Managerial Impacts of Requirements Development in Public Procurements

A Case Study at Trafikverket

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Abstract

This study aims to explore how the formulation and representation of requirements affect the quality of public procurements in Sweden. The study was conducted at Trafikverket, the Swedish transport administration, which plans and sustains infrastructure in Sweden, mainly roads and railroads. Requirements engineering theory, project management principles and the Swedish law of public procurements (LOU) has been used in combination with a series of interviews with experienced individuals in public procurement to draw further analysis. The study indicates that the quality of public procurements is negatively affected by requirement categories which are difficult to quantify, in practice making price the most utilised supplier evaluation tool by public procurers. Furthermore, procurements of complex projects require more extensive utilisation of tendering methods which facilitate communication between the supplier and the procuring entity, in order to constructively develop an accurate requirement specification. Such methods exist in the frame of LOU but are currently underutilised. In order to learn and sustain knowledge of new procedures, public organisations need to invest resources into recruiting and sustaining these types of skills.
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1. Introduction

In 2016, the total revenue of public procurements in Sweden amounted to 683 billion Swedish kronor (counting the base price and excluding VAT), which comprises 17% of the country’s BNP (Konkurrensverket, 2019). A total of 18000 procurements were conducted across 4000 organisations subject to The Swedish Public Procurement Act, which is a law governing the procurement for public organisations in Sweden.

The purpose of the act, according to Upphandlingsmyndigheten, is to “use public funds to finance public purchases in the best possible way by seeking out and taking advantage of competition in the relevant market in order to get a good deal” (Upphandlingsmyndigheten, 2019). The act serves to ensure that procurements are non-discriminating, transparent and proportional. This serves as a way of inhibiting corruption in public companies.

However, public technology-administrating organisations may risk falling behind a fast-paced technology market while being harnessed by the low-paced development of the procurement laws. This may be especially apparent in cases where procurements concern complex high-technological systems, where the lack of experience with such technology may reflect itself in an inadequate requirement specification prior to the procurement, which affects the procurement negatively. It, therefore, becomes increasingly relevant to investigate the development of the requirement specification’s relation to the procurement process, along with implications of different procurement models. This thesis may be seen as a critical analysis of how established organisations conducting public procurements are challenged by products and services which are increasingly more difficult to define.

In this study, an investigation on the subject was conducted at Trafikverket, which is a public organisation responsible for long-term planning of Sweden’s infrastructure as well as building and servicing public roads and railways. (Trafikverket, 2019). According to Konkurrensverket, it was the public organisation with most issued procurements in 2017 (Konkurrensverket, 2019). Consequently, Trafikverket plays a major role in the planning and execution of public procurements and may in view of other organisations serve as a potential role model regarding the practice of this process. For this reason, along with the fact that Trafikverket conducts technically complex procurements regarding major transport
facilities, may be regarded as a suitable organisation to investigate regarding the development of public procurements.

1.1 Problem formulation

Public procurement of technical systems is a complex process entailing well-defined requirements and tactful decision making by the participants during the tendering process. The goal of procurers is to acquire a product or service quality that fulfils the defined requirements at the lowest possible price. The supplier’s interest, on the other hand, is to increase their profit by securing a lucrative contract with the procuring entity, while fulfilling the requirements of the contract at minimum expenditure. This conflict of interest may lead to different views of the contract and non-constructive procurements.

The requirements – which set the boundaries of the procurement – may be developed and formulated differently depending on the chosen procurement strategy. It is therefore of interest to study the influence of procurement strategy choice on the requirements, how it affects the interaction between the procurer and the supplier and the impacts on the quality of the procurement. Furthermore, it is of interest to investigate what the managerial implications are for public organisations that aspire to manage these aspects of public procurements.

There are multiple motives to conduct this study, the most obvious being to provide a new perspective on public procurements. Since public organisations are funded by taxpayers, it is of public interest to facilitate constructive and more qualitative procurements, where the decisions made in the procurements are fair and well-informed, in order to maximise the value of the taxpayer’s money. This could potentially reduce the long-term costs of poor decisions and therefore have a positive impact on the public economy.

Secondly, the study would contribute to the research of public procurements by introducing an interdisciplinary perspective of the procurement process. So far, there exists a lot of research on requirement specifications, and the regulatory aspects of procurements and tendering. However, there is limited research on the process aspect of procurement and how the strategy and execution of the procurement affect the quality of the end result.
1.2 Purpose

The purpose of the study is to map how the procurement procedure is commonly being conducted in public procurements, with emphasis on complex products and services. The study further aims to develop an understanding of the relation between different procurement processes and development of requirements, and lastly the organisational requirements of managing these aspects.

1.3 Research questions

- How are requirements commonly being developed and represented in Swedish public procurements?
- How are public procurement processes related to the development and representation of requirements and procurements?
- What are the organisational demands on the procuring entity when managing different strategies of procurement and development of requirements?

1.4 Delimitations
Since procurements may involve different products and services, the procurement process may differ depending on the amount of capital at stake and follow the different procedure at different types of organisations. Therefore, the study is primarily focused on organisations following the Swedish law of public procurement. As a comparison, a few private organisations are involved in the study, however only regarding the procurements which involve “big” investments, i.e. over 1 million Swedish kronor. This is approximately the limit for public organisations being able to choose between different procurement processes approved by the EU, according to LOU (Upphandlingsmyndigheten, 2019). Hence, the public procurements are more adaptable and thus more comparable to the private procurements held outside the frame of LOU. The study is further delimited to organisations involved in procurements of large technical systems, either existing solutions or systems that have to be designed in cooperation with the vendor.
1.5 Sustainability aspects

According to the Brundtland Report issued by the United Nations in 1987, the definition of sustainable development is a “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (UN, 1987). Furthermore, the report has defined three dimensions that encompass sustainable development: *environmental sustainability, economic sustainability, and social sustainability.*

A deeper insight into the procurement processes may facilitate the development of new mindsets and policies regarding public procurements, which contributes to the strategic development of the public sector. More extensive knowledge and skills in public organisations regarding procurement also have the potential of stimulating the development of new competencies in the field.

Considering the extent of the impact on the public economy that public procurements entail, providing further insight into such processes have the potential to contribute positively to the welfare of the public. Public systems and services that have been procured through well-informed decisions and described by a properly formulated requirement specification presumably pose less risk to the functionality. This may have a substantial impact on the welfare of the society since public systems and services include infrastructure, medical equipment, water- and waste systems and national defence.
2. Literature Review

The purpose of the study is to identify how requirement formulation affects the quality of public procurements, from a managerial perspective. In order to establish a solid foundation for the study, we begin by introducing existing frameworks within the field of requirements engineering and proceed to categorise the requirements. In order to clarify the rules of procurement in this study, the theory chapter also explains the current methods of public procurement in Sweden. The chapter then proceeds to describe relevant aspects of project management, i.e. what role the requirements play in different types of projects. Lastly, the project management section is complemented by organisation theory, since different organisation types may govern their project differently and have different tendencies with regards to working habits and communication.

2.1 Requirements
In public procurements, two categories of requirements are relevant: requirements on the supplier and requirements on product or service (Upphandlingsmyndigheten, 2019).

2.1.1 Requirements on the supplier
There are various ways of evaluating the feasibility of the supplier. Ray Carter originally developed a seven-factor model for evaluating suppliers (Carter, 1995), later extended to 10 factors and is currently being referred to as “Carters 10 C Model” and is utilised in several major international organisations (Mindtools, 2019), (Helmold et al., 2017). The 10 factors are:

1. Competency (Skills and knowledge to perform task)
2. Capacity (Capacity to produce and access to resources)
3. Commitment (Quality, proof of high standards)
4. Control (To what extent is the supplier dependent on others)
5. Cash (Refers to financial stability)
6. Cost (Or in other words: price)
7. Consistency (How well the supplier demonstrates consistency)
8. Culture (Consistent ethics, policies and common core values)
9. Clean (Referring to sustainability)
10. Communication (Accessibility and communication plan)

(source: ibid)

Although the model aims to encompass the most important aspects to consider during a supplier evaluation, it must be noted that there may be several unknown factors not covered in the model. The model may also seem redundant to the reader regarding some
factors, since “Commitment” and “Consistency” could be seen as correlated. In addition. Furthermore, while the 10 C model may serve as a theoretical basis, the implementability of the model must be compared to the existing procurement policies, which in Sweden is governed by the Public Procurement Act (Swedish: Lagen om Offentlig Upphandling), known as LOU (Riksdagen, 2019). According to LOU, a procuring authority may only put the following requirements on the supplier regarding the following aspects:

1. **Authority** to practise profession (in accordance with 2 §)
2. Economic and **financial** position (in accordance with 3 and 4 §§)
3. Technical and professional **capacity** (in accordance with 5 §)

(Riksdagen, 2019)

Note that the term “capacity” above with reference to 5 § (the same act) is given a more extensive definition, where “capacity” might translate to both “competence” as well as “capacity” in the list formulated by Carter.

By deduction, the requirements allowed to be put on suppliers by the procuring entity, according to LOU, are:

1. Authority (The supplier must be legally authorised to perform the task)
2. Financial stability
3. Competence
4. Capacity
5. Price (indirectly, since lower price is more favourable in competition)

### 2.1.2 Requirements on products and services

Below, we begin by defining the purpose of requirements and describing the standards by which specifications are typically written. The theory regarding requirement specifications has been done previously by Osman & Hamad (2018), during a study also conducted at Trafikverket.

A requirement is an attribute in a system which is necessary to define a capability, characteristic or quality of the system. It should be possible for the requirement to be
observed from the system externally. The purpose of the requirement is to enable the system to create value for the intended user. (Young, 2004).

In order to discuss the relevance of requirements, it is essential to understand why they exist. According to Wiegers, they are necessary in order to resolve issues in the development phase in order to reach the desired state. A documented representation of the desired state clarifies the goals for a developer to reach the state (Wiegers, 2013), (Osman, 2018).

Requirements are commonly divided into *Functional and Non-functional Requirements* (Robertson and Robertson, 2012), where functional requirements address the core purpose of the system, whereas non-functional requirements are those that are necessary but do not describe the function, such as fulfilment e.g. standards and accuracy. However, Broy (2018) has further developed a system of categorising requirements in more detail and argues that the distinction between functional and non-functional may be vague and does not provide a sufficient categorisation between requirement types. Broy proposes the following categorisation:

2.1.2.1 System-specific requirements
These are requirements that are attributed to the system itself, such as properties, quality and logical behaviour. The technical system may be represented as a *black box* or as a *glass box*, depending on whether the system should be viewed internally or externally. The internal view is useful if the system is to be further analysed internally, whereas the black box view regards the system as a subsystem of a bigger system. All technical requirements should be strictly defined in terms of logic, time and probability. (Broy, 2018)

2.1.2.2 Operational Context
These requirements clarify and limits the circumstances under which the system is designed to be used, e.g. weather, temperature, geological and electromagnetic environment. Although not describing the product, the operational context requirements indirectly govern parameters and preconditions for the functionality of the product (Broy, 2018)
2.1.2.3 Usage Context

The usage requirements may be relevant in terms of interface and usability, in order for the system to be operable. The system may have to interact with the user, and therefore usability requirements are needed. (Broy, 2018)

*Figure 1. System (black box) and its relation to other systems, user and the context. (Broy, 2018, p. 176)*

Figure 1 illustrates how the requirements of the system interacts with other entities, which may be physical users, subsystems, parent systems, or other data collection systems. In other words, requirements for the internal functionality of a system is not enough; there must also be requirements for possible interactions with the environment.

2.2 Requirement Specifications

According to Andersen (1994), a *requirement specification* may be seen as a documented list of documented requirements, which serves as a ling where the forming stage and the analysis stage is connected in the design process.

Hence, requirement specifications are documents which embody the demands which the user desires of the system. The specifications are supposed to be clearly formulated and have a clear structure where demands are requirements may be documented. (Osman, 2018). The requirement specification thereby becomes a communication tool between the
developer and the recipient. In the design phase of a system, requirement specifications become a foundation and boundary for the developer to respect (Sommerville and Kotonya, 1998).

There are numerous aspects which describe reasons as to why requirement specifications should be formulated (Osman et al., 2018):

2. “The purpose is that the recipient may verify that the correct system is developed and what the demands are.” (Wiegers, 2013), (Eriksson, 2008), (Davis, 2005), (Sommerville and Sawyer, 1997)
3. “The developer may understand what is developed” (Wiegers, 2013), (Sommerville and Sawyer, 1997), (Eriksson, 2008)
4. “Requirement specifications utilise the project managers as foundation for managing the budget and decision making” (Wiegers, 2013), (Eriksson, 2008), (Davis, 2005), (Sommerville and Sawyer, 1997)
5. “Requirement specifications Is used as a foundation for testing” (Wiegers, 2013), (Eriksson, 2008), (Sommerville and Sawyer, 1997)
6. “Requirement specifications are utilised as a foundation for developing user manuals” (Wiegers, 2013)

(List originally formulated by Dana & Osman, 2018, p. 12)

According to Sommerville and Kotonya (1998), it is essential the requirement specifications are describing what functions and attributes a system should fulfil, but also which integrated systems that are connected to a certain system, and in which circumstances and relations the system is supposed to be usable.

2.3 The determining factors of requirement specifications
According to existing literature, there are some common factors which determine appropriate requirement writing. The purpose is to minimise confusion for the recipient of the requirements and ensuring that the requirements may not be misunderstood, enabling the product or service to fulfil its task more accurately.
2.3.1 Completeness
The requirement must have all the information for the requirement to be understood. A requirement cannot be underdetermined (lack information), in which case, all the information required to implement the requirement is not available to the reader (Wiegers, 2013). All conditions under which the requirement is applied are stated and expresses the statement or idea as a whole (Young, 2004).

2.3.2 Correctness
In order for a requirement to be correct, it must be verified with the source of the requirement (Davis, 1993). This may be regarded as how well the requirement is formulated in terms of functionality. (Wiegers, 2013). It is necessary for these requirements to be inspected by the relevant users since they are the only ones who may determine whether the requirement is adequately fulfilled (Davis, 1993), (Wiegers, 2013).

2.3.3 Necessity
The requirements have to be relevant and to the developer and the end-user. This may only be done by having an authority with sufficient competence to create the requirement. The authority then functions as a source to the requirement, which can be tracked backwards if needed. (Wiegers, 2013)

2.3.4 Feasibility
In order for a requirement to be practically implementable, the system's environment and limitations must be regarded during the requirement formulation. It is necessary for a knowledgeable developer to participate during the requirement compilation process in order to determine whether the requirements are feasible, and also and assess which requirements entail high costs. (Wiegers, 2013)

2.3.5 Prioritability
In order to determine the internal importance among requirements, the requirement authors should develop a way to represent the requirements in terms of importance. Different requirements may vary in importance, which may be relevant in case there are not sufficient resources to follow through all requirements, or if there is a change in the budget. (Wiegers, 2013)
2.3.6 Clarity
According to Wiegers, there are two types of ambiguous requirements. The first type is the logically unclearly formulated requirement, which is related to grammar and may be corrected by any individual. However, some formulations may be interpreted differently by different people; hence, it may not be corrected by a single person. Therefore, it is important to peer review the requirements. They must be peer-reviewed by equally competent peers, and in case of different interpretations, a glossary may be created with different possible interpretations in documented form, and the issue may be resolved. (Wiegers, 2013)

2.3.7 Consistent
In order for the requirements to be executable, they must be coherent and consistent with other requirements. It is not enough that they are consistent with requirements in the same document; they must also be consistent with any requirement in any other document describing the system. There are two types of inconsistencies: Terminology and Time. Terminology refers to descriptions of certain requirements, and this issue may be apparent if different words are used to describe the same thing, which may be difficult to detect. There may also be a time-related conflict, if certain states are not in order among different documents, or the system may wrongly be expected to be in several conflicting states at the same time. Davis (1993), (Wiegers, 2013)

2.3.8 Verifiable
The requirements must be possible and relatively easy to verify and without consuming abundant resources. This step is necessary to verify that the requirements have been correctly implemented according to the source and that it has been unambiguously implemented. (Davis, 1993).

2.3.9 Modifiable
Sometimes, requirements have to be rewritten in case the procurement of a new system is to be held. Therefore, the requirements should be easy to modify, and there should also be a system to reference changes in the document, so that changes may be traced in case an error search has to be done. It may also be relevant for future projects to see whether certain types of requirements are better than others, and the reason why. Furthermore, it is necessary to have a reference system to other documents which are affected by a certain requirement. Otherwise, keeping track of all related requirements affected by a certain change will
prove to be a tedious task, depending on the complexity of the system and the number of documents. (Wiegers, 2013)

2.3.10 Traceable
It is necessary for a requirement to be traceable, and it is important that the requirement has a reference. They must have an identifier which allows the reader to trace the requirement back to its origin. Therefore, it is important that every requirement is written individually in separate sentences and not grouped together with other requirements. Grouping together requirements make referencing more difficult, since every requirement may stem from different components with requirement specifications of their own. It is also easier for a reader to track the requirements development and role in the document system in case of ongoing requirement analysis, or if the requirement has to be modified. (Davis, 1993)

2.4 Agile Requirement Engineering
In some instances, it may be desirable to obtain an agile approach to requirements engineering. This may be the case when the industry is fast paced with ongoing technology shifts (Ramesh et al., 2010).

![Agile RE Diagram]

Figure 1. Changing premises for requirement engineering stimulates development of new practices and challenges (Ramesh et. al. 2010, p 456)
The figure above illustrates the stimulants of agile practices in requirement engineering and the following practices and challenges. The risk of a flexible approach that the process is less predictable in terms of result and cost, and more difficult to structure and document. The advantages are that agile practices allow adaption to change premises, and the iterative process may lead to requirements that more accurately describe the system. Below, several characteristics of iterative requirement formulations are mentioned.

2.4.1 Face-to-face communication
The agile approach favours face-to-face communication as opposed to written specifications (Tonnquist, 2018) The idea of this concept is to convey abstract ideas in an understandable way and not being tied to extensive lists of text. This approach may be beneficial when the top manager has abundant insight into the customer demands, and the customer is not available for requirements inspections. (Ramesh et al., 2010)

2.4.2 Iterative approach
Instead of listing a set of pre-determined conditions beforehand, the developers seek to understand the concept and by iteration be able to narrow the requirements down to what is being desired by the customer. This approach could be beneficial if the requirements change during the developing phase. (Ramesh et al., 2010),(Tonnquist, 2018).

2.4.3 Frequent requirement prioritization
The requirements are constantly re-prioritized during the developing stage. Once it is clear that a requirement may be fulfilled, the developers work on the next most highly rated requirement in the priority list. This ensures that the most relevant functionality of the system is being fulfilled first. It may also be helpful in case the recipient changes the priority of requirements during the developing phase. (Ramesh et al., 2010)

2.4.4 Constant planning
If the requirements are expected to change during the development, it implies re-scheduling of the project. If the development project is bound to change from the start, the developers are aware of possible alterations in the development and may, therefore, be more flexible and adaptable in the planning. (Shim et al., 2019), (Ramesh et al., 2010)
2.4.5 Prototyping
More changes imply the need for more stage-gates and check-ups, in order to verify that the
development is heading in the right direction. The prototypes are also a straightforward way
to present the development to the recipient and modify the work process based on the
customers’ feedback. (Cohen et al., 2004), (Ramesh et al., 2010)

2.4.6 Review meetings
In conjunction with the prototype development, the review meetings include the developer
and quality inspectors as well as the stakeholders, in order to provide feedback and ensuring
the project is progressing and being on schedule. In these instances, the managers and
stakeholders are provided with an opportunity to give feedback and to re-align the
development in the right direction. (Ramesh et al., 2010) (Cohen et al., 2004)

Furthermore, agile methods are suitable when:

1. it is difficult to visualise how the end product will look
2. The requirements are unclear
3. The situation is constantly changing
4. Most people are full-time dedicated to the project
5. The project is conducted in the same geographical location

(Tonnquist, 2018)

Conversely, the agile approach is less relevant when the opposites are fulfilled: clear goals,
concrete requirements, part-time workers and wide geographical distribution are more
suited to the “standard model” mentioned previously. (Tonnquist, 2018)

2.5 Project management
There exist various models of managing projects, and we must therefore distinguish
between traditional project management and agile project management. Exploring the
different ways of managing projects is necessary in order to observe how requirements are
formulated and acknowledged throughout the project.

2.5.1 XLPM
The standard model of project management in which the phases are Pre-Study, Planning,
Execution and Ending. (Tonnquist, 2018), (Antvik, 2005), (Lööw, 1999)
There are five tollgates in the XLPM model, which can be seen in the figure. Tollgate 2 may be considered the end of the planning phase, and the execution reaches from tollgate 2 to tollgate 5. Each tollgate has its own requirements that need to be fulfilled in order to reach the milestone before the project is allowed to continue to the next phase. Milestones serve to ensure that the project has partially fulfilled the partial goal and are suitable points in the project to evaluate expenditure of resources such as time and money (Tonnquist, 2018).

Projects at Trafikverket almost exclusively follows the XLPM model (Excellence in Project Management), originally developed by Semcon in 2015. (Trafikverket, 2019).

In this study, which focuses on Trafikverket’s organisation, the Pre-Study and Planning phase are the main phases of interest. The reason for this is that Trafikverket does not execute the project in the organisation. The project execution is procured and contracted by Trafikverket and handed over to the chosen vendor. (Osman et al., 2019)
2.5.2 The knowledge paradox

In projects following the XLPM model, the requirements and requirement specifications are formulated at the beginning of the project. The requirements may change later on, or requirements may be added. However, is that changing the conditions later on in this type of project is more costly, the longer the project has progressed (Tonnquist, 2018).

The issue with this phenomenon is that projects that are difficult to define in terms of requirements or goals is that the amount of knowledge – which is required in order to formulate requirements - increases the longer the project progresses. (Samset, 2016) This behaviour may be referred to as the “knowledge paradox” in projects.

Therefore, the challenge with standard project models such as XLPM is that flexibility regarding requirements is restricted, or otherwise costly. This implicates that projects with uncertain goals or limited knowledge faces the risk of not reaching the desired goals or being unnecessarily costly since all information is not acquired in the planning phase. This means that decision-makers do not have enough information at the beginning of the project to make the appropriate decisions.
2.6 Swedish Public Procurement act

Public organisations in Sweden are obliged to follow the Public Procurement Act, which entails following the documents on how procurement and tendering is to be conducted. The purpose of the act is to ensure that the procurement is transparent, non-discriminating against vendors and that the requirements are proportionally sound. The options for tendering are limited by this act. However, there are four different strategies that may be employed over a certain threshold value, which is proportional to the capital at stake in the procurement. In these instances, the method of choice may differ depending on the system or service being procured, (Upphandlingsmyndigheten, 2018)

2.6.1 Open tendering
This is standard practice for amounts below the threshold value but may be employed over the threshold value as well. It is the most common method of procurement where all vendors. In this case, a demand calls for developing requirement specifications which may not be changed. Thereafter follows the tendering phase and exclusion, selection and lastly contracting and completing of the contract. (Upphandlingsmyndigheten, 2018)

![Diagram of the phases of open tendering](image)

*Exclusion phase is optional. (Moe et al., 2017, p. 145)*
2.6.2 Selective Tendering
In selective tendering, the vendors with relevant qualities are invited to the tendering process, where the requirement specifications are revealed in more detail. The number of vendors may be specified by the procuring organisation but must be at least five. Lastly, a selection is made, and the contract may be completed. (Upphandlingsmyndigheten, 2018)

2.6.3 Tendering with negotiations
In this case, there is a pre-selection stage where vendors are invited to develop requirement specifications along with the owners of the procurement. This may be useful in case the requirement specifications may not be completed of different reasons. The exclusion of vendors may be done gradually throughout the selection stage. After the tendering, negotiations may be held, and the contract is signed. (Upphandlingsmyndigheten, 2018)
2.6.4 Competitive dialogue
By this approach, a selection of vendors is invited to have a dialogue and develop requirement specifications along with the procuring organisation. Different iterations are conducted, and once this phase is done, the vendors may leave an offer. However, it is not possible to negotiate the offers once they are made. This approach is the most solution-oriented but may only be approved if the procurement involves innovative solutions or systems that the organisation is highly unfamiliar with.

![Figure 8. The phases of competitive dialogue. (Moe et al., 2017, p. 146)](image)

2.7 Organisational learning and forgetting
In an organisation administering information, the knowledge learned and shared by individuals within the organisation may be generating or depreciating, depending on the individuals of which the organisation consists, and their ability to acquire, share and document knowledge. (Argote, 2013)

2.7.1 Organisational learning
Organisational learning occurs whenever one or several individuals in an organisation acquires experience and recalls in for further use. These individuals may also share the information with other employees, solidifying the organisational learning. The intensity may be proportional to the characteristics of the experience such as degree of ambiguity, location, timing and rareness (Argote, 2013), but also to the characteristics of the organisation, e.g. organisational culture, structure, or a specialist vs generalist organisation. (ibid)
2.7.2 Organisational forgetting

Organisational forgetting is the tendency of an organisation to lose information or experience of certain events, skills or procedures, thereby ‘forgetting’. The tendency to forget tends to be greater in organisations where “learning by doing”, i.e. tacit knowledge is largely prevalent. In combination with a turnover in employees, information may vanish in the organisation over time. (ibid)

2.8 Asymmetric information and opportunism in procurements

In procurements, the supplier typically has more information about their provided product and services than the buyers. (Perloff, 2008). The information may include critical components, typical strengths and weaknesses and knowledge about the implementability of their solutions. This asymmetry of information between the supplier and the procurer may manifest itself in an inaccurate formulation of requirement specifications by the procurer (Knutsen-Öy, 2015). Such inaccuracies in the requirement specifications may lead to additional costs due to workarounds in the contract at a later stage. Such additional work may benefit the supplier since the supplier may charge the procuring entity for the changes in the requirement specification (Perloff, 2008). In other words, suppliers may be prone to exploit the information asymmetry that is prevalent in public procurements.

In order to counteract the information asymmetry and the ensuing opportunistic behaviour, public procuring entities may try to equalise the market information through public transparency in the dialogue with suppliers. Following this praxis, other suppliers may access documented information about the interaction between the procurer and a particular supplier. (Knutsen-Öy, 2015)
2.9 The project management triangle: Time, Cost and Quality

The project management triangle illustrates the relationship between three key components that determine the outcome of a project.

![Diagram of the project management triangle](image)

Figure 9. “The iron triangle” (Atkinson, 1999, p. 338)

The factors *time*, *cost* and *quality*, determine the outcome of the project, and the relation is inversely proportional to one another. As an example, a fixed cost and time will restrict the quality of the delivery. Likewise, fixed time and quality will affect the cost of the project.

The variables may be affected positively or negatively depending on altering the premises of the project. *Time* may be affected by the given deadline; *the cost* depends on the resources required, such as materials and employees required. *Quality* may be affected, for instance, by adding or removing requirements.
3. Methodology
The study has been based on academic literature, empirical information gathering and lastly critical analysis. The research has followed a non-linear order due to the abductive character of the study. As the research progressed, additional information was gathered, and the relevance of the research questions as well as the theoretical content has been reflected upon to ensure the consistency of the study.

3.1 Perspective of research
The study has been heavily explorative since the topic was proved difficult to find existing literature on. The choice of perspective had to be iterated several times in order to find the appropriate lens from which to view the research question. The literature struggles to describe in detail the role that requirement specifications play in different procurement procedures. However, there seemed to exist extensive research on the topic of requirements engineering and regulations regarding public procurements, as individual subjects. For this reason, the question had to be investigated empirically in order to fill the gap in the literature and introduce an interdisciplinary perspective on the topic. The recommended approach for this is an explorative research methodology, as described by Blomkvist and Hallin (2015). Therefore, the method of gathering empirical information was to investigate the requirement formulation procedures and procurement processes through explorative interviews with experienced specialists on the subjects. The identified themes could then be described and further analysed by finding relevant literature, followed by formulating a new hypothesis which could then be verified by additional empirical data. Thus, the study may be characterised as having an abductive approach, meaning that the theory and empirics are added continually, in order to ensure that as much relevant facts as possible is being processed in the study (Blomkvist et al., 2015).

3.2 Literature review
The literature was found by searching academic databases, exploring academic journals and books. Web of Science was used primarily, which was accessible through the supplied range of university’s academic search engines. Even in cases where the literature was only partly relevant, the reference list of such sources could be searched for more relevant literature. The study started initially with an inductive approach, by conducting probing interviews with the issuers of the study, and through the coding process, the main theoretical fields could be
identified. During the exploration of the literature, various questions could be formulated and be further investigated while gathering empirical data.

From this stage, the theoretical research may be described as *Grounded Theory*, which is the process of alternating empirical gathering and theoretical research by continually analysing the currently acquired information (Blomqvist et al., 2015). This method is consistent with the previously mentioned abductive approach. Through this methodology, the gathered information from different sources may be categories and therefrom, common themes may be recognised. In the later stages, the coding may be more selective once the relevant issues are identified.

### 3.3 Empirical data

The empirical information was gathered through semi-structured interviews with specialists that have experience with technical requirement specifications or has insight into the procurement process. In the process of sourcing interviews, the organisation was primarily contacted by telephone. In case of insufficient information or when prompted to do so, the organisation was sent an e-mail with information about the purpose of study, assurances of confidentiality and question samples followed by an interview request. In the interview requests, it was mentioned that a physical interview was the preferred method, but interview by telephone would also be acceptable.

The organisations were chosen based on the fulfilment of the initial limitations of the study: Large, established organisations with experience regarding public procurements and complex technical systems. The selection was by these conditions fairly limited, due to a widespread absence of responses from external organisations or failure to consistently sustain the communication. In total, 15 organisations were approached. However, the responses from employees at Trafikverket was generally positive. Consequently, the majority of the empirical data in the study consists of interviews with these respondents. There are possible negative limitations the generalisability of the empirical data, since the identified issues may only be occurring in this particular organisation. On the other hand, the findings from these interviews were completely or partially confirmed by the two respondents from the external organisations, which points to a certain validity of the data.

The semi-structured system consisted of an initial set of questions that were predetermined, although some questions were excluded from certain interviewees since they
were not able to answer them due to lack of insight. In practice, this led to interviewees answering some common questions, and other questions which only they could answer. The drawback of this system is that the interviews were not totally consistent in terms of questions posed, but the advantage was that it allowed for deep insights into every interviewee. (Blomkvist et al., 2015)

However, the character of the open questions allowed the person to elaborate freely, thus extracting as much information as possible from the interviewee. This had the occasional benefits of several questions being answered with the same response, and also add relevant information which was not encompassed by the initial questions could be brought to the surface (Hyman et al., 2016). Such additional information could further stimulate the abductive process.

During the gathering and analysis of the empirical data, a qualitative method was chosen since the process perspective, and description of supplier assessment were described with concepts which are not trivially quantifiable. The qualitative approach, according to Bryman and Bell (2011), emphasises the interpretation of the interviewee’s perspective and recognising common themes of the responses. This is done by coding the answers, i.e. identifying themes in the responses, categorising them and observe recurrences.

3.4 Research Quality

The quality of research in terms of reliability of information may depend on in the source has provided correct information, and also how the information was intercepted and interpreted by the interviewer. (Blomkvist et al., 2015).

In this study, the interviewer was provided access to a secondary source of information. i.e., the interviewer was observing the information interpreted by another observer. The fact that the empirical part of the study consists of secondary-source information may pose a risk onto the objectivity of the information. Furthermore, the empirical study presumes that the interviewees are truthful in their answers.

On the contrary, the diversity of the positions of the interviewees contribute to a wider range of perspective on the same topic, making an eventual consistency among the interview answers more probable to be true.
Furthermore, the number of interviews in this study was limited, which may pose a risk in terms of statistical validity. If a greater sample of interviews were held, it is possible that contradictions among the interviews would have been existent and would also expose the prevalence of potential outliers. However, there were no contradictions in the series of five interviews regarding the issues mentioned in the table in the empirical data chapter. In order to secure statistical significance, further research must be conducted.

3.5 Limitations of methodology
The qualitative approach does have certain limitations. Firstly, it can be prone to subjectivity issues regarding the researcher, since a qualitative approach relies on the researcher’s judgment of what are important themes to consider and what is irrelevant. Furthermore, qualitative studies may be difficult to replicate, especially in the case of unstructured and semi-structured interviews, where the behaviour of the interviewer and the interviewee may vary (Bryman, 2011). There are possible negative limitations the generalisability of the empirical data, since the identified issues may only be occurring in this particular organisation. On the other hand, the findings from these interviews were completely or partially confirmed by the two respondents from the external organisations, which points to a certain validity of the data.

The methodology of conducting semi-structured interviews could have been more statistically significant with a greater number. In order to simplify the task of acquiring responders, a simpler questionnaire requiring less time to complete could have been issued to more people, thereby possibly introducing quantitative methods. The main reason for a more qualitative approach is that causality between different factors is more straightforward to observe, at the expense, the complexity of decoding the interviews. (Blomkvist et al., 2015)

It should also be noted that a major part of the thesis was conducted at Trafikverket, which may strengthen the relevance of the results for this particular organisation. However, this condition may be a source of bias (ibid) and only provide accurate results for this specific organisation. In order to verify that the prevalence of these issues can be generalisable or all Swedish public organisations, further studies must be done.
3.6 Ethical Considerations
According to Vetenskapsrådet (the Swedish research council), there are four main requirements that characterise ethical research: the *information* requirement, the *consent* requirement, the *confidentiality* requirement and the *ethical use* requirement. (Vetenskapsrådet, 2019).

The interviews were intended to be performed in an environment where the interviewer and interviewee would feel comfortable revealing information relevant to the study. At the beginning of the interview, it was made clear that the interview would be anonymised, in order not to preserve integrity and confidentiality for the interviewee in case opinions were to arise that would be undesirably controversial from their employers’ organisations point of view. The purpose of the study was made clear at the start of every interview, in order to reassure the interviewee of the intent of the questions. The questions were posed using a common language, using technical terms only when necessary. The purpose of this was to facilitate understanding of the question and to encourage free thought rather than raising awareness of the quality of the language. It is also relevant to mention that there have been no financial or personal factors that have affected the relationship between the researcher and the issuers of the study.
4. Empirical data

This chapter describes the insights from different interviews, with different persons: A, B, C, D, E and F. Person A, B, E and F are employed at the same organisation (Trafikverket), albeit at different positions. Person C works for Norrtälje Kommun, and person D is employed at AF, an established private consulting corporation. All interviews were conducted face-to-face, except for person D, who was interviewed by telephone. The interviews varied in length from 30 minutes to one hour, with approximately ten questions in total, that were openly formulated with the purpose of allowing for deep reasoning from the interviewees. The questions posed may be found in the appendix.

4.1 Interview A

This person works as a technical specialist within rail design and was previously employed at Banverket (Swedish Rail Administration), and then followed the organisations' transformation into Trafikverket. He has been in the organisation for 20 years in total. He is familiar with the technical aspects involving railroads, such as geology, signal systems, and the mechanical aspects of railroads. Due to his experiences, Interviewee A is familiar with which requirements are relevant for a railroad and may, therefore, contribute with expertise in the requirement formulation. As of the time of the interview, he works with compiling requirement specifications from other requirement authors in different locations and makes sure that they are coherent before the procurement. He describes himself as a “link in the railroad traffic planning”, and his task is to ensure that the technology is compatible with the infrastructure. This is especially important in urban areas, where the transport system has to exist in symbiosis with the environment in many aspects, such as accessibility, noise and safety.

Regarding procurements, he claims that the “technical specialists are responsible for writing the requirement specifications that belong to their area”. This forms a basis for the “description of mission” in the procurement process. He says that they rarely procure technical products, but rather issue mission contracts to organisations of interest. Trafikverket has standardised processes for writing requirement specifications, and they also have them well documented. The general requirement specifications may be reused, whereas the “facility requirements” (i.e. project-specific requirements) are individual for every project but may be used in conjunction with the general requirement specification.
He continues, explaining that there are two categories used for requirement prioritisation; “must-requirements” and “should-requirements”. There are also implicit requirements, for example, those that adhere to a certain industry standard. To exemplify, “[in railroad procurements] we never have to discuss the width of our railroads (1435 millimetres), since that is the standard for Swedish railroads”.

Interviewee A continues by claiming that sometimes, however, the formulation of requirement specifications may take longer time than usual, due to that “it is not always the most insightful persons who write the requirements”. This, according to Interviewee A, is an issue with consultants who “may technically be skilled at writing requirements, but do not have sufficient knowledge about the project and therefore unable to see the big picture”. He also states that the requirements often come in very late in the pre-procurement process and may even be added in the planning stage, which he claims is far from optimal form a resource perspective. He further claims that “during procurements, there is a heavy emphasis on the price”, at the cost of competence since it is difficult to value and compare non-tangible factors among different vendors. By this strategy, he claims, the “cheapest is more often than not the most expensive, in the end”.

4.2 Interview B
Interviewee B works as “technical support”, mainly in projects involving railroad systems and mostly with regard to signal systems. As an experienced employee within Trafikverket, his role is to act as an internal consultant in requirements development, as is often involved directly in writing the requirement specifications.

The most difficult aspect of writing requirements, he claims, is to make sure all aspects are covered in the document. This involves “functionality, environmental and quality factors”. However, there are certain templates to follow in order to ensure consistency regarding internal standards. The requirements, however, are adapted depending on the project.

Interviewee B continues, emphasising that services are generally more difficult to write requirements for than well-defined systems or products, due to the ‘soft’ factors. “Physical products and systems are more easily described than services since the description of services requires ‘soft’ terminology. Ideally, it is desirable to procure a resource which is as tailored to the demand as possible. However, some suppliers optimistically take their best shot on what Trafikverket wishes.” Suppliers, he claims, “tend to overestimate their abilities
in vaguely formulated concepts such as ‘experience’, and they also want to win the contract.” Therefore, well-formulated requirements are needed, which should be general enough in order to include as many potential suppliers as possible, but also specific enough to be tangible. This becomes especially difficult when procuring services since the requirements then include “soft” aspects, which are not as easily defined.

Furthermore, the requirements must not be “directed”, i.e. formulated in a way to purposefully exclude suppliers based on irrelevant factors. The people responsible for writing requirements are most often technical specialists. This is done with support from people conducting the procurement, in order to ensure that the requirements are consistent with the regulations for public procurement. It is necessary that experienced people write the requirements or that, at least individuals with such experience are involved during the process in order to avoid ambiguous formulations. He explains: “Ambiguity may lead to less interest among suppliers in the tendering announcement, or disputes arise about the interpretation of requirements after the procurement.”

Regarding the procurement process, interview B explains the ‘selective tendering’ procedure: “Offers are continuously turned in to Trafikverket, and the range of suppliers may to some extent be narrowed down over time.” In order to assess the supplier’s competency, interviews are conducted where the procurer asks questions regarding the requirements, although he claims that “occasionally, some suppliers perform well in the interview only to disappoint in the execution phase of the contract.” Once all assessments are done, Trafikverket follows an evaluation template in order to evaluate certain aspects of feasibility, including quality, experience and price. He states that “commonly, the determining factor in practice is often the price, although the bias toward price is not intentional.” He says that “price is easier to evaluate than softer factors.” It also becomes easier to avoid appeals later on from the suppliers, since the price is a tangible factor to rely on in order to motivate the choice.

He also mentions that after contracts have been signed, the supplier may find obscurities in the requirement specifications, which may lead to ÄTA-missions (ÄTA, short for Ändring, Tillägg, Avgående, which refers to Changes and Supplements to the requirement specifications). Such changes lead to additional work, increasing the supplier’s revenue and profit, since they may charge the buyer for the service. Therefore, in order to avoid – or at
least minimise - ÅTA-claims and the ensuing additional costs, it is important to formulate precise requirement specifications before the tendering process. “Vague formulations tend to be expensive at the end of the day”, he summarises.

4.3 Interview C
Interviewee C has worked as a procurer at Norrtälje Municipality for 20 years. He mainly manages procurements regarding infrastructure and facilities, but also regional hospitals. The municipality has centralised the procurements, which simplifies the control and governance.

In case of an upcoming procurement, the responsible procurer becomes a project leader and appoints requirement specialists to write requirement specifications. “The requirements specialists are often hired consultants”, and interview C emphasises the importance of constructing a coherent and communicative requirement group, since misunderstandings may prove costly in later phases. “However, the limited amount of expertise may lead to a less qualitative review of the required documents. Lack of peer-reviewing may lead to ‘directed’ requirements (i.e. indirect discrimination suppliers through irrelevant requirements), he continues.

The municipality categorises their procurements to include *services*, *contracts* or *products*, the interviewee explains. “Services and contracts are the most difficult categories to procure since it is often easier to describe a product – which mostly has tangible qualities - than the quality of services which often have ‘softer’ terminology”, he states.

The procurer may present the requirements to the suppliers either by straightforwardly sharing the requirement specifications or present the project through a meeting where the goals of the project are described. The advantage with a project presentation is that the suppliers more easily obtain a “top-view” of the project, i.e. an overall perspective of the goals, which enables the supplier and the procurer to share the same vision of the project. The drawback is that this “top-down” approach comes with the cost of losing details; the procurement may be more time- and resource-consuming since the details must be specified and negotiated anyway at some point.

In the tendering process - which is mainly done through open tendering or selective tendering – the assessment is done through interviews. Interviewee C states that “it is important to be thorough in asking the same questions to all potential suppliers and to follow the same interview template”.

35
Lastly, interviewee C explains that suppliers are often seeking the opportunity to appeal post-tendering, or to drive through ÄTA-missions in order to gain profit. He approximates that “up to 15% of the costs in procured contracts are due to ÄTA-cases, where approximately 80% of those cases are due to obscurities in requirement specifications of the procuring entity, and 20% due to the supplier”. He concludes that if their tendering methodology allowed for requirements to be introduced later in the tendering process, this could compromise competition which could affect price negatively. However – he finishes – “Ultimately, the most important goal should be to acquire the right resource. What is seemingly the cheapest option may turn out to be the most expensive in the long run”.

4.4 Interview D

Interviewee D has a leading role in electronic design. He is currently employed at ÅF, an established corporation with specialisation in consulting. Since it is a private organisation, it is not subject to LOU. However, the interviewee is familiar with the concepts and procedure of LOU since they have had public sector organisations as their customer. Interviewee D has participated in product development projects and have, therefore, been involved in developing and managing requirements.

He explains that the requirement specifications vary between different technological areas. According to him, “the most complicated requirement specifications regard the maintenance of new technology, and software”. It becomes increasingly difficult to create a sensible requirement specification as technology advances and the projects become more complex.

Although the company has some public sector customers, they mostly have private clients, which allow them to incorporate a more agile approach in their projects. The requirement specifications and tendering may be similar to LOU, but the requirements may enter at a later in the tendering process since there are no rules prohibiting it. “We usually develop a requirement specification in cooperation with the customer. We explain the cost and time needed to fulfil the requirements. Sometimes requirements are added..”. The supplier can charge additional fees when new requirements are introduced, but interviewee D states that “What delivers the most value for the customer is often what is the cheapest choice in the long run”.

Regarding the development of requirement specifications, he explains that “most products (in his field) are based on old products, and therefore there usually exist documents which
may act as a starting point.” The system perspective – with certain critical requirements – are first created and developed. Thereafter, more details may be added later on in the development stages of the project. In some fields, however, the process may be allowed to be exclusively agile, such as a software development project. “Traditionally, requirements are developed first before moving on to the design phase. But this philosophy is decreasingly applicable to complex tasks, especially software. In those cases, new requirements may be added during or even after the project is completed.”

Furthermore, interviewee D explains that the rules that LOU embodies “make it difficult to implement agile requirements planning in practice since the LOU rules favour structure and clarity.” This leaves little room for decision making based on experienced judgment or “reading between the lines”. He continues: “The fundamental purpose of LOU is to give the stakeholders (the taxpayers) as much value for the money as possible, i.e.

\[
\text{Return on investment} = \frac{\text{Value added to the customer} - \text{Resources spent by customer}}{\text{Resources spent by customer}}.
\]

The supplier with the greatest return on investment (referred to as ROI), is, in theory, the optimal choice for the project. The main challenge with this model, he explains, is that the resources spent are relatively straightforward to calculate; this is usually indicated by the price in the contract. “However, the added value is difficult to forecast since different suppliers have different levels of competency and capabilities, which are more difficult to evaluate and concretise.”

He continues to suggest a possible law change regarding LOU, where “motivating the choice of supplier can be done in a later stage, in order to smoothen the practical procurement process.” Since the motivation for choosing a supplier is still part of the process and publicly provided, albeit, after the procurement, the purpose of inhibiting corruption would still be fulfilled.

Lastly, the interviewee was prompted - if possible - to provide an example of the claimed weaknesses of the commonly applied public procurement practice. He proceeds to explain the procurement of service, including IT consultants, conducted by Arbetsförmedlingen in 2016 (the Swedish Public Employment Service).
The procurement was valued at 200 MSEK and Arbetsförmedlingen, being a public organisation, following the Public Procurement act. However, there were several instances of companies offering what later became known as “zero-krona junior consultants”. This behaviour included manipulating the hourly rates across different categories of services in the contract, by lowering the prices of junior consultants to nearly zero while keeping the senior services at a significantly higher price. This meant that the apparent contract price could be lower. The companies employing this strategy could thereby win the procurement, using the bias toward price to their advantage*. Once the contract is signed; however, the supplier may avoid issuing the lower-priced consultants for the job. This may serve as an extreme example of how modern products and services and old procurement policies collide and highlight the importance of developing this field in public organisations.*this story and phenomenon are also covered in media, see reference list (IDG, 2016)

4.5 Interview E

Interviewee E is a senior counsellor and director of sourcing at Trafikverket. He has been employed at Trafikverket since 2010 and has been involved in many major projects since. Before Trafikverket, he was employed at Kammarkollegiet (The Legal, Financial and Administrative Services Agency in Sweden), where he was also worked with public procurements. Currently, he works mainly with safety aspects of projects.

He continues to describe the procurement process: When a procuring project is issued, the ‘purchasing’ unit is involved early and cooperates with the investment unit and technical specialists who develop requirement specifications. Once the planning phase is done, the procurements are announced publicly, and suppliers may apply to participate in the tendering process before the given deadline is due. “Thereafter, the tendering commences and generally follows the same procedure independent of project type. In most cases, the price eventually becomes more important as the selection process progresses. Although questions may be asked by the suppliers during the interview stage during the tendering process, there are frequently ÅTA-mission after the contract is signed”, which inevitably leads to a much higher contract cost for Trafikverket in the end.

Interviewee E explains that there exist value models that serve to weight the supplier assessment on a broader range of criteria. However, using “these models usually lead to complaints from the suppliers (that did not get the contract) after the tendering is complete.
This leads to an appealing process which may be costly in regards to time and resources for Trafikverket, especially if they lose the case. When I worked at Kammarkollegiet, the appealing process could take one or two years in the worst case. Therefore, the procurers are often deterred from using such value models, leading to a lack of experience of such processes and fear of such initiatives.” On the other hand, placing focus on price might have the effect that the suppliers push down their prices, and at the same time compromising long-term quality.

He concludes that ideally, the procurements should strive to not price-focused, but the will to change is punished by the suppliers. However, in order to grow experience, the only way of learning the new procedure is to practise it, which might be done in a smaller project that may serve as trials for introducing new tendering processes. He says: “We must be more persistent and daring. We should use the more flexible tendering procedures, but such initiatives are inhibited by fear and lack of experience, so we are stuck in the old procedures”.

4.6 Interview F
Interviewee F was employed at Banverket in 2001 and followed the transition to Trafikverket in 2010. Thus, she has been in the organisation for a total of 18 years. Currently, she is responsible for qualified procurers and sourcing of resource consultants and consulting missions. She also forms a strategy for procurement. Examples of typical procurement projects have included rail-substitution, the substitution of shunts, and several of the “Big” projects (referring to Trafikverkets department “Stora Projekt”, i.e. “Department of Big Projects”).

She moves on directly to describing the employee structure: Trafikverket hires a lot of consultants, which in theory serves the purpose of ensuring competence for the ongoing tasks. However, it poses several risks: firstly, it increases the risk of potential bias in their work due to their involvement with previous employers. Secondly, the fact that consultants are being employed temporarily means that their acquired experience from the procurement process vanishes from the organisation. To exemplify, she mentions a procurement case of a relatively big project, where all consultants involved left the organisation once the mission was finished, thereby not contributing to organisational learning. “They (the consultants) want to work in the big projects. They want to develop
their skills and learn. Many of them succeed well in doing so. However, they often leave within a few years in favour of other employers”.

Moving on to the procurement process, she describes that the procurements start with a planning phase, i.e. development of requirements, followed by public announcement, then the tendering process with supplier interviews and lastly a decision where the contract is signed. Regarding the supplier assessment leading to the decision, she claims that a lot of contracts are procured at the lowest price, which we have increasingly been recognising as something of an issue. Sometimes, it has been apparent after during the execution phase that the supplier lacks the capability of performing the task, which inhibits the progress of the project.”

Although most procurements have been decided on prices, she mentions that “some value models exist, taking other factors into account such as ‘experience with similar projects’”. The utilisation of such value models usually leads to appealing processes by the suppliers that lose the procurement. However, she emphasises that Trafikverket wins most of such disputes.

Interviewee F continues by emphasising the issue with the habit of approaching all procuring projects with the same template. However, the experienced procurers who have been in the organisation lack “time and willpower” to initiate new procurement processes. She then concludes by pointing to the employee turnover issue: “Because of our employee turnover among the consultants, no one remembers and learn from the procurement mistakes properly. Maybe it is a question of leadership. Recently in Linköping, all procurers left once a certain procurement was concluded. In order to develop, we have to retain these experiences in Trafikverket.”
4.7 Summary of empirical data

All interviewees have experience with public procurements (LOU). Furthermore, they contribute to the study with different perspectives since they are employed in different positions. From the interviews, the themes could be coded and interpreted in order to categorise common issues. The main issues identified regarding the procurements were:

1. The procurement consistently struggles when the supplier assessments include “soft” quality aspects, e.g. “competency” and “experience.”
2. Lowest price is consistently the deciding factor which determines the supplier that is awarded the contract in public procurements.
3. Public procurements consistently lead to ÄTA-missions, raising the procured price in the execution phase of the project.
4. A high turnover of employees affects organisation learning and retention of experience negatively.

Below, a table is found with the identified issues:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Interview A</th>
<th>Interview B</th>
<th>Interview C</th>
<th>Interview D</th>
<th>Interview E</th>
<th>Interview F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procuring services with “soft” requirement aspects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Price focus in tendering</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Procurements leading to ÄTA</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Employee turnover</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Table 1. Four common themes mentioned by the interviewees*

In the table, a “Yes” can be found if there was a prevalence in the interview when interviewee described the issue. If an interviewee contradicted the prevalence of such issue, a “No” could be found. If the interviewee did not mention the issue, the cell is filled with “-”.

As can be seen in the table, there were no contradictions found in the series of interviews that were conducted, regarding the issues mentioned above.
5. Analysis and Result

In this section, we recall from the empirical data chapter, observe possible chains of causality and support the thesis with frameworks from the literature chapter.

In the relation between management, requirement specifications and outcome of public procurement, there appears to exist at least four observable issues, according to the empirical study.

Firstly, in order to procure missions and services with a nuanced assessment template entails assessing the suppliers by so-called soft factors which are difficult to quantify and may be ambiguous. Consequently, these factors do not fulfil the Clarity characteristic mentioned in 2.3.6, which is one of the conditions for formulating a good requirement. The obscurity of such requirements in practice lead to those procuring entities subject to LOU tend to value the supplier rating heavily based on the most easily quantifiable factor, i.e. price. This bias is mentioned consequently in the empirical data and therefore, identifiable in table 1.

The effects of such procuring attitudes tend to encourage the suppliers to minimise their offer price in the tendering process, in order to attempt to settle the contract with the procuring entity. In order to fulfil the lower contract price, however, the supplier, according to the “triangle” of project management mentioned in 2.7, has to compromise other aspects of the project, such as quality and time. Consequently, the procuring entity is therefore consistently provided deliveries being delayed or with lower quality.
Thus, the lack of sufficient methods of evaluating soft factors when assessing suppliers in public procurement inevitably leads to compromise in terms of time or quality for the procuring entity, illustrated by fig. 10.

“Soft” assessment factors are difficult to quantify

Emphasis on price in supplier assessments

Suppliers lower prices to win contract

Project quality or deadline is compromised

Procuring organisation forced to invest more resources

*Figure 10. The implications of soft assessment factors in public procurements*

In order to resolve this issue, further studies are needed in terms of developing a framework and assessing suppliers by means of soft factors.

Secondly, the fact that many procurements lead to ÄTA-missions is an indicator that the requirement specifications do not describe the mission to the fullest extent. As described in the empirical data chapter, most LOU-subjected procurements are conducted through open or selective tendering. As described in 2.6, these tendering procedures require that the requirement specifications are formulated before the tendering begins. Once the mission
contract has been signed, the process of turning the requirements to reality is commenced. However, if the procuring entity or supplier realises that the requirements specifications are unclear or not sufficient – which often is the case due to the “knowledge paradox” in projects described in the 2.5.2– it leads to an ÄTA-mission with the purpose of addressing these deficiencies. It may even be the case that suppliers deliberately exploit the information asymmetry as discussed in 2.8, by securing the contract and charging the procuring organisation a premium for additional work not included in the contract. The ÄTA-mission, as mentioned in the empirical data - is usually profitable for the supplier, while turning into an unexpected additional expenditure for the supplier. Consequently, insufficient requirement specifications face the risk of being costly for LOU-subjected procuring entities following the open or selective tendering procedures, as can be illustrated in figure 11.

![Diagram](image.png)

*Figure 11. The implications of inaccurate requirement specifications and information asymmetry*

The more complex the procured system is, the more extensive the requirement specification becomes and likewise, the risk of insufficiencies and costly ÄTA-missions. Therefore, the use of open and selective tendering procedures must be re-evaluated for such situations.
Instead, *negotiated* tendering and *competitive dialogue* may be considered useful in such cases, in order to stimulate communication between the procuring entity and the suppliers. The extensive amount of negotiations and communication during these procedures resembles the *agile* research engineering method (as described in 2.4) in the sense that the development of requirements is done in iteratively and demands extensive communication between supplier and procurer. This may increase the amount of information upon which the requirement specification is formulated – thereby to some extent addressing the “knowledge paradox” mentioned above.

![Figure 12. Tendering with negotiations or competitive dialogue facilitates extensive interaction](image)

Furthermore, extensive dialogue between procurer and suppliers inhibits information asymmetry regarding requirements (mentioned in 2.8), since all shared information between the actors is known, encouraging not only competition with regards to price, but also
regarding information. If a certain supplier, in this case, offers low prices with the intent of withholding critical information regarding the requirements, such as in fig 11, the competing suppliers may now counteract the lower price with suggesting additional requirements. Consequently, the dialogue iteratively improves the quality requirement specification, resembling the above-mentioned agile development.

Thirdly, skilfully implementing new tendering procedures in an organisation requires knowledge and experience, which must be learned over time. However, in an organisation where there is a great prevalence of temporary employees, newly acquired experience may vanish from the organisation once the temporary employees leave. For an organisation that wishes to learn new procurement practices sustainably, investing resources in retainment of such employees will be a critical factor for the success of such transformation.

6. Conclusion and suggestions for further research
This study has been exploring the behaviour of the requirement formulation in Swedish public procurements, with Trafikverket serving as a case study. Optimising requirements formulation presumably benefits the outcome of the procurement, since it describes the characteristics and quality of the procured product or service. However, the requirement formulation stage has been witnessed to be a critical phase since it demands accurate communication between the customer and the supplier.

One of the conclusions of the study - that public organisations may benefit from adopting procedures which facilitate extensive communication in this stage may lead to more well-formulated requirement specifications. However, these types of procedures may lead to unnecessary amounts spent on the procurements, particularly for procurements of simpler systems. It is also important to note that sometimes, not all suppliers are willing to invest generously in procurement, leading to fewer suppliers participating in the tendering stage. Few participants are presumably not beneficial for the procurement entity, since the price increases due to less competition.

The outcome of the empirics is supported by theory, with regards to the issues concerning unclear requirement specifications. In the interviews, it was revealed that services are more difficult to procure than products, due to the complex characteristics of service description. Describing services require the use of metrics which are difficult to quantify. Currently, the
task of concretising vague assessment metrics apparently lacks in the literature, which serves as an incitement for further studies in this field.

An implication of the thesis’ presumption that complex projects require more communicative tendering procedures, is that a new research question arises; which projects may be considered ‘complex’ or ‘simple’, since these two terms are inherently vague, and requires a more rigorous definition? Where exactly does the line go in the decision of approaching the procurement with open/selective tendering or negotiated/competitive tendering? Perhaps is there a combination of the two? These questions may also be considered subject to future studies.

The law of public procurements (LOU) serves several purposes; to optimise the value for tax money, to prevent corruption and assure that all potential suppliers capable of delivering a product or service are granted the same fair opportunity of acting in favour of the public. A question of a more juridical character is: How well do the rules of LOU fulfils its intended purpose, and how the law may be modified in order to facilitate procurements of increasingly complex systems and services? How may the rules be developed to facilitate procurements, including ‘soft’ assessment factors? These questions may be considered subject to future studies, albeit in the field of law.
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**Interviews:**

Interview with Dana Osman, 15 feb 2019, Solna strandväg 98, Solna

Interview A, Trafikverket (anonymised)

Interview B, Trafikverket (anonymised)

Interview C Norrtälje Kommun (anonymised)

Interview D ÅF, (anonymised)

Interview E, Trafikverket (anonymised)

Interview F, Trafikverket (anonymised)
Appendix I

Questions (in Swedish)
“Vad är din roll i organisationen?”

“Vilka typer av projekt har du varit delaktig i?”

“Hur går er upphandlingsprocess till, typiskt sett (vid stora inköp)?”

“Har ni olika upphandlingsförfaranden, (om ja:) Hur väljer ni upphandlingsförfarande?”

“Har ni några riktlinjer för formulering av kravdokument? I så fall vilka?”

“Vilka är ansvariga för att skriva kraven?”

“Har ni ett system för att organisera kravdokumenten? Om ja: För- och nackdelar med det”? 

“Hur presenterar ni kraven för leverantörerna inför upphandling av komplexa system?”

“Uppkommer det problem med att krav inte uppfylls?”

Om ja: “Hur kommer ni tillrätta med det problemet?”

“Hur tycker du man bör gå tillväga för att undvika svåröverskådliga kravdokument”

“Har du några exempel på upphandlingar som gått fel, och varför? (öppen fråga)”

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