CHALMERS
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Decision-Making by Contractors in Large Infrastructure Tenders

Master's Thesis in the Master's Programmes Design and Construction Project Management and Infrastructure and Environmental Engineering

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Department of Civil and Environmental Engineering, Göteborg, Sweden, 2016

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ABSTRACT

The majority of tenders in the building industry have until recently been solely decided from a monetary perspective. There is now a shift towards qualitative, non-price criteria being integrated in the tendering process by the clients. As decision-making is an essential part of the tendering process, it will be affected by this change. Therefore the thorough understanding of how decisions are made during the tendering process as well as which possibilities to improve, help and influence the organisation has, is crucial. Furthermore problems and challenges that can arise during tender decisions are looked at. The processes during the tender phase, including decision-making, are rarely investigated. The objective of this thesis is to close a part of the gap in research and to increase the understanding regarding decision-making in tenders. Due to the gap in literature, the research is explorative. A single case-study at a large contractor in Sweden was conducted, with a focus on large infrastructure tenders. Three types of data were collected and used during the case-study: secondary data from organisations involved in the case-study, on-site observations, and 10 interviews. Through pattern matching and content analysis four main themes of decision-making were identified in tendering: Experience, Intuition, Expertise and Collection of Information. In addition to the four themes input and feedback in relation to the tender and the minimisation of costs were identified as main influences. Challenges include biases, a conflict of the objectives profitability and sustainability, a lack of structures for knowledge transfer and restrictions regarding time and cost. Deliberate Practice, including the modification of input and feedback by the organisation, is suggested for organisations to influence the decision-making process in order to improve implementation of new parameters into the tendering process.

Keywords: Infrastructure Tender, Decision-Making, Tender Process

Contents

Preface

This master's thesis was conducted from January to May 2016 at the Division of Construction Management at the Department of Civil and Environmental Engineering at Chalmers University of Technology. The case-study was carried out at Skanska Sverige AB in the region Major Projects, in collaboration with the regions Infrastructure and Foundation.

We would like to thank associate professor Petra Bosch for supervising this thesis, helping with limiting its scope and providing us with support, ideas and helpful advice throughout. We would further like to express our utmost gratitude to Per-Ola Svahn, our contact person at Skanska Sverige AB, for the great advice, the genuine interest in our work, the encouragement and the opportunity to conduct this case-study.

Moreover, we would like to thank our interviewees for taking the time to be a part of our research, and contributing with their knowledge and experience.

Göteborg, May 2016

Karin Hill and Sabine Marie Pelka

1 Introduction

1.1 Background

The majority of tenders in the building industry have until recently been solely decided from a monetary perspective. Consequently the building industry has specialised in preparing offers with minimal prices. Even if the tender price is currently still the dominating decision criterion (Wong et al., 2000; Laryea, 2012), there has been a shift towards qualitative, non-price criteria being integrated in the tendering process by the clients (Waara & Bröchner, 2006). With an increasing need to focus on other factors such as environmental and social sustainability, value creation or life cycle costs, contractors have to adjust their ways of preparing and presenting offers in order to win projects.

This change in criteria will likely have a large impact on the decision-making during the tendering-process, as decision-making is an essential part of the tendering process (Jato-Espino et al., 2014). In literature it is described as a key factor for successful tendering, especially with respect to the large amounts of information and knowledge within the field of construction (Jato-Espino et al., 2014), as well as the complexity and necessary coordination of individuals and tasks (Mohemad et al., 2010). Many different processes and requirements need to be considered, which makes decision-making a difficult operation (Jato-Espino et al., 2014). With new criteria to take into consideration, the corresponding factors and methods need to be adapted. Crucial for this transformation is the thorough understanding of how decisions are made during the tendering process, as well as which possibilities to improve, help and influence the organisation has.

1.2 Problem Formulation

While the decision whether to tender or not, as well as decisions regarding final prices for offers has been extensively researched, the processes during the tender phase are rarely investigated. Due to the tendering process' competitive nature and the commercially sensitive data connected to it, only very little and selected research in this area has been permitted or facilitated by contractors (Akintoye, 2000; Laryea, 2012). Therefore the first part of the research in this thesis aims to provide an overview over the processes involved in tendering by the contractor.

The decision-making in tenders is mostly based on experience (Akintoye, 2000). Even though numerous models have been developed to aid decision-makers during the tender, very few of them are used in practice due to their incompatibility with the actual course of action in tendering groups (Fayek, 1998). Problems with the strategy of experience-based decision-making can arise due to its tendency for bias and inconsistency (Mohemad et al., 2010), as well as due to the lack of experience teams will be presented with in case of new developments such as the change of criteria by the client. These challenges will be the basis of the second part of the research in this thesis.

1.3 Objectives

The objective of this thesis is to fill a part of the gap in research regarding decision-making in tenders by showing what decisions are made during the tender phase, how they are made, and what they are influenced by. Furthermore problems and challenges that can arise during tender decisions are pointed out, especially with regard to new preconditions and requirements influencing an established decision-making process. Lastly, some suggestions regarding how the organisation can improve the decision process and facilitate transitions for tender teams are made. Special consideration is thereby given to a shift in focus from cost to qualitative parameters.

1.4 Research Questions

The research questions aimed to be answered with this thesis are:

1. How are decisions made by the tender-team during the preparation of an offer?
2. What challenges are encountered during the decision-making process in the tendering-phase, especially regarding changing client criteria?
3. How can the organisation help tender-teams with improving or changing their decision outcomes?

1.5 Limitations

Decision-making is a broad field of research and heavily interconnected with other fields such as psychology, sociology, organisational research and management research. The focus of this thesis is narrowed to individual and group decision-making and connected challenges. Both individual and group decision-making are investigated within the concept of naturalistic decision-making. Organisational decision-making will only be considered from the perspective of individuals and groups within the organisation that make the decisions. There will be no focus on communication styles, but instead only the content of communication such as feedback and input. Furthermore the involvement of the field of knowledge and learning will be limited to the aspects directly connected to experience and learning from it. Other areas of research such as culture and leadership will not be touched upon.

Limitations imposed by the case-study for this thesis are caused by the sample consisting of one consortium of departments involved in major infrastructure projects within one contractor. All research has been conducted in Sweden and with respect to the Swedish market. The amount of clients is very limited in infrastructure projects, as they are usually public institutions.

2 Theoretical Framework

The theoretical framework provides the underlying and general knowledge necessary to understand the results, analysis, discussion and conclusion of this thesis. It furthermore presents the theoretical structure within which the findings of research were analysed. The first part of the theoretical framework provides general information regarding public procurement, tendering in the construction industry, contract forms and project delivery methods. The second part presents research on decision-making by individuals, groups and in an organisational context. Biases are highlighted up as an aspect of individual and group decision-making regarding challenges.

2.1 Public Procurement of Large Infrastructure Projects in Sweden

As a member of the European Union, Sweden has to adhere to the EU-public procurement laws (Strand et al., 2011). These laws provide the opportunity to use one of two different award criteria: lowest price, or economically most advantageous offer (SFS 2007:1091). In the latter case, a combination of quantitative and qualitative criteria is used. Both their content and their evaluation have to be documented (Strand et al., 2011). Public entities, such as the Swedish Transport Administration, are furthermore not allowed to discriminate against suppliers from outside of Sweden. They have to provide the same conditions for all applicants, only include conditions that are necessary for the task, and have a transparent selection process (Trafikverket, 2016a; SFS 2007:1091). Usually standard agreements such as the Swedish AB 04 for design-bid-build projects and ABT 06 for design-build contracts are used by the Swedish Transport Administration (Trafikverket, 2016b). In case the special nature of a project, deviations from these standard agreements can occur. They should, however, be kept to a minimum and can be found in the section of administrative regulations in the tender documents (Trafikverket, 2016c). Furthermore, requirements regarding financial, social and environmental sustainability in Trafikverket are embedded in policy documents that are to be followed during the procurement (Trafikverket, 2016d).

2.2 Tendering Process

The tender process is located relatively early in the life-cycle of a structure. Walker and Lloyd-Walker (2012) identified in total four life-cycle phases. In phase 1 the strategic need for a structure is determined, followed by phase 2, in which feasibility is assessed and concepts are developed. In the last part of phase 2 methods are planned and costs estimated. This phase can be seen as the tender-phase in turnkey-contracts, see Figure 1. Turnkey-contracts include both the design and the construction of a project (Haswell & De Silva, 1989). Thereafter phase 3, the project delivery, begins, in which detailed planning, construction and hand-over take place. Phase 4 includes the operation, and finally the disposal of the structure (Walker & Lloyd-Walker, 2012). The involvement of contractors in the different phases can vary with contract types and project delivery methods (Haswell & De Silva, 1989).

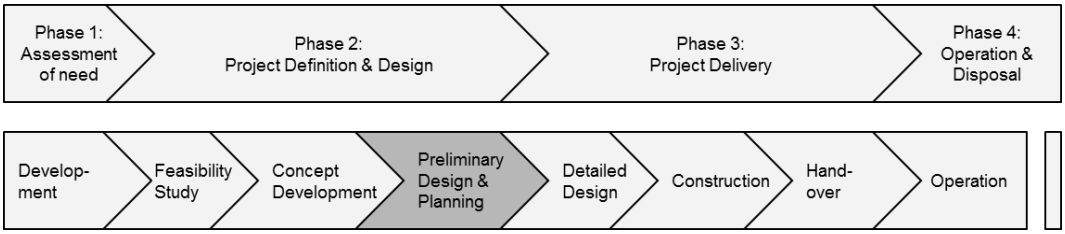

Figure 1 Lifecycle of a structure, based on Walker and Lloyd-Walker (2012)

The tender process itself is, according to Betts (1990), based on a project's detailed analysis and an estimation of the costs of executing the respective works. Laryea (2012) describes the basic characteristics of tendering by a focus on lowest price, time-pressure, ambiguous tender-documents, and often even unethical behaviour by the involved parties. Betts (1990) developed a model of the detailed processes within a tender, see Figure 2, beginning with a decision to bid or not bid in a tender, made by the contractor. This decision is followed by acquiring information about the project, amongst others through the tender documentation provided by the client. In this phase, core areas are identified and the structure and time plan for the tender is set up (Betts, 1990). The process then splits up into three core areas: determining necessary resources, necessary labour, and possible methods. In these areas decisions regarding the use of subcontractors, amount and type of labour, as well as the preferred method are made (Betts, 1990). Afterwards the order of tasks is optimised and cost estimates for all factors are conducted. In final reviews regarding the cost estimates, methods, time plan, and handling of risks and uncertainties senior management prepares to transform the cost estimates into a final tender sum (Betts, 1990). The decision on the final tender sum is the last step of the tender before handing it in to the client, who then has to decide which offer to choose. The involvement of senior management in approval of estimates is also described by Akintoye and Fitzgerald (2000), who relate the intensity of involvement to the overall size of the project. Other areas for reviews include taking market conditions and risks into account in meetings described in more detail by Laryea (2012). Mid-tender reviews are used by employees involved in the tender to explain their approaches and receive more input regarding expectations and ideas on the topics of administration, contract, finances, methods and possible issues (Laryea, 2012). The final reviews cover similar topics, but are used more as a basis for the final price, as for improvement and inspiration regarding the tender (Laryea, 2012). Both are a help in the decision to bid or not in a tender. However, in spite of their usefulness in minimising risks, the meetings are considered as a cost-factor and should be optimised in terms of duration and participants (Laryea, 2012).

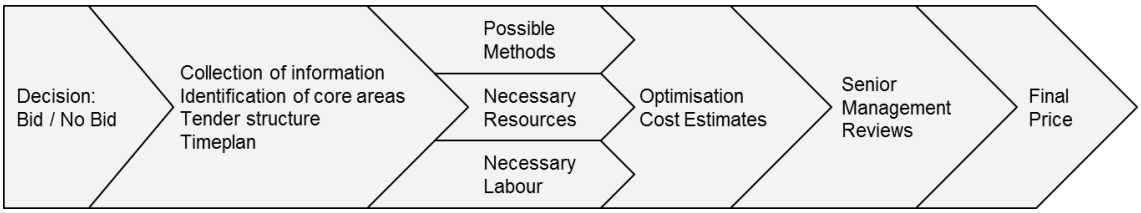

Figure 2 Simplified version of the tendering process, based on Betts (1990)

The accuracy of the estimations in the tender are, according to Akintoye and Fitzgerald (2000), depending on the previous experience of a contractor in the specific type of project, as well as the size of the contractor. Larger contractors are more likely to have a structured and well-organised department concerning themselves with estimates in tenders. On an individual level a lack of experience of site work among the tender employees also commonly contributes to mistakes in accuracy (Akintoye, 2000). The contractors, however, see the main cause for inaccurate estimates in insufficient tender documents provided by the client, instead of their own lack of structure or experience (Akintoye & Fitzgerald, 2000). Laryea (2012) criticises competitive tendering for its wastefulness, as there inevitably will be a waste of resources, when several companies are preparing tenders for the same work and only one is to win it. Furthermore it is claimed that the process is prone to end in resource-wasting disputes, not alone due to the nature of the tender documents it is based upon (Laryea, 2012).

2.3 Contract Types

The contract type of a project determines the payment method between the client and the contractor (Haswell & De Silva, 1989). Examples for common contract types in construction are *Unit Price*, *Time and Materials*, *Cost-plus* and *Fixed price* (Haswell & De Silva, 1989). *Unit-price*, or bill of quantities, contracts include a detailed list of all work required in a project is prepared by the client. The approximate quantities of work are estimated, for which the contractor prepares an offer with unit prices or rates. The contractor receives payment in accordance with the unit prices after the work has been executed. Changes in quantities have to be negotiated between client and contractor. *Time and materials* contracts are also based on unit prices and rates, however, no quantities are agreed upon beforehand by the parties. (Haswell & De Silva, 1989). *Fixed price*, or lump sum, contracts, are based on a scope of work that the contractor agrees to provide for a specific sum, which determines the value of the contract (Haswell & De Silva, 1989). *Cost-plus*, or cost/reimbursement contracts are based on contractors being reimbursed for their costs and receiving an additional fee to cover overhead and profit (Haswell & De Silva, 1989). In addition, the client and contractor can agree upon a guaranteed maximum price. If the total cost lies above the guaranteed maximum, the client can reduce the contractor's fee by an agreed upon percentage. If the total cost is lower than the guaranteed maximum, a bonus for the saved cost can be paid out to the contractor (Haswell & De Silva, 1989). The contract methods are often closely connected to the chosen project delivery method, due to compatibility reasons (Haswell & De Silva, 1989).

2.4 Project Delivery Methods

Several different project delivery methods are applied in the Swedish construction industry. They vary in factors such as the degree of contractor-involvement, or project structure. Examples are the relatively established design-build method and the traditional design-bid-build method.

In a design-build project delivery, the client chooses a single entity to be responsible for both the design and the construction of the project. The level of detail in the information provided by the client can differ significantly, as can the financing structure (Hale et al., 2009). In design-bid-build projects separate entities are

responsible for design and construction respectively (Gransberg et al., 2006), see Figure 3.

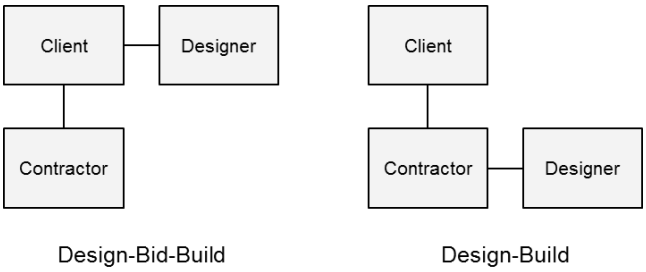

Figure 3 Project delivery methods: Design-Bid-Build and Design-Build

2.5 Early Contractor Involvement

An alternative to traditional design-build (DB) and design-bid-build project delivery systems is Early Contractor Involvement (ECI), as a type of partnering agreement. ECI projects can use either DB or DBB project delivery systems. In ECI projects, the client appoints a contractor early on in the project to provide support with planning, the assessment of buildability and estimation of costs (Nichols, 2007).

The main differences between traditional DB and DBB, and ECI lie in the level of cooperation between the client and the contractor, the point in time at which the contractor becomes involved, as well as the method of determining the total cost. An example for the differences between the traditional DB project delivery and ECI can be found in Figure 4. In traditional DB projects, usually a price is provided by the contractor as a part of the offer and provides the only or one of the selection criteria for the client (El Wardani et al., 2006). In ECI both parties agree upon a target price together after collaborative planning and estimating in the design-phase (Nichols, 2007). Since the target price in ECI is set after the first collaboration phase, the client has to decide which contractor to work with mostly based on qualitative parameters.

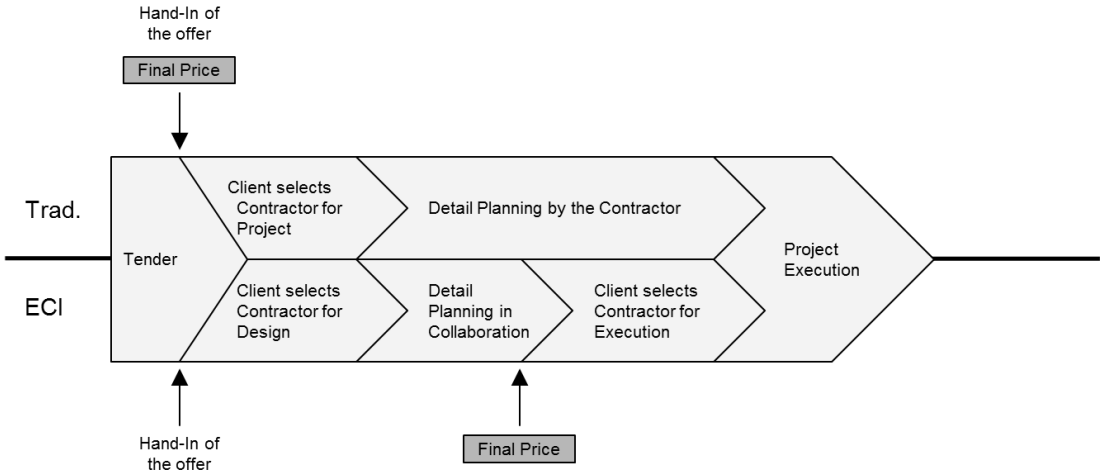

Figure 4 Comparison: Design-Build in traditional and Early Contractor Involvement projects

2.6 Decision-Making

In construction-related research on decision-making three types of techniques are classified: judgmental, where decision-makers rely on expertise and experience to different degrees of subjectivity; rational, where formal techniques or mathematical models provide the basis for decisions; and emergent, where the consensus is based on interaction between multiple participants in the decision-making process (Bakht & El-Diraby, 2015). Akintoye's (2000) research shows that in tenders the decision-making is mostly based on experience, which corresponds to the judgmental technique from Bakht and El-Diraby (2015). The lack of usage of the technique of rational decision-making in tendering is described by Fayek (1998) that argues that even though numerous models have been developed to aid decision-makers during the tender, very few of them are used in practice. Fayek's (1998) research in tendering corresponds to the findings of Klein (2008) arguing that people are in general reluctant to use tools in decision-making and will instead turn to experience.

The research by Klein (2008) falls within the area of naturalistic decision-making, which aims to 'describe how people actually make decisions in real-world settings' (Klein, 2008, p 456). The research of naturalistic decision-making partly stems from research on biases, that had shown people's reluctance to use models, and the effect this has, in decision-making (Klein, 2008). There has been a number of models within the frame of naturalistic decision-making, they are very similar and all see the large role of cognitive processes in decision-making (Klein, 2008). In light of the current state of research on decision-making in construction, and more specifically in tendering, the theoretical framework of this research will focus on describing the cognitive processes of naturalistic decision-making, as well as the biases connected to these processes. In addition to that, the three levels of individual, group and organisational decision-making, as well as their strengths, weaknesses and connections provide a framework for the decision-making process within organisations.

2.6.1 Individual Decision-Making

Within the framework of naturalistic decision-making there is a wide support in literature for the view that humans have two processes in the brain: one that is subconscious and pattern seeking and one that is deliberate and analytical (Salas et al., 2009; Sloman, 1996; Lundh et al., 1992). The two processes work simultaneously (Salas et al., 2009) and vary in domination based on personal preferences (Salas et al., 2009; Sloman, 1996), problem type and personal knowledge (Sloman, 1996). The two decision-making processes are part of the human cognitive system, where humans manage information through perception, memory, thinking and lingual processes (Lundh et al., 1992).

The first of the two decision-making processes, which is the subconscious and pattern seeking, is described by Sloman (1996, p.3) as: "Sometimes the conclusion simply appears at some level of awareness, as if the mind goes off, does some work, and then comes back with a result". This analogy is describing the way our subconscious identifies patterns and systems based on knowledge stored in the subconscious. The conscious mind might not be aware, that this knowledge is stored. These theories are supported by Lundh et al. (1992) and Salas et al. (2009). Lundh et al. (1992) further

describes how this process, also referred to as intuition, selects the information that our subconscious deems relevant for the problem. This information is then used by the conscious mind to analyse the problem. Decisions on what information to use are thereby made before the conscious mind starts analysing, or is consciously aware of any decision-making. The subconscious and pattern seeking process is useful for judgmental and complex issues as well as under time pressure (Salas et al., 2009; Lundh et al., 1992).

Salas et al. (2009) and Lundh et al. (1992) describe the second of the two decision-making processes, which is the deliberate and analytical, as one where the brain consciously reasons and uses logical thinking. The brain follows rules, such as those of society, logic and nature (Sloman, 1996). This process is more time consuming than that of the subconscious and it can only take into account a limited amount of information (Salas et al., 2009), according to Lundh et al. (1992) normally no more than 5 factors simultaneously. Further, the deliberate and analytical process decides on a method for processing the information selected in the subconscious process. The deliberate and analytical process is the most efficient option for straightforward, simpler tasks (Salas et al., 2009).

Intuition is, as previously stated, a description of the subconscious decision-making process. An additional aspect of intuition is its critical role in expertise decision-making, the ability to create expert performance (Salas et al., 2009). The authors further discuss how expert-intuition builds upon the concept of intuition combined with the concept of expertise, where expertise is defined as having an extensive knowledge or capability within a certain domain acquired through practice over time. Salas et al. (2009) describe the process of expert-intuition as expertise being stored in the subconscious, which is then through the cognitive process of intuition made useable in decision-making. According to Salas et al. (2009) the expert-intuition stems from an individual's extensive knowledge and intuition within a specific domain based on large amounts of repetition and experience within that domain. The authors further explain how this makes it possible for an individual to take into account experience without actively recalling it, thus using a larger number of factors than would be possible in the limited conscious decision-making process. The subconscious process helps the individual in identifying the uniqueness of the situation and to focus on factors, which will improve the quality and efficiency of the decision-making (Salas et al., 2009). Compared to a person having expert-intuition a novice would need more time and information to decide on the next step (Salas et al., 2009).

2.6.1.1 Biases in Individual Decision-Making

Together, the deliberate and the subconscious decision-making processes create a selection of information and methods in problem solving and decision-making. This will, as Lundh et al. (1992) points out, create a solution but does not, contrary to algorithms, guarantee correctness. It merely creates an answer and occasional errors in thoughts and inference are made. These errors partly stem from biases that are embedded deeply into the thought process and usually stay undetected by the respective person (Tversky & Kahneman, 1974). Examples for these biases are Confirmation Bias, Framing Bias, Status-quo Bias, Anchoring and Sunk Cost Fallacy, which are, to some extent, impacting each other.

The concept of Confirmation Bias describes the issues caused by an unintentional search or interpretation of evidence in a way that confirms pre-existing beliefs (Nickerson, 1998). Contradicting information and evidence is not searched for and in some cases even ignored or reinterpreted in a way that supports the favoured hypothesis. Non-supportive arguments that are acknowledged are considered with less impact than they rationally should, giving more weight to supportive arguments in respect (Nickerson, 1998). Another form in which Confirmation Bias can influence a decision is the assignment of weight to information that is related to the pre-existing belief, but not diagnostic. Non-confirming information is furthermore under stricter scrutiny. This is not just the case for hypothesis in which the person is personally invested in, but also in those in which there is no personal stake involved (Nickerson, 1998). One possible cause for this bias is the tendency to collect information to either confirm or disprove one hypothesis at a time. Different hypotheses or the possibility of a hypotheses being true or false simultaneously are not considered. Another cause is the primacy effect, which Nickerson (1998) describes as the tendency to form an opinion based on information collected early on in the process and then evaluate information obtained at a later point in time based on this initial opinion.

The importance of the Framing Bias has been emphasised by Tversky and Kahneman (1981). It is described as the influence of the wording of a problem. If the problem is formulated in a way that a choice resembles a loss, the subject is far more likely to make the risk taking choice in order to avoid a loss. Regarding choices involving gains, however, subjects often make their decision in a risk-averse manner. This means that a rephrasing of a problem can cause a significant shift in the outcome of the decision.

The Status-quo Bias describes the observation that individuals disproportionately often decide to keep the situation in its current state instead of introducing change. Samuelson and Zeckhauser (1998) provide several reasons for this behaviour. Making the same decision can be rational, if the situation setting is independent with an identical setting as the earlier time a decision has been made. Another reason could be that the current situation is known, whereas another situation would have to be discovered before it could be considered, which corresponds to the Confirmation Bias. Furthermore losses are weighed heavier than gains in decision-making. This loss aversion makes people less likely to choose a new alternative for possible gains, as the fear of possible losses connected to the new alternative is considered more important for the decision. In connection to this, individuals feel more negatively for negative consequences that stem from a wrong decision, than those caused by indecision and inaction. This regret avoidance leads to a tendency to keep the current situation by instead of making an active decision to change it (Samuelson & Zeckhauser, 1998).

Anchoring is described by Tversky (1974) as a bias where an initial value obtained by a person influences the estimation regarding a topic they have to make. The person uses an initial value as a starting point and adjusts it to obtain a final answer to the actual question. This is the case, even if the initial value is not based on rational information, but completely random. Tversky and Kahneman (1974) point out, that the adjustments made to the initial values are usually not sufficient, leading to inaccurate assessments. This becomes a significant problem in planning-processes, such as the design of a building project. Planning-processes have a conjunctive

character, which means that a series of events must be successful in order to achieve overall success (Tversky, 1974). Even in case of high single event probabilities of success, the overall success-probability may be relatively small, especially when the amount of single events is high, like in complex planning situations. Due to the high single-event probability the overall probability is overestimated, causing an unjustified optimism about the success of a project. The opposite is true for disjunctive events, such as the failure of a complex system, where small single-event probabilities are added up to an underestimated, relatively large overall probability (Tversky, 1974).

Sunk Cost Fallacy is one of the possible reasons for the Status-quo Bias. It describes the irrational behaviour of persons deciding to keep investing into a decision against a better, rational judgment (Arkes & Blumer, 1985). Even in cases where the prior investments objectively has no influence on a current decision, the decision-maker often feels that there has been too much invested already to quit an endeavour (Arkes & Blumer, 1985). As the main reasons Arkes and Blumer identify the desire of decision-makers not to appear wasteful and a feeling of having invested too much to quit, therefore projects that should be stopped are continued until completion in spite of evidence that an abortion of the project could prevent severe losses.

2.6.1.2 Bases for Individual Decision-Making

The amount, as well as the structure of the information used as a base for a decision plays a central role in the quality of the decision-making. Increased amounts of information cause decision-makers to be more selective when acquiring information, thus leading to less information being processed and a decline in decision quality (Lurie, 2004). Furthermore, differences in the structure of information impact the quality of decision even if other factors such as the amount of alternatives and attributes is constant. These effects are increased through time pressure during the decision-making process (Lurie, 2004). The process of making decisions in a case-based environment is impeded further by the fact that the conditions under which the decisions are made change through every decision, distorting the situation and preventing knowledge about the possible outcome of other choices (Brehmer, 1990).

As described in Section 2.6.1, additional to information in complex settings expert-intuition is an efficient way of making decisions (Salas et al., 2009). It is therefore important for complex organisations to understand how experts develop their expertise and the framework that facilitates this development (Salas et al., 2009). Salas et al. (2009) state that experience alone does not guarantee that the individual develops expertise. An issue with experience-based decisions is that subjects often overestimate their own experience, causing an unjustifiable confidence in their own abilities to make the best decision (Brehmer, 1980).

Brehmer (1980) points out that research found that even though people have no experience regarding the validity of a rule, the plain finding of a rule suffices for subjects to believe that appropriate decisions can be made. Engineers have been identified by Kidd (1970) to be a group of professionals with a tendency for overestimation in judgments within their area of expertise. Nickerson (1998) points out, that other professional groups such as weather forecasters are more aware of their level of expertise and attributes that awareness to the immediate feedback they receive

for their predictions. Salas et al. (2009) endorses the idea that there is a direct link between the availability of feedback in a domain and the learning from experience.

Furthermore, Brehmer (1990) supports the idea of simply learning through experience has been criticised in research as flawed. But also points out that, before learning from experience takes place, it has to be known and defined what it is that should be learned from a situation. When concepts are complex and contain numerous dimensions, many possible explanations for an outcome arise, making it difficult to see if applied rules are invalid in the specific case, or even in general (Brehmer, 1990). Thus learning from a series of cases can only happen, if the cases are used for active testing of hypotheses (Brehmer, 1990).

Salas et al. (2009) combines the theories of the previous authors, claiming that feedback and planning, or goal setting, are crucial for expert-intuition development in modern and complex organisations. Salas et al.'s (2009) theory is referred to as *Deliberate Practice* and is described as the procedure where individuals both execute multiple tasks that are similar in nature and seek information from existing experts, within a domain. The process of setting up goals helps the individual to get a clear focus and to understand later feedback (Salas et al., 2009). This can be compared to Brehmer's (1990) theory on hypotheses. To explain the importance of feedback Salas et al. (2009) describes how the individual uses feedback from external sources to improve the subconscious decision-making processes, by storing knowledge and thus extending their competence. It is then further highlighted that the individuals are driven by the will to improve their performance in later tasks within the domain. The feedback part of *Deliberate Practice* can be compared to Nickerson's (1998) findings, showing that individuals provided with feedback on their work improve their expertise. If the individuals in an organisation are not performing *Deliberate Practice*, they will not learn from experience (Salas et al., 2009) and hence not improve or develop their decision-making within a domain.

2.6.2 Group Decision-Making

Decisions can be made by different types of decision-makers, amongst which Bakht and El-Diraby (2015) classify three types: single decision makers, and hierarchies or networks of decision-makers. The last two fall in the category of group decision-making, which is used as a tool to access a larger pool of information through exchange between the group members (Bakht & El-Diraby, 2015). The expert-intuition observed on an individual level can be seen and increased in this exchange, where group members collaborate in finding patterns (Salas et al., 2009). The exchange also enables the different individuals to identify gaps in each other's intuition based decisions; this however requires the members to be considered experts within the domain (Salas et al., 2009). Bakht and El-Diraby (2015) consider the information exchanged as something explicit that influences the group members' initial preferences and opinions. It can be possessed by three different parties. Common information is possessed and generally accepted by all group members before the decision-making begins. Unique information is only known to one member of the group in advance. Partially shared information is known to a part of the group members before the decision-making process (Dennis, 1996). In the case of unique and partially shared information, their exchange is central to group decision-making (Dennis, 1996). Salas et al. (2009) reinforces the importance of exchange, stating that

communication and coordination are crucial to enable the competences of all group members. As vital Salas et al. (2009) also declare the importance of members knowing and recognising their own and other team members roles and knowledge within the group. However, much information known only to some of the group members never gets shared in discussions (Stasser, 1992). This issue will be explained in more detail in Section 2.6.2.1.

Observations made by Davey and Olson (1998) include that in a professional group setting goal-oriented decision-making and the respective methods are preferred by participants. There was no problem found with discussing issues directly and negotiating solutions in a confronting manner. Another aspect of group decision-making, the decision scheme, has been investigated by Green and Taber (1980), who found that the feeling of participation varies with the method chosen to obtain a solution. They further state that the feeling of personal involvement was highest in consensus decisions, whereas decisions made by a nominal or a majority vote gave lower feelings of participation by the group-members. This observation was confirmed by, amongst others, Devine et al. (2001), who described an increase in confidence in and satisfaction with unanimously made decisions, when compared with majority decisions.

2.6.2.1 Biases in Group Decision-Making

As described in the Section 2.6.1.1, biases are subconsciously embedded into the process of decision-making. For groups, a theory that is widely applied to embedded processes leading to faulty decisions is Groupthink (Rose, 2011; Flippen, 1999). The concept of Groupthink was proposed by Janis (1972) and described as a group's inability to consider adequate alternatives and criticism of a decision before reaching consensus. Even though Groupthink has been widely accepted since its introduction, Rose (2011) and Flippen (1999) both discuss how experiments aiming to prove it have been inconclusive, creating a controversy around the concept. Janis (1972) presented symptoms, facilitators and consequences of Groupthink (Rose, 2011; Flippen, 1999). Common symptoms and facilitators can be group cohesion, viewing individuals outside the group as enemies, leadership not being impartial, and low self-esteem of individuals and group. Group cohesion is the part that has been most widely questioned (Rose, 2011). Groups not conformed to Groupthink can be identified through encouragement within the group and by the leader to offer criticism, present own ideas and to consult with experts from outside the group (Flippen, 1999).

Even though cohesion within a group is not unanimously proven to create Groupthink, Martin-Alcazar et al. (2012) explain how group diversity has been proven to increase desired decision-making results. The authors do however point out the need for companies to be aware of the challenges connected to increasing diversity for example difficulties in reaching consensus, creating an open communication or solving conflicts. By a number of authors diversity has been categorised into two major areas: Demographic Diversity, which encompassed factors such as age and gender and Human Capital Diversity, which includes, for example, competencies and experience. Human Capital Diversity mainly affects cognitive processes and is therefore especially important for decision-making with a high level of complexity (Martin-Alcazar et al., 2012). This is in accordance with the theories on cognitive decision-making on an individual level. Demographic Diversity is assumed

to influence the individual's cognitive process preference (Martin-Alcazar et al., 2012) thus also increasing the probability of Human Capital Diversity.

According to Dennis (1996), there are three activities group members engage in during the discussion process before making decisions: recalling, exchanging and processing information. Each of the activities confronts the participants with specific issues:

Information recall harbours a probability bias, since the more people have an information, the more likely it is remembered and brought forward in the discussion (Stasser & Titus, 1987; Greitemeyer et al., 2006), thus influencing group discussions towards common information.

Information exchange harbours the issue of not all recalled information being shared, because firstly, participants need to make the choice to contribute the information, and secondly, there needs to be an opportunity to provide the information. Especially in a verbal exchange, where participants take turns speaking, information does not get shared due to being forgotten while listening to others, or a seeming loss of relevance over the course of the conversation (Dennis, 1996).

Information processing can happen in two different ways. It can be actively processed by a participant through integrating it into the situation and their own preferences, or it can be peripherally processed through presentation or reactions of other group members. Preferences can hereby be influenced by a desire to follow the majority, minorities often need to be extremely persistent to influence the preferences of group members (Dennis, 1996).

These three issues of remembering, having an opportunity to share and actually process the information provide the basis for the Sampling Bias. The Sampling Bias makes group decisions prone to rely on common and shared information instead of using the advantage of information diversity provided by the group members. The benefits of group decision-making, and thus the justification for spending additional time and resources when compared to individual decision-making, disappear. Even if the group is aware of the fact that their individual information is different, the Sampling Bias is not reduced (Greitemeyer et al., 2006). A countermeasure can simply be a long information exchange period, as more members share a larger variety of information in order to avoid redundancy (Greitemeyer et al., 2006). A further consequence of the Sampling Bias can be the premature decision-making through reaching a consensus on a suboptimal alternative, because it conforms to the individual group members' pre-discussion information. It is highly unlikely that information countering this early-found consensus is shared among group members (Greitemeyer et al., 2006)

2.6.3 Organisational Decision-Making

Organisational decision-making has the goal of finding optimal solutions for a problem within an organisation (van der Horst, 2002). Depending on the complexity of the problem, the decisions can be made by either an individual or a group that is part of the organisation. Strategic long-term issues are most often subject to group decision-making (Zhang et al., 2015). The ambiguity of information and preferences within organisations, as well as the longitudinal context created by decision-makers

being involved in on-going processes and the consequences of their decisions have a large influence on how decisions are made (Shapira, 2002). Furthermore the large influence of incentives, the repetitiveness of many tasks and decisions, as well as underlying conflicts through internal politics and opposing agendas provide an entirely different background before which decisions are made, when compared to non-organisational decision-making (Shapira, 2002).

Organisational decision-making can be seen as a form of both individual and group decision-making, since organisations as abstract entities are not able to make decisions, but rather the people they consist of (van der Horst, 2002). However, in order to understand decision-making within organisations, it is important to investigate and understand the frame within which the processes take place. Mainly, four different models have been developed with the organisation as the unit the analysis is based on: rational, political, procedural and anarchic decision-making. This separation of different models is similar to how Shapira (2002) describes how decisions are made in organisations: rationally, rule following, sense making and evolutionary.

Rational decision-making is described as an iterative process, in which information is gathered in order to lessen the effects of uncertainty, and then acted upon accordingly (van der Horst, 2002). A set of defined criteria provides the background against which information is evaluated. This evaluation of information provides a best alternative, which is then selected. Through further evaluation of the decision outcome the criteria are optimised for following decisions (van der Horst, 2002). Through a deductive process without biases the optimal solution is found. This process is based on the knowledge actors possess regarding alternatives, consequences, the ordering of preferences, as well as the rules decision-makers follow (March, 1991). A common issue with the model of rational decision-making is the inability of individuals or organisations to gather and take into account all available and relevant information. This restriction has been investigated in more detail by Simon and Barnard (1957), resulting in the concept of bounded rationality, in which individuals act rationally based on their own strongly simplified version of their environment. In an organisational background it is usually not solely the individual with certain experiences and knowledge that created the frame for bounded rationality, but rather it is the organisation that selects what is taken into account in order to make a decision (van der Horst, 2002). This selection regarding what to take into account, set up by the organisation in order to steer and influence decision-making processes aim to integrate past experiences through which the achievement of the organisation's objectives can be maximised (van der Horst, 2002). March (1991) further points out the issue, that preferences are assumed to be subjectively absolute, stable, consistent, precise and not influenced by the choices they are applied to in the model of rationally made decisions, which, however, is not the case in reality.

The model of procedural decision-making is another iterative model and based on a series of processes that need to be undertaken in order to eventually reach a decision (van der Horst, 2002). The first step hereby is the understanding of the issue, followed by the discovery of an appropriate solution and eventually a decision (van der Horst, 2002). According to March (1991) the factors which the finding and selecting of appropriate solutions is based upon are the situation, the decision-makers identity and the matching in deciding which decision is appropriate with a certain identity in a

certain situation. This differs significantly from the rational decision-making, in which the consequences of choices are evaluated and not their appropriateness.

The basis of appropriateness of a choice is shared by the model of political decision-making, which is usually applied in normative decisions (van der Horst, 2002). Instead of finding a solution through applying an optimal procedure, the decision is made in normative situations through value judgments. The moral acceptability and justifiability of a decision is the central aspect (van der Horst, 2002).

In contrast to the other three decision-making models, which are based on assumptions regarding a certain stability, human cognition and the ability to react to complex situations, the garbage can model, developed by Cohen et al. (1972), takes the fluidity of conditions within the organisation into account. Decisions are, according to the garbage-can model, influenced by unclearly articulated and changing preferences, ambiguous environments, the selective participation of decision-makers in decisions due to their limited time and energy, as well as the inconsistency and irregularity of organisational learning. These influences lead to an anarchic decision-making process that is difficult to steer and simulate, but closer to the reality (van der Horst, 2002).

3 Method

3.1 Research Approach and Design

Research for this thesis has been conducted in an explorative manner due to the large gaps in literature about decision-making in the tendering process. Based on this explorative nature of the research, an approach with an inductive tendency was chosen. As opposed to deductive research, where a hypothesis is developed based on theory and then either confirmed or disproved by collected empirical data, in inductive research collected data is used to develop corresponding theory (Bryman & Bell, 2003). The design of the study is qualitative, which is the research strategy recommended for inductive research by Bryman and Bell (2003). Qualitative research lays an emphasis on words instead of data in form of numbers, which is typical for quantitative research (Bryman & Bell, 2003). A further reason to choose a qualitative research design is its focus on processes in a natural setting instead of outcomes in artificial settings (Bryman & Bell, 2003), which corresponds to the objective of researching decision-making processes in the tender department of a contractor. Qualitative research is claimed to provide more in-depth results (Bryman & Bell, 2003) and rich descriptions of the studied subject (Merriam, 2014). It is, however, more subjective than quantitative research and the possibility of generalising the results is not naturally given (Bryman & Bell, 2003).

The research for this thesis took place in the shape of a case-study over the course of 20 weeks. Due to restrictions regarding time and opportunity the research is conducted as a single case-study. The choice of a case-study as a research-method corresponds to the chosen qualitative study design, as it provides the opportunity to collect intensive and detailed data (Bryman, 2008). A case-study is described by Merriam (2014) as an "in-depth description and analysis of a bounded system" (p.40). This is a suitable research method to investigate processes within an organisation and by Yin (2003) suggested for researching current events. Further advantages of case-studies pointed out by Merriam (2014) are its ability to investigate complex social units with multiple potentially important variables and its origin in real-life situations. Limits to the quality of a case-study are mainly set by the researchers' characteristics, as the researcher is seen as the primary instrument in the collection and analysis of data (Merriam, 2014). A disadvantage with single case-studies is the difficulty to generalise the findings. However, Merriam (2014) points out, that results that can be generalised are not the only results that can further research on a topic and that the impact of single examples is widely underestimated. Disadvantages of single case-studies, as opposed to multiple case-studies, is the lack of comparable data to draw conclusions (Merriam, 2014). An advantage of choosing a single-case-study for this research is the opportunity to gather more in-depth data (Merriam, 2014). The limited time, the explorative character of the research conducted, as well as the knowledge gaps in the field made the choice of a more detailed data collection in a single case-study preferable over a broader, but also shallower collection of data that would have been possible in a multiple case-study. The level of analysis for the case-study is the tender group, as well as to some extent the individuals within it.

3.2 Literature Research

Literature research was performed in parallel to the case-study in order to create a theoretical framework and to provide a context for the findings of the study (Dubois & Gadde, 2002). Focus areas of the literature review were decision-making, tendering processes within the field of infrastructure in the construction industry and client requirements in large infrastructure project. The main sources were published scientific articles and books, which have primarily been found through searches in databases for, amongst others, the following keywords: "expertise", "experience", "group decision-making", "organisational decision-making" and "decision-making biases".

3.3 Data Collection

Three types of data were collected and used during the case-study: secondary data in form of documents provided from organisations involved in the case-study, on-site observations, and interviews.

Secondary data was obtained from the organisation's intranet, regarding help approaching and conducting tenders, and overall goals, vision and objectives of the company. Further data was available in the form of tender documents and general policies from clients.

Observations are considered one of the methods to gather primary information in qualitative research, and differ from interviews through their first-hand experience character, instead of a reproduction of events that have occurred at an earlier point in time (Merriam, 2014). One of the disadvantages of observation as a method of gathering data is the selectivity and subjectivity of human perception (Merriam, 2014). However, the outsider-position as an observer in a case-study helps to perceive processes that have become routine for the subjects of the case-study, leading to a better understanding of other findings from, for example, interviews (Merriam, 2014). The results from observation can later be used for triangulation, in order to substantiate the findings (Merriam, 2014). The observations made during the case-study were gathered through occupying a work-space in a shared office with the tendering department, and common social activities, such as breakfast and lunch breaks.

The interviews were conducted in two phases and were conducted with employees involved in preparing offers and the corresponding decision-making processes. The purpose of the first phase containing three interviews was to get an overview of the tendering process and an insight into the decision-making by employees within it. The second phase of interviews had more detail-oriented questions regarding the content and methods of decision-making, inputs and feedback during the tender, as well as the implementation of new factors into the decision-making process. The setup in two episodes provided the opportunity to obtain both an overview over the topic, as well as in-depth individual opinions regarding the decision-making processes.

Interviews can be structured in three different ways: unstructured, semi-structured and structured, and are one of the primary methods to obtain data in qualitative research (Merriam, 2014). While structured interviews are mostly used in questionnaires and

large surveys, unstructured interviews are more common with exploratory research, or when the interviewer is less familiar with the topic. Furthermore, semi-structured or unstructured interviews correspond to a qualitative research approach, while structured interviews are more suitable for quantitative research (Bryman & Bell, 2003). Based on the background information that was obtained regarding the processes within the organisation, the first interviews were semi-structured with a structured introduction to obtain information about the employees' work experience, followed by suggestions for questions to keep the interview focused on the tendering process and its phases in a specific project. After connecting the findings from the first round of interviews with corresponding literature, questions for the second round of interviews were developed. The interviews in the second phase were also semi-structured with open-ended questions, providing the opportunity for interviewees to elaborate on specific topics. All interviews were conducted face-to-face in order to gain a deeper insight and provide opportunities for clarification and further explanation (Opdenakker, 2006). The interviews were carried out in Swedish, the native language of the interviewees, to facilitate answering to questions and make more in-depth answers possible. Recording the interviews supported a later transcription and analysis of the answers creating more accurate results than merely taking notes (Opdenakker, 2006).

For this thesis 10 interviews with 9 employees have been conducted. The length of the interviews ranged between 45 and 90 minutes. Among the interviewees were two tender managers and one commercial manager who was leading the process of a tender, two members of tender teams who held special responsibility for preparing the answers to questions regarding qualitative parameters in the tender, one regional manager, one district manager, one sustainability manager and one employee working with sustainable business development within the organisation. The interviewees within the tender teams were selected based on their experience with the tendering process, as well as with the integration of qualitative parameters. A further selection criterion was the employees' involvement in different projects within the department, in order to collect more varied data based on the different requirements and conditions of each project. The interviewed managers were selected, because they were direct superiors of the interviewees within the tender team and thus responsible for large parts of input and feedback to the tender team. The interviewees working with the implementation of sustainability were selected due to their work to integrate a new parameter in the tendering process on either an organisational or a project level. The selection of interviewees was limited by the time-frame of the thesis, the availability of the employees, as well as the size of the consortium of departments in which the case-study took place. Interviews with external influences on the tendering process, such as clients and consultants were not conducted, as their input and feedback are not subject to direct influence and change by the organisation.

The interviews, with employees directly involved with tenders, focused on the actual tender process, as well as the decisions and issues encountered. General managers and employees working with sustainability were mainly interviewed on input and feedback for the tender teams. The interview question can be found in Appendix 1.

3.4 Data Analysis

The data gathered from the interviews and observations, the documents, as well as the literature was analysed through a coding system, in order to find connections and contradictions between them (Kvale & Brinkmann, 2014). The terms used as codes were developed based on the data gathered from the first phase of interviews. Concepts that were identified as main themes used by the interviewees to describe decision-making were Experience, Expertise, Intuition and the Collection of information. Further recurring factors influencing the decision-making in the tender were Inputs and Feedback. The comparison of collected data was done by hand, without the help of coding software, which was not perceived as an issue with the amount of collected data. The relatively small sample size made this type of analysis possible. A content analysis was carried out, in order to focus on the content of the gathered data rather than the way it was expressed (Kvale & Brinkmann, 2014). This was chosen because the study focuses on processes and the actions of the interviewees not their feelings and interrelationships. Content analysis is described by Insch et al. (1997, p.3) as "a family of procedures for studying the contents and themes of written or transcribed text". Insch et al. (1997) recommend the method of content analysis for interviews, and name the coding of answers to open-ended interview questions as one of content analysis' purposes.

Kvale and Brinkmann (2014) state that transcription in itself is a translation between spoken and written language. To avoid further translations that risk interpretations based on language skills of the authors, the analysis was carried out in Swedish and results and selected quotes were then translated into English.

3.5 Reliability and Validity

Reliability and Validity are considered important criteria in assessing the quality of research. (Bryman & Bell, 2003). Even if mainly considered relevant in quantitative research, to some extent these criteria are applicable for qualitative research as well (Bryman & Bell, 2003). The criterion of external reliability, which is described by LeCompte and Goetz (1982) as the degree to which a study is repeatable, is considered difficult to achieve in qualitative research, as the results of the study are extensively linked to its social setting, which cannot simply be reproduced for another study. Internal reliability, which can be achieved through the agreement of multiple independent observers (LeCompte & Goetz, 1982), has been ensured through the individual analysis of interviews, observation and documentation by the authors of this thesis. The results of these analyses were later compared and discussed and conclusions drawn. The criterion of internal validity assesses the overlap between observations and the theoretical conclusions drawn from them (LeCompte & Goetz, 1982). Internal validity is considered a strength of qualitative research, as prolonged interaction with, for example, a case-study, is assumed to lead to a high congruence between observations and the respective conclusions (Bryman & Bell, 2003). External validity is considered an issue in qualitative research, as the results gathered by single case-studies and with relatively small sample sizes are hardly generalisable.

Validity and reliability of the results of this research have thus been approached mainly through triangulation of investigators and data (Merriam, 2014). Triangulation of investigators was executed through independent analysis of each interview by the two authors. Triangulation of data through gathering information with different methods, such as observation, interviews and documentation, from different projects and interviewees. Furthermore, secondary data was gathered from both a contractor and client perspective.

4 Case-Study

The organisation, within which the case-study took place, is a multinational construction company, whose headquarter is located in Sweden. With 11.000 employees in Sweden, it is one of the largest construction companies in the country and has participated in numerous large infrastructure projects. The division focused on is specialised in those major projects and collaborates with other departments within the organisation during those. The consortium of departments for large infrastructure projects usually consists of the departments for major projects, infrastructure and foundation works. For reasons of simplification, and the de-facto practice observed during the case-study, the consortium of departments will be considered as a single department in this thesis.

4.1 Tendering Organisation and Process

Four large infrastructure projects were studied in particular, regarding the processes and decisions during the tendering phase. All projects were estimated above 1 billion SEK. For three of them, the tender had already been handed in to the client, however, the tender for one project was still being prepared during the time the case-study took place. The client in three of the projects was the state, and the municipality in the remaining one. The contract type for all projects was a turn-key contract, however, different project delivery methods were used: three design-build-systems and one Early Contractor Involvement (ECI).

The clients' ranking of offers in the tenders was executed based on different sets of parameters. One design-build project was purely evaluated based on total cost, after a pre-qualification of competitors based on experience and company size. The two other design-build projects were awarded based on total cost and additional qualitative requirements, such as a description how risks would be approached and handled. The ECI project was awarded based on qualitative parameters and a percentage fee.

For design-build projects the company has a well-established procedure and structure for preparing an offer, see Figure 5. However, the qualitative factors, which more frequently have been included in the requirements, have induced slight changes. In the tenders including qualitative parameters, a further role was introduced to the team structure with the responsibility of ensuring compliance with the additional requirements and coherence between these factors and the remainder of the tender, see Figure 6. ECI is a relatively new concept for the organisation, and because of its difference to the common tender in design-build projects, a new approach had to be found. In order to adapt to the requirements the respective project delivery method sets for the team, two structures have emerged. The team structure for design-build projects has evolved over a longer period of time, whereas the team structure for the ECI project is an attempt to modify the existing structure to the new challenges and ways of working, see Figure 7. Due to the novelty of ECI projects, the design-build-projects provided the main focus in establishing the overview and details of the current tendering process for this thesis. The ECI project was mainly investigated from the viewpoint of introducing new methods into the tendering-process.

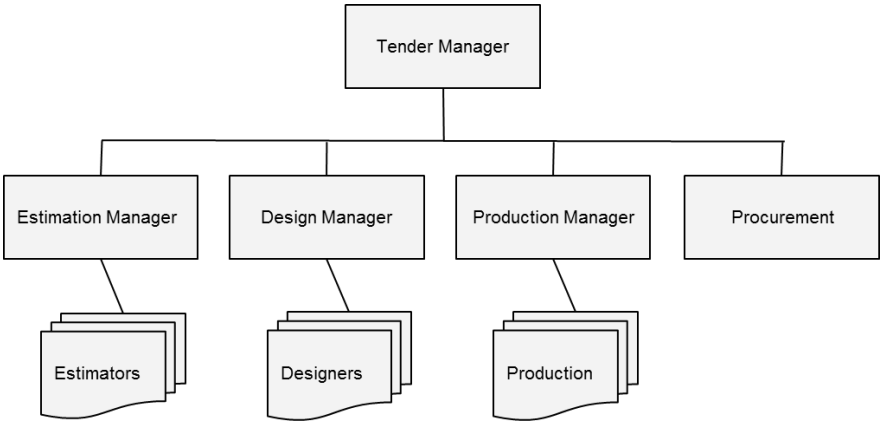

Figure 5 Team structure: Design-Build evaluated based only on price

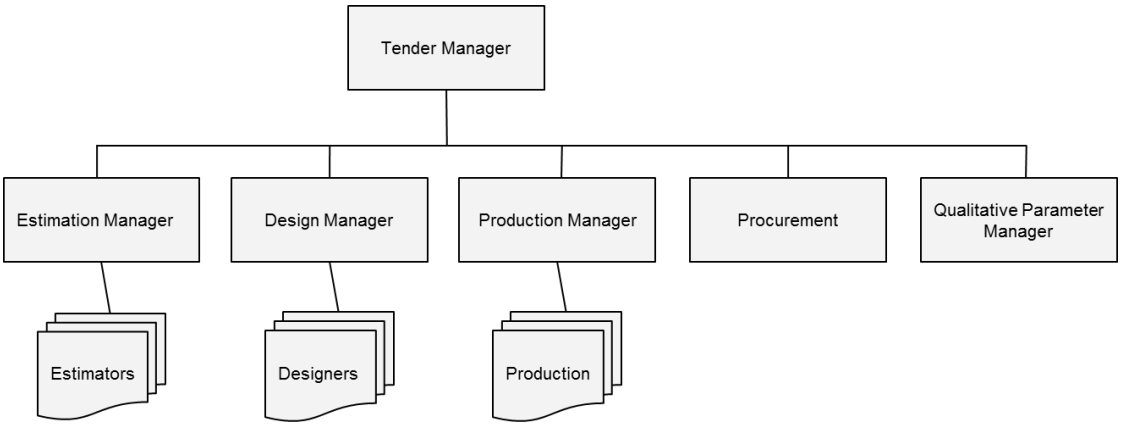

Figure 6 Team structure: Design-Build evaluated based on price and additional requirements

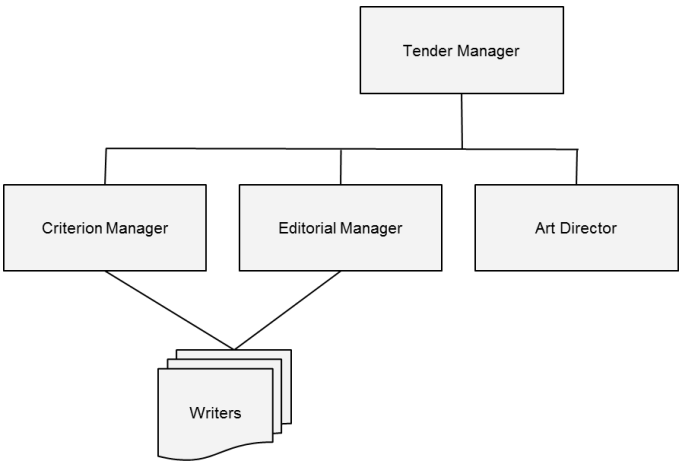

Figure 7 Team structure: Early Contractor Involvement

The tendering process within the organisation can, regardless of the contract-type, be split up into different phases, see Figure 8. These phases usually overlap considerably, due to an on-going iterative optimisation process during the tender.

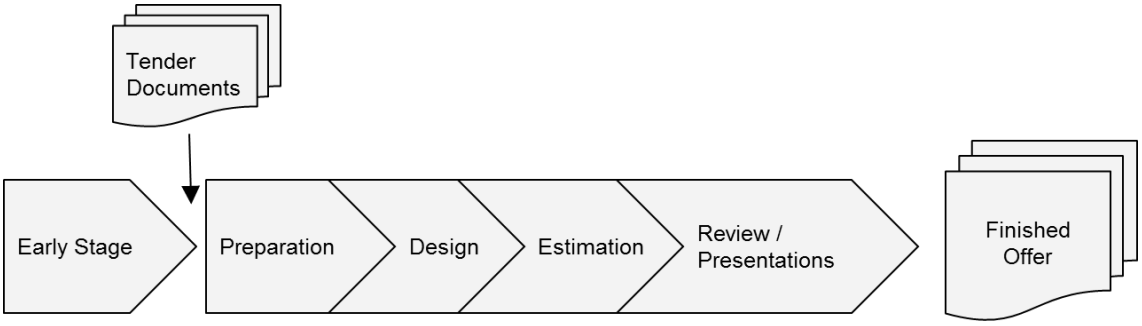

Figure 8 Phases of the tendering process

An overview of the phases, and their related processes, decisions and people involved is provided in Appendix 2.

4.2 Decision-Making Support by the Organisation during Tendering

In the tendering process two official systems are in place supporting decision-making on an organisational level. Other routines with similar intentions are dependent on management initiatives. A system is considered official, when organisation-wide rules and regulations are in place that determine its process and the desired outcomes. Unofficial systems have no such organisation-wide application. Neither the unofficial systems' processes, nor their desired outcomes are defined in writing in the centralised official guideline regarding methods and procedures of operation. The purpose and procedure of the unofficial systems are determined by the employees involved.

One of the official systems encompasses the usage of pre-ORA (Operational Risk Assessment) and ORA, risk assessment tools to decide whether to continue the tendering process, see Figure 9. The ORA-system is applied on projects exceeding a certain project size. The goal of the assessments is to prevent loss projects caused by overlooked risks and risks whose consequences could have been minimised through preparation. The risk assessments consist of the tender-team reporting pre-defined information about the risks of the project and the decisions regarding their handling to a risk team. The risk team consists of senior managers, whose hierarchy-level depends on the size of the project. For the projects in this case-study the risk team reported to is on company group level. As shown in the table in Appendix 2, the pre-ORA is conducted during the Preparation phase. Approval of the pre-ORA is necessary in order to officially begin the tendering process within the company, even though in practice Early Stage work has to be done before this step. The ORA occurs during the Revision phase and the approval in this step provides a permission to hand in a bid.

The other official system consists of review meetings referred to as 'Meetings with management' during the Revision-phase, with three different focus areas: revision of methods, revisions of estimation and final price, Figure 9. In these meetings decisions on assumptions and methods both in production and in estimation are revised and a final price is decided upon.

The unofficial routines management follows are based on two types of councils that support tendering. One council works on a more comprehensive level and consists mainly of regional managers. Outside of the project-specific tendering process, the council's main task is to analyse the market and prepare for possible tenders. Once future tenders have been identified, a second type of council, the tender council, which consists of regional and district managers with responsibility for the respective tender, prepares a tender organisation. During the tendering process the council regularly meets with the tender manager for updates and adjustments. The main assignment is to support the tender-team, especially in questions regarding resource prioritising and cost. Management also provides decision-support in unofficial meetings with individuals at the workspace.

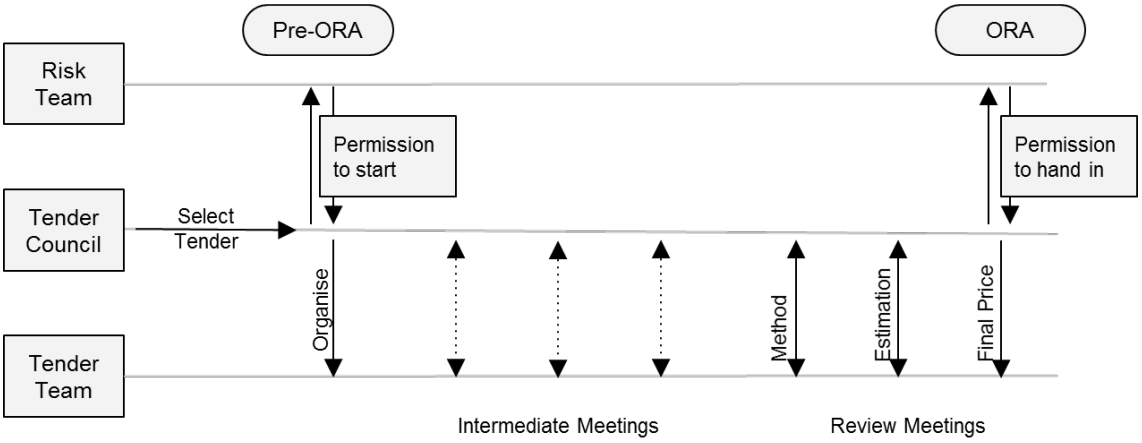

Figure 9 *Simplified overview over the decision support provided by the organisation*

5 Results and Analysis

In order to understand the decision-making processes within tenders, it is important to consider which decisions are made by individuals within the tender team, as well as the tender team as a group. It is furthermore relevant to investigate how these tender-related decisions are made. The term individuals in the tender team refers to the tender team members as well as the tender manager. Furthermore, input and feedback within and from outside the tender team by direct management, the organisation and external parties provide the basis for the decisions made in tenders. Hereby the managers within the region, such as district and regional managers are considered direct management. The term of organisation refers to all involved parties in the organisation, which are neither part of the tender team nor the direct management, for example higher management, risk teams and in-house experts. The simplified connections between input, feedback and the output of decision-making can be seen in Figure 10. Hereby it is important to note that decisions made outside of the tender team, for example by direct management, the organisation or the client, can be considered as an input for the decision-making inside the tender process. Further influences to decision-making include the structural framework within which decisions are made and the objectives that are to be achieved through making decisions. Both of these can be the cause of challenges that need to be investigated in order to improve the decision-making within tenders. This chapter therefore focuses on the type of decisions made by individuals and groups, how these decisions are made, and how inputs, feedback, organisational structure, tender structure and biases impact and cause challenges in decision-making within the tender.

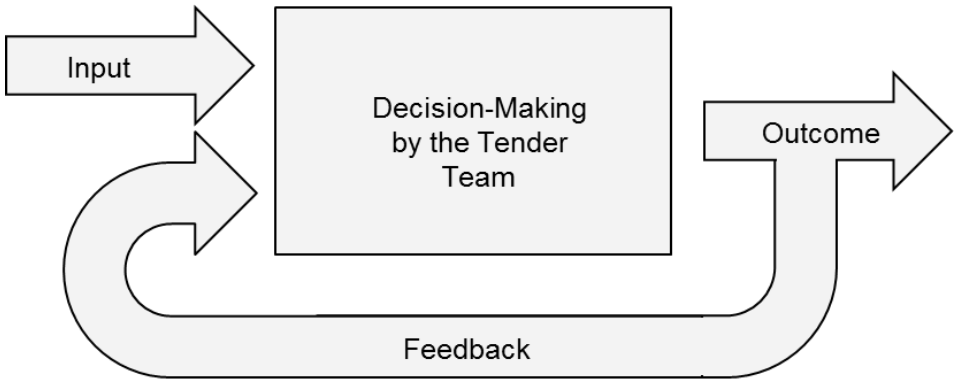

Figure 10 Simplified overview of the decision-making of the tender team

5.1 Decision-Making in the Tender

5.1.1 What Types of Decisions Are Made in the Tender

The tender team consist of a tender manager and tender team members. The members and the manager have slightly different responsibilities regarding decision-making. The responsibilities of the individuals are set by the group and normally consists of an area of expertise, i.e. production methods or estimation. Each team member primarily makes decision within the area of expertise they are responsible for. If members feel inexperienced within their area they tend to make decisions that they perceive as small. An example for a decision that would be considered small is the amount of excavation in an area to base estimations on in a project.

If an individual does not feel comfortable making a decision within their area, the decision is instead made in a group context. Examples for this kind of decision are construction methods, or basic assumptions such as unit prices for estimation. Those decisions are then discussed in the group and confirmed or changed. Some decisions are instead discussed directly with the tender manager, who also either confirms or changes them.

The overall responsibility for the tender lies with the tender manager. This responsibility encompasses decisions on what questions and issues to focus on and discuss, both within the tender team, but also in regards to management. The tender manager sometimes makes executive decisions, at times going against the tender team. The overall responsibility for the tender also makes the tender manager ultimately responsible for the tender team's decisions and progress, described by a tender manager in one interview as follows: *"As tender manager, I am responsible. Sometimes I go in and tell them 'Now we will do it this way', and then we move on."*

Some decisions are not considered individual responsibility and are therefore directly addressed by the tender group as a whole. Decisions directly addressed by the group are core decisions for the tender on content and structure. Examples mentioned by the interviewees were decisions on priorities for the tender, decisions deemed to be of strategic value, decisions that have an impact on multiple areas of expertise and setting project specific goals and deciding how strict to follow them. All decisions during the tender are made by the tender team first. In the interviews both direct management and members of the tender team expressed that management trusts the experience of the tender team and their capability of making the detailed decisions regarding the tender. A manager shows the confidence in the tender team in an interview: *"We appoint a tender team because they know how to do this."*

Because the tender team is trusted with making decisions on their own, the tender team also largely decides which questions and topics regarding decisions to lift up to both direct management and other parts of the organisation for consultation and support.

5.1.2 How Decisions Are Made by the Tender Team

Even though there is a difference in responsibility and what types of decision tender managers make, compared to the rest of the tender team, no difference has been observed in how they make their decisions. Therefore the tender manager is not differentiated from the rest of the team in this chapter.

The decision-making in the case-study consists of four main themes of decision-making bases: Experience, Intuition, Expertise and Collection of Information. These are used in a synergetic manner but also as complements to each other when one is perceived to be lacking. A more detailed description of them can be found in Section 5.1.2.1. The themes were identified both when interviewees were explicitly asked about how they make decisions as well as in their descriptive examples of decision-making during the tender. The usage of the themes occurred both at individual and group level. In addition to the four themes of decision-making both the individuals and group have one main objective: keeping cost down. This objective is constantly present, irrespective of which of the four bases is used for making decisions. The main objective of cost will be further described in Section 5.1.2.2.

In addition to the four main themes and the main objective, occurring at both individual and group level, some patterns were described only at group level. Interviewees stated that the group makes decisions in both formal and informal settings i.e. during pre-decided meetings and spontaneous conversations at the office. All group members voicing their opinion was stressed as an important part of group decision-making by the interviewees. When the group is making decisions it is encouraged that the members develop new ideas, make suggestions regarding existing ideas and question those ideas in all areas discussed. The importance of member voicing their opinion is clearly exhibited in the quote by a tender manager: *"Because if you sit there, and people feel that they may and dare to speak, then it becomes great. You have no clue who could be sitting on the idea, it does not have to be the one that has been there for the longest time, it could be the least experienced one. That everyone dares to question and ask questions, you have to be a bit brave, have some guts… If you go there and create an environment where everyone dares and are allowed to express themselves it becomes great, really."*

Even though different views are encouraged, there is a widely spread intention to conduct group decision-making consentaneously. The wish expressed in multiple interviews for everyone involved being in agreement is exemplified with two quotes below:

"It is important that everyone on the team is in agreement too."

"And almost all of the decisions, I would like to say, are made in large agreement within the group."

5.1.2.1 The Four Main Themes of Decision-Making Bases: Experience, Expertise, Intuition and Collection of Information

The four main themes of decision-making identified during analysis of the interviews were Experience, Intuition, Expertise and Collection of Information. The themes provided the bases on which the tender team made their decisions, both individually as well as at group level, see Figure 11.

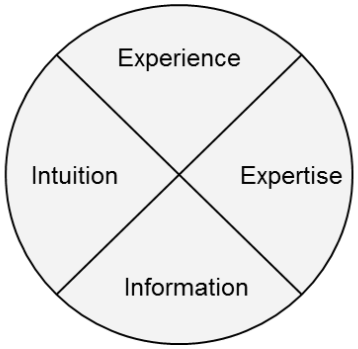

Figure 11 The four main themes of decision-making bases

The interviewees describe decision-making using experience frequently. They refer both to their own experience, but also to using others experience as a basis for decisions. *"It is a lot of experience from others. From my own experience and then also asking around of course. There is the group working together, so it is about trying to collect that experience and try and get the best out of it."*

Lack of experience was also frequently discussed as a problem in decision-making. When the members perceived a lack in experience they would cope with this by using expertise, collecting additional information or by moving the decision upward in the organisational hierarchy. A team member would thereby ask the group or tender manager to make the decision, who in turn might ask direct management. This redirection of responsibility is used to counteract a feeling of insecurity that arises from the perceived lack of experience, as one interviewees described it *"Yes, but that was probably also because I was completely new at doing that type of work, so I would say that I was not completely comfortable making all of the decisions. If I would have done it today I might have made more decisions on my own."*

How the group might involve expertise from outside of the group if they perceive a lack of experience is exemplified in a statement by an interviewee: *"Because we felt that we could not really do that on our own, we needed their help."*

Another way of avoiding to confront a lack of experience, was the proneness to applying routines the team was accustomed to, even in situations with changed parameters. This mechanism did not clearly show at the individual level but rather for the entire group.

Intuition showed when the tender team members were asked to describe how they would make a decision, but was not used explicitly by them to describe it. In the case-study intuition is assumed as used when the interviewees have described decisions being based on that something felt right, for example*: "And then, based on what I read, I collected the things that felt right, simple as that."*

Intuition is tightly connected to experience and the interviewees likely use experience as a rationalisation of intuitive decision-making when describing their own process of making decisions. The following quote by one of the members describes making a decision by somehow just making a decision, indicating intuition as basis: *"But then how would you know that? If you have not investigated all of it 100 %, then you do not really know. But somehow you have to, for example from experience and by calculating a bit, say that we will take this one."*

"I have to get the information needed. The more information, the better the decision." is just one example of how the interviewees press the importance they see for the Collection of Information as a decision-making basis. Information is often combined with the concept of expertise, using expertise to obtain additional information and prioritise it. *"Making a decision just like that on a lot of money, that is very stupid, because there are people that know these things. And I am not an expert in everything, so I cannot make all these difficult decisions. It is my job to make decisions, it is a really large part of the tender manager's job. But then I need to get the material to make these decisions, I cannot just make these decisions on a whim, because then it just goes very wrong."*

They also perceive lack of both information and expertise to be problematic when attempting to make a decision within the tendering process. When the tender team members experience trouble with Intuition, Expertise and Collection of Information they attempt to cope in the same way as described for experience earlier; by using the expertise and experience of others more or turning to executive hierarchal decisions.

5.1.2.2 The Main Objective of Decision-Making in Tendering: Keeping Cost Down

The objective of low cost at an individual and group level, stems from direct management and the organisation. The conclusiveness of the cost objective can be exemplified in this statement by one team member; *"Like, do you choose a longer or shorter bridge, - Which one is cheaper to build?, - Longer bridge!, - Well good, Then we know, then we run with that."*

At a group level keeping cost down also appears in the context of limiting decision-making, for example by limiting the amount of information that can be collected or the amount of expertise to consult. The focus on low cost was both explicitly expressed by the interviewees, but also indirectly expressed through focus on minimising time and maximising efficiency. However, the objective of minimising time and maximising efficiency was still lowering costs. The limitation and low cost focus are displayed in the following interviewee statements.

"They want to keep going, calculate, calculate, calculate, until they are a 100 % sure, but we do not have time for that, and we cannot afford that in the tender phase."

"Really, it comes down to money, what will be the cheapest"

The tender managers and direct management argued that the tender groups strive for consensus sometimes collides with the objective of low cost because consensus decisions require more time and resources. This elevated use of resources is

counteracted by tender managers and direct management by emphasising the importance of limiting time used before making a decision. For these managers limiting the decision-making time meant i.e. to not have too many options for a prolonged amount of time, which would lead to increased costs.

5.2 Input

The tendering process receives various influences both from inside and outside the organisation, which can take place in the form of inputs and feedback. Some of these inputs are present at the beginning of the tender, providing a framework of information and structure for the tender team to work with. Others appear at different points during the process, influencing and steering the development of the offer and the decision-making. Inputs originate at different hierarchy levels inside the organisation and can stem from direct management, the organisation in general and from external sources such as the client or consulting partners. An overview over the inputs received by the tender team is presented in Figure 12.

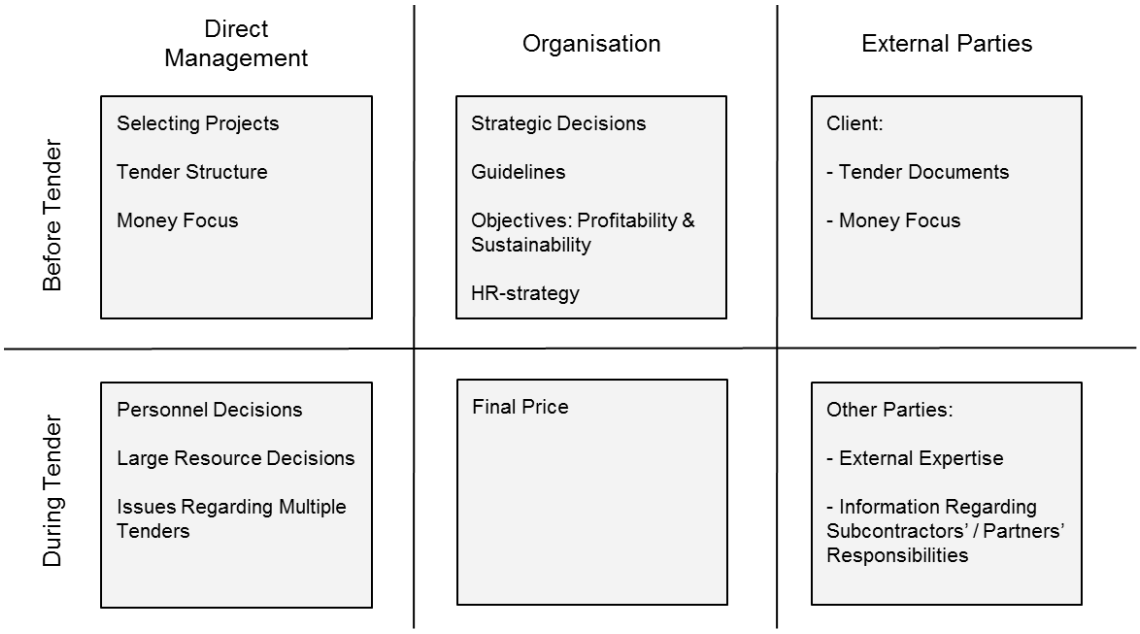

Figure 12 Overview over the inputs received by the tender team

5.2.1 Input by Direct Management

Another group within the organisation highly involved with creating the tender's framework is the direct management in form of regional and district managers. The first step of involvement is the prioritisation and distribution of different infrastructure projects in Sweden among the regions and districts. These decisions can take place years before the tender documents are provided by the clients. The second step is to assign employees and other resources to the respective projects, which is seen as a key-task of management by a manager: *"Other than that it is to be a support, make sure the right personnel is there."*

The managers interviewed also considered themselves responsible to provide a structure for the respective tender organisation. Even though the tender team as a group sets priorities for the tenders, direct management provides direction through decisions that indirectly influences the tender priorities. This was pointed out by a manager: *"But of course if I say, or my corresponding roles, that this is completely unimportant, we do not care about it, then of course nothing happens. So we cannot do that. Somehow we have to tell them: This is probably something that we should be doing"*

Apart from this indirect input regarding priorities, the clear focus of the tender provided by direct management is cost and money: *"We do have a very large focus on money."* No other factors than winning the project and thus keeping the cost to a minimum were mentioned by team members and tender managers.

"If there is something that is a bit shaky, then they want to know more about that, but there is no '- In this project I want you to … ' "

"In the tender the focus is to take the project. You are supposed to win the project, find the right methods."

This focus on cost and money stays prevalent throughout the entire tender process and has been mentioned by each interviewee.

In problematic tenders, the district manager mentioned a more extensive involvement in the tender including support for the tender team and help with problem solving. Larger decisions regarding risk, estimation and personnel in the tender project as well as issues regarding multiple tenders are occasionally made executively by direct management and provide further input to the tender team.

Most input from direct management affects what decisions are made by the tender team, but the way direct management makes decisions can also be seen as an input on how the tender team makes decisions. During the interviews it became clear that the managers' individual decision-making also uses the four decision-making themes found in the tender teams decisions, described in Section 5.1.2.1. A good example of this is the following quote from one of the manager interviewed regarding the use of intuition: *"If you have been there for a long time you do not have to look at the drawings a lot, it is enough with almost seconds for you to get a picture in front of you. Somehow you get the information without really grasping how it happens."*

In line with how the individuals in the tender team as well as the tender team as a group works, direct management also rely on hierarchy and turn to higher management for assistance if they are unsure about a decision. Like the tender manager, direct managers will also make executive decisions if they feel decisions are dragging out or that the tender team has made an error.

5.2.2 Input by the Organisation

The organisation provides input to the tender team both directly and indirectly. The indirect input is made irrespective of a specific tender and encompasses earlier strategic decisions in form of policies, strategies, visions and objectives, whereas the

direct input includes tender-specific decisions made by upper management and committees formed to support tender organisations.

Similar to the direct management, the organisation shapes the tender framework. Further inputs that were highlighted during the interviews were the structure provided through a centralised official guideline regarding methods and procedures of operation, which is used as a basis for the tasks executed before and during the tendering process. There have been two objectives that have been communicated by the organisation specifically: profitability and sustainability. Whereas the first is understood as a strict directive by the tender managers, the second is divided into two parts, one of which is considered compulsory, including safety, ethics and diversity, and the other being considered more of an overall goal to achieve on a more voluntary basis, including environmental and social sustainability. Profitability is communicated as winning the tender through low cost.

"We want to earn money, but do it in a sustainable manner, so there is a responsibility for us too."

"It is kind of, unfortunately I have to say, a question that is pretty far down on the agenda in a tender. In the tender the focus is to take the project, find the right way of working. So, the aspect of green construction is unfortunately too low in priorities in the tender."

A more indirect input is provided through hiring policies and human resources decisions made by the organisation. Through attempting to retain employees the organisation tries to strengthen the methods that have been strategically decided upon and practiced by the employees over the course of years when they reach management positions. As a regional manager pointed out: *"Well, Sometimes I can see that it is healthy to get other viewpoints into the organisation, I can probably see that. But I think we need the stability with the routines of our way of working from the start. Otherwise we will not be able to trust the estimation."*

During the tender, the organisation mostly provides input in form of selecting or helping to select suitable employees for the project, as well as providing a final price, which does not get decided upon by the tender team or direct management, but an upper management committee. In the interviews it has been stated repeatedly, that the further the tendering process has progressed, the more input in form of the above mentioned decisions by the organisation reaches the tender team.

There is no official decision-making structure or method provided as an input for the tender team. The organisation does however provide input that affects how the tender team makes decisions. Experience, Intuition, Expertise and Collection of Information, the four main themes identified for decision-making in the tender team are encouraged by the organisation. One way is by controlling and thereby demanding the usage of them in different part of the tender process. An example of how information is required is the ORA-system, where the tender team must submit information to be reviewed by the organisation. When one of Experience, Expertise, Information and Intuition is deemed by the organisation to be lacking in a tender, usually noticed through communication from the tender team through official meetings such as the

pre-ORA meeting, the others will be increased to compensate. Examples of these types of compensation are shown in interviewee quotes below.

"You have to have a second opinion on the concrete structures. You have to have someone with you that is good at installations."

"And then there are a few free agents that you can add if there is something special that you need to press extra."

In accordance with the way the tender-manager and direct managers sometimes made executive decisions, or where asked for input because of insecurity of the tender group, higher management involved in the decision-making sometimes makes executive decisions. When higher management makes decisions, they are also held responsible for the outcome of their decisions, stated by an interviewee as follows: *"When the big bosses, or higher, are there, then they are also taking a responsibility ... Then you are part of the decision, and then you are in on it, also taking responsibility."*

The responsibility tied to making a decision is thereby clearly stated throughout the hierarchy of the organisation.

5.2.3 Input by External Parties

The external parties influencing the decision-making in the tender through their input are mainly the client, subcontractors, collaboration partners and consultants. The external source of input that has been highlighted as the most influential one during the interviews is the client. Besides the client, external input is usually selected carefully during the course of the tender process. If the expertise and experience inside of the organisation is insufficient, external input from subcontractors or consultants is inquired.

The largest part of information that is provided by the client, is distributed through the tender documents at the starting point of the tendering process. The tender documents contain a limited amount of information that provides the scope, goals and priorities for the content of the tender and the project. Meetings between client and contractor preceding the tenders are common for knowledge exchange and consultation. However, since the client in infrastructure is usually a governmental agency such as the Swedish Transport Administration or the Traffic Agency, the input and the selection criteria are limited by public procurement laws. These laws were mentioned by several interviewees, as they were perceived to heavily restrict the input that can be provided by the client during the tender, as all competing parties have to receive the exact same information. The information provided by the client is not entirely limited to the tender documents, though. When the early phase of tendering, before the tender documents are published, was discussed with interviewees, it was pointed out that it was very common to use the official information on the project in order to prepare for the tender. The mentioned information is publically available before the tender starts and their usage was exemplified in the interviews as follows: *"In the early stage they gather all the materials that are public, like working plans, railroad plans or what might be available. There is quite a lot of material in that."*

The main focus of the client is to purchase the project with the lowest price, which is a requirement in public procurement law. Additional requirements can be set, but may not be too specific, an example for this is a lack of focus on a project's sustainability in the tendering process. This specific focus on price, or percentage in the case of ECI-contracts, is a fact internalised by all interviewees:

"You have to remember, if you look at it historically, we are almost always competing on lowest price. There is one parameter: what is on the last row, is what we are competing on."

"The way LOU (the public procurement law) is phrased today, makes it hard to have extra high demands on environmental aspects and give the project to whoever is the best. You can have high demands on environmental aspects, but it is still the lowest price that will win in the end. That is changing though. There is a new LOU in 2017, where you will be able to include environment and sustainability in another way in the procurement process."

5.3 Feedback

Feedback is given in hierarchical order. All initial decisions are made and reviewed internally by the tender team first, followed by feedback from direct management and finally from the organisation inside an official feedback framework. The feedback is given either during the tender in order to improve the offer or afterwards to recapitulate decisions made. An overview over the feedback received by the tender team is presented in Figure 13.

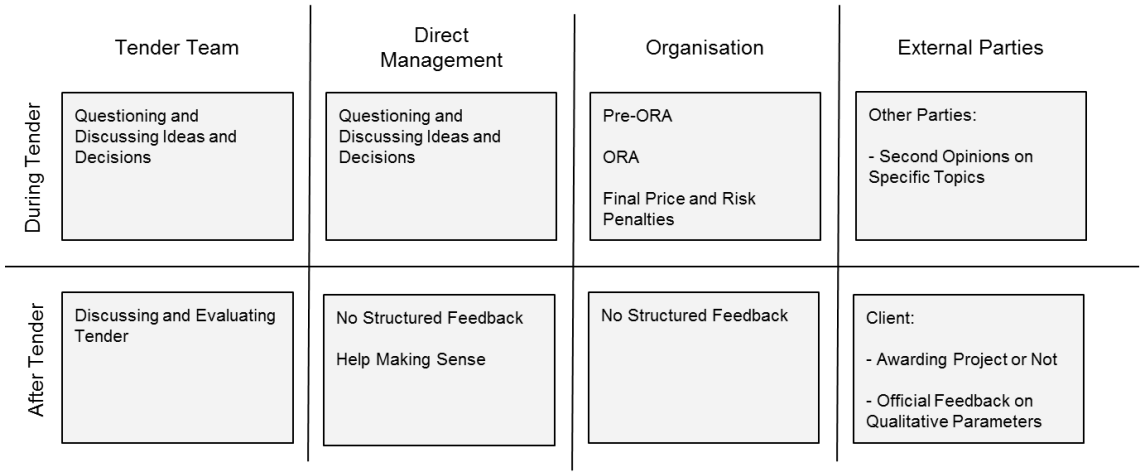

Figure 13 Overview over the feedback received by the tender team

5.3.1 Feedback within the Tender Team

Between the tender team members' feedback is mostly exchanged in an informal context. The group members question each other's' ideas in discussions, which is described by a tender team member as follows: *"People are definitely interested and discuss it. I believe they are, really. And they do want to contribute. But I suppose it is in the form of discussion and chatter, kind of more openly in the group. We do sit together, so I suppose it is more in that manner."*

Strategy meetings are implemented in order to create a platform for tender, estimation, design and production manager to give feedback to each other. Additional experts on issues that are pressing at the given time can be invited to those strategy meetings for advice. The overall feedback process is iterative. Feedback is given on work, which is then adapted and given new feedback on. This process is described by a tender manager as: *"Then they get to design and when they are done designing and we decide that this is good, then the estimator enters the project. Then he or she takes what is done and starts putting money on it. Sometimes you might have to go back and revise something."*

The tender manager is described by tender team members as their primary source of feedback, as one of the tender manager's tasks is approving the decisions made by tender team members. But even tender managers seek feedback by others within the group or experts in the respective field within the organisation. One tender manager answered: *"I try to always talk to people that are competent that are around. There are so many people that are really, really competent."*

A problem that was pointed out regarding internal feedback is that due to the individuality of the projects and their cost-focus, feedback can be difficult: *"We are supposed to decrease cost so that it is this much cheaper. Cheaper than what? We have no set price."*

It was pointed out as especially important that there are unofficial reviews within the tender group before the offer is presented to management outside of the tender team. Reasons for this were creating agreement on what was presented and finding mistakes early in order to not seem incompetent or negligent. *"In this part we will first have an internal review with the estimation. How do we feel, and every estimator gets to present precisely his or her line of thought. There you talk a lot in detail."*

The post-tender feedback is not based on any official structure or routines, but instead consists of individual members of the tender team discussing, what knowledge and which methods should be applied in the next tender and which should be avoided. One tender manager explained: *"We usually sit down and discuss a bit, but it is not very formal. Maybe it should be, a post-hand in meeting for tendering, or something like that, but that is not something that we have had.*"

Issues with appropriate post-tender feedback processes have been pointed out by both tender managers and other tender team members. Regardless whether the team had won the tender or not, it was perceived that there was no time allocated to reflecting upon the tendering process. When asked whether the quality of the feedback was perceived as different in case the tender was won as opposed to when it was lost, the opinions of tender team members were in conflict. If the tender was won, often the tender team members explained that they were involved in the detail planning of the execution and shortly after beginning production of the structure. This was perceived as leaving no time to reflect on the tender, as the news tasks needed to be performed within a strict timeframe. However, another tender team member pointed out that seeing the planning in production provided an opportunity to receive feedback from the building site. This feedback could, for example, be received in form of a plan working or not working during execution. All interviewees agreed that if the tender was lost, the tender team and the direct management tried to understand and reflect

upon why the offer did not win. However, the beginning of the next tender was often perceived as so close that there was little time for reflection. These conflicting opinions on post-tender feedback are shown in the following quote from interviews: *"Yes, we have talked about that as well, unfortunately not in a very structured way either. But that is often the case. Because we entered the next project right away."*

5.3.2 Feedback from Direct Management

The feedback the tender team receives from direct management during the earlier stages of the tender process was mostly described as based on questions from the tender team to management instead of questions from management. A manager pointed out: *"It is rarely that we show up and tell them that '-That part does not feel like we are on the right track', it is rather that the people that work with it say '-We need support with this' "*

This view was supported by the tender managers, of whom one explained that: *"Well, I have the authority to do large parts of the tender work, it is more that I feel: This is probably a bit shaky, I probably have to get help here"*

The feedback from management was mostly depicted as taking place in unofficial settings in the earlier stages of the tender process, which could be observed during the research for this thesis in form of visits by the management to the tender team, as well as visits by tender managers to the management. Later during the tender the feedback was described as more structured, with official review meetings being held. The content of these meetings is prescribed by the organisation in the centralised guidelines regarding documentation of methods and procedures of operation. However, besides the official review framework regular scheduled meetings with both the tender managers and direct management were mentioned, which become more frequently as the tender progresses. Coordination and the answering of questions were pointed out as their major objectives

The interviews showed, that feedback in those unofficial meetings can be given in a multitude of ways. One example was the questioning of decisions made by tender team members and tender managers in order to create new perspectives and encourage broader consideration. Sometimes feedback was even described to be given in the simple confirmation of a decision made by the tender team. One direct manager described the act of questioning as follows: *"I might ask, '- Did you consider this solution?', you could probably call it some sort of additional questioning. I really try encourage that in the tender phase."*

The tender team claimed, that they rely on the managers' experience and intuition in providing feedback, as one tender manager describes: *"We do present some parts of the project and there things appear that management feels are a bit shaky, they are pretty good at having a feeling for: In this part they are probably not as aware as they need to be in the tender team."* This corresponds to the notion of the district manager, who named experience as the main basis for feedback: *"I try, with my experience and knowledge, to tell them that this is what it is like here."*

After the completion of the tender, there is no structured feedback by the management. The feedback is, according to a tender manager more limited to help the employees involved to make sense out of the situation, in case the tender was not won: *"It is more that you discuss afterwards, ' - We did not get this one now' and ' - why?' but it is not very formal either. What you do is that you go sit down in someone's room for a while and talk."*

5.3.3 Feedback from the Organisation

The amount and scope of feedback from the organisation was described by most interviewees as depending on the size of the project. It was pointed out, that the larger the project was, the higher in the organisational hierarchy the involved managers were positioned. This organisational feedback was claimed to be motivated by the desire to avoid loss-projects. The general underlying assumption among the interviewees was, that the large experience higher management gained through reviewing all large tenders, will lead to the discovery of mistakes and issues in the tender. The official reviews all take place at the end of the tender inside a framework described in Section 4.2. The only exception to this is the Pre-ORA at the beginning of the tender, where risks regarding the project are investigated in a comprehensive manner. The ORA is described by interviewees as a feedback on whether the requirements from the Pre-ORA were followed up on by the tender team. One of the major reasons mentioned as to why the ORA was more of a check than actual feedback was that it takes place at such a late stage of the tender, that major changes are no longer possible.

Another issue mentioned was the lack of feedback from the organisation on topics where the interviewees suspected individuals within the organisation supposed to give feedback to not feel like they have enough experience to do so. As an example new factors, such as qualitative parameters in tender documents were mentioned by a tender team member: *"On the qualitative parameters we do not get at all the same amount of comments and opinions, as we do on the rest of the estimation. … And of course it is read through, and sometimes they give opinions, but not at all like on the estimation."*

Post-tender feedback from an organisational level above direct management in form of an official review of the tender's process and outcome after the hand-in, was unanimously described as non-existing by the interviewees.

5.3.4 Feedback from External Parties

Feedback by the client as an external party is limited to the time after the tendering process, as the public procurement laws do not allow for individual feedback by the client during the tender. This was pointed out as a source of frustration by tender team members and tender managers, who describe problems with interpreting the tendering documents. The feedback received by the client after the tender can be both direct and indirect. The most obvious indirect feedback is whether the company won or lost the tender. A more direct feedback was mentioned by interviewees when qualitative parameters were part of the tender. For these, several interviewees explained, a feedback meeting between client and direct management was set up by the client, where the client's decisions regarding the rating of answers were explained. This was pointed out as a very helpful basis for improvement in future tenders by tender

managers and direct management. However, a restriction was mentioned, as the rating was perceived as subjective and related to the individual manager responsible on client side. Therefore the feedback was not assumed to be generally valid for other tenders by the interviewees receiving it.

Feedback from external parties other than the client was limited by interviewees to second opinions on decisions by partners and subcontractors, as well as external consultants. It was pointed out, that this feedback in these cases was explicitly asked for by the tender team or tender manager.

5.4 Challenges

The challenges described by the tender team during the tendering process were multifaceted and originated both from the general nature of tenders, as well as from the organisational framework. Challenges based on biases were not explicitly discussed in interviews, as individuals are not aware of the biases influencing their own and their group's decisions. However, due to the biases' general applicability to naturalistic decision-making, their influence needs to be taken into consideration. Further, needs to be taken into consideration. Further, the impact the decision-making environment has on the biases' severity needs to be evaluated. An overview over the main challenges is presented in Figure 14.

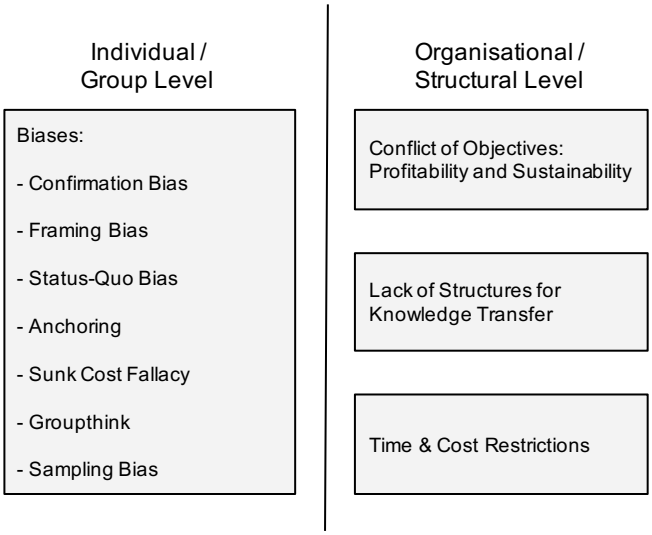

Figure 14 Overview over the main challenges in decision-making in tenders

5.4.1 Challenges Related to Tendering Process, Organisational Structure and the Construction Industry

The individual nature of infrastructure projects was pointed out as a major challenge in decision-making by the interviewees. Explicitly the complexity due to project size, amount of involved parties, a lack of standardised methods and restrictions regarding closing roads, railways and waterways were highlighted as issues in planning and execution. Due to the individuality, many decisions and structures have to be made anew in each tender, such as estimation methods, the writing of qualitative answers or

the establishing of a working routine with external partners. This excessive amount of coordination leads to an increase in time pressure and resources used.

Other challenges that were highlighted during the interviews were due to the general circumstances of public procurement tenders. Examples included time pressure due to short time spans to tender, unclear or incomplete documents provided by clients and restrictions through public procurement laws. Public procurement laws were pointed out as a reason for limited feedback and communication from the client during the tender, and slow change regarding the usage of qualitative parameters in tendering. In spite of sustainability being an overall strategic objective for both the client and the organisation, parameters regarding the sustainability of an offer cannot be the single criterion for awarding a tender.

Another challenge lies within the conflict between different objectives. The only input regarded as a concrete objective by the tender team was to win the project. The organisation's multiple objectives in their business plan, profitability and sustainability, do not translate well into the single projects and their tenders. While the sustainability manager expressed a wish for the regional and district manager to formulate goals regarding sustainability in single tenders, the direct management sees the opportunities for this integration of sustainability bounded by the objective of profitability received by the organisation. The tender managers perceive it as difficult to include goals other than lowering cost in order to win the project and maximise the profit into their tenders, if this is not encouraged by either the client or the direct management. This causes difficulties in implementing new goals, as the framework of input is so narrow and clearly aimed at fulfilling the traditional objective of profitability.

The most prevalent challenge regarding the organisational structure was the lack of official strategies for decision-making, input and feedback, especially after the tender is completed. The feedback process and thus the knowledge transfer from project to project was described as highly dependent on individuals within the organisation. This lack of official systems leads to the development of unofficial systems that were described numerously and in detail in the interviews. One example was the attempt to extrapolate a system for approaching hitherto unknown issues based on meeting individuals in individual projects, asking about their individual experiences. In spite of the interviewees pointing out, that the projects, as well as the corresponding managers on client side were different for each project and therefore knowledge from one project could not simply be applied to another, just this was attempted by tender team members and tender managers. Another challenge that was highlighted in the interviews was, that the large amounts of unofficial feedback during and after the tender was not documented in any way, as it took place in ad hoc situations without ways of creating a record of it. This way the feedback can hardly be used by other members of the organisation.

5.4.2 Challenges Related to Individuals in Decision-Making

The decisions in tenders are made by individuals, thus only a limited amount of information can be obtained, exchanged and taken into account in decision-making. Furthermore, the decisions are influenced by cognitive biases. As described in Section 2.6.1.1, biases are a fundamental aspect of the human cognitive system and therefore

likely to influence the decision-making in construction tenders. Since biases are usually not noticed by the decision-maker, the interview questions did not aim at asking the interviewees whether they have experienced biases in tenders. Instead the description of the tendering process and its inputs and feedbacks have been used to determine behaviour and structures that are likely to either increase or decrease the influence of biases on decisions made in a tender. The analysis focuses on the seven cognitive biases described in Section 2.6.1.1: Confirmation Bias, Framing Bias, Status-quo Bias, Anchoring, Sunk Cost Fallacy, Groupthink and Sampling Bias.

Regarding the Confirmation Bias, which states that individuals favour information that confirms their initial beliefs in decision-making, there were both structures that decrease the influence, and some that increase it in the tender. A decrease in impact of the Confirmation Bias should take place, when new opinions with possibly non-supportive arguments are introduced to the tender and solutions are being questioned. Through the review system with both mid tender reviews with management and final reviews with a risk team and a tender board the influence of Confirmation Bias should be decreased. This review system provides a broad field of sources for multifaceted feedback to the tender team, especially through the involvement of international senior management. Senior management in the final reviews has not been involved with the tender beforehand, apart from a short insight at the Pre-ORA. Diverse experience has been collected by senior management over numerous other tenders, some of them abroad in a different cultural setting. However, other factors might lead to an increase in impact of the Confirmation Bias on a tender level. The fluctuation of work force has been experienced as very low. Most of the interviewees have worked in the organisation throughout their entire career, up to over thirty years, and know each other from working together on multiple projects. The search for new information, especially that is non-supportive, is not encouraged by such a homogeneous system. An emphasis of direct management in the interviews, that new employees need to learn the company's way of working and that change is only accepted in few instances shows examples of behaviour that can reinforce this bias. Furthermore, almost all interviewees referred to a small group of people within the organisation that are experts within their field, which were consulted in unclear situations for advice concerning decisions. This accumulation of specialised knowledge provides a deeper insight into certain topics. However, usually only the opinion of one colleague was taken into account. This limitation to one source can be a challenge, as it limits the points of view on a topic, especially when the same colleague is consulted in all the department's projects. The challenge of a narrow scope of opinions is further extended by consulting colleagues in the same department, which answer to the same management. Similarities in thinking and expressing themselves were prevalent in almost all interviews, as the employees from the same department had similar vocabulary and opinions. An exception from this was the sustainability manager, who was not connected to the department in any direct way.

The Framing Bias is connected to how a problem's formulation can influence a decision-maker's risk-aversion. As it is less likely that decision-makers take risks in order to save money, than in order to prevent the loss of money, this bias can have a large impact on decisions in a tender. The bias is also represented on an organisational level in the objective of not having any loss-projects. The risk penalties in final reviews that were mentioned in the interviews might increase the impact of the

Framing Bias. If the senior management perceived the answers of the tender team as too vague, or a method as too risky, a risk-penalty was added to the final price. If risk-penalties are added, the final price, which presents the central criteria for awarding a project to a contractor, increases. This leads to the conclusion, that taking risks in tenders to save money is punished with a higher final price and therefore a smaller likelihood of winning the project, which is a reinforcement of the Framing Bias.

The Status-quo Bias is the tendency of individuals towards keeping the current state instead of inducing change. This bias was observed most clearly in the interviewees' answers, that change and improvement are an option, but that they are content with the way decisions are currently made in tenders and want to continue with it. A further indicator were attempts of employees involved in the tender to apply their common methods in order to face new challenges, instead of trying to find new approaches, for example the common tender process being applied to the ECI-tender. Another example was the difficulty to implement new objectives, such as sustainable building, besides the current main objective to win the tender through low costs. The interviewees working with implementing sustainability in the organisation, as well as direct management, emphasised the voluntary nature of implementing environmentally sustainable aspects into tenders. This lack of incentives for tender teams to change their behaviour might, in combination with the Status-quo Bias, prevent or slow down a successful change towards more sustainable construction.

The bias of Anchoring describes the influence an initial value has on the estimation precision of individuals. Usually the adaption made to the initial value is insufficient, leading to overestimation of success-probability in conjunctive events, such as complex construction projects with numerous single events and decisions. Anchoring suggests, that the tender team is likely to assume that the risk of project-failure is lower than it actually is. A structure countering the effects of this bias is the extensive Pre-ORA / ORA review system. The involvement of a risk team gives the opportunity that managers aware of this bias are reviewing the assumptions of the tender team.

The Sunk Cost Fallacy points out individuals' reluctance to stop a project in spite of rational reasons, because of feeling like too much has been invested already. This bias also has the structure of review meetings working against it. Since both the Pre-ORA and the ORA were described by interviewees as providing an opportunity to stop the tender from proceeding, this bias can only manifest in a smaller scale inside the tender. Examples for this could be the decision to pursue a certain design or production method, because a large amount of the tender budget has been invested in calculations concerning the method already, in spite of its possible unsuitability.

The group-decision environment of tenders provides further biases influencing decision-making, such as the Sampling Bias. It is more likely that information possessed by all group members is shared, than information just one group member has acquired. Since most interviewees have been working in the organisation for over a decade, there is a significant likelihood of a large pool of shared information. Given the time limitation of the tender, it is to be expected, that mostly the already shared information finds application in the tender team discussions.

Although the existence of Groupthink bias is controversial there is a large agreement on how groups not conformed to it can be identified. One main indicator is the

encouragement of group members to question existing ideas and develop new ideas together with assistance and feedback from expertise outside of the group. These are factors that have been present throughout the results, as questioning decisions and creative thinking is encouraged by management on different levels.

5.5 Sustainability and Qualitative Parameters as Examples of How the Organisation Works with Implementation of New Parameters

To understand how the organisation approaches the topic of decision-making when confronted with new parameters, the aspects surrounding the recent increase in qualitative parameters in infrastructure projects was looked at as well as the organisation's attempt to implement environmental and social sustainability into the tendering process. As these two areas are presently being implemented in the organisation, they provide suitable current examples for the case-study. To investigate the decision-making as well as the inputs and feedback regarding sustainability and qualitative parameters the interviewees were explicitly asked about and added as a detailed focus in interviews. To clarify how new parameters have been approached in relation to the tender, the findings will be described in two subchapters, Section 5.5.1 and Section 5.5.2. The description of these processes in detail will cause some repetition from previous chapters, this is, however, necessary to be able to compare the implementation with the more overall description of tender decision-making.

5.5.1 Implementation of Sustainability

At an organisational level the company has defined the meaning of sustainability within the organisation, leading to five focus areas: Safety, Ethics, Diversity, Environment and Social. According to the sustainability manager the first three of these, Safety, Ethics and Diversity are mandatory aspects. Environmental and Social sustainability are considered to be more voluntary. Each region has a large freedom to define what the two more voluntary areas mean to them, as well as if and how to work with them. The freedom of the regions to define the work results in highly decentralised decision-making regarding Environmental and Social sustainability. Because of the high level of voluntariness there is no real structure of input and feedback regarding the areas in the organisation. This can be considered as the opposite to how the organisation handles Risk in tenders, which is monitored during the entire tendering process. For example one of the tender process' only two official sources of feedback the ORA-system, concerns risk. The organisation attempts to implement sustainability by making it a part of the business plan, creating a system with two parallel objectives: profitability and sustainability.

The regional management is offered assistance by a "Sustainability Business Development partner" in implementing the respective objectives from the business plan. The direct managers expressed the importance of sustainability during the interviews, but were not prepared make sacrifices regarding profitability to achieve the sustainability objective:

"I think it is important. I say that, but I also say that this may not take too much energy in my organisation and in tender work, and steal creativity from other parts."

"We do not allow ourselves that process in the tendering phase. And there are a lot of reasons for that. First of all it costs a lot of money."

The interviewees also explain the lack of sustainability focus in tenders and projects with a lack of interest by the client. In large infrastructure projects the state, in form of the Swedish transport administration, is usually the only client, and is perceived to only be interested in lowest price and to be considering sustainability as a cost. This singular interest can partly be traced back to public procurement laws limiting the selection criteria. It was also pointed out, by all hierarchy levels present among the interviewees, that the organisation wants to be ready when the client is prepared to pay for solutions that increase sustainability in infrastructure projects.

The managers and other interviewees outside of the tender team also pressed the importance of enthusiasts in the tender team to create change within sustainability. These interviewees said that the change will not be pushed out into the organisation but rather should come from within. The priorities and feedback that management provides for the tender team, focuses primarily if not singly on lowering cost and increasing profitability. This focus in combination with their expressed view that sustainability is considered a cost makes their stated priority of sustainability contradictory to their actual actions on input and feedback within the organisation.

The "Sustainability Business Development partner" is sometimes involved in the tendering to give assistance in increasing sustainability directly to the tender team. This assistance includes, among other tasks, to implement the "Green map" a tool to measure environmental sustainability in a project. The tender team members, on the other hand, do not mention this work when discussing the tendering process and had no recollection of environmental impact, outside of risk handling, being discussed at all. However, all interviewees from tender teams frequently referred to risk, lowering costs and finding the best price, representing the profitability objective.

5.5.2 Implementation of Qualitative Parameters

The clients are increasing the amount of tenders with qualitative parameters instead of just lowest price. Most interviewees expressed this as something positive. They believe the organisation works well, that there for example are good procedures and methods in place for the planning and execution of projects in general, and that an increased focus on their ability to execute the projects according to the clients' wishes regarding qualitative parameters would increase their chances of winning bids. The preparation of qualitative parameters for a tender is still considered to be a new process within the tendering in the organisation. It was therefore relevant for the case-study to look into more detail on how the organisation approached these new parameters being added in the tendering process.

Qualitative parameters in a tender usually consist of questions regarding project execution description, organisational structure, personnel and risk-management. Many of the interviewees expressed that the qualitative parameters were something new and different. However, when they were asked in more detailed it became clear that most of what was to be described within the qualitative parameters was already being done within the tenders, just in less detail, described by the following quotes from two different team members:

"It is an aid, really, in the execution process. These questions, I do not believe that they are anything else. It does not affect the tender, not the price directly, but the execution process I believe is affected."

"What you would normally just think of or keep some sloppy notes on, you really have to describe in a more detailed manner."

New for the organisation is tendering based on text and not just based on a price. The interviews showed that the organisation responds by attempting to transfer their existing lowest price tendering to the text based part of the tender. An extra position is added in the tendering process and appointed coordinator of the qualitative parameters and the process surrounding them. This leads to the coordinator working in parallel with the regular tender team. The coordinator mainly receives feedback from the tender manager, but when expertise within an area is needed asks other team members to assist with input and/or feedback. This procedure is very similar to the group decision-making that normally occurs in the tender teams, where each member is responsible for their area of expertise.

When asked about qualitative parameters almost all interviewees focus on how the text is written, not the content of the text itself. The client usually asks for information on execution of the project, personnel, risks and organisational structure. What the interviewees discussed, especially management, when asked about qualitative parameters in the interviews are mostly the need to use external expertise for layout and wording and interpretations on wording by the client. The feedback within the organisation on methods is continuously given based on the monetary estimations. The qualitative part of the tender is considered the memorandum of the tender enclosed to the client. The difficulty in receiving feedback on work with qualitative parameters from the organisation was described by multiple interviewees. In the interviews they derived this to the fact that qualitative parameters in Sweden is a rather new phenomenon and that the organisation therefore has no experience in reacting appropriately.

Most interviewees believed that the organisation would improve their abilities to work with qualitative parameters by planning and executing more projects where the parameters are a factor, building up experience. One interviewee also expressed the belief in learning from experience in this statement: *"I guess I believe that everything that you experience is stored somewhere in some way. Everything from how you should deal with staff, to how you do something physically or technically or present something. All of those things are stored in some way that you always carry with you. How to solve situations that arise, and so on. I believe that. Somehow you build up a sort of knowledge bank."*

6 Discussion

This chapter compares the findings from the case-study regarding the tendering process with descriptions of the tendering process in literature. Furthermore, the decision-making themes identified in the case-study are compared with literature on individual, group and organisational decision-making within the framework of naturalistic decision-making. The challenges in decision-making in tenders are matched with decision-making challenges pointed out in both general and tender-specific literature. Lastly possibilities to influence the decision-making in tender teams is discussed within the framework of intentional learning from experience.

6.1 Tendering Process

Overall the tendering process observed during the case-study is very similar to descriptions of tenders in literature. Compared to the phases of a construction project by Walker and Lloyd-Walker (2012), all sub-cases within the case-study take place in the project-phase of preliminary design and planning. Inside the tendering process, the phases and tasks are very similar to those mentioned and analysed by Betts (1990), as the tender team began the tender process with inquiries of information and an identification of focus areas, followed by structuring the tender, deciding on methods and estimating the respective costs. No large differences to Betts' (1990) description of the tendering process were observed in the case-study. Smaller differences that were encountered included early collaborations with subcontractors in the case-study, which were not mentioned as part of the tendering process by Betts (1990). Other deviation from Betts' (1990) schema include the mid tender reviews and support by direct management during the tender, which were present in the case-study. Another discrepancy that could be observed was that Betts (1990) does not mention any collaboration with design consultants, which was a large factor to take into account in decision-making in the case-study. This likely has its origin in the article's early publication date. Design-bid-build project delivery does not require the contractor to prepare a design for the project and was much more common in the 1990s. Furthermore, in the case-study, a much stronger focus has been put on the pre-tender phase by the tender team, than Betts (1990) presents. This intense level of preparation for a tender with available public information before the tendering documents are published was not mentioned in the literature reviewed for this thesis. It was, however, a central part of the tendering processes in this case-study. This additional tender-phase, as well as the other differences between Betts' (1990) description and the case-study might thus be a possible focus for further research.

The meetings between management and the tender team present in the case-study, such as mid tender reviews by direct management and final reviews by senior management, were very similar to those found and described by Laryea (2012). Laryea (2012) points out that the mid tender reviews are used to explain approaches and methods and receive more input and feedback from management regarding the tender. Final reviews focus, according to Laryea (2012), on the final price, in spite of encompassing similar topics as the mid tender reviews. These observations regarding the purpose and content of the different review meetings during a tender are confirmed with this case-study. Furthermore the findings from the case-study concur with Laryea's (2012) observation that the final reviews are taking place at a point in the tender, when no large changes are possible anymore, because the hand-in date is

too close. The feedback system of final reviews in the case-study provided by the company fulfils the same purpose stated by Laryea (2012): to provide help in the decision whether to bid or not to bid. If the reviews are unsuccessful, a handing-in of an offer is highly unlikely. Akintoye and Fitzgerald (2000) confirm the case-study observation that the involvement of senior management in the reviewing process increases with size of the respective project. The official system for reviewing tenders in the case-study confirms the findings from research regarding organisational reviews within a tender.

Akintoye and Fitzgerald (2000) point out that large contractors usually have less problems with cost estimations and thus tendering than smaller companies, as they tend to have a well-structured department responsible solely for preparing tenders. However, in this case-study the borders between the estimation department and the production on site were blurred, since the tender manager often became project manager and other employees followed from the tender team into the execution phase of the construction project. This diversion from literature provides the opportunity to avoid the lack of site-experience of employees in tender departments Akintoye (2000) highlighted as an issue in preparing tenders. The positive effect of tender team members working on site in case of won tenders is increased by the organisation's strategy to let employees start their career on site. The findings from the case-study thus contradict parts of the research regarding the challenges encountered in tenders based on tender team members' lack of practical experience.

6.2 Decision-Making in Tendering

It has been evident during the case-study that the tender team did not use any specific methods in decision-making, but instead relied on experience. This is in accordance with the research of Akintoye (2000) and Fayek (1998) on decision-making bases in tendering. Apart from experience, which corresponds to previous literature on tendering, three additional decision-making themes were identified: Intuition, Expertise and Collection of Information. Three of the themes, Experience, Intuition and Expertise fit well within naturalistic decision-making (Klein, 2008) and the theory of two decision-making processes working in tandem by Salas et al. (2009), Sloman (1996) and Lundh et al. (1992). The usage of Experience and Intuition connects well with the theory of a subconscious and pattern seeking system (Salas et al., 2009; Sloman, 1996; Lundh et al., 1992), whereas the usage of Experts or Expertise corresponds to the reasoning and rule following deliberate and analytical system (Salas et al., 2009; Sloman, 1996; Lundh et al., 1992). Collection of Information was prominent in the analysis and could correspond to the deliberate and analytical system. This is however not clearly covered in the theories by Salas et al. (2009), Sloman (1996) and Lundh et al. (1992), and should therefore be additionally looked into as it could fill a currently existing gap in literature. The connections described between the two cognitive systems and the four decision-making themes are illustrated in Figure 15.

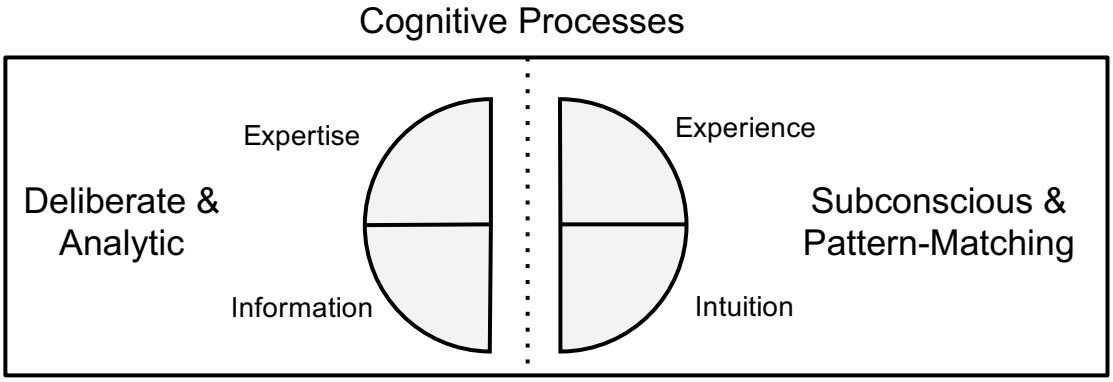

Figure 15 Connection between the two cognitive systems and decision-making themes

Supplementary to the four themes of decision-making, there were additional concepts present regarding group decision-making. Two of the most prominent concepts in literature on group decision-making are the importance of clear roles and communication within the group (Dennis, 1996; Salas et al., 2009) and the positive effect consensus has on individuals' feeling of involvement and satisfaction with the decision outcome (Green & Taber, 1980; Devine et al., 2001). In the case-study, the clear responsibilities of each team member, extensive informal communication and a proneness for consensus, were all largely present. The presence of these factors in the study do, in accordance with the literature presented, have a positive effect on group level decision-making.

The organisational decision-making observed in the case-study does not correspond directly to one of the four organisational decision-making models by van der Horst (2002) and Shapira (2002). Instead of a systematic organisational approach to decision-making the only clear pattern visible in the results was a reproduction of the individual and group decision-making at an organisational level. The fact that organisational decision-making is so individualised also means that the four organisational decision-making models are adapted by different individuals in the organisation. This adaption of several of van der Horst's (2002) and Shapira's (2002) models instead of merely one makes it difficult to identify one that is prominent in the organisation. This leads to the conclusion that these theories on organisational decision-making are not sufficient for the reality studied in this case and new models might have to be developed for this particular setting.

6.3 Challenges in Decision-Making in Tenders

Some of the main challenges in decision-making in large infrastructure construction tenders are located on an individual or group level within the tender. These challenges are mainly rooted in cognitive psychology and the connected biases, such as the Status-quo Bias or the Confirmation Bias. Other main challenges were present on an organisational level and caused either by external influences such as the general structure of a public procurement tender, or an organisational tender structure conflicting with the organisation's objectives.

On an individual and group level the most prevalent challenge in decision-making and the introduction of new parameters for the case-study was grounded in the Status-quo Bias, which Samuelson and Zeckhauser (1998) describe as a cognitive resistance to change. This bias needs to be overcome in order to be able to introduce change such as new parameters into a tender's decision-making. In the case-study the bias was reinforced by the organisation through expecting voluntary participation and engagement and a lack of incentives for employees regarding the introduction of new parameters. In order to be able to weaken the influence of a bias it is necessary to understand where it is rooted. One of the reasons Samuelson and Zeckhauser (1998) provide for the Status-quo Bias is not applicable to this case-study: the rationality of approaching identical situations in the same way, as the individuality of each project was pointed out repeatedly. However, several other reasons for the presence of the Status-quo Bias were suggested in the literature. These following reasons and their possible consequences can be assumed to be present in decision-making in tenders. The larger weight of losses than gains in human psychology (Samuelson & Zeckhauser, 1998) can prevent investments in areas where not enough expertise, experience and information are available yet. Regret avoidance, based on individuals feeling more negatively about unfavourable consequences of a wrong decision, than those of indecision (Samuelson & Zeckhauser, 1998), can lead to passivity among decision-makers. The reason most obviously connected to the lack of experience, expertise and information regarding the implementation of new parameters is the fact that a different situation would have to be discovered before being available for consideration (Samuelson & Zeckhauser, 1998). Due to their generality, these reasons can be assumed to be valid for the construction sector adapting to client needs based on how decisions are made. When new parameters are intended to be implemented, the possible causes for Status-quo Bias should be considered and attempts should be made to counteract them by organisations.

Diversity within the group and the organisation in general is a precondition that could provide effective support against the absence of knowledge about alternative solutions, counteracting a possible cause for Status-quo Bias, Confirmation Bias (Nickerson, 1998) and Sampling Bias (Dennis, 1996; Greitemeyer et al., 2006). The more diverse a group is, the smaller the amount of shared knowledge is. This means that the likelihood of sharing individual knowledge increases, which is described by Dennis (1996) as one of the main reasons for investing the additional resources needed for decision-making in groups. However, diversity can also create new issues for organisations that would need to be addressed and handled. Examples for this are increased difficulties in reaching consensus, creating an open communication or solving conflicts (Martin-Alcazar et al., 2012). Investigating and evaluating how the diversity in tender teams could be increased is therefore an advisable strategy for organisations attempting to improve their tendering and introduce new parameters.

Further biases that were described as challenging regarding decision-making in literature were not as prevalent in the case-study. Examples for this are the Framing Bias as explained by Tversky and Kahneman (1981), Anchoring, which is described in more detail by Tversky (1974), and Sunk Cost Fallacy investigated by Arkes and Blumer (1985). Organisations in situations similar to this case-study that involve experience and expertise based decision-making and the implementation of new parameters are thus more likely to be disrupted by the Status-quo Bias and the influence of the Confirmation Bias.

Other challenges are encountered on an organisational level. In the selection of offers the client is heavily restricted by public procurement law and its decision criterion concerning the economic advantageousness of an offer (SFS 2007:1091). Due to this restriction and the resulting focus on the final price, a challenge typical for construction tenders is the cost of tendering in general and the fact that organisations do not get paid for preparing a tender. Instead the cost of tendering is part of the organisations' overhead cost, which influences the final price of an offer indirectly through a margin that is added to the offer's actual cost. A higher final price might then cause the organisation to lose the tender, thus, tendering costs should be minimised. The limitation on tendering costs, however, puts a limit on obtaining information from experts, as well as discussions and meetings during the tender, which are expensive resources. This constraint is a central challenge in the case study and is confirmed by Laryea (2012). A cheaper tender, leads to a smaller amount of information and expertise to base decisions on, which in turn leads to higher risk. This higher risk can lead to, for example, a lower profitability in projects through losses, or, as in the case-study, to the addition of a risk-penalty through a reviewing instance in the final tender meetings. Both of these outcomes are not desirable for the organisation, as the first increases the risk for loss-projects and the second decreases the possibility of winning the tender. More expensive tenders, on the other hand, lead to similar problems in a reverse way. Higher investments into information and expertise provides a more sound basis for decisions and thus lowers the risk for loss projects, however the possibility of winning a tender is decreased through higher costs and a higher final price. One of the large challenges organisations face in tenders is therefore the identification of an optimum amount of resources to invest in a tender.

Public procurement laws do not only restrict and steer infrastructure tenders in terms of their resources, but also influence the priorities of objectives within them. The fixation on final price and the limitations on taking other criteria into consideration, such as qualitative parameters, hinders the implementation of objectives with other foci, such as sustainability. While both sustainability and profitability are objectives for tenders in the case-study, the traditional focus has been on the latter, which confirms research on procurement criteria by Wong et al. (2000) and Laryea (2012). All review methods during the tender, as well as all tangible goals were directed towards cost and risk, and thus indirectly towards profitability. This imbalance was further amplified through the cost-focus of public procurement law and the high level of voluntariness regarding environmental and social sustainability aspects in the case-study. Sustainability has mostly been viewed as a cost-factor when considering its implementation in the case-study, in spite of the examples of cost saving connected to more sustainable outcomes, as the additional education, information or personnel needed is an investment decreasing profitability temporarily. This conflict presents a large challenge for future infrastructure tenders, where procurement methods conflict with sustainability goals by both the client and the contractor. This topic should thus be investigated further and adaptations to the procurement law or the objectives considered.

6.4 Influencing Decision-Making in Regard to New Parameters

As previously described in Section 6.2, no formal decision-making methods are used by the tender team. That people will not comply with decision-making methods does not, however, mean that their decision-making cannot be influenced. On the contrary, Salas et al. (2009) theory on expertise-intuition, which corresponds the four themes of decision-making: Experience, Expertise, Intuition and Collection of Information, states that it is possible to influence what people learn from experience and therefore the outcome of the decisions they base on these experiences. This influence on decision-making is referred to as *Deliberate Practice* (Salas et al., 2009). A model building on the theory of *Deliberate Practice*, is suggested to influence the decision-making process in order to improve implementation of new parameters into the tendering process.

Deliberate Practice theory by Salas et al. (2009), if combined with the findings of Nickerson (1998) and Brehmer (1980), states that one does not simply learn from experience. There needs to be an input of knowing what is intended to be learnt and a feedback on the result of the decision, to influence what is learnt from experience and thus used in future decision-making. For the input the authors agree that a goal or a hypothesis of what a decision is to achieve is needed. The feedback must also provide an idea of whether the hypothesis was correct or not. When this process is repeated numerous times within the same domain, decision-making is improved. This concept can be illustrated with the previously presented simplified figure of decision-making, input and feedback, shown in Figure 10. The process inside of the box, representing the tender team's decision-making, cannot be directly changed due to obstacles such as the reluctance in use of decision-making methods and the Status-quo Bias. However, the input and feedback can be changed to influence the outputs of the decision-making process in the tender. The input can include a hypothesis, to influence the process according to *Deliberate Practice* (Salas et al., 2009).

The suggested model of *Deliberate Practice* (Salas et al., 2009) was already observed in the case-study, but was taking place undeliberately. Both input and feedback were centred on the objective of profitability. This objective had been translated into a subconscious hypothesis by the tender team: that an option is probable to generate the lowest total cost. The decisions in the tender are made in accordance with options that the tender team believes will confirm this hypothesis. The group decides on specific goals for each tender that conform to the hypothesis. In the case-study feedback, corresponding to the subconscious hypothesis, in form of both official and unofficial responses was identified. Feedback in the case-study was purely cost-based, regardless whether it was obtained from direct management, the organisation, or the client. This cost-based feedback was mirrored inside the tender team. Through the tender team's optimisation process of finding lowest cost alternatives, the subconscious hypothesis is continuously proved or disproved. This process of subconscious *Deliberate Practice* is described in Figure 16 together with an illustration of the theoretical concept of *Deliberate Practice*.

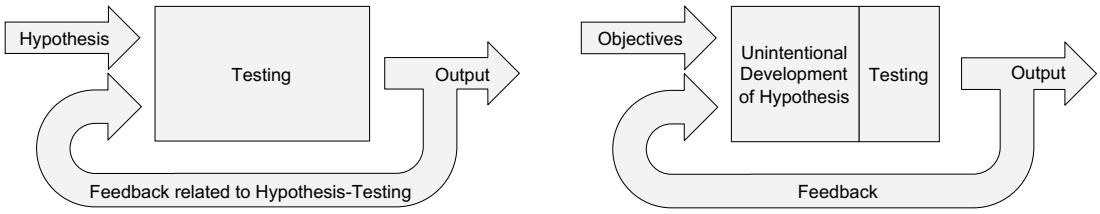

Figure 16 Comparison between Deliberate Practice and the current situation in the case-study

Hence, the members of the tender team are acquiring, expert-intuition within tendering for lowest price. Based on these findings the principles of *Deliberate Practice* are already present in the tender team, it does however only adhere to the objective of profitability and is not consciously used by management to steer decision-making. Since the second objective of sustainability is neither represented as a concrete input, nor considered in feedback, no unintentional integration of sustainability in the hypothesis can occur.

Therefore an option could be to translate all new parameters into monetary numbers for comparison, however the usage of *Deliberate Practice* can more easily be generalised and used in different parameters, even if it is not possible to translate them into monetary terms.

Because the hypothesis needed for *Deliberate Practice* can be created from input in the tendering process, and the input can be modified by the organisation, *Deliberate Practice* can be used to implement new parameters in the tender process. To succeed in using the model, management needs to consciously create a suitable hypothesis, and corresponding feedback for the tender team. Suitable, in this case, means that the hypothesis needs to be adapted to the parameters the organisation intends to implement.

7 Conclusion

The objective of this thesis was to show which decisions are made during large infrastructure tenders, how they are made, which challenges the tender team encounters regarding decision-making and how the decision-making can be influenced by the organisation. There are large gaps in research regarding decision-making in tender. For this thesis, a qualitative case-study was conducted in a Swedish construction firm, with the aim to answer the following research questions:

1. How are decisions made by the tender-team during the preparation of an offer?
2. What challenges are encountered during the decision-making process in the tendering-phase, especially regarding changing client criteria?
3. How can the organisation help tender-teams with improving or changing their decision outcomes?

Through interviews with members and managers of different tender teams, management working closely with the tender teams and employees responsible for implementing sustainability on both an organisational and on a project level, several themes regarding how decisions are made within tenders were identified:

- The members of the tender teams base their decisions on Experience, Expertise, Intuition and Collection of Information. If one of these bases is perceived to be lacking, the other bases will be used as substitutes.
- The decisions are made in a hierarchic order. If a member of the tender team does not feel experienced or knowledgeable enough to make a decision, the responsibility for the decision is transferred to a decision-maker on the next hierarchy level upwards. These transfers are present on all hierarchy levels investigated for this thesis.
- Decisions are aimed to be made consentaneously and the team members are encouraged to question ideas within the tender team. Executive, hierarchic decisions exist, but are usually avoided.

The challenges that were experienced by tender teams reached from being based in cognitive behaviour to organisational structure and the general arrangement of tenders:

- The largest challenge on individual or group level are cognitive biases that impact the decision-making through, for example, a collection of information favourable of an initial opinion or a tendency to uphold the current status-quo in decisions.
- On an organisational level, the largest challenge is posed by two parallel objectives, sustainability and profitability, of which only the latter was explicitly integrated in an input and feedback system by the organisation.
- The knowledge-transfer between tenders, especially regarding post-tender feedback is heavily dependent the individuals involved with the respective tender conveying what they have learned. A lack of structured post-tender feedback, and thus documentation, makes it difficult to use experience gained in a tender broadly.
- There are strict time and cost restraints on tenders, limiting the amount of information and expertise that can be gathered in order to make decisions. Since tenders are paid for by the contractor, the costs are added to the

overhead, which needs to be minimised to profit from project and to win tenders. A lack of investment in information and expertise can, on the other hand, lead to faulty decisions and profit-losses in projects. Therefore an optimal amount of resources to invest in tenders needs to be found by the contractor.

Influencing the decision-making in a tender can become important for organisations, especially when change needs to be induced. Due to the use of naturalistic decision-making described by in tenders and difficulties in arranging the use of structured methods as pointed out by, the possibilities to influence the decision-making process are limited. The following methods were identified in this thesis:

- The organisation cannot influence the decision-making process directly, however, the Input and Feedback the tender team receives can be modified to possibly influence the process indirectly. If there are two objectives influencing the desirable decision outcomes, the input and the feedback provided by the organisation need to conform to these objectives.
- Learning from experience in tenders is the primary method to gain knowledge and abilities needed by the tender team. The concept of *Deliberate Practice,* which describes effective learning from experience, can be used by the organisation to improve and influence the decision-making in tenders. This improvement can be steered through providing hypotheses to be tested by the tender team, as well as corresponding feedback.

7.1 Limitations and Further Research

The research for this thesis has been conducted in one consortium of departments in a contractor in Sweden. In order to externally validate the results of the case-study, further research in other tender teams, departments, contractors and countries is needed.

The amount of research on decision-making tenders is very limited in general, thus further research, especially regarding what is used as bases for decision-making is recommended. The narrow focus on experience-based decision-making regarding tenders in literature so far, does not take the practice of using expertise, intuition and information into account.

A development in the tender process identified in the case-study is the work performed by the tender team in the pre-tender phase, where numerous, mostly publically available, sources are consulted for information, before the tender documents are published. This development was not taken into consideration in literature consulted for this thesis and can provide new opportunities to reduce time pressure in tenders through the relocation of tasks outside the tender time span.

Regarding the development of new, mostly qualitative parameters taken into account for tenders, as well as the implementation of sustainability as a business objective, more research on *Deliberate Practice* and the interdependency of input and feedback regarding tenders is recommended. Furthermore, sustainability objectives and the current criteria of public procurement laws are in conflict. More research on the integration of non-cost parameters in public procurement can likely provide possible solutions.

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9 Appendices

Appendix 1 Interview Questions
Appendix 2 Description of Tender Phases

Appendix 1 Interview Questions

The same introductory questions were used in all 10 interviews and will therefore only be stated ones in the beginning of this Appendix.

Introductory questions:

1. What is your current Job title / Job description?
2. How long have you worked for Skanska?
3. What have you worked with before this job? (both at Skanska and other employers)

Interview Questions Phase 1:

Questions for tender managers

Tender process and decision-making:

1. When you think about the last tender you worked on, at which phase in the tendering process did you come into the project?
2. What information did you have to begin with?
3. Would you say that the tendering process has different phases?
4. For the different phases:
   a. Are there any specific moments or situations that you think represent this phase best?
   b. What were the main tasks of this phase?
   c. Who did you mostly work with during this phase?
   d. Do you remember any specific decisions that were made during this phase?
   e. And how they were made?
5. Is the tender process you described now typical for your work or was this an exception?
6. Do you think that other people working in the same field organize the tendering process similarly?
7. Are there any people you think we should also talk with to maybe get a different perspective on the process?

Interview Questions Phase 2

Questions for direct management

Role and involvement in Tender process:

1. Can you give us an overview over your responsibilities?
2. Can you describe your involvement in the tendering process of the last large infrastructure project you were involved in?

Input and Feedback:

1. How did you provide support to the project group over the process?
2. Does your support have more of a process and structural focus, or is it directly related to the content of the project?
3. Do you focus on certain aspects of the project in your support?
4. Who decides which aspects you focus on?
5. What information do you receive in return from the projects?
6. How does the organisation influence your interaction with the project group?
7. Do you feel like you have an impact on changing Skanska's input into project groups, for example, through the centralised guidelines regarding documentation of methods and procedures of operation?
8. Skanska has a goal of 10 % revenues being in socially sustainable projects, have you tried to implement this in your department, if so, how?
9. Can you give us an example for a decision you made during the last tendering process you were involved in?
10. What is your impression on how the tendering groups make decisions?
11. In your opinion, is this a good way for the purpose of the projects?

Questions for tender team members

Tender process, Input and Feedback:

1. During the early phase of a project (before the tendering documents are available) how did you decide the main objectives or focus of the project?
2. Can you give us examples of information/knowledge/lessons from earlier projects that you have used in your current one / the one before?
3. What did your working process with qualitative parameters look like in your project?
    a. Can you give us some examples of specific tasks?
4. Where did you get the information you used in these tasks?
5. How much of your work is developed on project-level?
    a. How much is decided in advance on a higher level?
6. How do other employees participate in your work as a person responsible for the qualitative parameters?
7. Could you give us some examples of responses you got on the project from the Pre-ORA?
    a. How did you use this in your project?
8. Could you give us some examples of responses you got on the project from the ORA?
    a. How did you use this in your project?
9. Could you give us some examples of responses you got on the project from the final reviews?
    a. How did you use this in your project?
    b. How were these responses different in projects with / without qualitative parameters?
10. How would you say that you applied 'green construction' at you latest project?
11. Can you give us an example for something you learned from your last tender?
12. Do you think there is a difference in what you learn if you win or lose the tender?

Questions for employees working with implementation of sustainability

Interview 1 - Implementation, Input and Feedback:

1. Do you think it will be possible to focus on large infrastructure projects in this interview?
2. Sustainability is a very large area. Do you focus on certain core topics or do you try to change things over the whole span?
   a. Could you describe the focus areas?
   b. How do you decide which areas to focus on?
   c. Who else is involved in that decision?
3. Can you describe how you try to distribute the new information regarding sustainability through the organisation?
4. Which areas of your work do you think would be most important during the tendering process?
5. Are you currently trying to influence decisions made in the tendering process?
6. Are you content with the feedback / influence the organisation has regarding sustainability in the design process?
7. There seems to be a conflict between the client or the contractor starting a new way of working, kind of like the hen and egg problem. Who do you think should go first?
8. How do you communicate this in the organisation?

Interview 2 - Implementation, Input and Feedback:

1. What are some examples regarding working with sustainability in large infrastructure projects that are already applied?
2. What are some examples regarding working with sustainability in large infrastructure projects that you wish would find their way into construction?
3. To what degree is your work controlling the sustainability aspects that are already decided in projects and to what degree is your work collaborating in developing sustainable solutions with people from the department?
4. Can you give examples for both the controlling and the developing tasks?
5. When you work with developing solutions, at what stage in the project is that usually occurring?
6. Do you try to gather sustainable solutions from older projects to help implement them in current ones? If so, how?
7. Do you actively try to motivate and interest people into making more sustainable decisions? Who do you usually target?
8. Are you involved in any of the final meetings in the tendering process? How?

Appendix 2 Description of Tender Phases

Early Stage	*Preparation*	*Design*	*Estimation*	*Revision*	*Required structure of Finished Offer*
understand project with publically available materials **first cost estimate** **strategic pre-work:** sign contracts for collaborations find key persons set preliminary conditions for design and method set unit-prices for value-engineering later on	**read tender documents** **understand client requirements** **structure and distribute tasks** **Pre-Operational Risk Assessment** **prepare structure for estimation and planning**	**introduce designers** **set structure for estimation** **iteration of design and method** **computation of quantities**	**introduce estimators** **create timeplan** **estimate price**	**internal revision of estimations** **meetings with management:** revision of methods revisions of estimation final price **Operational Risk Assessment**	**price** **financial strength of company** **references**
understand project with publically available materials **first cost estimate** **strategic pre-work:** sign contracts for collaborations find key persons set preliminary conditions for design and method set unit-prices for value-engineering later on	**read tender documents** **understand client requirements** **structure and distribute tasks** **Pre-Operational Risk Assessment** **prepare structure for estimation and planning** **limit alternatives for design and method**	**introduce designers** **set structure for estimation** **iteration of design and method** **computation of quantities** **develop and write description of execution**	**introduce estimators** **create timeplan** **estimate price** **optimisation** **conclude report on additional factors**	**internal revision of estimations** **internal revision of execution report** **meetings with management:** revision of methods revisions of estimation final price **Operational Risk Assessment**	**price** **soft parameters (reduction of price)**
understand project with publically available materials **first estimate of resources and time** **strategic pre-work:** sign contract for collaborations develop strategy to approach tender process set preliminary conditions for writing	**read tender documents** **understand client requirements** **structure and distribute tasks** **Pre-Operational Risk Assessment**	**develop method of execution** **Workshop:** develop understanding of client requirements develop style of writing	**write report**	**revision of report** **Operational Risk Assessment**	**Report 35 pages:** Collaboration Design Phase Construction Phase **oral presentation for client**