between different requirements theories within this thesis.

The different approaches are described in a more detailed level in the following sections.

3.1 Requirement Engineering

The scope of this thesis is the requirements phase. It defines what businesses, customers, users, developers, and stakeholders need from the new software, system or service. Requirements also define what must be done to meet the demands of the business needs. (Hull, E., Jackson, K. & Dick, J., 2011, p. 2) A requirements document presents a consistent and clear description of what to be implemented. (Sommerville, I. & Sawyer, P., 1997, p. 38)

Traditionally, a requirements engineering (RE) process for producing and managing a requirement is performed at the beginning of a project. In large and complex projects there is often a need to change the requirements in later phases. Therefore, the RE process could be seen as an incremental and iterative process. (Quintela Varajão, 2010, p. 113).

3.2 Requirements Specification

Because of its function and content, the requirements document is a valuable source throughout the lifetime of a system. Therefore, the requirements document should be written and produced in a dynamic way. This means that the requirements document should be possible to modify if the requirements change. To make a completely new document for every change is too time consuming and if the document is difficult to change, errors could persist until an updated version is produced. (Sommerville, I. & Sawyer, P., 1997, p. 60) A requirements document could be very large and it could be difficult to
capture all requirements without resorting to a specific convention or jargon. (Hull, E., Jackson, K. & Dick, J., 2011, p. 2)

Often requirements documents are more read than written, so producing readable documents is generally cost-effective. More readable documents will probably be less misunderstood and save time. (Sommerville, I. & Sawyer, P., 1997, p. 54) That makes it important to have a well-understood and clearly documented structure. A well-organized structure could help to: (Hull, E., Jackson, K. & Dick, J., 2011, p. 75)

- **Minimize** the number of requirements
- **Understand** large amounts of information
- **Find** sets of requirements relating to particular topics
- **Detect** omissions and duplications
- **Eliminate** conflicts between requirements
- **Manage** iteration (e.g. delayed requirements)
- **Reject** poor requirements
- **Evaluate** requirements
- **Reuse** requirements across projects

An effective way when presenting the structure for the reader is a content list or index. It helps the readers to find what they are looking for and it facilitates the review of the document. (Sommerville, I. & Sawyer, P., 1997, p. 57) Requirements document are often hierarchical with different headings and subsections. The structure helps to categorize the requirements and their contexts, which help the reader to understand the content. Example of different context descriptions: (Hull, E., Jackson, K. & Dick, J., 2011, p. 80)

- **Background information** that places the requirements in context
- **External context** describing the enclosing system, often called "domain knowledge"
- **Definition of the scope** of the requirements (what is in and what is out)
- **Definitions of terms** used in the requirement statements
- **Descriptive text, which** bridges different sections of the document
- **Stakeholder descriptions**
- **Summary of models** used in deriving the requirements
- **References** to other documents
An index presents how the document is built and the structure of the information. The structure could often be read in several ways. Therefore, it is important to have sections telling the reader how to read the document. It will help the reader judge the requirements and it will save time for the reader and fewer problems connected to communication will occur, which will generally save money. (Sommerville, I. & Sawyer, P., 1997, p. 45)

It is not only necessary with a section telling the reader how to read the document, there is also a need for information how to write or change the document. It is very common that requirements change or need to be added in a project. There will be parts that need to be presented in all documents, and some parts that only occurs in some documents. Defining those parts helps the management of requirement variances. (Sommerville, I. & Sawyer, P., 1997, p. 43)

In the structure and information of how to manage the document there will occur terms that could be difficult to understand or could be interpreted in different ways. Problems with terminology are very common when there are several readers and writers, with different backgrounds, of the same requirements document. To avoid misunderstandings, a glossary for defining domain specific terms is important. (Sommerville, I. & Sawyer, P., 1997, p. 51)

It is not only the structure and information about the content that could facilitate requirement management. In large sets, there could be conflicting requirements since a requirement could concern several parts of a system. One way of preventing conflicting requirements is to classify them. One example is to gather all requirements regarding safety together when checking consistency, even if the primary classification is something else. (Hull, E., Jackson, K. & Dick, J., 2011, p. 77)

### 3.3 Writing Requirements

There are several ways of writing understandable requirements but they all follow some general guidelines. Some requirements are negotiable and some are not. Generally, if the non-negotiable requirements are not meet the product is of no use. A consistent language is the key to conveying the hierarchy of the requirements for both readers and writers. One approach to indicate the hierarchy is to use “shall”, “should” and “may”. This is recommended by the International Standard Organization and presented in section 3.6.1. (Hull, E., Jackson, K. & Dick, J., 2011, p. 80) Apart from the language aspect, every statement of requirement has certain criteria that should be fulfilled. These are: (Hull, E., Jackson, K. & Dick, J., 2011, p. 85)

- **Atomic**: each statement carries a single traceable element
- **Unique**: each statement can be uniquely identified
- **Feasible**: technically possible within cost and schedule
• Legal: legally possible
• Clear: each statement is clearly understandable
• Precise: each statement is precise and concise
• Verifiable: each statement is verifiable, and it is known how
• Abstract: does not impose a solution of design specific to the layer below

Despite all research and guidelines there is no general requirement standard that fits all situations and organizations. Developing a requirements document is about to define an organizational standard and structure, custom made for the current company. The requirements document should encapsulate what the people in the organization consider the best practices. Sometimes, there is a need for several standards in the same organization. (Sommerville, I. & Sawyer, P., 1997, p. 41) One perspective when developing a requirements standard is to look at existing documents from different parts of the organization and find common characteristics. (Sommerville, I. & Sawyer, P., 1997, p. 42)

There is also a possibility to look at already developed standards for the industry when developing a standard for an organization. One standard, and the most accessible, is the ISO/IEC/IEEE 29148:2011 which suggest a structure for the requirements document and also how requirements could be expressed with a testable and understandable language. (Sommerville, I. & Sawyer, P., 1997, p. 42)

3.4 Requirements Standards and Templates

When the best practice, present requirements documents characteristics and industry standards are analyzed, a new organizational standard could be developed. There are several benefits when using a standard, often in the form of templates, in an organization. The first is that the reader could use experience from previous documents and understand the document, and its context, within less time and the relations between different parts. (Mary Geruch, 2010a, p. 12) The second benefit is that document reviewers could use their experience to find errors and missing parts in the document. (Sommerville, I. & Sawyer, P., 1997, p. 42)

3.4.1 Template

The primary reason that templates exist is that they save time. They are models, created once and then refined along the way. It may take a project manager four hours to create a requirements document from scratch but only one hour using a template. (Mary Geruch, 2009, p. 1) Many project teams conduct a lessons-learned after a project ends to review what went well and what could have gone better. An agile team takes this one step further and reviewing after each interaction. Template creators and users benefit from adopting this technique to optimize their template collection. (Mary Geruch, 2009, p. 5)
It is important to understand the motivations behind the changes in a requirements document. Understanding makes processes more efficient. Therefore, the understanding of the projects use and the optimization of templates improve effectiveness. (Mary Geruch, 2009, p. 5) Many organizations create templates and ignore them for a long period of time. It is important that templates are being updated based on feedback and new knowledge. It will help the organization to incrementally improve projects deliverables over time. (Mary Geruch, 2009, p. 5)

A new project manager may forget to include certain sections, or a senior project manager may face a blank piece of paper and neglects to include certain dependencies with other projects. Appropriately designed templates provide guidance for those who are just learning and provide a more-experienced team member to include information that they might otherwise have forgotten. (Mary Geruch, 2009, p. 2) The template can work as a trigger to help team members at all levels to think through the entire project and its outcomes. (Mary Geruch, 2009, p. 2)

A template should be consistent where it makes sense but at the same time be flexible. They should have similar formats, font standardize and simplified headers and sections. It is important to have standard naming conventions across projects and create a template with standard features. (Mary Geruch, 2009, p. 2)

Good requirements are critical to delivering a successful solution. Whether the deliverable is a Web site, application, back-end service or re-engineered process, the requirements need to be good. Yet many organizations fail to defining and managing requirements. (Mary Geruch, 2010a, p. 2) There is no checklist that can be used to always deliver high-quality requirements. (Mary Geruch, 2010a, p. 4) Business partners or IT team’s members do not care if the project’s requirements is not perfect as long as its deliverables meet the business needs and are maintainable and robust rather than copious quantities of documentation. (Mary Geruch, 2010a, p. 7)

Team members should be allowed to customize templates for their specific need and eliminate formal deliverables in favor of a lighter-weight communication technique in cases where they are not necessary for project success. (Mary Geruch, 2009, p. 4)

3.4.2 Tools and the Future

Many organizations use simple, time-tested tools such as Microsoft Office to define and deliver requirements. Software suppliers have recognized a need for better requirements definition, and they have new tools for assistance. (Mary Geruch, 2010b, p. 5) Established suppliers as HP, IBM Rational, and Microsoft provide requirements management tools. The basics are to capture, version, link, trace and reuse requirements. (Mary Geruch, 2010b, p. 16) In the past, these tools were expensive and hard to use which meant that they often became shelfware. However the suppliers have been working to improve the usability. (Mary Geruch, 2011, p. 9)
3.4.3 Lean Approach with Templates

Lean is a way of thinking and to see aspects of the work. In a requirements perspective, Lean encourages organizations to eliminate waste and design as well as create requirements based on value. (Mary Geruch, 2010a, p. 5) To read a 200-page Microsoft Word document and understand and validate requirement are not modern any more. (Mary Geruch, 2010a, p. 5) All that is needed is just enough information in an understandable format. Lean is about removing anything that is not critical to delivering the right product. (Mary Geruch, 2010a, p. 5)

Lean is about not focus on creating perfectly formatted, temple-driven, text-heavy documents. They are often unnecessary, redundant and unread. There is no need for perfection as long as the communication works. It is more important to answer the questions what the stakeholders need to validate the requirements, and what your developers and testers need to do their work. (Mary Geruch, 2010a, p. 6)

At the same time, Lean does not mean the elimination of all processes, documentation or checklists. Instead, it is about evaluating the processes, documentation and checklists and add value and eliminate waste. (Mary Geruch, 2010a, p. 6) Lean focus on delivering “just enough” to serve a purpose without unnecessary information. (Mary Geruch, 2009, p. 5) A recommended way is to use quick sketches as opposed to textual documentation and create prototypes or mock-ups to communicate the purpose of the features. (Mary Geruch, 2009, p. 5)
3.5 Service-oriented Requirements Engineering

Competition for an organization, in an economy getting more global according to the technical development, forces the collaboration between in-house capabilities and external services. According to that, a new paradigm has emerged during the last years and that is the service-oriented computing (SOC) paradigm and it has lead to the development of service-oriented requirements engineering (SoRE). SOC and SoRE refers to the set of principles, concepts and methods for designing and deploying a Service-oriented Architecture (SOA). The service-oriented paradigm provides IT solutions for organizations and their increasing business changes. (Bayer, J. et al, 2008, p. 185) The paradigm implies a fundamental shift in the way new systems are being developed inside an organization. (Quintela, V., 2010, p. 118) When establishing the service solution in an organization, specific engineering processes have to be integrated and applications, services and domain ontology have to be engineered. (Bayer, J. et al, 2008, p. 185)

Although the scope of this thesis does not include the service requirements elicitation process a generic SoRE model, putting service requirements specification in a context, will be briefly presented below.

3.5.1 Generic SoRE Model

A systematic SoRE includes three phases: Business process modeling phase, Flow-down phase and Formal requirements specification phase. (Quintela Varajão, 2010, p. 117)

Business process modeling phase includes comprehension of business goals, detection of business processes detection and strategic information detection. Overall, business goals and the related supporting processes are identified and a high-level model is created. Flow-down phase creates more knowledge and understanding; every process discovered in the first phase is analyzed. The result is flowed down to the business architecture. Formal requirements specification phase includes requirements elicitation and requirements specification. This will give a base for the Service Level Agreements (SLA:s) and Operational Level Agreements (OLA:s), see figure 3. (Kearney, K. et al., 2011, p. 43)
According to ITIL, a SLA is an agreement between an IT service provider and a customer. It describes the service, specifies the responsibilities of the customer and the provider and documents service level targets. The SLA could cover several services in one agreement. OLA is an agreement between an IT service provider and another part of the same organization. OLA defines the goods or services to be provided and the responsibilities of both parties. (http://www.itsmf.se)

### 3.5.2 Structure and Quality

There are two aspects of a service for describing the service correctly: structure and quality. (Bayer, J. et al, 2008, p. 197) The structure of a service is the complete information about the service, i.e. the signature of the service. The signature is the name of the functionality and its input and output. The functionality is the effects of the service that are externally visible. (Bayer, J. et al, 2008, p. 197) The quality of a service (QoS) considers a variety of different quality aspects, e.g. performance, reliability or security. The QoS consider different quality requirements, which need to be fulfilled by the service. (Bayer, J. et al, 2008, p. 197)

### 3.5.3 Ontology and Semantics

Two terms occurring in the service requirements specification, when describing the structure and QoS, are ontology and semantics. Semantics is the meaning of a word or a
Ontology is a semantic base for a domain and provides a definition of common view. (Xin, Y., 2012, p. 591)

The information in the service requirements specification is the complete information that is needed to use a service and it is the service ontology that provides the ability to describe the behavior of a service. The specification includes attributes, and their values, according to domain ontology concepts. (Bayer, J. et al, 2008, p. 185) Service providing a specific functionality is described syntactically as well as semantically in the service requirements specification. (He, K., Liang, P., 2010, p. 1103)

3.5.4 Standard Language

Creating a standard form and language for requirements writing has several benefits. Omissions are less likely to occur and the requirements are easier to check. One reason is that the reader could lack of technical experience when reading the requirements. If there is a standard format, the reader can focus on technical terms because the format and structure is known. (Sommerville, I. & Sawyer, P., 1997, p. 96)

One way of standardizing the language is to use boilerplates. It is standard text that could be used to describe a requirement the same way every time. Boilerplates save time because the writer only needs to choose a boilerplate from a list, perhaps from a database, instead of writing it from scratch. Creating boilerplates from experience is one way of reusing old requirements. (Hull, E., Jackson, K. & Dick, J., 2011, p. 81)

Easy or well-known words are better to use in boilerplates because future readers could have different backgrounds. If a requirement is to be changed, the writer must understand the original requirement to know the intentions behind it. (Sommerville, I. & Sawyer, P., 1997, p. 96)

3.6 Best practices


In this section recommendations from international standard ISO 29148:2011 regarding SyRS are presented. The SyRS identifies the technical specifications for the selected system and usability for the human-system interaction. High-level requirements along with background information about the overall objectives are parts of the document. The SyRS may include conceptual documents to illustrate the system context, the principal domain entities, usage scenarios, data and workflows. (ISO Committee, 2011, p. 43)

The purpose of the SyRS is to provide a description of what a system should do after being constructed. The SyRS should describe all inputs, outputs, and required relationships between inputs and outputs and interactions or interfaces with the system’s external environment. (ISO Committee, 2011, p. 43) The SyRS communicates the requirements
between the acquirer and the technical community. One of the most difficult tasks when creating a new system is the communication within the project and its subgroups when using a document. Because of that, the SyRS requires different forms of formalism and language. (ISO Committee, 2011, p. 43)

ISO 29148:2011 communicates that different audiences have different needs, for understanding the requirements, when they are reading the SyRS. Therefore, the presentation should be adapted to the current readers. The adaption could be made with the use of models and prototypes. Still, care should be taken to ensure that the presentations are traceable to a common source of system requirement information. The audience should be informed that the current collections of information, such as models and prototypes, have one source for the resolving of any problems. (ISO Committee, 2011, p. 43) ISO makes a clear distinction between the system requirements, what the system should do, and the process requirements handling how to construct the system. (ISO Committee, 2011, p. 44)

3.6.2 Requirements Syntax

How a sentence is formulated, the syntax, affects how the reader understand a written requirement. The syntax also affects how easy it is to check if the requirement is fulfilled in a feedback process. According to ISO-standard 29148:2011, there are words and syntax that could be used for the development of a common understanding between writer and reader of the requirement specification. These are (ISO Committee, 2011, p. 9):

- Mandatory, binding, requirements are presented with term “shall”.
- Non-mandatory, non-binding, preferences and goals are presented with the term “should”.
- Non-mandatory, non-binding, suggestions are presented with the term “may”.

There is a risk when using the term “will” for non-mandatory requirements because there is a possibility that readers interpret the term as legally binding. The solution is to avoid the term. (ISO Committee, 2011, p. 9) When writing descriptive texts giving the requirements a context, verbs such as “is”, “are” and “was” should be used. It is best to avoid the term “must” due to the potential risk of misunderstanding as a requirement. Positive statements should be used and negative requirements, such as “shall not” should be avoided. Requirements should be written with an active voice such as “shall be able to select”. There are three ways of constructing requirements syntax according to the ISO standard: (ISO Committee, 2011, p. 10)

**Condition + Subject + Action + Object + Constraint**

*When signal x is received (Condition), the system (subject) shall set (Action) the signal x received bits (object) within 3 seconds (Constraint)*

**Condition + Action or constraint + Value**
At state 2 (Condition), the system shall detect targets at ranges up to (Action or constraint) 5 miles (Value)

**Subject + Action + Value**

_The system (subject), shall display customer orders (action) in ascending order (value) in which orders are to be paid._
3.6.3 ITIL
Information Technology Infrastructure Library is a recognized set of Best Practices for IT Service Management. ITIL is used by many organizations over the world to improve and establish capabilities in Service Management. One recommendation given by ITIL is to build and maintain a Service Catalogue. A Service Catalogue is a structured document or a database with information regarding all IT services. There is not only one-way to build a Service Catalogue, some companies use structured worksheets, others databases and other integrated Service Managements tools. ITIL promotes three basic steps for building a Service Catalogue:

- Collect information about Business Units and Services
- Determine what is important to define a service
- Determine dependencies

The purpose of the Service Catalogue is to create a central source of information on the IT service delivered by the service provider organization. A Service Catalogue should have four different sections. The first section should contain purpose, scope, definitions, acronyms, abbreviations, references, and an overview of the document. The second section should summarize the identified business units as receiving our services, the categorization of our services and the list of current services. In the third section a template is provided to add new services to the Service Catalogue. The fourth section should contain every service with all relevant information. (http://www.fastitiltemplates.com)

3.6.4 FURPS+
Hewlett-Packard categorizes the necessary quality attributes of a software system as functionality, usability, reliability, performance and supportability, referred to as "FURPS". FURPS+ is an acronym, which represents (www.ibm.com):

- **Functionality** – Capabilities, Feature set, Generality etc.
- **Usability** – Consistency, Documentation, Human Factors etc.
- **Reliability** – Recoverability, Accuracy, Mean time to failure, Frequency/Severity of failure etc.
- **Performance** – Efficiency, Resource consumption, Speed, Throughput, Response time.
- **Supportability** – Adaptability, Extensibility etc.

The “+” in FURPS+ is an add-on which should help the writer remember (www.ibm.com):

- **Design** requirements
- **Implementation** requirements
- **Interface** requirements
The “F” in FURPS stands for functionality. These are the functional requirements often represent the main product features in the main product. The functional requirements are not always domain-specific. FURPS define functional requirements as that they are used to express the behavior of a system, that by expressing both the input and the output conditions that are expected to create the result. The remaining “URPS” describes non-functional requirements. By non-functional requirement FURPS refers to the fact that a system must also exhibit a wide variety of attributes that are not described by the system’s functional requirements. (www.ibm.com)
3.7 The RSB-model

This thesis is based on requirements engineering, service-oriented requirements engineering and the best practices presented above. Together they will be called RSB-model, which is shown in figure 4. It shows the theoretical concept of this thesis.

![Figure 4: The RSB-model.]

3.8 Abstract of theories

The RSB-model, which is our theory model, is built upon three different sections. First there is the requirement engineering, which is a classical field within requirements. That part covers how a requirements specification is built and also how to write requirements. Requirements engineering also go through how to create a template and a standard for requirements. The second part of our RSB-model is the service-oriented requirements engineering. SoRE cover more about service and is derived from the requirements engineering field. SoRE cover structure and quality, but also goes through ontology and semantics, which are important parts within the service field. Lastly in the RSB-model this study has combined three different best practices. The ISO standards cover mostly the functional and the non-functional field, and FURPS is a complement to that. ITIL has a service catalogue, which basically covers the SoRE field.
4. Method

The way a researcher views the world is the research philosophy. It affects the research strategies, methods and how the theory is managed. (Saunders, M., Lewis. P., Adrian, T., 2009, p. 108) This thesis is built on a pragmatic philosophy. The reason is the research question, which does not unambiguously suggest either an interpretivist or a positivist research philosophy. Also, Scania has a lot of standardized processes and models for their work. Therefore, a positivist philosophy could be appropriate. The processes and models are also in a context where people have opinions about their work and the tools around them. That would propose an interpretivist philosophy. The research this thesis is built upon is variations in epistemology, ontology and axiology. For a pragmatic research philosophy, it is a perfectly possible way of performing research. (Saunders, M., Lewis. P., Adrian, T., 2009, p. 109)

The authors if this thesis used induction (Saunders, M., Lewis. P., Adrian, T., 2009, p. 126) as approach. The purpose was to collect data and get an understanding of the situation at Scania IT and then formulate theories as a result of analyzing the data. A theory is a formulation about the cause and effect relationship between two or more variables. The cause and effect relationship may have been tested. (Gill, J. & Johnson, P., 2002, p. 229) Therefore this study involves feedback from a project SFP2.0, see 5.3 Feedback.

There are several different strategies of collecting data. The strategies the authors chose was the case study. The case study strategy means an empirical investigation of a particular phenomenon, within its real life context using several sources of evidence, is done. (Saunders, M., Lewis. P., Adrian, T., 2009, p. 145) The context is important and the boundary between phenomenon and context are not always clear. The case study is a good way of getting a deep understanding of context and processes being performed within it. (Saunders, M., Lewis. P., Adrian, T., 2009, p. 146)

There are several variants of case studies. Because of the research question, Scania IT:s and Scania CV:s organization, the authors chose to do an embedded case study (Saunders, M., Lewis. P., Adrian, T., 2009, p. 146) and investigate the situations on several subunits at Scania IT. The embedded case study also gave more opportunities to generalize the theories that were made from the collected data.

When developing theories, the authors of this thesis used a regulatory perspective. (Saunders, M., Lewis. P., Adrian, T., 2009, p. 120) It means that theories are developed to solve problems within Scania IT:s framework of how the organization worked under the time for the investigation. One example is that Scania IT uses Lean as a framework within the organization.

Since the research question of this thesis is about understanding a context or a situation, a qualitative method is the most appropriate. (Trost J., 2010, p. 32) Therefore this thesis uses
a qualitative method in form of interviews to collect data. This method also resulted in that the interview questions improved during the research.

4.1 Primary Data
This study is primarily based on semi-structured interviews (Teorell & Svensson, 2007, s. 89). The authors conducted several interviews with employees at Scania but also with other companies.

4.2 Secondary Data
In the initial stage, as part of the pilot study (Saunders, M., Lewis. P., Adrian, T., 2009, p. 394) information was collected to give the study a knowledge base to start from. The information included qualitative data and was used to get a better understanding of the organization and all the processes that are used within Scania. The information consists of activity reports, internal reports and public documentations. The purpose was to gain knowledge and gather information for the collection of primary data.

4.3 Interviews
Interviews can be conducted by a fixed question schedule, where spaces for rearrangements or digressions are not allowed. An interview of this type is referred to as a structural interview, since it is dominated by a fixed structure. The opposite are unstructured interviews where there is no structure. This study has conducted interviews on a semi-structural way, lying between the structural and unstructural. (Teorell & Svensson, 2007, s. 89)

There have been 19 interviews in this study. Since this thesis is made at Scania, the internal interviews have been done in face-to-face meetings. The time of the interviews has been about an hour per interview. The first interviews were during the pilot study. Rosel Sandberg, Project Manager, and Sofia Ahldén Czeckowski, Provider Maintenance Manager, from COTS (Commercial off the shelf) department. Daniel Strand, Purchase Manager, from the SAI department (Purchase department) was interviewed to get an overview of the collaboration between Scania IT and the SAI. Göran Söderman, Manager, was interviewed to get an overview of how Scania uses SDP (Software development process).

After the pilot study, interviews on a deeper level to get a more specific understanding of the subject were done. Mikael Sandegren, Sourcing Manager, and Karin Skyman, Sourcing Manager, from the SAI department was interviewed to get a deeper understanding of what they need in form of a requirements specification. To get a better overview about service requirements Mikael Weckström, Senior Architect, from architecture were interviewed. Both Bo Fredriksson and Anders Flodén working as project leaders at the time for this study were interviewed. Anders Flodén was at the time for this study working as a senior project manager, to get the view of junior project managers we also interviewed Linda Sandberg.
Jesper Stenmark, Tester, and Daniel Knutsson, Tester, working at the test and change management department, were interviewed to get a picture about their needs regarding requirements. Tomas Åberg, Project Manager, were interviewed about collecting and storing requirements. Michaela Andersson, Operations Architect, were interviewed about SFP2.0, a project running at the time for this study. Lastly, Simon Wretblad, Development Engineer, was interviewed about requirement management software.

Also to get a wider understanding of the problem description this study involves interviews from three different companies, Ericsson, Studsvik and Sandvik. The names of the interviewed people from these companies will be anonymous and further on named PersonEricsson, PersonStudsvik and PersonSandvik.

4.4 Validation of Sources

The main source of this study is based on interviews, which means that the information comes from primary sources. At the same time the majorities of these interviews were conducted with employees at Scania IT. There is a risk that the information from the interviews was angled to promote Scania IT.

4.5 Validity and Reliability

This study was conducted to ensure the highest possible validation (Trost, 2010, s. 133). The interview questions have been designed the purpose of this study to the highest degree. One aspect of the reliability (Trost, 2010, s. 132) of this thesis is that it is based on an embedded case study, which means that not all parts of Scania IT have been investigated. This study focuses on the core departments regarding requirements and therefore this study does not involve all departments. Another aspect is that one or two people from each department were interviewed so if a similar study is made it is not sure that they get the same empirics. At the same time this study shows a broader and wider picture and that different departments suffer from the same problem, which proves the reliability of this study.
5. Empirics

The data collection in this thesis is based on two different approaches, internal and external. Internally this study focuses on the core department within the sourcing process. Externally this study involves three other companies’ work regarding requirements. Finally this section also contains feedback from different departments.

5.1 Internal

To get a picture of how Scania IT is working with their sourcing process we interviewed different core departments regarding requirements, see figure 5.

5.1.1 SAI Department

The purchase department SAI has two problems regarding requirements specification. The first problem, according to Strand, is that the requirements specifications that the SAI department receive are of varied quality. When the requirements specifications are of varied quality, the SAI department has to complete the specification. The second problem is that SAI have to do the same thing over and over again.

"We (SAI department) put a lot of time to clean up specifications, in particular to control the quality."

(Strand, Purchase Manager)

One way to solve the problems with the quality is to use templates. According to Sandegren there are different templates today and it is the SAI department that sends out these templates. But the templates are of various quality and project managers tends to use their own methods each time. Generally, project managers use their tools and methods they have experience in.
“There is nothing wrong with the project leaders and their methods, it just gets different each time, and the results differs a lot.”

(Sandegren, Sourcing Manager)

Sandegren also experiences a big difference between a junior project manager and a senior. A senior manager, often more experienced, has usually worked with requirements more. It implies that the quality is often better. At the same time, a senior manager does not guarantee for good quality and information can still be missing.

According to Sandegren, one simple solution to the quality problem could be to use an approver. The approver should read through the specification and the optimal situation would be that the approver is not involved within the project. Sandegren often experiences that the requirement specification does not shows what should be purchased, it can only be read about implicitly. Strand is clear about that the better the requirement specifications are the better work the SAI department can do. There is no uncertainty that existing requirements specification is in different quality. Strand shows us an example on what they are working with.

“Look at this example and ask yourself the question, what is to be purchased? I do not think you will see it, you will not even see the product being described.”

(Strand, Purchase Manager)

Regarding the second problem, when SAI must do the same work over and over again, the knowledge from different projects are not transferred and used when constructing the requirements specifications. Another problem is that SAI does not get the information about the priority level of different requirements. If the requirements were prioritized it would help the SAI department to better plan their activities and improve their economics and working environment, according to Strand.

“I’m driving in the dark, I do not know what is most important and that breaks us in the beginning of the procurement”

(Strand, Purchase Manager)

5.1.2 COTS Department

Sandberg and Czechowski at the COTS department have the same picture of the requirements specification situation as the SAI department. According to Sandberg, all project managers create their own requirements specification and that makes the quality vary. Czechowski also agrees with Sandberg and points out that there should be a standard template with relevant subjects. If something is not needed in the template, it should be possible to write “not applicable”.
Both Sandberg and Czechowski also point out that the level of IT knowledge varies at the SAI department. Some employees at the SAI department have IT backgrounds and can understand the requirements more easily, but many do not have any experience with IT at all.

“It is important that we standardize the requirement specification, so it has the same appearance each time. That will also ensure the quality of the specification”

(Sandberg, Project Manager)

Another important point with having a standardized requirement template is that the suppliers get the same structure each time Scania sends something out. According to Sandberg, Scania can ask the same supplier several times but the specification can differ each time. A standardized specification makes Scania look more professional for the suppliers according to Sandberg.

The problem with requirements specification is not new or unknown; the SAI department has started to send out templates for RFI and RFQ to the project managers. Sandberg means that these templates are not complete and they need to optimize these templates to reach a higher level and make them more professional. The SAI department and the COTS department have the same goal with the requirement specification; there is no difference at all according to Czechowski. It is important that the collaboration between these departments works well. (Sandberg)

“For the maintenance of a system, it is important that the requirements can be changed and that the requirements are properly documented. A standardized way to write requirements would facilitate the maintenance for the COTS department.”

(Sandberg, Project Manager)

5.1.3 Project Managers

The project managers are responsible for writing and sending out the requirements. Flodén also agrees that a standard template would help him in his requirements process. Also, Flodén points out that it would be great if he could reuse old requirements in new projects. Flodén do not use or have a standard template, instead he uses experience from old projects or discuss with his colleagues. Flodén understands the SAI department and also point out that a RFI or a RFQ cannot only exist of Excel documents. It is important that there is a context added to the Excel arc and further explanation when needed.

“It would help us to use a template, then we don’t have to do it from scratch each time”

(Flodén, IT Project Manager)

Fredriksson agrees with Flodén about having a template with standard headings to help the project manager with the requirement writing. Fredriksson also thinks that the
communication between the project managers and SAI department needs to be more frequent. According to Fredriksson there should be no problem with only using one template. That is because system requirements and service requirements does sometimes overlap. There are also cases when you have some system requirements and some service requirements. In that case it is pleasant to have both these subjects in the same document.

Both Flodén and Fredriksson are senior project managers with many years of experience. L. Sandberg is a junior project manager and only got three months of experience from Scania IT. L. Sandberg tells us that she does not write the requirements in this project, because she lacks knowledge and experience. But she still has to figure out how to collect and present them in the project.

“There is a lot of work in the beginning for me as a project manager, I need to identify what to write and how to write it, this is my first project as a manager at Scania IT.”

(Sandberg, L. Project Manager)

The SAI department sends out templates but at the same time L. Sandberg got the information that the requirement tends to be unclear and sometimes fuzzy. L. Sandberg tells us that a standardized template with more information and a syntax guideline really would help her in the requirement phase. In this project L. Sandberg estimates the requirement phase to 400 hours and some of these hours have been spent on asking colleges how to document requirements. L. Sandberg tells us that a standardized template definitely would help to reduce some of those 400 hours. In the project L. Sandberg is managing, they have reused some requirements from old project. There is no database or dedicated space where these requirement are saved, instead L. Sandberg had to ask several senior managers and other colleges. L. Sandberg points out that a central database where you can find old requirements would also reduce the requirement phase time.

5.1.4 Enterprise Architecture Office

Scania IT has a tradition of in-house development and operations regarding software and system. The last 5-10 years the operations are still in-house but Scania IT buys more and more applications. According to Weckström there is a strategy that Scania IT should buy before own development. Weckström also points out that if there is not an advantage against, especially competitors within the truck market, Scania IT should buy instead of develop. Weckström agrees that Scania IT would need a template, especially within sourcing. [EH1]

“There is no standardized way of working with requirements today, instead we use earlier experiences. We need to get better on this subject for sure”

(Mikael Weckström, Senior IT Architect)
Overall, Weckström continues, Scania IT is better on functional requirement than non-functional requirements. There is also a wide variation in knowledge levels on the requirements writers, some requirements writers are senior project managers but in many cases they are consultants, according to Weckström.

5.1.5 Test & CM

The quality of requirements, according to Knutsson and Stenmark, varies depending on the project. The quality depends on the experience of the requirement writer since they often start from a blank paper, according to Stenmark. In some projects, Knutsson tells us, the tester is involved early in the project and can be a part of the requirement writing. The testers wants to be involved early in the project to ensure the testability of the requirement but it happens that the tester is involved later in the project, when the requirements are already written, Knutsson continues.

“The quality of the requirements varies, it happens that I as a tester do not understand or that the requirement itself is not clear enough, but I do not think this is unique for Scania IT, it is a common problem with requirements.”

(Jesper Stenmark, Test Process Development)

According to Knutsson it is important that the suppliers get structured and unified requirements. Stenmark fills in and tells us that Scania IT is buying more and more COTS products, and therefore will use unfamiliar suppliers. In those cases it is important to have a standardized requirement template to ensure consistency and quality. There is also some requirement, according to Stenmark, that is more recurrent. Therefore a possibility to reuse some requirement, rather than writing them from the beginning would be helpful.
5.2 External

5.2.1 Sandvik IT

Sandvik IT mission is to support Sandvik and its IT users’ needs. In many ways it is similar to Scania IT’s mission. In some cases at Sandvik IT the project managers is responsible for the requirement and in some cases there is a business analyst working with the requirement. Sandvik IT does not use a template but they have a checklist to control the requirements. But according to PersonSandvik the requirements vary in quality and are dependent of the knowledge-level of the requirement writer. PersonSandvik also tells us that he wishes the requirements were more standardized because it would help to ensure the quality of the requirements within Sandvik IT.

“The most common observation is that projects get stuck because the requirements need to be verified and accepted by the client. One thing that could help this problem would be better requirements.”

(PersonSandvik, Development Support Manager)

Regarding the division between software, system and service [EH4] requirement PersonSandvik tell us that generally they have processes for system- and software requirements. They also split and make a difference between functional- and non-functional requirements. But the service requirements are not fully completed. Sandvik IT is moving more and more from own development to buying products from suppliers. According to PersonSandvik, the requirements specification will be more and more important when buying from suppliers.

5.2.2 Ericsson

The process for managing a project at Ericsson is standardized but not the requirement process. PersonEricsson tells us that Ericsson have a similar situation as Scania IT. The quality of the requirement differs depending on department and project manager. The major problems with Ericsson’s projects are the requirements, especially within the IT department according to PersonEricsson. Ericsson divides operations from development, with two different departments. AO (Application Operations) has standardized requirements and use templates. AD (Application Development) uses a framework, but according to PersonEricsson, a standardized requirement template would help to minimize problems and help the requirement writer not to start from a blank paper each time. Another problem that Ericsson is suffering from is the time limits.

“Often the project time in the beginning of a project is too short, up to the first decision point, the time spent on the requirement specification is not enough.”

(PersonEricsson, Strategic Sourcing Manager)
Often, according to PersonEricsson, the time for writing requirements are underestimated. Instead of starting with a blank paper, a template with some headings and some following questions would have facilitate the requirement phase and save some time according to PersonEricsson. PersonEricsson also points out that a template with needed headings would probably get the requirement writer to think through the different parts and also help the writer not to forget valuable information.

“All work on guidelines and standardized template would help us, not to start with a blank paper each time is really helpful”

(PersonEricsson, Strategic Sourcing Manager)

5.2.3 Studsvik

Studsvik are at the time of this study investigating the possibility to outsource their IT department. According to PersonStudsvik, Studsvik want to outsource their operations and support of IT systems. At the time of this study, it is not clear to what extension. Studsvik has sent out RFQ to five companies and are waiting for response. Regarding the requirements, PersonStudsvik tells us, that they have hired consults to help with the requirements document. That is because Studsvik do not have the right competences to write requirements. Studsvik were looking for a company with experience and a standardized way to write requirements, according to PersonStudsvik.

"We have not followed any template or standard when writing the requirements, instead we hired experienced consultants to help us with that part"

(PersonStudsvik, CIO)

PersonStudsvik tells us that it would have been good with an own requirement template. That way, Studsvik could have checked the consultants work with the requirements. One problem according to PersonStudsvik is the ontology. The technical terms the IT department is using are not understood the same way by the other departments. It would have been helpful to clarify what the IT department meant with some terms to avoid misunderstandings according to PersonStudsvik.

5.3 Feedback

5.3.1 SFP2.0

SFP2.0 is a project at Scania IT during the time of this thesis. The project consisted of five different drivers and they were working with the requirements writing for the RFQ. SFP2.0 used our template to send out to these five drivers and one of the drivers, driver 2, also used our help when writing the requirements. The employees working with the requirement
in this project were not used to work with requirements. According to Andersson most of the people within this project had never worked with requirements before. Andersson tells us that they used parts of template, including the guideline.

“The people who had a little experience working with requirements did use the template in some extent but not the new requirements writers”

(Michaela Andersson, Operations Architect)

Andersson says that the template was good, especially the guideline. The template provided a united vision about the end result and all the drivers got the same information. But one of the biggest problems was not related to the template. According to Andersson the time limit of the requirement phase was too short. According to the project plan, sent out by the managers, the quality was the first priority, but according to Andersson that is impossible since the time was too short to provide good requirements.

“We could have done a better requirement specification which would have improved the RFQ, but time did not allow that. A general “lesson-learned” is that we have too little time for the requirements writing”

(Michaela Andersson, Operations Architect)

Regarding improvements of the template, the drivers did wish for dropdowns in the Excel document when needed. Some questions only require yes/no/partial answer and it would have been better with dropdowns in that case according to Andersson. Otherwise the division of the documents and the headings are relevant and the guideline is a good tool. Andersson continues with saying that it is really important that the requirements are of high quality since in a couple of years all people within this project will work with other projects. It is also important according to Andersson that the requirements do not leave anything out because the suppliers cannot guess what the system should do.

5.3.2 Test & CM

According to both Knutsson and Stenmark, if the requirements writers follow the template and guideline, their work with verification and validation will be no problem. Stenmark continues with saying that the priority levels in guideline are good. According to Knutsson a tester always has to look to the structure and dependencies between requirements, but that the template really would help them in their work. Knutsson also says that the template including the guideline would probably help the architect in his work as well.

“The guideline is really good, it is strange that we don’t already have this. Just do the right thing from the beginning and it facilitates for the result all the way to the end”

(Jesper Stenmark, Test process development)
Regarding the division between functional-, non-functional- and service requirements the testers do not really look into the service part. According to Stenmark the service requirements are more of the COTS departments work. But still the template and the guideline still work for all three areas according to Knutsson.

5.3.3 COTS
According to Czechowski the template would work really well. Czechowski tell us about using the template as a filtering channel. First the requirement writer can brainstorm requirement and then use the template including the guideline to filter down the requirement and also increase the quality of them. Czechowski tells us that many projects send out the requirement right after the brainstorming and that is why the quality varies. The COTS department work would be easier if the requirements are of a higher quality. Czechowski tells us that she would use the template in some project to make it more what Scania IT wants from the suppliers.

5.3.4 SAI Department
Since each procurement is unique it is hard to follow a checklist, according to Skyman. Therefore it is important that a template consists of content that is covering necessary information and do not fall into detail. Skyman tell us that our template fulfills that demand but also that headings will be replaced and removed over time. Another important issue according to Skyman is the administration of the template. It is important to point out a responsible unit for maintaining and updating the template according to Skyman.

"Who is the owner of the document and who is responsible for the administration? This is important questions since these function are necessary for the template to function"

(Karin Skyman, Sourcing Manager)

5.4 DOORS
DOORS (Rational Dynamic Object Oriented Requirement System) developed by IBM is a requirement management tool (http://www.ibm.com). The strength with DOORS, according to Wretblad, is the possibility to link different requirements with each other. That way it is easy to trace a change in one requirement and how that change affects other requirements. Wretblad tells us that Scania uses DOORS in some projects, but it is not a standard. There are also some problems with DOORS, the GUI is not fully updated and it demands some education according to Wretblad. On the other side it is easy to reuse requirements and Wretblad tells us that his department always uses old requirements and modifies them rather than writing new requirements. DOORS also include a script language, DXL, which makes it possible to make own scripts, which for example fill in values automatically.

"Scania has employed DXL-script consultants to develop some scripts, but today there is no one with DXL-script knowledge at Scania."
Wretblad tells us that Scania did an investigation several years ago to examine different requirements management tools. DOORS was the best tool according to Scanias demands. DOORS works as a container and the user can add for example, Excel documents, pictures etc. If the receiver of the requirements uses DOORS, it is easy to filter the database to decide what the receiver could see. If the receiver does not use DOORS, the users can export the document to Word.

"It is possible to export the document into Words, but there may be some further work to get the formal structures right"

Wretblad also points out that some education before using DOORS is recommended and also that DOORS becomes a standard and adopted by the existing processes.
5.5 Scania and Standards

This thesis, and the assignment it is based on, is about developing a standard for requirements specification. This part presents how Scania works with standards and why it is important to work with a standard instead of having all employees always working according to their own experience. (Internal documents)

Scania has summarized important words and values, which Scanias work should rely on, in Scanias house model as seen in figure 6 in the marked areas “standardized working method” and “normal situation” are presented. To have a standardized way of working is a core value at Scania. (Internal documents)

An important question is why Scania consider standards important enough to have it as a core value in the Scania house. The answer is based on the business context Scania figure in. Year 1970 there were about 25 companies on the heavy truck market. Year 2008 there was only 6 left. The companies that have survived the competition have been able to keep the costs down in a better way than the companies that have disappeared. Keeping down the costs is the key to survival because the heavy truck actors on market have more capacity to deliver trucks than demand for them. It means that heavy truck companies cannot charge their customers more when manufacturing costs increase. The companies need to compensate and decrease the manufacturing costs, and a method to achieve that is standardization. (Internal documents)
The effect standardization has on an organization originates from the possibilities to handle errors. As shown in figure 7, there is an opportunity to analyze what has gone wrong when working with standards because the working procedure is known. The error handling focus is removed from the individual worker to the method. If there is no standard, every error must be managed by investigating what the individual, responsible for the actions that caused an error, and then give the individual feedback. In an organization with thousands of employees, an individual working method feedback would take more resources than just focusing on improving a general standard. (Internal documents)

![Diagram showing work methods with and without a standard.]

By using standards, unnecessary elements in the work process are found in a more efficient way. It eliminates waste and creates a normal situation, which also is a core value in the Scania house. By using standards, unnecessary elements in the work process are found in a more efficient way. It eliminates waste and creates a normal situation, which also are a core values in the Scania house. (Internal documents)
5.6 New Directives at Scania IT

At the time for the research, Scania IT performs reorganization and also developing new ways of working for improving Scania IT efficiency and result. One of the new development directives for future work is “flow-driven development and service delivery”. There are some directives affecting the requirements work. In the future, there will be more focus on managing risks earlier in a project. More work should be done for securing requirements before moving on to the implementing phase. (Scania IT guide, internal documents)

5.7 Language and Publishing

Scania has a language and publishing unit. They are working with communication and terminology used at Scania. One example is Scania lexicon, which is a database with terms and their description. The majority of the terms are connected to the process of building trucks or the use of mechanic terms in texts for advertising. If a user does not find the wanted term, the user could add the term to the database and fill in all facts and context about the term. The language and publishing group has a vision of expanding the lexicon to other areas because a consistent way of communication at Scania would save resources, according to Alma Hjerten.

Another example of what kind of work the language and publishing unit does is the work with the software Acrolinx. It has several functions, for example spelling check, grammar check, style check, terminology check and functions facilitating reuse of content. Acrolinx can be used as a plug in program together with other programs as Microsoft Word. (http://www.acrolinx.com)
6. Analysis

The analysis starts with an identification of problem areas that needs to be understood for developing a solution and the profits that could be made if the problems are solved. After that, the proposed solution is presented and also some perspectives on the solution.

6.1 Absence of Standards

According to the RSB-model the problem regarding standardize requirement is not only within service requirements. These theses focuses on standardizing requirements writing on a general level and then apply the solutions on the service requirements. Therefore the requirement specification is improved on a more general level including the service requirements.

The main problem at Scania IT regarding requirements specification in sourcing, and the cause for this thesis, is the absence of a standard. It is a well-known problem among employees and the problem is not unique in the work with sourcing. It is also a more general problem where there is an absence of requirements specification standard in projects at Scania IT overall. There are some guidelines on how to work with requirements in the SDP, but they are at the software level and not used as a standard by all projects.

The absence of a requirements specification standard in an organization where there are people with a large spread of educations and background has several consequences. The specification varies in quality and execution, which causes communication problems when people outside a project reading the requirements specification. It could be a supplier in the work with replying a RFQ or it could be a person at the SAI department when buying new software. The communication within Scania IT and the communication with external parties are different every time. A consequence of this is that SAI needs to do more work because they cannot understand the requirements specification. When SAI needs to do more work a whole project takes more time. The absence of a standard also delays projects because new project leaders need to find or find out how to write the requirements documents.

An absence of a standard makes it hard to improve the overall situation. If there are no rules or guidelines, there is also hard to point out what needs to be improved. It is hard to determine the normal situation, which is important according to the Scania house.

6.2 Proposed Problem Solution

In order to standardize the requirements specification, the authors of this thesis have developed a standardization model consisting of three phases, see figure 8. The model is built on the RSB model and empirics collected during the thesis work. Experience from other companies that could contribute to the solution have not been found since the interview companies also have the same problems as Scania IT when it comes to standardized service
requirements. According to the time limit of the thesis work, focus has been on working with developing a base for phase 1 and manage phase 2 and 3 in a more general way.

In phase 1, a foundation and a concept for writing requirements are developed. The goal is to introduce a concept that could be used immediately by Scania IT, which is one of the assignments behind this thesis, and develop a foundation for the work in phase 2 and 3.

In phase 2, the goals are to improve the work from phase 1 and develop an ontology that is stored in a database.

In phase 3, the concepts from phase 1 and the database from phase 2 are combined in requirements management tool software. The goal is to have a standardized way of expressing requirements and also reuse requirements when possible.

It is necessary with education in every phase for maintaining and developing a new standard way of working. Each phase and its content are presented in more detail below.

6.3 Phase 1

Phase 1 covers the concept behind the template development and an implementation plan. The goal with phase 1 is to introduce a template that can immediately be used by Scania IT, but also to build a foundation to the other phases to get a higher standardization. Below follows a more specific explanation of each step in phase 1, see figure 9.
### 6.3.1 Template Concept Development

The first phase propose a template since that helps both the writers and the readers of the requirement specification. A template helps the writer to not start from a blank paper each time and also to remember all relevant topics. The templates works as a filtration channel, first the writer could brainstorm down requirements and then use the template to get a structure. The guideline also helps with getting the same syntax each time, which will improve the quality of each requirement. It will also be easier, both for the writer and reader, with a template since earlier experience could help them to find errors and missing parts in the document. The purpose of the template is to work as a trigger to help both readers and writers of the document to think through the entire project and its expected outcomes, according to the RSB-model.

The template consists of one Word document and one Excel document. Requirements context with further explanations could be in the Word document and the pure requirement in an Excel document. Different diagrams to explain requirements or relations should be placed in the Word document. By doing that, it is easy to find the requirements and if the reader needs more information it is easy to open the Word document to get a brother understanding.

It is important to realize that the template is a recommendation and cannot be applied straight on to a project, according to the RSB-model. The writer of the requirements needs to use a “Lean approach” and decide which parts that particularly project needs from the

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
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<td>Template Improvements</td>
<td>Requirements Management Application</td>
</tr>
<tr>
<td>Template Development</td>
<td>Database Development</td>
<td>Language Standard</td>
</tr>
<tr>
<td>Template Implementation</td>
<td></td>
<td>Requirements Reuse</td>
</tr>
</tbody>
</table>

![Figure 9: Standardization phase 1.](image-url)
template. The headings within the template are only recommendations that are good to read through and are not mandatory to all projects. This is because all projects differ and it is impossible to cover all projects with one template.

6.3.2 Template Development

There are different opinions on how to structure a requirements document. One solution is two have a separate service requirements document. The proposed template does not have a separate service requirement document since service requirements many times overlap with the non-functional requirements. It is easier to refer between headings when having them in the same document. Therefore it is better to have only one document with functional-, non-functional- and service requirements. Another advantage is that it is simpler to only have one document than several since it easier to get an overview of the content.

The headings in the template are based on our RSB-model, see appendix Template. Functional and non-functional heading are mostly based on the ISO-29148:2011 part of the RSB model. The service requirements are mostly based on the ITIL part. The template also consists of a guideline, also based on the RSB-model. The guideline consists of three different sections. The first section covers the priority levels when writing requirements to indicate the hierarchy. This will help the reader to understand the importance of different requirements. The second section covers the syntax when writing requirement to help the reader understand the requirements. The goal with both the priority levels and the syntax is to ease for a common understanding and eliminate misunderstandings between writer and reader of the requirements specification. The third and last section covers five properties to think about when writing requirements. These combined makes it possible for an approver to read through a requirement specification without specific knowledge about the project to ensure the quality of the requirements. These different sections combined give a guideline on how to write requirements but also things to think about when writing them, see Appendix.

6.3.3 Requirements Quality Value

To ensure the quality of the requirements the template also consists of the Requirement Quality Value (RQV) template. The RQV template is a tool for ensuring the quality of the requirement specification. The definition of a checklist is an organized tool that outlines criteria of consideration for a particular process. The RQV template is a checklist with content based on research in the requirements engineering field, which is also presented in the guideline, see appendix. The writer, reader or approver fills in a value on each statement in the RQV template and gets an overall value that reveals the quality fulfillment of the requirements specification.
By using the RQV template the requirements will be checked in a structured manner to ensure that the requirement fulfills all the different statements in the guideline. An approver can also use the RQV since it does not require knowledge about the project. The RQV evaluates if the requirements are written to fulfill the statements from the guideline.

There are physiological benefits from a structure like the RQV template. It is not unusual that project leaders and other people writing requirements are working under stress and pressure. Studies and research in the stress management field is not included in this thesis, which means that only generally benefits are briefly presented. The benefits are support people with their tasks when they work under stress and reduce the actual stress level.

The function of a checklist is a support resource and has been proven effective in error prevention and performance improvements. That is something that military units and airline companies already take advantages of when their personnel are working under stressful conditions. (Hales, B., 2008, p. 22) Similar advantages could be used when the requirements specification is written in a stressful environment.

The RQV template also provides structure when reviewing the requirements specification. According to guidelines from Karolinska Institutet, routines and structures when solving problems could contribute to decrease stress at work. (Parmsund, M., et al., 2009, p. 2)

### 6.3.4 Template Implementation

A possible way of combining the template with Scania IT:s work approach is to integrate the template in the standard information that they project leaders, and other personnel working with requirements, are getting when they start with a project.

Integrate the template in the standard information would probably increase the distribution and also legitimize the template in a more efficient way than if the template were given to individual projects one at a time. To spread it to individual projects would not contribute to the standardization to a great extend. That is because it would probably contribute to the current difficulties to evaluate the way Scania IT works with requirements because the lack of central guidelines to evaluate.

One example of standard information integration is that today information is sent out by SAI to project leaders in the work with RFQ:s. There is a possibility to integrate the word
document in the information about the RFQ. If requirements writers follow the headings and guidelines in the word document, several headlines in the RFQ will be written with the Word document as an information base such as background and scope.

The suppliers that answer an RFQ should describe if and how they will fulfill the requirements. According to both the RSB model and the empirics the guideline will facilitate the work with the requirements in the RFQ because the communication between Scania and suppliers will be clearer.

Another example of possible implementation for the template is that the Vendor Management Office (VMO) has developed a framework for the sourcing process in an IT project. The framework clarifies how the work with sourcing at Scania IT should be performed. It guides managers that will use sourcing in their work. The sourcing framework consists of documents available at Scania Inline, which is Scania’s internal network. The template could be integrated in the sourcing framework. It would take advantage of the information about sourcing at Scania IT is concentrated to one single point. A third example is the directions for the SDP process where it is possible to download information from the internal network.

The template included in the standard information would not complete the standardization models in phase 1. People in projects need to know that the new template exist and also how to be used. The template should be used in a Lean way. It means that all unnecessary elements should be deleted. It requires that the writer is familiar with the concept and understand the different potential readers and what they need to know.

Scania IT:s way of working includes that many of the project leaders in different projects have the possibility to communicate with each other. One example is the PULS meeting where all the project leaders report the status of their projects. The template could be presented and then also discussed in forums such as the PULS meetings.

More formal education as seen in the standardization model is one way of integrate the standardization concept. One example is Scania education center, which would contribute to the integration of the template. There is information about the template concept in the template itself but if personnel at Scania IT are not aware of the template, there is a risk that people are doing after their experience in the same manner as today.

Workshops could be an alternative to formal education because of the size and complexity of the concept surrounding the template. It could be easier to gather people if there are workshops under a limited time rather than parts of an education under several days.

Overall, the content in the template should not be unfamiliar for personnel that have work with requirements at Scania IT before. Some headings could be expressed in an alternative way or be at a more detailed level. A reason for the personnel’s possible unfamiliarity is the use of FURPS at Scania IT. FURPS as a concept is integrated in the project leader education
where rational unified process (RUP) is taught. The template covers all the content that FURPS stands for, and more. The template is built on an ISO standard, which gives the requirements writer more headings to use in the requirements work. The authors of this thesis have concluded that ISO is a better guidance that FURPS because FURPS is a little bit to general. The integration perspective of this is that it should not be a major transition, from Scania IT: s tradition using FURPS because of RUP, for the personnel. It should rather be an addition to today’s way of working.

6.4 Phase 2
Phase 2 contains activities regarding technical development and work according to the Scania house values.

![Diagram](image)

**Figure 10: Standardization phase 2.**

6.4.1 Template Improvement
One of the key words in the Scania house is continuous improvement. It is important to continuously develop the template and also test the template in different situations. Because of the size of Scania IT, there have not been possible to collect every experience in the organization before developing the requirements standardization process and its template. New experiences could imply changes in and it is important to allow and take advantages of new perspectives. Also, according to the template parts of RSB-model there are no templates that fit all projects and sections of an organization.

One way to improve the template is to discuss the template. Scania has an internal network called Inline, which also includes a wiki. These two channels can be a possible way for Scania to improve the template. Scania is also developing a social network with the name Agora.
Forums that facilitate a discussion about the template could be useful. To arrange big meetings for template improvements could be hard to implement. Agora forums may be more cost efficient and also available for all involved parts when they have time for evaluation.

Since a template is dynamic and need constant improvements there is a need for a central unit who is responsible for the template and its development. Because of the VMO:s working tasks it is suitable that VMO is responsible for developing the service requirements template. VMO should form a group with people from different units involved in the sourcing process. The responsible unit would need to improve and keep an updated version of the template available for the possible users. Also, this responsible unit can gather information from different parts of Scania IT. As an example, Tomas Åberg is working at the time for this study on collecting old requirements and storing them. The goal is to adjust them to be at a more general level. These old requirements have been used at least once before and therefore they should be approved.

6.4.2 Database Development

In the work with this thesis, one recurrent subject was the need for the opportunity to reuse old requirements. A database provides a base for the reuse of old requirements at Scania IT. For example, a service requirement that states 24 hours uptime a day for a service delivered to Scania. If 24 hours a day is a general requirement, the requirement should be included in many projects that are buying services. Today, the requirements writer need to know that such a requirement should be included or search for the information. A database with old requirements provides a base for searching for requirements regarding a specific area and also the possibility to check how other projects have used the same requirement.

One possible way to collect requirement is to synchronize with Tomas Åberg’s attempt to store old requirements. Another way of collecting old requirements could be if project leaders would add their requirements to a database. Such a strategy will likely need a group of people that are responsible for the database and the maintenance of the content, which is seen in figure 12, a centralized function handling the requirements quality is missing at Scania IT today. The authors of this thesis believe that centralized function managing both requirements content quality, and how to improve the way requirements are written would be of importance.

The ontology part of the RSB model states that an ontology is the semantic base for a domain and provides a definition of the common view. The database development is one of the key issues to standardize the requirements specification writing because the database will consist of, and preserve, the Scania IT requirements ontology.

Today, there exists a database with technical information about different types of parts needed in the truck manufacturing at Scania. The method for extending and developing the database is that the user could add technical terms when they are writing about something
that does not already exist in the database. Instead of a team working with adding terms, the database is being extended in the daily work. A requirements database could be developed in the same manner. If every project leader at Scania IT always added there requirements in a new database, the database would be developed in a short time relatively the effort from each project.

There is also a possibility to add information about the context surrounding a requirement in a database. It would help requirement writers in future projects to understand faster and also get input from earlier project experiences. One example could be information about how a supplier works or a minimum level of service that Scania IT always should require.

It is also a possibility to store information that facilitates the communication with different types of suppliers. One example is if one supplier in India expresses a requirement in one way and Scania does it in another way, there could be communication problems. Semantics may differ for the same word or different words are used for the same thing. Information in a database, about a supplier’s ontology, could give support to the requirements writer or project leader when writing requirements in, for example, a SLA. The concept of shared ontologies is showed in figure 11.

![Ontology model](image)

Figure 11: Ontology model.

According to the RSB model, well-known words are better to use when writing requirements because it facilitates the communication aspect. The work with determine what words are well known concern several units at Scania. As seen in the SoRE process, requirements writing are going through several phases before it is ready to function as a base for a SLA. That combined with the organizational structure at Scania making SAI performed one part of the sourcing process and Scania IT another makes it challenge to determine what word should be classified as well-known and thereby constitute a part of the ontology stored in the database. The authors of this thesis suggest that a unit, responsible for investigating this question, is set up at Scania IT. The unit could consist of people from VMO, SAI and the Language and publishing group. People from the language and publishing group has experience with working with developing ontology at Scania as they working with
constructing the Scania wiki. The others have both technical and sourcing strategic knowledge. The same group could then work with developing boilerplates for the requirements writers.

![Diagram](image_url)

Figure 12: Responsible group for phase 2.
6.5 Phase 3

Phase 3 is about the connection between the concept developed in phase 1 with the experience and technical development in phase 2 with requirements management software.

The database, developed in phase 2, is connected to software for writing and managing requirements. The requirements writing could then be more standardized and the reuse of old requirements is easier to achieve. Several project leaders at Scania IT have requested reuse of requirements. There are both theories and empirics which point out the possibilities to save time and money if the requirements writers do not need to start from scratch in every project, which also could have the same suppliers and need similar service in more than one project.

There are several applications for managing requirements at the market. One, which is already in use at some units at Scania, is DOORS. Experience makes it clear that DOORS is a program with high potential but it requires some work with details in the application. That is because DOORS needs to be adapted to Scania’s way of working. After the adaption, DOORS should be a possible application for phase 3.

One reason for implementing requirements application later than the template and database is that people in an organization can learn the suggested requirements writing concept in an environment they are using today. The database will also take some time to develop. After phase 3 there should be a standardized way of writing requirements and a possibility to reuse requirements from other projects.
6.6 Profits of Using the Standardization Phases

The aim of using the template is to provide Scania IT with a standard model when writing requirements. The template helps to standardize the design, which will higher the quality since it will be easier to find different parts in the requirement specification. The division between the Word document and the Excel document helps to create a balance between context and details. Both new and experienced requirement writers can take advantages from the template and not start from a blank paper. Not to start from a blank paper is also a time saver. The template can be used as a filtering channel to, as the generic SoRE-model flow-down phase in the RSB-model, to increase the quality but also to think through the requirements before sending them out. The template is included in the first phase in the standardization phases. The whole standardization phase’s model will create a shared ontology, which will improve and avoid misunderstanding in the communication. Also the possibility to reuse requirement will save time and resources over time and also increase the quality since there is a possibility to reuse approved requirements from earlier projects.

Scania is moving towards a flow-driven development, which means that in the future there will be more focus on managing risks earlier in a project. Therefore the requirements phase will be more and more important. The quality need to be the first priority and not the time when writing requirements. To standardize the requirements makes it easier to evaluate and improve since all have a common starting point.

Implementing changes according to the standardization model developed in under the work with this thesis ease the work for Scania IT when it comes to requirements engineering connected to the values in the Scania house. It would be easier for the employees to know if they are doing the right thing because they have a guideline to follow because of the standardization.

Using the RQV template for evaluating the requirements could be an important tool for stressful situations. According to the new work process guidelines at Scania IT, more work should be done to ensure that parts of projects are done correctly before the result of one phase is moved to next phase. The RQV template could be useful in those situations because of the potential of reducing errors in the requirements specifications.

Projects at Scania IT could be running for a long time and the results of different projects need to be managed for years. Consequences of this are that requirements are changed or they need to be understood by people managing the result. By using a database connected to software like DOORS would help Scania IT to change, manage and understand requirements written in different projects.
7. Conclusions

This thesis was built on a purpose and research questions. The purpose of this thesis was to find a standard way to create specifications for functional, non-functional and service requirements in the procurement of sourcing IT services on a general level. The main research question was: how can a standard way to create service requirements specification be standardized? The question was divided in three sub questions, which are presented below.

- **How can a standard template be designed?**

The template created in this thesis, based on the RSB-model combined with the empirics, shows how a standard template can be designed. The template consists of a word document and an excel document and is presented in its whole in appendix. The word document starts with an introduction to give the reader a context, purpose and a glossary. Further on, there are three main headings; functional-, non-functional- and service- requirements. Lastly there is a guideline to help the writer with syntax, priority and different properties when writing requirements.

- **How can the template be implemented at Scania IT?**

To implement the template this study suggests that a responsible unit is formed and managed by VMO, consisting of people from several units involved in the whole sourcing process. The responsible unit can use different information channels as Agora, Inline and Wiki to anchor the template. To spread the template they can use the Sourcing Framework as a base and implement links to it from other information platforms. A part of implementing the template is also to continuously improve the template and adapt to new experiences. To centralize the template in sourcing framework will therefor facilitate improvements.

- **How can Scania IT work with standardization in the future?**

This study suggests a three-phase model for working with standardization in the future. The standardization model is leading the work with requirements to the use of requirements management software connected to a database. The database should consist of information about the ontology that should form the requirements writing. The database should also consist of old requirements that could be reused in new projects. There is also a possibility to store information about supplier’s ontologies and general information. All together, the standardization model should lead to a more standardized requirements writing and save resources in the requirements writing process.
8. Discussion

The authors of this thesis got an assignment from VMO at Scania IT because VMO had discovered a need for investigating the possibility to improve how requirements were written in the sourcing process. The requirements standardization processes, developed by the authors, has the potential to solve several problems in the requirements writing in both the short and long time perspective.

In the short perspective the service requirements template, built on the ISO and ITIL standards connected with a syntax guideline, could be used immediately to improve the quality of the requirements as well as a method that invites the writer to clarify the context surrounding the requirements. It would also improve the communication between the SAI department and Scania IT in the sourcing process.

In the long perspective, the requirements standardization model gives a basis for a greater change in how requirements are written and managed at Scania IT. Of course, the model is not comprehensive but it gives a base or idea for how the goal for the requirements engineering process could be complemented. After several months of investigating, the authors see a great potential for improvements and that much of the resources needed in a change for improvements already exist at Scania in Södertälje. One example is the work with standardization of technical terms at the Language and publishing unit and another is the R&D unit that already uses software for requirements writing.

The changes the authors propose in this thesis imply changes in the work process and also in an organizational way. One key issue for implementing the changes and also optimize the result is education. Scania has an education center in Södertälje and educates the employees in different subjects. To develop a course in requirements writing in for example in sourcing, based on an overall requirements management strategy with software for requirements writing, is to use opportunities already existing at Scania. It would also help the organization to change the way of working and use the strengths of a standard.

It is not only Scania IT that is working with requirements writing and has a need for buy or source products and services. Other units at Scania and other companies have a need for standardization in the requirements writing process. The authors impression is that Scania could gain efficiency and save resources in time but it depends on how prioritized the requirements work will be in the future. Scania IT has an opportunity to be at the forefront, especially when it comes to service requirements writing and reuse requirements in system development processes combined with sourced services, which is likely to increase in the future.
10. Bibliography

10.1 Published sources


Karlsson, C, Olsson, N. (2011) When non-functional requirements takes the backseat in IT projects at Scania – that is a recipe for costly consequences!


Xin, Ying Wang. (2012) *Advanced Materials Research*

### 10.2 Non-published sources


http://www2.lingfil.uu.se/kurser/detaljschema/ht05/ling_sempra_introsem_hs.pdf (2013-03-16)

10.3 Interviews

Aldén Czechowski, Sophie; Provider Maintenance Manager, Scania IT, Interviewed 2013-01-21
Andersson, Michaela; Operations Architect, Scania IT, Interviewed 2013-04-03
Flodén, Anders; Project Manager, Scania IT, Interviewed 2013-02-06
Fredriksson, Bo; Business Relationship Manager, Scania IT, Interviewed 2013-02-06
Hjerten, Alma; Language Adviser, Scania IT, Interviewed 2013-04-24
Knutsson, Daniel; Testmethods, Scania IT, Interviewed 2013-03-26
PersonEricsson; Strategic Sourcing Manager, Ericsson AB, Interviewed 2013-03-18
PersonSandvik; Development Support Manager, Sandvik IT, Interviewed 2013-03-14
PersonStudsvik; CIO, Studsvik AB, Interviewed 2013-04-17
Sandberg, Linda; Project Manager, Scania IT, Interviewed 2013-02-16
Sandberg, Rosel; Project Manager, Scania IT, Interviewed 2013-01-21
Sandegren, Mikael; Sourcing Manager, Scania IT, Interviewed 2013-02-08
Skyman, Karin; Sourcing Manager, Scania IT, Interviewed 2013-04-21
Strand, Daniel; Purchase Manager, Scania IT, Interviewed 2013-01-17
Stenmark, Jesper; Test Process Development, Scania IT, Interviewed 2013-03-26
Söderman, Göran; Manager, Scania IT, Interviewed 2013-01-18
Tomas Åberg; Project Manager, Scania IT, Interviewed 2013-05-07
Weckström, Mikael; Senior IT Architect, Scania IT, Interviewed 2013-02-07
Wretblad, Simon; Development Engineer, Scania IT, Interviewed 2013-04-15
11. Glossary

**Sourcing** – (ITIL Service Strategy) using an external service provider to manage IT services.

**Functional Requirements** specifies a function of a software system or its components. A function is described as a set of inputs, the behavior, and outputs.

**Non-functional Requirements** are requirements that specify criteria that can be used to judge the operation of a system, rather than specific behaviors.

**Service Requirements** are requirements that specify how a service should be executed.

**COTS (Commercial Off-The-Shelf)** Commercial-Off-The-Shelf Software (COTS) is pre-built software usually from a 3rd party supplier. COTS can be purchased, leased or even licensed to the general public.

**SDP (Software/Scania development process)** The process shall be used in an iterative/incremental way. New functionality for the user shall be developed during every iteration. The work shall be performed in a Lean and Agile way.

**NAP (None-Automotive Products)** Procurement process for non-automotive products.
Appendix

Template:

Revision History

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How to write and read this document

<The text in blue and italic is for guidance only, delete before the document is published. It is most likely that you do not need to use all the headings in this document, delete any section that is not needed.

Go to the relevant headings and fill in the information the reader needs to know for understanding your requirements in that area. Then, write your requirements in the excel document. Remember to mark your requirement with the right heading in the excel document. To get a faster overview it is recommended to use UML-diagrams, such as Flow charts, Use-cases, Sequence diagram etc. when needed.

Remember that use cases are not requirements. Use-cases describe interaction and behavior of one or several requirements.

After each update of the document make sure to increase the revision number and update the revision date. Also let an approver read through the document and sign of, it is highly recommended that the approver is not in your project group.

Please note that Chapter 1, Introduction, is highly recommended in all cases and that this template includes FURPS.>
1. Introduction

The introduction should provide an overview of the entire document. Explain how the reader should read and use this document and where the reader can find documents such as the excel document, use-cases etc.

1.1 System Context

Explain the context of the system. That can be useful for future work and investigation. When writing descriptive texts, giving the requirements a context, verbs such as “is”, “are” and “was” should be used. Avoid the term “must” due to potential risk for misunderstandings.

May add a context diagram here.

After reading the context, the purpose should be easy to understand.

1.2 System Purpose

What is the purpose of this system, define reasons why the system is being developed or modified.

1.3 System Scope

A brief description of the scope, what project(s) it is associated with and anything else that is affected or influenced by this project.

Describe all relevant top level benefits, objectives, and goals as precisely as possible.

1.4 Glossary and Definitions

Define special words and difficult definitions; be aware of the knowledge level of the reader(s).
2. Service Requirements

<If any of the requirements in this section are covered in other documents do not duplicate the content, just reference the other document>

2.1 Service Description

<Describe a brief description of what the service does, and the expected outcome.>

2.2 Service Features

<Briefly outline the main features and functionalities of the service.>

2.3 Service Components & Constrains

<Identify the components and constrains of the service. What other technologies, services, processes and resources must be in place and operation for this service to be able to function and deliver value to the customer>

2.4 Expected Service Lifecycle

<Describe the expected lifecycle of the service. Plan for the service long term, renewal, update, replacement, retirement.>

2.5 Service Hours

<Write about agreed time period when the IT service should be available, e.g. What are the service hours? During what period of time is the service available? During what weekdays is the service available? What are the planned maintenance windows for the service?>

2.6 Service Level Agreement

<Define the SLA’s required for the service. Is the SLA’s for the service standard or customized? What are the SLA’s for the service?>

2.7 Education

<Define if any education is needed in order to use the system or the service.>

2.8 Service Reports

<A list of operational reports available for the IT service.>
3. Functional Requirements

<Insert the functional requirements in a excel format or give the reader information where to find it. E.g. “The excel document is attached to this document.”

To get a faster overview it is recommended to use UML-diagrams, such as Flow charts, Use-cases, Sequence diagrams etc. where needed. The recommended tool for creating UML-diagrams is EA Sparx”

*Use 5. Guideline when writing requirements*>
4. Non-functional Requirements

Use only the headings that are necessary for your project, use a lean approach and remove unnecessary information. Specify the requirements in detail in the excel document, write further information, such as context, under each specific heading below.

Remember to classify the requirement in the excel document

Write clear requirements in your non-functional excel document and the context about under the headings below.

**Use 5. Guideline when writing requirements**

4.1 Usability

This section should includes all of those requirements that affect usability.

Examples:
- Specify the required training time for the users to become productive at particular operations.
- Specify measurable task times for typical tasks
- Specify requirement to conform to common usability standards, IBM’s CUA standards or Microsoft’s GUI standards etc.

4.2 Reliability

Specify the reliability requirements in quantitative terms, including the conditions under which the reliability requirements are to be met. This may also include the reliability apportionment model to support allocation of reliability values assigned to system functions for their share in achieving desired system reliability.

4.3 Supportability

Supportability indicates any requirements that will enhance the supportability or maintainability of the system being built, including coding standards, naming conventions, class libraries, maintenance access and maintenance utilities.

4.4 Performance

Quantitative criteria covering endurance capabilities of the equipment required to meet the user needs under stipulated environmental and other conditions, including minimum total life expectancy.

**Response time** for a transaction (average, maximum)

**Capacity** (e.g. the number of customers or transactions the system can accommodate)

**Throughput** (e.g. transactions per second)
Degradation modes (what is the acceptable mode of operation when the system has been degraded in some manner)

Resource utilization (e.g. memory, disk, communications, etc.)

4.5 System Interface

<Specify requirements for interfaces among system elements and with external entities. Interfaces among system elements should include interfaces with the human element. Interfaces with external entities should include other systems.

A graphic representation of the interfaces can be used when appropriate for the sake of clarity.>

4.5.1 User

<Describe the user interfaces that are to be implemented by the system.>

4.5.2 Hardware

<Describe any hardware interfaces that are to be supported by the system, including expected behavior, logical structure, physical addresses, etc.>

4.5.3 Software

<Describe system interfaces to other components of the system. These may be purchased components, components reused from another system from another system being developed from subsystems outside of the scope of this system requirement document.>

4.5.4 Communication

<Describe any communications interfaces to other system or devices such as local area networks, remote serial devices, etc.>

4.6 System Operation

4.6.1 Human System Integration Requirements

<Reference applicable documents and specify any special or unique requirements, e.g., constraints on allocation of functions to personnel and communications and personnel/equipment interactions.>

4.6.2 Maintainability

<The quantities maintainability requirements that apply to maintenance in the planned maintenance and support environment.

Time: e.g. mean and maximum downtime, reaction time, mean and maximum time to repair, mean time between maintenance actions.

Rate: e.g. staff hours per specific maintenance action, operational ready state, maintenance time per operating hour, frequency of preventative maintenance.>
Maintenance complexity e.g. number of people and skill levels, variety of support equipment, removing/replacing/repairing components.

Maintenance action indices e.g. maintenance cost per operating hour, staff hours per overhaul.

Accessibility to components within systems and to parts within components.

4.7 System Modes and States
<Specify if the system can exist in various states or modes. Use diagrams to explain.>

4.8 System Security
<System requirements related to both the facility that houses the system and the operational security requirements of the system itself.>
Examples can be, access limitations, log-on procedures and passwords, data protection and recovery methods, log-on history. Communication restrictions between areas in the system.

4.9 Information Management
<Define the requirements for the system’s management of information that it receives, generates, or exports. Examples include types and amounts of information the system is required to receive and store.>

4.10 Policies and Regulations
<Organizational policies that are important and other regulations that affect the system.>

4.11 System Life Cycle
<Quality activities such as review and measurement. Life cycle also includes provision of facilities needed to provide operational- and depot-level support, spares, sourcing and supply, provisioning, technical documentation and data, support-personnel training, initial cadre training and contractor-logistics support.>

4.12 Licensing Requirements
<Licensing enforcement requirements or other usage restriction requirements which are to be exhibited by the system.>

4.13 Applicable Standards
<This section describes by reference any applicable standards and the specific sections of any such standards that apply to the system being described. For example, this could include legal, quality and regulatory standards, industry standards for usability, interoperability, internationalization, operating system compliance, etc.>
5. Guideline

You will need to prioritize your requirements in a clear way. For a three-level hierarchy, use the terms “shall”, “should” and “may”. Avoid other terms.

- **Mandatory** requirements shall be presented with term “shall”.
- **Non-mandatory** requirements shall be presented with the term “should”.
- **Optional** requirements shall be presented with the term “may”.

When using terms above, use one of three following syntax structures for formulate clear requirements in the excel document:

**Condition + Subject + Action + Object + Constraint**

*Example:* When signal x is received (Condition), the system (subject) **SHALL** set (Action) the signal x received bit (object) within 3 seconds (Constraint).

**Condition + Action or constraint + Value**

*Example:* At state 2 (Condition), the system **SHOULD** detect targets at ranges up to (Action or constraint) 5 miles (Value).

**Subject + Action + Value**

*Example:* The system (subject), **MAY** display customer orders (action) in ascending order (value) in which orders are to be paid.

When writing requirements, positive statements should be used and negative requirements, such as “shall not”, must be avoided.

Make sure that all requirements fulfill each statement below:

- **atomic**: each requirement carries a single traceable element;
- **unique**: each requirement can be uniquely identified;
- **feasible**: each requirement should be technically possible within cost and schedule;
- **correct syntax**: each requirement should follow the recommended syntax above;
- **verifiable**: each requirement is verifiable, and it is known how, “yes/no”;

6. Appendix

<Insert anything here you may like to attach to support the requirements document.>

Excel

![Excel Image]
## Requirements Quality Value

Regarding specification: Example

Reviewer: 

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Numbers of requirements that satisfies the criteria</th>
<th>RQV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic</td>
<td>190</td>
<td>0.95</td>
</tr>
<tr>
<td>Unique</td>
<td>100</td>
<td>0.50</td>
</tr>
<tr>
<td>Feasible</td>
<td>194</td>
<td>0.97</td>
</tr>
<tr>
<td>Correct syntax</td>
<td>200</td>
<td>1.00</td>
</tr>
<tr>
<td>Verifiable</td>
<td>175</td>
<td>0.88</td>
</tr>
</tbody>
</table>

**Total RQV** 0.86

Fill in the green fields and the RQV is calculated.