MASTER'S THESIS ACEX30

Evaluating current Project Models and effects on Procurement and Sub-Contracting during Construction Projects in Sweden

Suggesting a Roadmap for Future use

Master's Thesis in Design and Construction Project Management

Ahmed El-Abyad
Alvin Leimo

Department of Architecture and Civil Engineering
Division of Construction Management
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2023

Evaluating current Project Models and effects on Procurement and Sub-Contracting during Construction Projects in Sweden
Suggesting a Roadmap for Future use

Master's Thesis in the Design and Construction Project Management Program

Ahmed El-Abyad

Alvin Leimo

Examensarbete ACEX30
Institutionen för arkitektur och samhällsbyggnadsteknik
Chalmers tekniska högskola, 2023

Department of Architecture and Civil Engineering
Construction Management
Building Production and Construction Management
Chalmers University of Technology
SE-412 96 Göteborg
Sweden
Telephone: + 46 (0)31-772 1000

Ahmed El-Abyad, Alvin Leimo
Gothenburg Sweden, 2023

Evaluating current Project Models and effects on Procurement and Sub-Contracting during Construction Projects in Sweden
Suggesting a Roadmap for Future use

Master's thesis in Design and Construction Project Management

Ahmed El-Abyad

Alvin Leimo

Department of Architecture and Civil Engineering
Division Construction Management
Building Production and Construction Management
Chalmers University of Technology

ABSTRACT

The Swedish economy depends heavily on the construction industry, which has made a considerable contribution to its expansion and prosperity. The construction industry has a significant influence on the economy due to its large workforce and significant investments. The extended duration of the projects and the requirement for high-quality results within budget limits provide problems for the construction sector in terms of procurement. Contracts are essential to ensure the achievement of intended results, and their legal obligation necessitates a careful approval procedure. It can be difficult to strike a balance between short-term and long-term goals in the construction industry, which has an impact on the desire for innovation and resource efficiency.

The aim of this thesis is to address the research questions: How do the project delivery models design-bid-build (DBB) and design-build (DB) stand against each other from a quality and end-cost standpoint? By looking specifically into:

1. How do the project delivery models affect the number of total procurements offers and sub-consultants in the value-chain?
2. Does the number of total procurements offer, and sub-consultants then effect the result in terms of quality and end cost?

and make recommendations for constructing a roadmap that shows the influence of various procurement decisions on the results of the project.

The research focuses on assessing the advantages and disadvantages of current project delivery models and procurement frameworks with the objective to spot areas for improvement and provide guidance for the roadmap. The research questions examine alternative models and tactics for procurement and how they affect Swedish building projects. The research methodology consists of literature reviews, survey, and interviews with experts from significant construction firms within the Swedish construction sector. This thesis offers suggestions derived from the findings and offers insights into the construction industry's procurement decision-making process.

The thesis also examines a variety of parameters, including accountability, the quantity of actors engaged, systems of compensation, risk management, methods

of evaluation, and stakeholder cooperation. Based on the fluctuating nature of labour demands, construction businesses tend to depend on subcontractors rather than keeping a sizable permanent workforce, making risk management particularly important. Yet, this reliance on contract workers and subcontractors hinders productivity, restricts opportunities for economies of scale, and lowers the quality of the production and client satisfaction.

The thesis states that it is challenging to respond to the study question since procurement procedures are not the main factors influencing bidding, tendering, and subcontractor stages along the value chain. The conclusion also underlines how the DBB and DB frameworks differ in the final product's quality, with DB having a small edge. Furthermore, the DB framework must go through improvements that emphasize partnered projects and highlight current standards to become the new standard. It is also advised to use modern digital applications to enhance customer and contractor communication throughout the project lifetime. It is advised that future thesis studies investigate how initial procurement choices affect the aftermarket and property oversight phases of building projects.

Key Words: Construction management, procurement management, supply chain management, contracting, construction engineering, Sub-Contracting

Preface

During this project we learned a lot and had to re-make previous assumptions about the industry. We would like to say thank you to our supervisor, Professor Dimosthenis Kifokeris, for believing, coaching, and taking the time for us during this process. We also would like to thank Henrik Melkstam and Linus Malmgren from Coreco Consulting for bringing their expertise within management consulting and construction industry as well as helping us with contacting the right stakeholders in the industry, as well as for their initiatives during this process and believed in our project and made it possible to make this report come through. We also want to thank the professionals interviewed and who took the survey. Without you the results of this thesis would not be possible. Since this is one of the last things we do before leaving Chalmers to go start our careers and go into business we would like to thank all the teachers during our time in Chalmers and our fellow students who we grew with over the years. Finally, we want to thank our close relatives and family for their support in the process. No one mentioned and no one forgotten. We hope that you will enjoy this read and get some insights into this simple yet complex topic at hand.

1 Introduction

The construction sectors significance on the Swedish economy and development is hard to overvalue, due to both the magnitude and sheer largeness as well as the products it yields in form of both houses, commercial premises, and infrastructure. As of the second quarter of 2022, the construction sector had about 352.000 workers in different contractor firms, not including all the technical consultants, architectural offices, and other related jobs to the sector (SCB, 2022). Furthermore, the construction sector contained 10.8 % of Sweden's total BNP with investments amounting to 551 billion SEK in accordance with SCB's national operation of arithmetic's in 2020 prices (Byggföretagen, 2022). That implies a substantial number of procurements involving these investments and combined with the different attributes in the construction sector makes for a challenging process from a procurement perspective. The reason behind that could be that the finished product after a project, whatever kind it is, will be long-lived. That puts a great demand on the quality of the project while also to be completed withing investment budget and temporary organization contractors.

The deliverables and outcomes anticipated by both parties, together with any information exchange by the vendor to the client, should be stated in the contract. Anything not expressly stated in the contract cannot be lawfully recognized. A contract's legal bindingness necessitates a more thorough approval procedure, frequently including the legal department, even if all project papers could be subject to some sort of review and approval (PMBOK, 2021). In all circumstances, the review and approval process' main objective is to make sure that indeed the contract accurately reflects the goods, services, or outcomes that the seller is promising to deliver while remaining in conformity with the legislation and rules governing procurements (PMBOK, 2021). In turn, combining all the mentioned factors creates a gap between short-term and long-term objectives that can harm both the need for innovative solutions and the need for resource effectiveness.

In the construction sector there are about 117.000 construction companies of which 87 % had a maximum 4 members of staff (SCB, 2021. The traditional big three in Sweden's construction sector that also have project internationally is called Skanska, Peab, NCC that together have more than 20.000 employees with a turnover of 115 billion SEK in their Swedish division (Byggföretagen, 2020).

1.1 Readers Guide

This thesis was done together with a management consultant company with ambition of finding new ways of helping their client and challenge old ideas about how competition, markets, supply, and demand behaves in relation to each other within the construction industry. If you are an expert in the field, we think you should find what you look for in the method and results part. If you just interested in learning more, explore the literature guide and then jump directly

to the discussion and conclusion. If you want a very comprehensive and in-depth experience and explanation of the subject at hand, we recommend you take the time to go through the whole paper.

In the method part, we explain how and why we research the subject this way, as we were unorthodox and used literature study, survey, and interviews. The result of the study is divided into three parts, literature, survey, and interview study. In the literature study you will find old and newer sources of information about the topic to bring a thorough understanding of the area investigated. In the interview part we will get a summary of the categories of answers we got from the respondents, 10 working professionals working with large construction companies in Sweden. In the survey you will find the data from a survey of 40 businesses professionals in construction sector in Sweden, as far as we know it unique in its kind. In the analysis it discussed the different answers from the results with our own thought as well as how they relate to each other to find different connections. In the conclusion, the question of our study is answered in a comprehensive way using results from all the different studies that was done. After conclusion, a Roadmap was constructed to highlight how one should think if to make their own procurement decisions, as a mean to contribute to the scientific community. Finally new finding and researches is showcased to conclude the paper.

1.2 Background

According to the Swedish Competition Authority, it is difficult to overestimate the importance of an efficient and innovative construction industry for the sustainable development of our modern society. The importance depends partly on the size and scope of the industry, which affects employment and the national economy, partly on the large environmental impact of the construction processes, and partly on the fact that the industry's products greatly affect the development and well-being of society, citizens and the environment. According to the Swedish Competition Authority, it is often claimed the construction industry is characterized by a lack of efficiency such as construction errors, time and cost overruns and a lack of innovation. For example, in the form of reluctance to change and lack of ability to adopt new technology. Swedish investigations often focus on how these problems and shortcomings stem from a lack of competition in the construction industry, while investigations in other countries rather emphasize the lack of cooperation. The Swedish Competition Authority believes that the construction industry is undergoing some change, and that the clients' choice of procurement strategies is an important potential driving factor in this change. Cooperation and competition are believed to be important means to promote increased efficiency and innovation (Konkurrensverket, 2019).

The Construction Industry is known to be project-based, which means that the industry's productivity and degree of development largely depends on efficiency and innovation in individual projects. The conditions for promoting activities within a construction project are greatly influenced by the client's procurement

strategies, as these can provide both opportunities and incentives for contractors and consultants to apply their existing resources effectively and/or invest in innovation (Byggföretagen, 2020). The Swedish Competition Authority therefore believes that professional purchasers thus have a great opportunity to influence the industry's development by choosing procurement strategies that promote efficiency and innovation (Konkurrensverket, 2019).

In its most basic form, construction procurement refers to acquiring labor and purchasing supplies. It is engaged in the timely and effective completion of a project. This is essential when starting a project since it lays out the whole summary of the project from design to execution. At the same time, managers must guarantee that all government limitations and requirements are followed to prevent any fines or violations of the law. Individuals allowed to acquire products and/or services for the project would include project team members, management, or members of the organization's purchasing department, if relevant (PMBOK, 2021).

The procurement procedures used in the construction industry are only one example of how the industry has a long history of being conservative and resistant to change (Konkurrensverket, 2019). A management consulting firm that specializes in supply chain management and procurement for the construction sector has been contacted as an external supervising contact. Their clientele includes construction, real-estate, and public agencies seeking help on these difficult challenges. Even though they are industry specialists, they believe there are certain knowledge gaps when it comes to procurement and supply chain management, which are crucial for delivering the best final product in terms of quality and cost. They believe that the lack of understanding in procurement process optimization stems from lessons learnt in previous projects not being carried over to the next project. Furthermore, a road map should be created to assist contractors in making the best procurement decisions to complete projects with a high-quality output and low cost.

We want to highlight that in the construction industry, project delivery models and procurement strategies are completely linked, often functioning as two sides of the same coin. Understanding the interdependence between these two components is crucial for successful project execution. Project Delivery Models refer to the contractual frameworks and organizational structures that define the relationships and roles of various project participants. Examples include Design-Bid-Build (DBB), Design-Build (DB). Procurement Strategies relate to sourcing and acquiring the necessary goods, services, and workforce for a construction project. They can encompass aspects like tendering processes, supplier selection criteria, and contract types. The chosen project delivery model often dictates the suitable procurement strategy. For instance, a DBB model typically involves a two-step tendering process—first for design and then for construction, while a DB model might opt for a combined approach.

Therefore, to get additional understanding in the field, the two common major frameworks for project delivery procedures in the construction sector, design-bid-build and design-build, should be reviewed. Henceforth, it will be relevant

to assess these two frameworks and provide a road map based on current information for various scenarios. Also, it is worth noticing how these frameworks fit into the context of the Swedish construction sector and market conditions.

1.3 Aim

The Scope and aims of the project are to answer the research questions as stated in 1.4, and then make Suggestions for building a roadmap on how different decisions of the procurement framework effects the result. By analysing weakness and strengths, discovery of potential improvements can be made into current frameworks to form the roadmap.

1.4 Research Questions

The research questions investigate different models and strategies for procurement and how they affect the result in construction projects in Sweden. By stating the questions:

How do the project delivery models design-bid-build (DBB) and design-build (DB) stand against each other from a quality and end-cost standpoint? By looking specifically into:

1. How does the delivery models affect the number of total procurements offers and sub-consultants in the value-chain?
2. Does the number of total procurements offer, and sub-consultants then effect the result in terms of quality and end cost?

1.5 Limitations

Several limitations were identified during the working process. To make a more reliable report these issues could have been researched during a longer time span than the time that was available to make the report. The study was also conducted for projects that were constructed during a macro period that according to SCB (2022) can be seen as a long-term economic boom In Sweden, 2015-2022. With exemption for 2020 that because of the COVID-19 pandemic made Sweden go into a short recession, quickly jumping back into a period of economic boom. Conducting the studying during a recession might have affected the strategies, business models and behaviours of companies and suppliers.

Figure 1.1 *Economic barometer construction in Sweden. Confidence indicator. Index mean value =100. Seasonally adjusted values. Konjunkturinstitutet.*

Other limitations where that the limit of our network and resources made it possible to only assess and interview a smaller part of the market segment of construction business professionals in the construction industry. The interview process as later described was conducted during a month and more comprehensive results could have been made if more time were available in the project.

1.6 Delimitations

The chosen limitations were as following due to previously mention lack of network in the construction industry. The Swedish construction sector was chosen because they operate within the same framework containing market conditions and similarity among companies and projects investigated, such as economic activity, rules, regulations, business culture and best practice among contractors and suppliers. Since construction industry is a complex industry because each project often has unique conditions even, thou, they share the same regulations on functional demand, safety, and permit processes. Several different types of projects are done within the frame of the same industry ranging from infrastructure, housing, office buildings to other kinds of unique projects the choice to limit the scope to only apartment buildings used for private tenants were chosen. Both housing cooperative and rental business models for the housing were both chosen even though costs differ with 43% between the models as the physical objects produced where deemed to be in the same category (Sveriges Allmännytta 2020). As a way of defining an area of research this study will focus on companies that has 500 and more members of staff that makes up 0.00024 % or 28 companies of construction companies in Sweden. Consequently, this subset will be the base of contacting companies for interviews.

2 Method

An abductive method was used to explore the clearly defined research issue that was presented in Section 1.4. According to Bell et al. (2019), this is accomplished to get a subjectivist perspective by combining numerical and cognitive reasoning. As a result, the method provides for a balance between alternative explanations and interpretations of the data, and an understanding is ultimately obtained through an ongoing conversation between the researcher's prior assumptions and the data acquired (Bell et al., 2019). As a result, the technique developed a back-and-forth procedure involving the gathering of empirical data from interviews, statistical data from survey and a review of theoretical literature.

Additionally, the methods listed below were chosen to be qualitative research strategies, offering an iterative structure and a flexible approach to examine the stated research issue. Furthermore, the concept of procurement maturity was considered in regards of how it is affecting the relationships in the value chain and consequently the value chain and contractor model relationship. Also, worth noting is that procurement maturity is an ongoing process which in turn makes it relevant to analyze how far each contractor has reached in implementing it.

2.1 Systematic Literature Review

A literature review was made to establish a theoretical framework where the authors of this study could gain insight into the frameworks and the processes regarding DB & DBB as well as other relevant background information required to understand the context of the issues at hand and draw relevant and plausible analyses and conclusion from this. The literature review was done using a systematic review approach to make a thorough review of the subject at hand as well as decrease the risk of the research question being affected by the authors own biases. The systematic review was conducted using the guidelines as proposed by Bell, Bryman, Harley (2015). Having an evidence-based approach to the research question to get an apprehensive view of the problem. To plan the systematic review for the research questions at hand, four elements had to be decided: Context, intervention, mechanisms and outcomes.

2.1.1 Context and challenges

The chosen setting to research the question at hand was chosen to be the construction industry. To gain both the fundamentals as well as the latest scientific findings in the study we established two categories of relevant context. The first one being construction industry, as the latest being construction industry in Sweden and findings from the last 10 years.

Consequently, we faced several difficulties while working on this project. Some of these included the fact that a large amount of data was collected and evaluated to answer our questions; large amounts of data were collected throughout the literature review, interview study, and survey. Understanding, interpreting, and deriving conclusions from such massive data sets was challenging for us but simultaneously vital for our abductive method and reaching a fair analysis.

2.1.2 Intervention

In the study, the effects of the activities related to different types of procurement of sub-contractors in building activities in multistorey buildings for housing were studied.

2.1.3 Mechanisms

Mechanisms in this study can be explained by relationships such as contracts between business partners of different characters. Ranging in the spectrum from new and temporary relationships to more long-lasting strategic business relationships as well as private relationships.

2.1.4 Outcomes

The intended outcome of this review is to establish a framework of knowledge which can be used to draw important conclusions from and understand the context of the interview study that is later conducted. An unintended outcome of the literature review could be that other angles at which one should look at the research questions can be discovered. Issues that were first deemed to be unimportant by the researcher can in the new shed light of the literature review gain more importance, as well as the questions at hand can gain less. This new data can then be used as to suggestions on how to do further research on the topic at hand.

2.1.5 Research Strategy

Relevant keywords to the topic of the study and identified during the education program as well as in discussion with the associated company providing information and aim, were used to search and find studies available in open-source libraries on the web, the choice was using Google Scholar and Chalmers Library as tools for finding them. The selection on which sources to use was made by seeing their relevance and closeness to the key questions. Keywords that were used as follows: "*construction management", "procurement management", "supply chain management", "contracting"* and *"Sweden".*

As for choosing which sources to be excluded or included after conducting the search according to previous keywords and databases, criteria were set. What was deemed to be eligible criteria for making the sources of information and the data it contains relevant to the study, matric of criteria were made. Two matrices were made, one for the fundamentals and one for the new insights into the areas investigated.

Definition	**Criteria**
Language	English
Year Range of Publication	-
Topics	Procurement of sub-suppliers in the construction industry, Design Build Bid, Design-Build

Type of Publication	Scientific Journals & Articles, Governmental Reports, Doctoral thesis
Peer Review	Yes
Keywords including more than 2 of the following	"*Construction management", "procurement management", "supply chain management", "contracting" "Sweden" "subcontracting" "sub supplier"*

Chart 2.1. Criteria for Fundamentals.

Area	**Criteria**
Language	English or Swedish
Year Range of Publication	2012-2022
Topics	Procurement of sub-suppliers in the construction industry, Design Build Bid, Design-Build related to multi-story private housing, Innovation and new business model in construction management related to multi-story private housing,
Type of Publication	Scientific Journals & Articles, Governmental Reports, Doctoral thesis
Peer Review	No

Chart 2.2. Criteria for New Insights

2.1.6 Databases and Articles

For the literature study a systematic review was done where 68 different articles relating to the subject was researched and evaluated. The articles were found using Google Schoolar, open search engine for finding academic articles. Using search key word such as Construction management, procurement management, supply chain management, contracting, Sweden, subcontracting or sub supplier. The titles and abstracts of identified articles was checked against pre-determined criteria for eligibility and relevance. In this case these criteria's where that they should be about the subject and either provide a fundamental base for knowledge in the area researched or that they would be a fresh source of new knowledge and additional to the scientific community. All the articles reviewed can be found in Appendix 3.

2.2 Survey

A Survey was conducted to get a statistical basis of our research questions and to get more context for the interview study that was conducted later.

The participants of the survey were individuals working in the construction industry in Sweden, both as contractors and clients. They were recruited through a foundation for construction management with a large network of business professionals in the construction industry using, email invitations and social media advertisements.

The survey was conducted online using a survey platform. The survey was divided into 21 questions, including multiple-choice, open-ended, and Likert-scale questions. Participants were able to complete the survey at their own convenience and were not required to complete all questions.

Qualitative data obtained from open-ended questions were analyzed using content analysis. Participants were informed about the purpose of the survey, the nature of the questions. The study was also done anonymously with no need to give out contact information, in order to freely be able to respond to questions.

The survey relies on self-reported data, which can be subject to biases and may not always reflect the actual practices of participants. The sample size was also limited as 40 people attend, which may affect the generalizability of the findings. Additionally, the survey was only conducted in Sweden, and therefore the results may not be applicable to other countries or markets.

2.3 Interviews

To obtain objective information, we interview different business professionals within different roles where they had to some extent work with procurement or bidding process in construction industry to get a broad understanding of the context and problems related to our research questions. Interviews with a variety of industry stakeholders involved in the procurement process as well as those who must cope with the effects from contracting and procurement to get a fair, objective, and comprehensive view of such a complex topic.

The empirical data was chosen to be gathered through interviews with the stakeholders selected to represent various perspectives on the issue of procurement management in the Construction Industry and the economic results of these processes. Assessing the different models and strategies by contacting and interviewing business professionals in the industry.

The interviewees were chosen by a carefully engineered selection process. Business professionals were searched, found, and contacted using the tool LinkedIn to find the relevant business professionals using keywords in English and as well as their Swedish translations in combination with the names of the top 28 biggest construction companies in Sweden such as, construction manager, project manager, site manager, procurement engineer, contracting engineer and others. These companies were chosen because they are all enterprises with more than 500 permanent workers, making them comparable objects in similar size. According to LinkedIn (2021) 78 % of business professionals in Sweden use

LinkedIn, making it a reliable source of finding the right persons for the study. To gather the qualitative data, semi-structured interviews were held. This was primarily done to allow interviewees some latitude in their responses while yet ensuring that the topic at hand was covered. According to Bell et al. (2019), semi-structured interviews are often excellent for conducting a qualitative study because they give the interviewer the freedom to expand on and add questions that are not covered by the guide, giving them a better grasp of the interviewees' responses. The writers go on to say that it is okay if the questions don't go exactly according to the plan (for instance, the order in which they're asked), which might help you have a more casual and easy-going conversation that, in some ways, isn't entirely pre-planned. Bell et al (2015) also sees that asking background questions about the interviewee at the beginning of the interview can improve semi-structured interviews by making them more comfortable for the rest of the talk which was also used during the study. An interview guide was made (see attachments) to in order to fill the requirements for being structured, objective and to collect comparable data from the subjects. Questions were chosen from the criteria's that the interviews should not take more than 1 hour since the subjects have a limited amount of time to dispose for the study. The questions where related to construction projects that fit the criteria of the study. After the interviews were done the interviews where transcribed by re-listening to audio recordings of the interviews. The data was then analyzed grouping the answers into blocks of similar answers to gain insights on trends, to be able to compare and draw conclusions from their answers as well see how they related to the data from the systematic literature review.

3 Theoretical Framework of reference

This chapter includes a presentation of theoretical literature and findings from the literature review related to the topic of the research questions that is used to function as a framework and baseline to both understand and interpretate the results as well as then then to build upon with the newly learned interviews as described in chapter 2.

3.1 The Construction Industry

Key conditions that make the construction industry different is that products are immovable, long lived and production is to some extent geographically dependent. Buildings in the modern age are large, complex constructions composed of a variety of systems that interact with each other and the end users. This complexity together with construction's connection to a specific geographical location means that construction processes are conducted as temporary projects, involving collaboration of many different stakeholders, value chains and activities with respective interdependencies. In comparison to the manufacturing industry, building is usually also characterized by high customer customization and co-production with the customer, high service content and large environmental effects that are not priced at market prices (Bröchner & Kadefors, 2010).

Uncertainty from unknown geological conditions in the soil and rock where the construction is produced make up for a large unknown variable. This variable together with the characteristics of the construction industry create major challenges from a procurement perspective. The products' great importance for society, their long lifespan and high life cycle costs together with limited investment budgets and temporary project organizations create tensions between short-termism and long-termism. The need for coordination and cooperation between many different actors and their activities in complex projects, as well as the need for competition between actors to promote cost efficiency, also create tensions. On the one hand, there is also a great need for innovation and creativity to promote sustainable social development. On the other hand, there is a need for stable and safe technical solutions as well as effective utilization of existing resources and skills. This creates a tension between the long-term need for innovation and efficient resource utilization. The client must consider and manage these tensions when choosing a procurement strategy, which requires a systematic holistic view to avoid sub-optimizations (Bröchner & Kadefors, 2010)

According to MGI the construction industry is facing persistent cost pressure because of tight public budgets and housing-affordability issues. Analysis found that $69.4 trillion in global infrastructure investment would be needed through 2035 to support expected GDP growth and that every third global urban household cannot afford a decent place to live at market prices (MGI, 2017). Every year, there is about $10 trillion in construction-related spending globally, equivalent to 13 percent of GDP. This makes construction one of the largest sectors of the world economy. The sector employs 7 percent of the world's working population and, by building the structures in which we live and work, which create our energy, materials, and goods, and on which we travel, has an impact well beyond its own boundaries. For decades construction has suffered from remarkably poor productivity relative to other sectors. Other sectors have transformed themselves, boosting productivity. In retail, the mom-and-pop stores of half a century ago have been replaced by large-scale modern retailers such as Aldi and Walmart, with global supply chains and increasingly digitized distribution systems and customer-intelligence gathering. In manufacturing, lean principles and aggressive automation have been transformative. In comparison, much of construction has evolved at a glacial pace (MGI, 2017). According to McKinsey happening worldwide, players in the industry benefit from today's market failures, earning a substantial share of revenue and profits from change orders and claims, and reducing exposure to competition in an opaque market (MGI, 2017).The Swedish Competition Authority also confirms this behaviour as they believe that tenderers often deliberately submit tenders that are too low in contract procurements and then instead compensate themselves by "vacuuming" the request documents for ambiguities and ambiguities in order to try to demand compensation for ÄTA work. Another recurring problem, described by the Swedish Competition Authority, which arises with running billing and not least with framework agreements is the occurrence of contractors who over invoice the number of hours worked (Konkurrensverket, 2019).

3.2 Market Conditions

According to Harvard Business Review there are in America now about 730 000 building companies with an average of ten employees while in Europe there are 3.3m companies with an average of just four workers. Competition is fierce and profit margins are thinner than for any industry except retail. This fragmentation creates its own problems. Slim margins make investment even less likely. Often projects have more than a dozen subcontractors, each keen to maximize profit rather than collaborate to contain costs (Harvard business review, 2020). (MGI, 2017) empathizes as for the industry as a whole, regardless of country, local market structures and ease of entry have resulted in a fragmented landscape (both vertically and horizontally) of mostly small companies with limited economies of scale. Moreover, every project involves several steps and companies in every project with scattered accountability, which complicates the coordination. Contractual structures and incentives are misaligned. Risks are often passed to other areas of the value chain instead of being addressed, and players make money from claims rather than from good delivery. High unpredictability and cyclicality have led construction firms to rely on temporary staff and subcontractors, which hampers productivity, limits economies of scale, and reduces output quality and customer satisfaction. (MGI, 2017)

According to SCB: s labour force surveys, the number of people employed in the construction industry amounted to 341,500 people in 2021 (SCB, 2022). The investments amounted to 591 billion, which is 10.9% of Sweden's GDP. (Byggföretagen, 2022). However, the construction industry is sensitive to economic cycles, more than many other industries and its share of GDP has thus varied between 6-16% over the past 60 years (Sveriges Byggindustrier, 2013).

In Sweden, the industry's standard contracts, which form the basis of all procurements. With exceptions, Swedish contract law is in principle not regulated by law. Instead, the industry has developed jointly negotiated standard agreements that regulate the parties' rights in construction contracts. Where the most recent editions currently in force are “general regulations for building” for construction and installation work - AB 04 which refers to execution contracting and ABT 06 for turnkey contracting (Konkurrensverket 2019).

AB 04 and ABT 06 are structured in the same way and a cornerstone of both standard agreements is the portal provision in chapter 1 § 1 according to which the scope of the contract work is determined by the contract documents. This means that the contractor must carry out the work described by the client in his request documents and nothing else. Meaning that if the client forgot to include something in his request documentation, it is not included to perform as contract work for the contractor. That rule must at the same time be read together with the AB and ABT equivalent rule in chapter 2 § 3 according to which the contractor is not only entitled but also obliged to carry out ÄTA work prescribed by the client. What the client forgot, the contractor must still carry out, but has the right to be paid for in addition to the contract sum as ÄTA work (Konkurrensverket 2019).

To avoid contradictions and misunderstandings and facilitate actors' consensus on the details of an inquiry document, the industry has been providing the so-called AMA system through Byggtjänstförlag for several decades. This includes descriptive texts with different codes for a very large number of work steps within various technical disciplines such as Electrical AMA, Installation AMA, Ground AMA, etc. This also includes AMA AF with AMA AF 12 as the latest edition, which functions as almost standard-setting template for how the administrative regulations (the AF part) are structured with different sections such as 33 procurement regulations and contracting regulations, etc. and with various underlying codes that, among other things, fill in and adapt the standard conditions in AB and ABT. There is therefore a firmly established and, for the uninitiated, relatively complicated structure for how the majority of contract documents must be designed, which the client has to adhere to. Any shortcoming from the client in this regard entails an increased risk of the contractor having more or less well-grounded ÄTA discussions after the contract has been signed.

Therefore, according to Konkurrensverket(2019) there is a clear connection between the quality of the documents (technical descriptions, drawings, framework descriptions, non-priced lists of quantities, etc.) that the customer includes in his request documents to define the scope of the contract and the amount of ÄTA work that the contractor will be able to request compensation from the client in addition to the contract sum. According to Konkurrensverket(2019) there are low requirements in AB/ABT on the contractor when it comes to notifying contradictions and errors in the documents. It is required that the contractor has de facto discovered an error and that the customer can demonstrate this.

3.3 Stakeholders

This thesis discusses four major types of stakeholders in the construction industry: clients, principal contractors, consultants, and subcontractors which also contributes to the value chain. Customers who purchase construction services are typically termed to as clients. Clients might be classified as "singular," who only need construction services sometimes, or "professionals," who need construction services frequently. The majority of customers will want some form of guidance or support in the design of both the building product and the means to obtain it. Therefore, many experts are hired as consultants to provide advice on the project's specifications, including architects, builders, and technicians (Eriksson, P-E & Pesämaa, O, 2007).

Most of the fundamental construction tasks, such as those involved in the apartment's assembly, are often carried out by the primary contractor, who is the stakeholder primarily responsible for overseeing assembly activity on the construction site. Most general contractors hire specialized tradespeople, or "subcontractors," to handle tasks like as piping, heating systems, paintwork, electrical installation, bricklaying, carpentry, and flooring. In most cases, suppliers and subcontractors have a considerable influence on construction goods since they account for about 60%-80% of the overall net work performed in the construction projects (Eriksson, P-E & Pesämaa, O, 2007).

Furthermore, previous studies have shown that using a third-party facilitator can improve project outcomes by fostering and cultivating dialogue among involved stakeholders. The project facilitator's role and function are to serve as a go-between for the project team and the client so that information may flow freely in both directions. Among the objectives would be determining the strategic demands of the client and establishing and directing the design development process. The crucial choices that have an impact on the project's procurement process are made throughout this step (Love et al, 2004). Stakeholders' views of the same terminology may lead them to different conclusions about their meaning, which can have a significant impact on the success or malfunction of the procurement process and, more specifically, on project procurement. Understanding how the various stakeholders in the system interpret alterations in the project procurement is of utmost significance when it comes to the process of designing changes and putting them into effect. This could be particularly important when there is a requirement to implement new regulations or incentives (Kornevs et al, 2018).

Within the principal contractor firm, senior management expects to have decision-making power and competency. Subcontractors and suppliers, who have a vested stake in the outcome of the project, may demand a more collaborative approach to decision making for shared procedures, which can create conflicts of interest (Grenzfurtner & Gronalt, 2020). The interests of all stakeholders must be considered when a policy is established by top management in the principal contractor since it can affect the value chain, as explained in the following subchapter. Nevertheless, it must be stressed that a project may involve several transactions, each of which may have unique features. The major transaction is frequent between the customer and the general contractor, which thus comprises most of the project tasks and hence most of its value (Eriksson, P-E & Pesämaa, O, 2007).

3.4 Value Chain

To comprehend the value chain, one must first learn about the resources and skills that contribute to its constituent parts. Some academics have gone as far as to describe dynamic capacities as the organizational and strategic processes that lay the groundwork for managers to purchase and dispose of resources, integrate them, and rearrange them to develop innovative approaches to create value. Therefore, they are the primary forces driving the development of added resources that may be used to gain an edge in the market. A company's competence emerges from its capabilities, which are developed and coupled with other assets. An organization’s value chain is the accumulation of interconnected actions that it undertakes from within to generate productivity, thus it is easy to see how competencies are tied into the concept. One form of competitive advantage is the execution of value chain operations in a way that gives a company the opportunity to outmatch competitors. The first step in gaining an edge over the competition is to boost the organization 's strategy and competitiveness by bolstering its ability to undertake value chain operations at a higher level of competence (Porter, 2001).

It is proposed that the teams share equal responsibilities for the design development process to assigning a single person or team to that role. Shared accountability could increase the quality of contract documents generated since members of the team are incentivized to ensure that modifications, whether any, are coordinated and inaccuracies and oversights are recognized early in the development process. Successful implementation of the strategy demands a leader capable of coordinating and integrating activities and resources across the whole procurement procedure (Love et al, 2004).

The procurement process can be associated with specific value chain activities but more importantly it supports and defines the whole of the value chain. In this context, procurement does not relate to the goods or services being acquired but rather to the process of acquiring them for use in the value creation process within the company. The acquired inputs that were acquired may include, for instance, raw materials like concrete or wood, supplies like installation equipment and other commodities, and then assets like machinery, office equipment, and mobile buildings. However, while bought inputs are most often seen in primary activities, they are also present throughout every part of the value chain. To put this into perspective, consider that much like all value-creating activities, the procurement process makes use of resource technologies including vendor-handling processes, qualification requirements, and database management systems. The conventional buying department is responsible for purchasing some products, such as raw materials, while the project managers, office managers, and even the CEO are responsible for purchasing other items, such as machinery, temporary employees, and office supplies (for strategic consulting). Even while the buying department, for example, serves several value activities and implements purchasing regulations that may apply across the board, each procurement activity typically has a value activity that it supports. The cost of procurement operations is often a tiny fraction of the total cost, but it has a significant influence on the organization's expenses and uniqueness. Improved procurement processes may have a significant impact on the pricing and quality of acquired inputs, in addition to other activities related to receiving and utilizing inputs and sharing information with suppliers (Porter, 2001).

The clients who were using a comprehensive collaborative approach to procurement, which included collaborative processes such as early subcontractor involvement, bid assessment using soft parameters, incentive-based reimbursement, and intensive use of collaborative techniques such as shared objectives and a shared IT-database. The processes were found to be beneficial for subcontractor engagement and integration since they allowed for a collaborative construction project that included all stakeholders were incorporated. Yet this did not lead to noticeably more value creation or innovation on the part of subcontractors (Eriksson, P-E et al 2007).

MGI (2017) claims that construction is not the first industry to encounter lagging productivity and disruption in the value chain. From other industries such as shipbuilding, commercial aircraft, manufacturing, agriculture and automotive, lessons can be learned and translated into the context of the construction

industry. There are patterns to be recognized among the companies handling the change best and, in the end, did raise the value of their business due to kickstarting their Innovation journey with production technology and new work methods later leaning into investing in digitization and data driven products and services.

3.5 Contractor Models

3.5.1 Design-bid-build

The technique of project delivery known as Design-Bid-Build (DBB) is the one that is utilized the most frequently and has a close connection to fixed-price contracts (Kadefors et al, 2019). Conventional methods of acquiring goods and services utilize defined price competitive tenders, a process in which customer provides as much information as they can about the project they want (i.e., a defined design), and then examines several offers with an eye toward selecting the one with the lowest established current bid. Most often, clients and their contractors work jointly to create the detailed design for projects acquired through DBB contracts. Clients can save money by using in-house designers in these situations. The customer employs an architect or designer who then draws out plans and other legal paperwork. The company may hold a bidding procedure or get into negotiations with a chosen contractor once they have the proper documentation in hand. After then, it's up to the contractor to build everything and hand it over to the client. Any necessary subcontractors can be selected by either the architect or the contractor. In this case, the contractor is exclusively liable for carrying out the task (Borg & Lind, 2014).

This selection technique may function effectively in projects that are quite easy and uncomplicated with little uncertainty, where firstly the skills and experience of the vendors are of minimal significance and secondly, the tender prices have remained near to the final price because of a modest degree of variations. The quality of collaboration may be improved by adopting a strategy based on the tender process of a smaller pool of qualified contractors and the following review of bids which again considers 'softer' factors, such as the bidder's organization, experience, and reference projects. Thus, the partner selection based on shared innovation goals might be helpful. A client has the option of hiring a reliable contractor who is ready and able to collaborate on such a development project (Kadefors et al, 2019).

Furthermore, to reduce the time it takes to implement DBB projects, businesses could consider using cost-plus contracts that incentivize contractors for quicker completion of the work. In addition, highway building projects were completed more quickly and there were fewer negative externalities experienced by commuters because of the use of explicit time incentives (Park & Kwak, 2016).

The DBB methodology separates the design and construction processes entirely and the primary benefit of DBB is that the client's architect and engineer may provide the contractor with a fully developed design prior to the commencement

of construction. When the owner, architects and engineers, and contractor need to discuss compensatory modifications, the adversarial nature of the separate-party system, along with tight contractual terms, impedes flexible communication and learning outcomes between stakeholders, resulting in inefficiency in dealing with unanticipated events. Since the building process is controlled by dividing work into diverse options which are divided into multiple expert actors to be performed independently, the division of labour sometimes results in disengaged commercial relationships in conventional methods of procurement. When distinct areas of construction are divided traditionally, it might cause what is called "functional fragmentation" (Eriksson, P-E et al, 2019).

When parties may share relevant knowledge disclosures throughout the intersection of design and construction, alternative reward procedures like negotiation should be given considerable consideration. Indeed, several earlier studies acknowledge the drawback of open competitive bidding linked with the DBB approach that prevents project partners from giving each other sufficient insights during the design stage and propose the use of dialogues and agreements for complex projects (Park & Kwak, 2016).

3.5.2 Design-build

Design-build is a method of delivering projects in which the owner enters a contract with a single organization that is responsible for providing both the architectural design and the construction services. The design-build company may perform all these tasks alone, or they may hire third subcontractors to do some of them. Clients, concurrently, are becoming weary of the disadvantages brought on by the fragmented procurement structure and are more interested in integrated alternatives. Therefore, new forms of procurement are being developed, and design-build (D&B) contracts are becoming more commonplace in the construction industry (Lam et al, 2008).

Procurement strategies for design-build projects are often more sophisticated and crucial than those for other types of project delivery. Due to design-reliance builds on a single contractor for project delivery, the procurement technique used to choose that contractor must be as thorough as possible to guarantee satisfactory results. Therefore, some authors have contended that low-bid procurement selection may not be the best method for acquiring a design-build team (El Wardani et al, 2006). For greater project success, some have advocated using a multicriteria approach to choose a contractor that subsequently also impacts what different procurement methods is chosen as seen in the figure below.

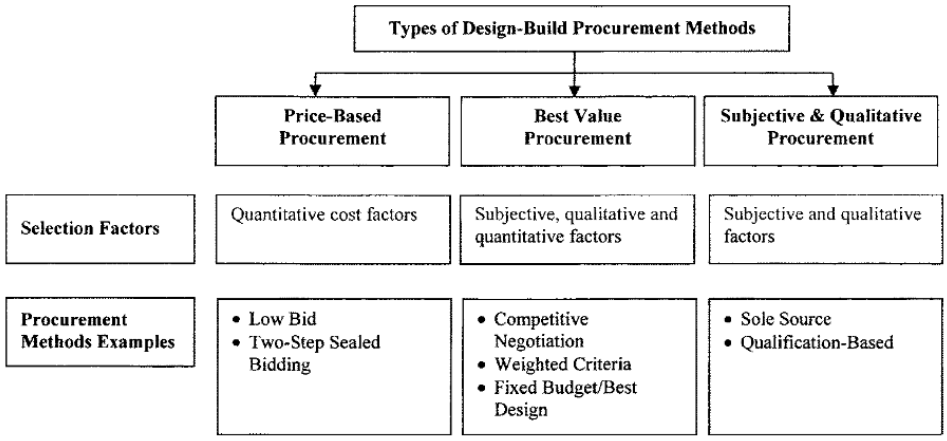


Figure 3.1 Different types of DB procurement methods.

Sole source: Entails hand-picking the design-build group based on criteria including previous work, technical credentials, and connections made via previous projects. As stated by El Wardani et al (2006). Public owners could be hesitant to use this procurement strategy because of the absence of price competition among potential D&B teams.

Qualification-based: The contractor chooses the team for the project by submitting a request for qualification (also known as an RFQ), and then usually arranges a D&B contract directly with the best qualified team at a price that is considered fair and reasonable. The team is chosen based on qualitative factors such as project's success rate in the past, the design-credibility, the team's technical proficiency, and their financial security. Under this structure, the contractor has the option of awarding the contract to a D&B team with whom they have developed long-term connections, that requires minimal scope design performed at the early stages of projects (El Wardani et al, 2006).

Best-value: With a best value strategy, the contractor requests bids from potential D&B teams, which are then evaluated largely because of technical factors and costs involved. After the proposal is submitted, negotiations can begin. The winning bid is the one that provides the most value to the owner. The owner's company, the nature and scope of the project, and other considerations are considered when determining the relative importance of the various criteria utilized in the assessment process used to choose the design-build team. It is possible for the best value procurement strategy to include involve a prequalification step, when the design-build team is evaluated on technical criteria prior to the final selection phase (El Wardani et al, 2006).

Low bid: The project value and associated financial variables are the primary criteria used by the contractor in selecting the D&B team. When using this technique of selection, designs are typically quite close to completion before procurement begins (El Wardani et al, 2006).

The traditional view is that the cost, time, and quality of a project all play major roles in its success or failure. To fully understand it, it must be examined from the technical, financial, educational, social, and professional aims of diverse people. Success criteria for D&B projects have been used in prior research to

delineate the advantages of this procurement strategy (Lam et al, 2008). More importantly, the design-build project is judged successful if and only if the client's requirements are satisfied. Although the primary advantage of the D&B procurement technique is its reduced time commitment compared to alternative methods, one review of the relevant literature determined that the performance of D&B projects may be measured using the same metrics as those of traditional construction projects (Chan et al, 2002).

By allowing the client to consider criteria that are unique to each project, the best value option emerged as the most adaptable technique among the several methods of team procurement often used for design-build initiatives (El Wardani et al, 2006).

The case study provided by El Wardani et al (2006) examined the efficacy of public design-build projects and provided descriptions of the one-step, two-step, and qualifications-based procurement strategies employed by public owners. Contracts are granted based on the best combination of technical qualities and cost of the project using the one-step procurement technique. The two-stage procedure begins with a technical proposal assessment to determine which teams will advance, and then the contract is given depending on either cost or best value. In a qualifications-based procurement strategy, conversations between potential bidders determine which firm will get the job. The qualifications-based procurement technique is often conducted early in the delivery phase, while only 5-10% of the design is done, giving the design-build team better control over the project's scope, cost, and timeline. Prequalifying the D&B team is another crucial step in the shortlisting process since it typically results in a reduced need for extra administrative time and a more manageable timeline.

3.6 Procurement Models and Theories

3.6.1 Kraljic's Theory of Supply Chain Management

Kraljic's Theory of Supply Chain Management (Kraljics, 1983) is a model that helps organizations effectively manage their suppliers by categorizing them into four quadrants based on two factors: supply risk/complexity and profit impact. The theory suggests that organizations should adopt different procurement strategies for suppliers in each quadrant to optimize their supply chain performance.

In the construction industry in Sweden, the application of Kraljic's Theory can provide a structured approach to managing suppliers and mitigating supply chain risks. For instance, suppliers that fall into the strategic quadrant (i.e., high supply risk and high profit impact) should be managed through close collaboration and long-term partnerships to ensure a reliable and continuous supply of critical materials and services. On the other hand, suppliers in the

bottleneck quadrant (i.e., low supply risk and high profit impact) can be managed through a focus on efficiency and cost reduction.

The construction industry in Sweden is characterized by a complex and dynamic supply chain, involving multiple tiers of suppliers and contractors. Therefore, the application of Kraljic's Theory can also facilitate the identification and management of risks and opportunities across the entire supply chain.
The application of Kraljic's Theory of Supply Chain Management in the construction industry in Sweden could potentially help organizations optimize their procurement strategies, manage risks, and enhance their supply chain performance.

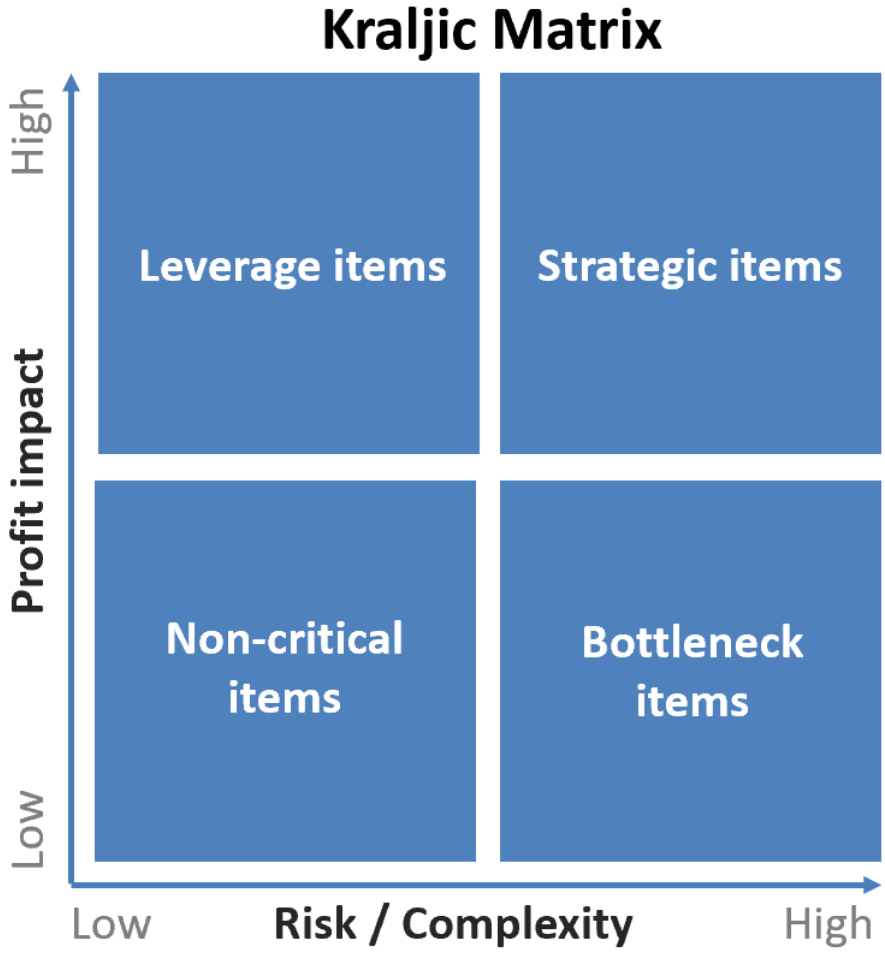


Figure 3.2. Kraljic's Matrix.

3.6.2 Transaction cost economics

In its largest context, Transaction Cost Economics (TCE) is a theory about the organizational features of commercial exchanges in complex settings where decisions must be made. Particularly of interest to TCE are agreements that are challenging to back out of without suffering a considerable economic loss, as well as recurrent transactions that are inherently uncertain in nature. However, as a theory of management, TCE has a lot to offer about the organizational structure

of organizations as well, thus its insights are not restricted to enlightening us on organizational limitations (Ketokivi, M & Mahoney, J, 2017).

Furthermore, TCE is not simply a theory of transactions; it can be applied to any circumstance in which several parties with only partially coherent goals enter into a contractual agreement to structure their activity. Even in complex settings, exchanges may take place, and this undoubtedly benefits everyone involved. However, in complex and difficult contexts, contracting parties need to gather information that may be expensive to get, they must negotiate upon and maintain a dynamically changing buyer-supplier contract, any disagreements may involve renegotiation, arbitration, and occasionally civil lawsuits, etc. Such expenses are instances of transaction costs, and they may be substantial enough to even have far-reaching effects. Understanding these effects is the key to TCE, which in turn allows us to focus on the right causes in an informed way (Ketokivi, M & Mahoney, J, 2017).

Transaction costs in the building sector have been divided into two broad classes. In the simplest terms these are called as pre and post contract transaction costs. The purpose of classifying transaction costs is to make it more apparent how and when various kinds of transaction costs arise in each project's lifecycle. The distinction between the forms of transaction costs before and after a contract has been granted and work has started, is mostly attributed to the strong relationship between the theory of transaction costs economics and the commercial exchange of goods and services. The categories of transaction costs classified as pre, and post contract transaction costs are separated and assessed further down below.

3.6.3 Pre contract TC

Prior to the signing of the construction contract, the client is responsible for the pre contract transaction expenses, which are incurred in preparation for the transaction involving two or more parties and consist mostly of the expenditures connected with the project's commencement. It is possible to identify and categorize pre-contract transaction expenses as follows: commencement cost, preliminary design cost, negotiation and contracting costs, and feasibility study costs (Ketokivi, M & Mahoney, J, 2017).

The costs of starting a project include things like hiring a team, reviewing proposals, and holding kick-off meetings. Preliminary design expenses include things like preliminary design plans and design workshops, which are used to help with the development permission and feasibility process. Feasibility study expenses are those involved with gathering and analyzing relevant data to determine the project's environmental, fiscal, and economic viability. Pre contract transaction costs are mostly attributable to the time and money spent on contracting and negotiations prior to the awarding of a project. Preparing bid materials, obtaining necessary clearances, and conducting business talks are all part of the process. The costs of negotiations and contracts are endured not only by the client and contractor, but also by failed tenderers; these expenses may be thought of as transaction costs because they arise from the possibility of

economic exchange. During the pre-contractual stage, it is important to distinguish between outside expenditures, such as technical, legal, and financial assistance, and internal costs, such as initial project planning expenses (Ketokivi, M & Mahoney, J, 2017).

3.6.4 Post contract TC

The expenses that arise after a contract has been signed but prior to the full transaction is finalized are known as post-contract transaction costs. Subsequently, responsible stakeholders include all actors bound by the contract. Costs incurred after a contract has been signed include those for establishing and maintaining a system of oversight and dispute resolution. In the same way that pre contract transaction costs are broken down before a contract is signed, so too are those incurred after a contract is signed. Expenses of this sort include those for keeping an eye on things in monitoring and controlling, settling disputes, and conducting the plans (Ketokivi, M & Mahoney, J, 2017).

The process of monitoring and controlling expenses include checking in to make sure that everything in the contract is as it should be and that both sides are fulfilling their commitments. Whenever there is disagreement between the parties, there will be expenses incurred to find a solution to the ensuing dispute. Expenses associated with alternative dispute resolution mechanisms and formal legal proceedings may be included. Direct costs, such as attorneys, legal consultants, and delays in production, and indirect costs, such as the deterioration of professional partnerships and the implications of distrust between the parties, add up quickly in the aftermath of a contract disagreement or lawsuit. Most post-contract transaction expenses fall under the category of "implementation," which refers to the time and effort put into the day-to-day tasks of carrying out the terms of the contract. These tasks might range from simple contract administration to the handling of claims and modification orders.

These costs are incurred as a direct consequence of developing, administering, and negotiating the contractual supporting documents utilized to regulate the relation between the contractually obligated stakeholders, and they are specifically linked to the costs imposed during the pre-contract stage to ensure the final delivered product is in full compliance with the contract terms paperwork (Ketokivi, M & Mahoney, J, 2017).

3.6.5 Compensation forms and models

Most construction workers in Sweden are paid on a fixed price basis, while running account compensation is also popular (Eriksson, P-E, 2007). In addition to these, we also shortly cover several additional extensively used compensation models here.

Before signing a fixed-price contract, the client and contractor have reached an initial agreement on the total amount. The ability to evaluate competing compensation plans quickly and easily is a key competitive advantage. The customer benefits since the contractor is on the hook for any cost overruns that may result from unforeseen complications or inefficient work. This also provides the contractor with motivation to maximize productivity and develop cost-cutting solutions. If you want to get the lowest price possible, Bröchner and Kadefors (2010) say you should contract a contractor competitively at a fixed price. Fixed-price contracts are recommended by Bajari and Tadelis (2001) when the project is straightforward, there is little room for error, and the product is simple and inexpensive to define and develop. As a result, the possibility of requests for ÄTA work more than the specified contract amount due to modifications or faults in the documents is limited, and the original fixed price may also apply at the conclusion. However, fixed prices are widely employed in complicated and unpredictable projects, which frequently results in changes and uncertainties in the schedule and price, which in turn leads to prolonged negotiations on ÄTA works and time extends to avoid fines. (Konkurrensverket, 2019).

One drawback of using fixed pricing is the lack of financial motivation to find efficient ways to complete the job. This is especially noticeable in large-scale initiatives that need for several stakeholders to work together to solve problems and coordinate their efforts. Another drawback of set pricing is that it provides no incentive for the contractor to provide more value via improved quality. than what was originally advertised (Konkurrensverket, 2019).

When keeping running accounts, the contractor is only reimbursed for the money it really cost to do the work. This is often governed by á-prices in building contracts. Based on the definitions in AB 04 and ABT 06, a á-price is a price that must cover the contractor's expenses for the finished item of work to which the á-price corresponds, including the costs for interest, central administration, and profit. According to Chapter 6, Sections 9–10 of AB 04 and ABT 06, if no á price has been agreed upon for a specific job, the contractor should be reimbursed in line with the cost principle. This states that the contractor will be paid the amount by which his actual expenses for the job in issue have been confirmed, plus a contractor's fee based on a percentage surcharge on the cost price to account for interest, central administration, and profit. In order to avoid accounting for the cost of each such employee on a cost-by-cost basis in the form of salaries, pension benefits, etc., it is common for the parties to agree on hourly rates for skilled labour and management that are in line with the contractor's own costs for providing these on a subcontract basis (Eriksson, P-E, 2007).

When keeping a running account, the client has full responsibility for ensuring the project is completed successfully. As a result, the client must be more adept at managing expenses than they would be under a fixed pricing arrangement (Bröchner & Kadefors, 2010). Without proper oversight, a customer may incur unnecessary and excessive expenses without any corresponding increase in project quality (Eriksson, P-E, 2007). On the other hand, running the books allows the implementation phase to begin earlier since the overall cost of the

project can be determined without lengthy design work, which speeds up and simplifies procurement.

In theory, the contractor can get to work right away, and the design can run concurrently with the construction works, cutting down on early project delays. Continuous invoicing makes sense for contracts with unusually short timelines since the contractor is not incentivized to prioritize profit above worker welfare. So, this method of payment works best when quality and safety are more essential than cost (Konkurrensverket, 2019). Since the contractor is compensated in accordance with actual costs, the parties become very adaptable to changes in the project. Progress billing, according to Bajari and Tadelis (2001), is best suited in complicated projects with significant uncertainty, where the likelihood adapting the project design to actual and changing conditions is high.

Aside from the basic types of running bill and fixed price, there are also other forms of compensation that frequently involve intermediate or variant forms of the basic types, such as incentive-contracts, budget model, bonus vs sanctions, and lastly running account with fixed contractor fee.

3.6.6 Procurement strategies

Procurement, in its simplest form, entails picking the most efficient and innovative contractor for a given task and then providing him with the means and incentives to deliver his finest work during the contract's execution. A detailed analysis of the various procurement approaches and their outcomes is provided below, highlighting the pros and pitfalls of each approach for various sorts of projects. Project outcomes (financial, time, quality, ÄTA, legal conflicts, etc.), but also longer-term and macroeconomic effects, such as competitive impact and innovation potential, can be influenced by the procurement tactics that are used (Konkurrensverket, 2019).

Choosing the appropriate form of contracting is an important choice in contracting. The two main types are performance and turnkey contracting, of which performance contracting has been the most common in the Swedish construction industry (Konkurrensverket, 2019). However, there are also special variants of these, such as controlled general contracting and functional contracting, which are discussed below. These forms of contracting determine the client and the contractor who is responsible for the design and the appropriateness of the technical solutions chosen.

As mentioned above, the client is responsible for the design in performance contracting. In other words, it is the client who develops the technical solutions, defines what is to be carried out and thus also determines the quality of the construction work to be carried out. To assist him, the client usually calls on several technical consultants, each of whom develops documents in their specialist field, which are then reviewed by the client to ensure that they are well differentiated from each other (Eriksson, P-E, 2007).

An advantage of the performance contract is that the client's extensive design work is presented in the tender documents, allowing the contractors' tender work is less extensive than in the case of turnkey contracting. This promotes the existence of multiple bidders and facilitates for SMEs with limited calculation and design resources to participate in the bidding process. Another advantage is that a competent and experienced client can more easily ensure that the get the quality they want by specifying the execution in detail (Cheung et al., 2001). One drawback of performance contracting is that the client's comprehensive specification limits the contractor's ability to innovate; once the contract has been granted, there are less opportunities for development in many areas of performance.

Traditional barriers between design and manufacturing hinder cross-stage learning (Styhre et al., 2004), which could increase project duration and decrease constructability. The client's consultants may have already moved on to the next project, which adds an extra layer of difficulty and expense to the redesign and negotiations with the consultant and contractor for additional tasks necessitated by the client's early comprehensive specification. This is most noticeable in large projects where the client pays for a detailed design years in advance, increasing the possibility that some aspects of the plan will become outdated by the time they are implemented and the overall interest cost (BKK, 2009).

General contractors in turnkey contracts have the final design responsibility and must see to it that the finished project meets all specifications.
In a turnkey contract, the customer instead provides descriptions of technological frameworks that capture his functional needs; the contractor then chooses the appropriate technical solution or solutions.
For the sake of productivity, turnkey contracts can encourage a deeper level of communication between consultants and contractors, leading to a more seamless blending of design and production knowledge. Contractors' production expertise can be leveraged throughout the design process to enhance the product's quality of the building, which in turn can improve the product's time- and cost-efficiency. It is faster to go the turnkey contracting route since not only does it require fewer purchases, but the contractor can also begin construction on the product before it is finished being developed (Cheung et al., 2001).

Larger clients are particularly harmed by the fact that contractors' independence in turnkey contracts results in greater product variation. This can make it harder to achieve operational and maintenance economies of scale, such as standardization and repetition, and raise life-cycle costs (Riksrevisionen, 2012). Because of this, a customer with a wide portfolio of buildings and facilities may be less efficient in the long run if projects are based on pure turnkey contracts. Turnkey contracts also have the drawback of raising transaction costs because many contractors, rather than just the client, must perform some degree of pre-design to compete (Mandell et al., 2013). There is a waste of resources because just one bid will be chosen, and work will continue from there. Full contracting runs the danger of resulting in fewer bidders and, as a result, higher transaction costs for contractors, for which the client ends up paying the bill.

Rather, the client usually includes, to a greater or lesser extent, several technical solutions in their tender documents, even for general turnkey contracting. Technical solutions for which the client is responsible according to Chapter 1, Section 6 of ABT 06 is correct regardless of the choice of the type of contract. This is popularly known as controlled general contracting and is a way of the client to retain control over certain aspects of the contract, as in a performance-based contracting (Chan et al, 2002). Controlled general contracting's drawbacks include the fact that, like performance-based contracting, it limits the contractor's flexibility for innovation and suggests the client takes on more risk because of being held accountable for the managed solutions (Konkurrensverket, 2019).

Controlling specific technical solutions that are crucial from an operating and maintenance perspective through the tender documents can help to avoid the danger of an excessively distributed portfolio that's also challenging and expensive to manage, which can be especially helpful for large managing clients (Eriksson, P-E, 2007).

For controlled general contracting to be properly procured, it is crucial that the client finish the design of the technical solutions to be established, and that the tender documents clearly identify the aspects that the client is completely accountable for the design. For this reason, it is worth noting that one of the main goals of the reforms implemented by the EU (European Union) on January 15th, 2014, has been to encourage contracting organizations to accept alternative tenders as often as possible and to make public procurement more receptive to innovation.

Procurement of a function means that the client and the contractor conclude an agreement on the construction and maintenance of a building because the end customers are provided with specified services, rather than the construction meets several technical characteristics. Functional contracting is thus essentially a total contract that also includes the operation and maintenance of the building (Shehu et al, 2012).

This integration encourages the interchange of knowledge between design, production, and operation. Eventually, improved design of the building from an operational perspective can lead to increased efficiency if actors responsible for design and production are informed about how the finished facility operates in the operational phase. To the extent that the maintenance contract is sufficiently long, the contractor's long-term obligation also encourages them to prioritize life cycle costs and environmental factors over strictly financial investment factors (Shehu et al, 2012). For functional contracts, the duration of the agreement is crucial. Shorter duration contracts are more akin to ordinary contracts. A lengthy enough maintenance agreement will provide an incentive to invest in new methods and consider the total cost of ownership. On the other hand, some potential bidders may be put off by contracts that last too long (Konkurrensverket, 2019).

The increased demand for measurement presents a problem for functional contracting, as it must ensure that functional needs are met in a continuous manner, that residual value is realized, and that the conditions are consistent with reality. Because the contractors' compensation is tied to the accuracy of these measurements, it is indeed important that they demonstrate their competence and only employ objective standards when conducting the measurements. Another issue that is occasionally mentioned is the difficulty in establishing a clear boundary between the contractor's obligation to fix any defects in workmanship free of charge during the warranty term and the contractor's efforts to fix the maintenance, as a norm, within the same period (Konkurrensverket, 2019).

3.6.7 Forms of coopetition

Procurement and management of construction projects is a complex process because it is many different actors that must be coordinated because their work and deliverables are interconnected and interdependent. The business relationships between actors in a construction project are influenced by the procurement strategies of the client. The concept is simply a combination from the first half of **coop**eration and the second half of comp**etition**. Competition therefore arises often arises when the actors have both opposing and common objectives, which is common in vertical business relationships between buyers and sellers. Cooperation is particularly important and appropriate in transactions characterized by high complexity, customization, uncertainty, long duration, and time pressure, as such transactions require coordination of activities and actors, flexibility and adaptation of activities and their content, as well as knowledge sharing and joint problem solving (Eriksson, P-E, 2010).

Complexity, individualization, duration, uncertainty, and time constraints are common features of many building projects. Constant emphasis on teamwork rather than individual achievement seems to fit their needs. Here is also an example of where a partnership procurement strategy may be useful.
While the goal of partnering is to make corporate interactions more collaborative and less competitive, partnerships can nevertheless be built on components of healthy competition (Eriksson, P-E, 2010). The client's procurement methods heavily weigh in on the equilibrium between cooperation and competition. The degree to which collaboration and competition are influenced depends on the procurement plan component in question. Clients can achieve varying degrees of collaboration and rivalry by rearranging the components in unusual ways.

Therefore, a coopetition approach to analyzing the components of the procurement strategy and the repercussion of their implementation is necessary if the client is to strike the right balance. Incentives and flat fees can be included in the cost of doing business to encourage coopetition. Direct procurement following agreement with a single supplier, on the other hand, encourages collaboration, as opposed to an open procurement approach with many offers. Limited bids from a select group of interested parties encourage cooperative

bidding. Competition is encouraged when tenders are evaluated with a heavy emphasis on the lowest price, whereas collaboration is fostered when weight is given to non-monetary factors. Promoting coopetition through a combination of soft parameters and the lowest price encourages more businesses to engage in cooperative activities (Eriksson, P-E, 2010).

4 Empirical Findings

This chapter will bring up the most relevant topics throughout the literature study, our interview study, and the survey. Furthermore, this chapter will set the foundation for the conclusion and the roadmap for future use.

4.1 Interview Study

The subsection mentions the results of our interview study, a series of interviews with professionals in the construction industry discuss their experiences in procurement and cost estimation, particularly in the context of multi-family housing projects in Sweden between 2015 and 2022.

The interviews focus on transaction costs, procurement strategies, contract types, remuneration forms, collaboration forms, the use of subcontractors, quality, and warranties. Overall, the results from the interviews offer valuable insights into the complexities of the construction industry in Sweden, emphasizing the importance of collaboration, effective management, and procurement processes in influencing cost and quality. They also highlight the need for clear communication, accurate time management, and choosing the appropriate contract type for successful construction projects.

The interviews also discuss and mention the importance of tailoring procurement strategies, contract types, and remuneration forms to each project's unique requirements. Effective collaboration and management of subcontractor relationships are critical for achieving desired quality and cost outcomes. Further standardization of collaboration frameworks and a deeper understanding of the procurement model can help improve procurement processes and outcomes in multi-family housing projects.

4.1.1 Contracting and Procurement

Procurement strategies vary depending on the type of project, ranging from simple structures, like rental apartments, to more complex, prestigious projects as well as the project leader's approach. A common theme from several of the interviews is that companies employ various procurement strategies, including construction-, D&B contracts as well as partnering arrangements, depending on the project's complexity and the company's expertise. DBB contracts seem to be rarer. The choice of procurement process depends on the project's specific requirements, balancing high standards with maintaining a competitive price.

Partnering and collaborative projects are increasingly common in both the public and private sector, but their success depends on clear frameworks and guidelines, as well as a mature organization capable of overseeing the process.

Partnership is seemed overall from most respondents to be successful in terms of transparency and open communication. Leading to a better working and business environment for the stakeholders involved. However, it is also mentioned that this approach can be time-consuming and expensive. The increasing trend towards collaborative projects seems to be especially prevalent in the public sector, but there is according to the respondents no clear frameworks for successful partnering, leading to that these projects can be either highly successful or face significant issues.

Another key reason for increased number of partnerships according to respondents is a trend towards more complex buildings and high-end buildings, with more specific and complex requirements, demanding more collaborative projects where clients are more actively involved in the process.

Comparisons are done between the manufacturing and construction industries, highlighting the need for structure, processes, and order in the former, and the unique challenges of construction projects. Collaborating with preferred supplier agreements and a trusted network of suppliers is also becoming more common for the larger companies that some of the respondents represent.

Early collaboration, choosing the right procurement and contracting forms, and carefully selecting subcontractors can lead to improved quality and pricing due to being able customizing the project according to the client's needs with the contractor's expertise.

Standard contracts, such as AB04, ABT06, and ABTU07, are commonly used, with modifications based on project-specific requirements. The choice between design-bid-build or design and build contract depends on the buyer's capacity to plan and manage the project. D&B contracts are usually preferred, as they transfer responsibility for any issues to the contractor, freeing the client from needing extensive construction expertise.

Clients often use staged payment plans based on project milestones, which can help ensure quality, deadlines, hold sub-contractors accountable and solve eventual liquidity problems for contractors. Price is the most important criterion when selecting a bid, followed by reference projects and adherence to guidelines and policies.

The number of bids received can sometimes be too low, and high requirements can limit the number of potential bidders. This creates a balancing act between setting ambitious standards and maintaining competition. The opposite can also be true, setting the requirements too low, allowing for unserious players to bid and be part of the project, leading to substandard quality projects in the end. Finding a balance between this is a challenge and requires skilled buyers.

Several of the respondent's state that there is lack of competence and a lot of junior engineers in buying positions, making request they do not really have vision as of how it will affect end cost and time plan for the projects. One of the interviewees advises those entering the field to learn about construction law and

notes a shortage of skilled professionals in the sector. Construction law knowledge is vital for those entering the field, and companies must consider legal implications when managing warranties and guarantee costs already in the procurement phase of the project.

Respondents claim that disputes between parties may often arise due to miscommunication or unclear expectations. Resolving these disputes can be time-consuming and costly. The use of standard contracts is more prevalent in the public sector than the private one to avoid these types of legal issues.

Several of the respondents, which were spread out in different areas in Sweden, including Stockholm, Östergötland, Göteborg and Skåne claim that the level of knowledge and competence in procurement and construction contracts varies between regions leading to different forms of procurement process and contracting in different areas of the country. Business culture is different in denser urban areas compared to rural areas as the market conditions and supply of goods and sub-contractors vary.

4.1.2 Renumeration Forms

The respondents answer that there is not a clear preference for one compensation form over others although fixed pricing is the standard form of renumeration. The recent years however there has been a trend in the market with increased companies going for open book partnering and other collaborative models, that respondents claim have been successful in promoting transparency and shared goals.

4.1.3 Subcontractors

Respondents claim that companies often rely on subcontractors when internal resources or expertise are lacking, or when multiple projects are won simultaneously. The use of subcontractors can impact cost and quality, and effective management of subcontractor relationships is crucial.

One of the respondents clearly state that they have rules set in place to have a maximum of two subcontractor levels in the supply chain. As many other industries they are in the process of acquiring or developing an automated system for contractor control. Too many layers of subcontractors can lead to safety risks and black-market labour. It's essential to have control over subcontractor chains and ensure they meet the same requirements as the main contractor.

Skilled project buyers, with competence and experience that also have control over subcontractor chains are crucial for achieving desired results as, there can be a limited control over sub-subcontractors causing a wide range of quality and legal problems for the contractor.

4.1.4 Transaction Costs

According to respondents, high transaction costs are a challenge in the construction industry, affecting the number of bids a company can participate in, and potentially influencing the final quality and price of projects. For a lot of contractors and sub-contractors it is a common challenge that the transactions costs are too high, affecting the number of bids a company can participate in, and potentially influencing the final quality and price of projects. For contractors in large housing projects, some of the respondents claim that costs are around 500-600 KSEK and takes about 6 weeks of time for their teams to complete the tender.

From interviewing the procurement side however, they claim that the number of bidders per project is not affected by transaction costs. An average of five bids per project are received, and the more bids they get, the better chance they have of finding the right price. The quality and price of the bidders are also affected by the type of contract they use, but there is no clear answer on which contract is better.

Other factors can affect the number of bidders such as more complex projects, which usually receive fewer bids, with only 3-4 major players in the market capable of handling the demands. This can influence the final quality and cost of the project.

Some respondents believes that a more standardized approach to collaboration would be beneficial as this would reduce transaction costs. This would involve creating clear frameworks and guidelines for collaboration, which are currently lacking and create tedious processes with lots of waste.

4.1.5 Quality Assurance

An unexpected result from this study was that some respondents claim that the ability to follow up on a project is more important in determining quality than the compensation form that was primary investigated. Many of the asked respondents don't have systems in place to answer the questions regarding quality and procurement, in a scientific way and were basing their answers more on common sense, old truths and best practices. Data driven decisions or research seems to be lacking. Overall, the respondents highlight the importance of having regular follow-ups and evaluations in the construction industry and the need for a functional system to support these processes. They highlight the challenges of implementing such a system and the importance of understanding the purpose behind different tasks to improve follow-up and evaluation.

A functional system for follow-up and evaluation, clear guidelines, and understanding the purpose behind tasks could contribute to improving the overall quality of construction projects as the interview discusses the challenges of managing warranties and guarantee costs, because of quality issues. It is noted that not even one of the biggest actors in the market have had a good system in place for tracking these costs in the past but are implementing a new system that will provide better data. Long lead times for addressing warranty issues and that

new requirements from customers to address issues more quickly can be difficult to meet for the entrepreneur. It is also suggested that there are many new, inexperienced engineers on the customer side who are not always clear on what they are asking for and what consequences this can have for the end cost of the projects.

The respondents discuss the challenges of implementing quality policies in their company, particularly in the context of partnering projects. They highlight that while partnering projects may improve communication and transparency between parties in project planning and production phase, they also risk not being clearly defined in terms of responsibilities and agreements which later affects the after-market, creating unforeseeable costs for the contractor. Long lead times for addressing warranty issues are particularly common among partnering projects, and while new requirements from customers to address issues more quickly can be extra difficult to meet in these cases.

The respondents claim and emphasizes the importance of focusing on after-sales service and warranty management, which can significantly impact the projects overall profitability.

4.2 Survey Study

Below is some insight into our survey study that we found interesting for our aim and provided a statistical basis for our analysis in chapter 5. Full survey study can be found in Appendix. The results from the study are presented in the charts below in a non-translated version as the last original survey was conducted in Swedish language. Translations provided in the text. The questions with a grading are graded from 1(strongly disagree) to 5(strongly agree) according to Likert scale system.

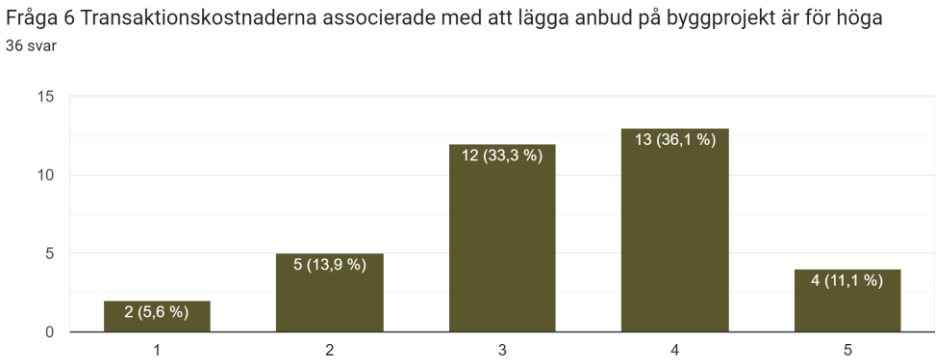
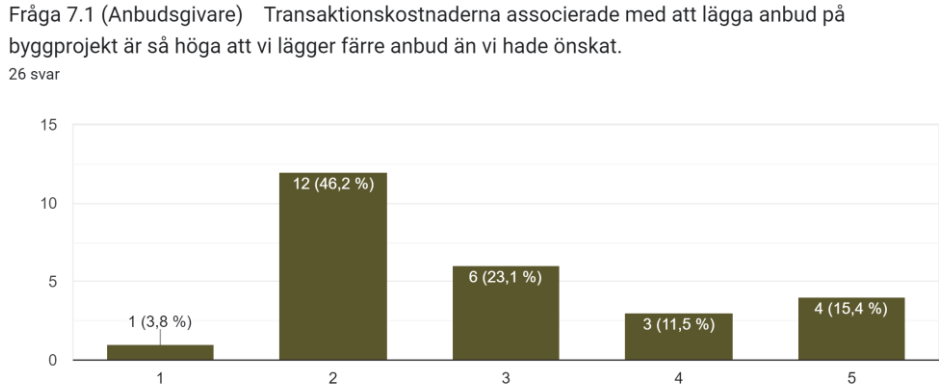


Chart 4.6 The transaction costs associated with making an offer in the bidding process for construction projects are too high. The data suggest that a small majority of the respondents agrees with the fact that making a bid is too expensive in today's industry with a mean value of 3,3 and a median of 3.



‘

Chart 4.7.1 The transaction costs associated with making an offer in the bidding process makes us make less offers than we would have wanted. The data suggest that the respondents do not think excessive costs of making bids stops them from making as many bids as they would have liked. Mean value 2,9 and median value of 2.5.

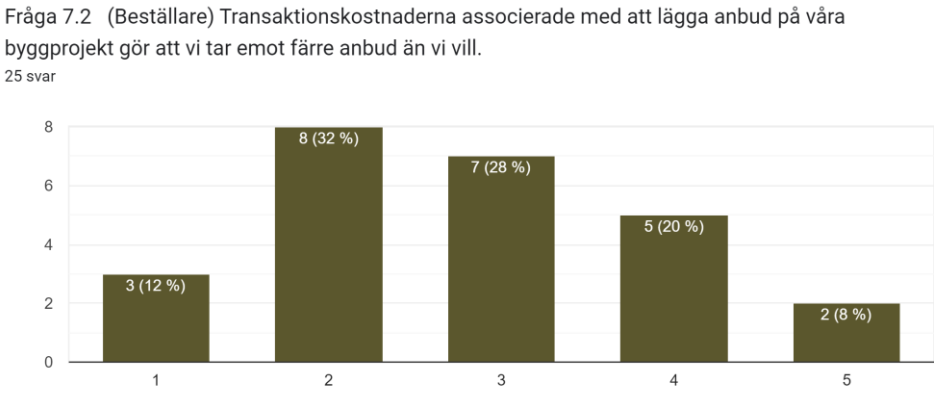


Chart 4.7.2 Transaction costs associated with making bids on our building projects makes us do less bids than we would have wanted to. Data suggest that buyers of projects do not seem to think they get to less numbers of bids, although the suggestion is not as strong as what the bidders thought on their end. Mean value of 2,8 and median value of 3.

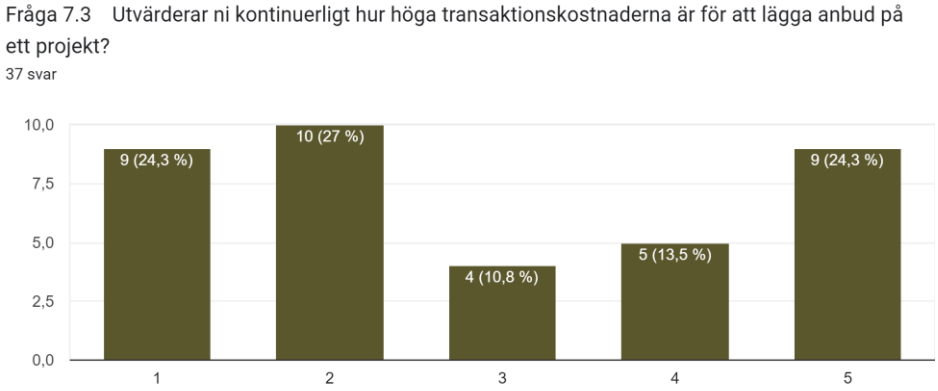


Chart 4.7.3 Are you continually evaluating how high the transaction costs are for making a bid on your projects? The data suggest that evaluation of transaction costs is done but not standard praxis yet and varies between companies. Mean value 2,9 and median value of 3.

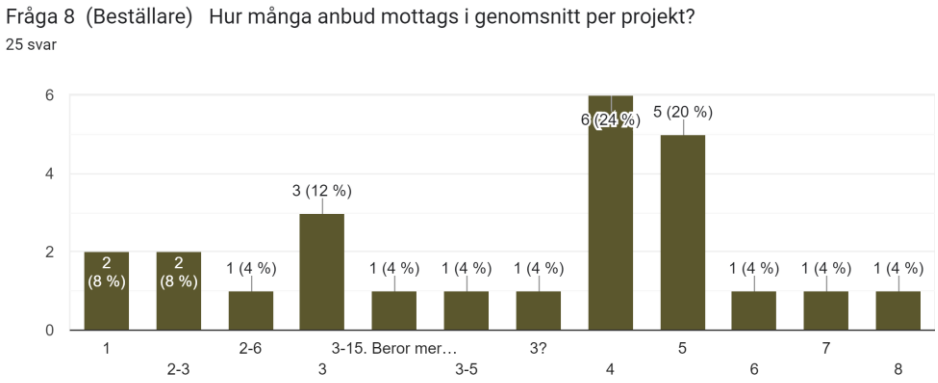


Chart 4.8 How many offers were done on an average for a project? (Procurement) The mean number of bids where 4.4 bids/ won project and the median were 4 projects.

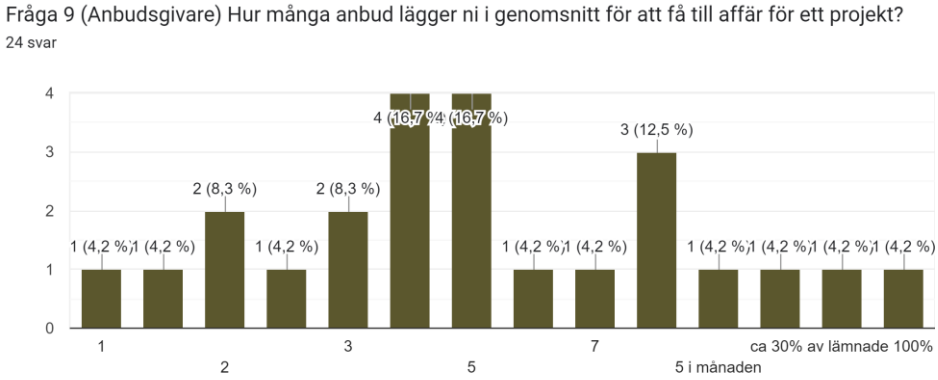


Chart 4.9 How many bids to you usually make to receive a deal for a project? (Bidder) In order to receive a deal for a project, on average amount was 4.9 and median 5 projects.

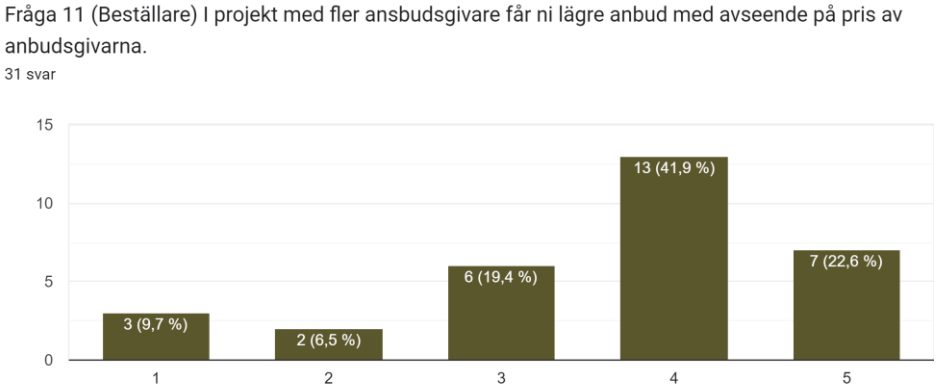


Chart 4.11 In projects with more bidders, lower prices are made by the bidders. A mean of 3,6 and a median of 4 suggest that procurement tend think they get a lower price if there are more bidders in the process.

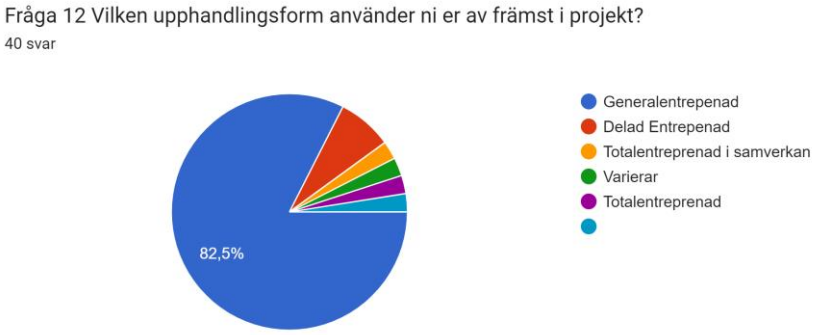


Chart 4.12 What form of procurement is most common in projects. With a result of 82% of the respondents choosing "general entreprenad" it is the dominant type of contracting agreement on the market.

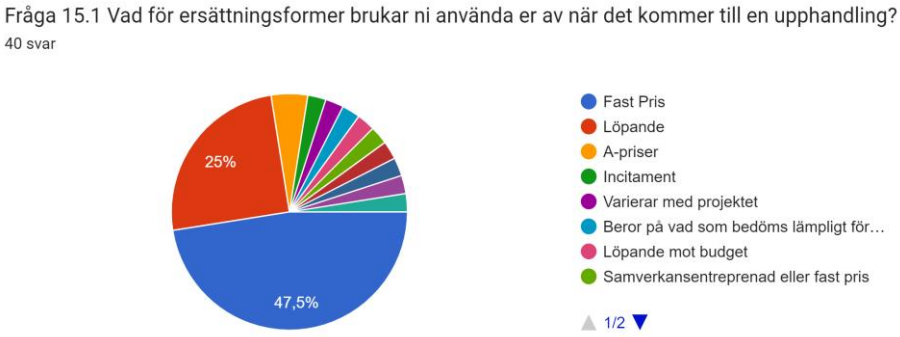


Chart 4.15.1 What form of reimbursement methods are most common in contracting? 48% of the respondents suggest that they used fixed price, 25% use on the current account billing and the rest use either incentives, collaboration or adapt strategy to the means and project as well as work to be done.

Question 4.17.2 - What are these cost optimizations and saving made by?

The respondents were able to freely express their answers in text as why they could see that partnering or collaborative models for projects made them save time and resources. The results where then categorised according to similarities in their answers touching subjects as shared information flow, improved business, and work culture, opening for new kinds of solutions and technical innovations, better workflow and de-suboptimization to put more focus on solving problems from higher perspective as well as more early involvement from different stakeholders and expertise.

When sharing information, the right type of collaboration and partnering provides a platform to use cost efficient solutions with incentives for all parts to benefit from these frameworks. As result of this the stakeholders, make extra efforts to provide better results in project. Sharing of information, methods, tools, and resources as well as mutual supplier agreements enables continuous improvements for all stakeholders. Networks and competence are also better utilised and used and makes it in everyone's interest to cut costs. Not putting it to other stakeholders as what otherwise is common in the industry.

As some claim partnering models does create time and cost savings other respondents also claim it mostly create another type of working culture with better business and working environment with less conflicts and a cultural change within the organization.

Respondents express that solution driven mindset when collaborating provides framework for flexibility from all partners involved in projects made it possible to increase quality, saving additional work and enabling better workflow in projects. New innovations and solutions helpful for all parts involved, for example how to deal with problems related to flooding in construction projects.

The respondents claim that by seeing projects workflows as a complete system enable to create better working environments and workflow as less focus had to be on suboptimization, argumentation and conflicts regarding costs between contractors and management. More quality, cost savings and smoother project journey.

Early Involvement by different stakeholders is by respondent's key for Collaborative models. Where they in projects get more visibility for all partners involved and key decisions can be made done earlier in process by involving different stakeholders with different expertise early in negotiations, procurement, and project planning with the clients, saving time and costs. Having discussions about what values should be created in the project early on improves over all workflow and end-result for the end user. Early involvement

from the stakeholders also makes the forecast of the costs more visible and accurate since the stakeholders have more transparency and trust between each other.

Chart 4.19.1 Do you see that the number of steps of sub-contractors in the value chain leads to less quality in the projects. With a mean of 3,857 and a median of 4 there seem to be agreement from the respondents that a longer value chain of sub-contractors lead to worse quality in projects.

Question 26: What could be done differently in today's construction business?

As one of the final questions, the respondents answered the above question and the answers where then categorised according to similarities. Some of the answers touched subjects such as increasing knowledge of procurement among contractors, price dumping and focus on lowest price, distrust and bias in business culture, change in LOU as it is creating unjust market conditions and bad practises in the business, too small number of suppliers in certain domains, too many changes from framework agreements and contracts as well as companies need to check their sub-suppliers better to have better visibility that they are following legal rules and regulations. Some of the respondents also claim the question could not be answered as it was misaligned and contain double meanings. As previously stated, after analysing the responses to this question from the survey, the following categories emerged.

Transparency and fairness in the bidding process. Several respondents highlighted the need for transparency and fairness in the bidding process. This includes ensuring that all parties follow the same rules and regulations, avoiding price dumping, and preventing dishonest pricing strategies.

Better communication and collaboration. Some respondents emphasized the importance of better communication and collaboration between contractors and clients, starting with early dialogues before issuing requests for proposals. This could help to prevent misunderstandings and ensure that both parties are on the same page from the outset.

Greater competence among clients, where some respondents suggested that clients need to be more knowledgeable about the costs involved in construction projects and be more aware of contractors' needs for profitability. This would

help to ensure that clients are not making unrealistic demands or setting prices that are too low.

More emphasis on quality than on price as several respondents highlighted the need to focus on quality rather than just on price. This would require clients to evaluate bids based on multiple criteria, rather than simply choosing the lowest bidder.

Problems with LOU (Public Procurement Laws) was mentioned by several respondents expressed concerns about the current legislation (LOU) governing public procurement. They suggested that it encourages price dumping and dishonest pricing strategies, and that it leads to inferior quality work and higher overall costs.

Finally, some respondents suggested that contractors need to take greater responsibility for ensuring that their subcontractors are operating legally and ethically, including paying fair wages and taxes.

In summary, respondents suggested that improvements are needed in transparency and fairness in the bidding process, communication and collaboration between contractors and clients, and greater competence among clients. They also emphasized the need to focus on quality rather than just price, and to address problems with the current LOU legislation.

5 Analysis

Several significant government investigations have indicated that the construction sector is resistant to change in many aspects, with enormous concentrations and insufficient competition at numerous stages (Eriksson, P-E, 2014). Despite this apparent hesitation, we will provide an overall picture of what may be improved in general to promote innovation and efficiency in the construction sector through strategically structured construction contracts.

Regarding the frequently discussed problem of reading tender documents to find deficiencies and errors that can be used as the basis for ÄTA works and additional compensation, we share the views of most respondents who believe that this phenomenon is part of the game, at least through customary execution contracts procured at the lowest price. The problem does not appear to be due to unethical contractor attitudes, but rather to weak and inaccurate bidding paperwork that do not offer a sufficiently solid foundation for the realization of building projects. According to some responders, tender paperwork has worsened in recent years and are not finalized before being distributed. These include inconsistencies and changes during the tender phase, resulting in contractor duplication of work.

These issues are discussed in the ensuing sub-chapter considering the interviews, survey, and literature research. The respondents said that there are primarily two approaches that clients may use to solve this issue. To begin, they may improve their abilities and accuracy in creating clear and transparent tender papers. This is vital in all sorts of projects, and we will consider it while designing our road map for future use based off our findings. Another option is to cooperate on the projects and let the contractors participate in the initial design work. Both options are more in-depth discussed and compared in usefulness with other options or approaches for procurement strategies and contractor models.

5.1 The Value Chain and Contractor Model Relationship

The balance between cooperation and competition is strongly influenced by the client's contractor model as mentioned primarily in the literature. Different components of procurement strategy influence cooperation and competition in diverse ways both internally and externally. Previous research has shown that organizations that make use of existing competences and resources efficiently, while exploring new business opportunities and develop new skills and technologies, achieve more sustainable competitive advantages. In practice, this has shown signs of implementation when choosing the right contractor model that fits the company's overall strategy in its value chain. One example brought up in the interview study was that the buying department follow the strategy for purchases set by the company to procure with clients that wants a general contract, which several other interviewees also do. This was motivated by working in all areas in a project than splitting it up with other actors as that always proved to be 'Cracked'. The same interviewee also mentioned that for their subcontractors in the value chain the norm was to have AB04 performance contracts with ABT06 if the work involves design work which usually is the case with installation subcontractors. The strategy was to simplify for the aftermarket department in locating who is responsible for what. Other interviewees mentioned that it depends on the scale of the project because larger ones may require several contractors in partnering agreements to achieve acceptable quality.

The standard contracts mostly used was as previously mentioned AB04 and ABT06 but when it comes to procuring for raw materials it was ABTU07. One factor that also was considered by one interviewee was the transactions costs in pre contract phase may sometimes exceed the usefulness of utilizing such standards. Furthermore, the quality of the design provided by the client may in some cases be incomplete which leads to the winning contractors hiring a subcontractor under ABT06 which adds to the transaction costs. As for the number of steps in the value chain both the survey and interviewees said two steps of subcontracting was allowed since as stated in chart 4.19.1 a longer value chain of subcontractors would provide a lesser quality but not more costly per se. The survey also gave us a median of 4 incoming bids for each project in chart 4.8, meanwhile for bidders it was 5 outgoing bids to land a deal as seen in chart 4.9. This would in theory mean to more than average bids per project that could stimulate a price pressure on the project bids which also is confirmed in chart 4.11 by most contributors in the survey.

In other instances, the subcontractors may posses' greater practical knowledge to produce a cheaper solution. Simultaneously, there exists a lack of incentives for subcontractors to save money or spend time enhancing the work done under performance contracts that few interviewees mentioned but finds support in the literature. Nevertheless, the amount of partnering contracts is on the rise based on the answers of one interviewee working for one of the big four contractors in Sweden with goals to reach 80 % partnering contracts and 20 % fixed price general contracts. However, the survey study does not confirm this statement as our results showed the clear opposite with 20 % partnering contracts and 80 % general contracts in chart 4.12 whereas 50 % consisted of fixed prices in chart 4.15.1. These 'goals' should more be considered as visions for the construction sectors way of procuring with some initial success but for the time being turnkey contract is by far the most common contracting form.

On the same subject of goals, procurement maturity has put its mark on the value chain and contractor model relationship. One example from a major contractor interviewee was that their procurement of sub-contractors also involves the same qualifications if the sub-contractor is procuring another sub-contractor. Therefore, the whole value chain is aware of what is expected, and additionally the interviewee mentioned the transparency it creates.

Consequently, the mindset of having the same goals throughout the value chain promotes partnering or collaboration values. Such can be that the sub-contractor's knowledge of the context project which connects back to the necessary transparency in the value chain. Our interview study revealed that this is growing in relevance but also that in some cases the procured form is still a traditional turnkey contract.

5.2 The Economics behind Procurement Strategies

The economic aspect is the principal factor behind every strategy for procurement as is the construction business's goal to maximize profit for every project. The respond of the major contractors that we interviewed is to have buying departments overseeing every project within the company's tender list. Divergently, one self-employed purchase consultant interviewee mentioned that major contractor is not always sure if the best solution is to have central departments within the company or placed in the building site. The concentration of tender knowledge leads to a realistic estimation of what each project should cost. The pre contract TC includes such work and one interviewee shared that a building project worth 150.000 million SEK would have a pre contract TC of between 400-500.000 SEK including the costs for both internal and external consultants which constitutes to roughly 0.33 % of the total project cost. The small amount of TC relative to the total project cost may have influenced the answers on chart 4.7.1-4.7.3 of the survey but simultaneously chart 4.6 reveals that a small majority of the respondents agree that pre contract TC is too expensive in today's industry. The pre contract TC is not being evaluated by the bidders as they do not think a rise in TC is associated with less bids per project. Furthermore, the survey shows that clients are not evaluating TC as a standard praxis and varies between companies as the risks of TC on procurements is not fully agreed upon.

Another factor contributing to pre contract TC is the preparation of boundaries created in the tender documents that several interviewees confirm is part of their procurement strategy. Meanwhile the literature study mentions that unfinished tender documents done under time pressure creates contradictions which leads to ÄTA works later during the project or with double work being done changing the tender document during the tender time. Client interviewees have also mentioned the use of requirements in the tender documents on contractors and subcontractors' economics for them to be able to submit a tender. For larger contractors there is a database in which they can confirm such factors and simplify the tender process from the client's perspective. Tender bids from contractors could vary greatly (as much as 100% differential) between each other as this is a consequence of their subjective understanding of the tender documents. The same client interviewee also states that more tender bids allow them to create an average price of the tendered project and understand which factors makes them differ such as good wages for their worker or if everything is taken into consideration by the contractors submitting the bid.

These projects have had a standard and traditional contract with a fixed price set at the beginning with the cause being the cheapest solution of procurement. When it comes to post contract TC which is not considered in the mentioned reasoning, several interviewees have stated a standard percentage of 10 % exclusively for ÄTA-works. One interviewee cites that "because a subcontractor looks good and cheap on paper does not equal the cheapest final price". The same interviewee brings up calling past project leaders that has experience with the relevant subcontractor and databases in which they can rate each subcontractor after a project but also admits a lack of monitoring and fulfilment. The empirical research on the appropriateness and impact of forms of compensation on project outcomes is not as extensive as the corresponding research on contract forms.

One interesting combination compensation form mentioned by one interviewee working for a large contractor is a running account model with incentives towards the installation subcontractors. The subcontractor provides them with an á-price for the materials and their fee which both parties agree to. If the final price is above the target price both parties stand for half of the exceeding costs, the same methodology is implemented if the total costs is below targeting price, then they will pocket 50 % of the saved cost. The literature study did provide both alternatives but the interview study showing the presence of a combining running account and incentive-based contract was a new finding.

The same type of findings about cost optimization was also found in the survey chart 4.17.2 that mentioned sharing information, solutions, and innovation as well as early involvement provides a platform for the use of cost-effective solutions with incentives for all parties to benefit from these frameworks and give more visibility for every stakeholder involved. Key decisions can be made earlier in the process by involving various stakeholders with various areas of expertise early in negotiations, procurement, and project planning with the clients, saving time and money.

5.3 The Effects of Procurement Strategies on the value Chain

Simply said, procurement is the process of identifying the most effective and creative contractor for a given project, providing them the chance to prove themself, and rewarding them for doing so. A comprehensive analysis of the various procurement techniques and their repercussions, in terms of benefits and drawbacks under various project circumstances have shown different outcomes for stakeholders in the value chain that will be presented below.

The results of a project (monetary, time, quality, ÄTA, legal conflicts, etc.) might have implications; however, longer-term, and macroeconomic effects, such as competitive influence and innovation potential, can also result from the choice of a procurement strategy. Consequently, a logical businessperson works to offer products of the lowest acceptable quality possible while complying to professional performance standards and the terms of the contract, as higher quality frequently results in higher costs and expenditures incurred by the contractor. In the survey question 26 about what can be done differently in the procurement process a greater focus on quality rather than price was raised, as numerous respondents emphasized the importance of focusing on quality as opposed to lowest price. Clients would have to assess offers based on numerous factors rather than simply selecting the lowest bidder. Furthermore, there has been a small tendency in procurement toward integrating more soft metrics and analyzing quality and value-added variables. Also, a fixed fee is not ideal if the client wishes to encourage creativity in the project.

Flexible and inventive thinking are more necessary for exploratory innovation processes than restrictions. When there is a lot of uncertainty, fixed prices perform badly and force businesses to use proven techniques to reduce risk. The difficulties concerning producing quality work as well as encourage innovative solutions are not new findings as it was a recurring theme among our interview study. Simultaneously, the interviewees had different views on the influence of said dynamic between quality and innovation as some saw it as a natural occurrence and others as an urgent problem to solve. The patterns we could draw from these statements was that contractors with a client partnership in the initial procurement and later turned to a turnkey contract had divided the project into several phases whereas payment was done for each completion before moving on to the next. Worth mentioning is that in these cases the compensation was done in a current account in which the final price was already agreed to in the procuring phase. Their experience of this procuring model was that it incentivizes better quality while not exceeding the initial budget. Furthermore, the subcontractors would have better focus on the current phase rather than the project timeline.

Contradictory, one interviewee from the aftermarket department in one of the big four contractor company in Sweden mentioned that partnership strategies have resulted in similar product as with DB and DBB contracts. However, since

projects have a minimum 5 years guaranteed instruction time so in situations when defects occur the aftermarket spends a lot of time and consequently money on running back the value chain to locate the relevant contractor and thereafter the subcontractor.

The interviewee stated the main weakness with partnership projects is that once the project is finished the partnership also ends and that creates ambiguity. This in turn becomes problematic when said situations spills time in re-establishing the contact and running back the value chain. Even though 1 % of the projects budget is allocated to such added work expenses, experience shows that having a procurement strategy that builds on choosing the lowest tender price may not be the cheapest alternative when adding all the costs through the value chain says the interviewee. Wasted time and resources because of miscommunication was a recurring theme in our literature study and while partnership contracts have combated some aspects or all aspects depending on who you ask the main drawbacks are still accountability and lack of follow ups. The same answer was found in survey question 26 where several responders stressed the importance of openness and fairness in the bidding process. This involves ensuring that all parties adhere to the same set of laws and regulations, avoiding price dumping, and eliminating deceptive pricing strategies. Furthermore, some respondents underlined the significance of improved communication and collaboration between contractors and clients, beginning with initial interactions prior to issuing requests for bids. This might assist to avoid misunderstandings and keep both parties on the same page from the start.

One future aspect worth mentioning is how the economic downturn will impact future projects. At the time of our interviews and survey study it was only briefly mentioned since it had yet to put its mark on the industry. Furthermore, at the time of writing, building projects for the year 2023 has drastically shrunk on the ground of higher costs. Naturally, contractors will look to reduce building costs and our theory is that these savings will be made in places that previously have been overlooked. One example could be the pre and post TC which during our interview and survey study was deemed to be at an acceptable level. For future research, the theoretical literature for collaboration procurements is small in comparison to the traditional procurement literature which is also becoming quite old. One certain area for future research is therefore to analyse in much bigger scales the newer collaboration strategies and update the traditional literature in a more recent context. Lastly, the introduction of IT-systems for quality control and overall lifecycle management is also a future prospect for research.

6 Conclusions

6.1 DB vs DBB

How do the project delivery models design-bid-build (DBB) and design-build (DB) stand against each other from a quality and end-cost standpoint?

The two project delivery models design-bid-build and design-build are as mentioned only frameworks which clients and general contractors utilize in their procurement process. The format of DB contracts make way for partnerships to occur between clients and contractors as such the rise of partnering projects have also made DB contracts popular. The traditional way of construction projects has been DBB contracts and that is still the majority as the survey study implied combining it with the lowest fast price as compensation form. However, the interview study had several respondents mentioning partnering and early involvement as their procurement strategy which in turn raises the question, which one is to prefer over the other in terms of quality and end-cost standpoint?

By analyzing the data from the result section, the answer is not visibly clear right away and several respondents from the interview study did not see a difference between the two models. That would imply a lack of knowledge from both the clients and contractors in procurement strategies which shows in the statement that "The way we have done it in the past works, so it does not need changing". This statement goes hand in hand with what traditionally have been the mentality of the construction sector. Despite numerous issues raised by the same respondents they have been deemed as natural consequences or small that they are seen irrelevant. At the same time when looking in the data specifically into the pre and post TC occurring in the procurement and building process one can see how a lot of these costs are related to DBB contracts. For the pre-contract TC these have primarily been to prepare the groundworks for the procurement process and later for the bidding and evaluating process. For the post-contract TC, the rising quota of ÄTA works which relates to deficiencies in both the contract basis and the manual labour.

Several respondents have answered that the main issue with DBB model is that they promote clients to choose the contractor with the lowest bidding price instead of the most appropriate one. The consequence is a harmful business relation between client and contractor consisting of finding imperfections in the contract basis or finishing the project in a minimalistic way. Quoting one interviewee "The lowest bidder may not become the cheapest project costs". Worth noting is that the other compensation forms have all given a different effect with a larger focus on transparency between client and contractor.

However, the data of both the survey and interview study is not showing a visible movement from DBB to DB model and several respondents implied that the end cost for both model was very similar. The same statement was found in the literature study while also raising partnership contracts as a better alternative for quality endpoints. The reason for the similarities in end-costs can be related to the lack of follow up between projects which makes the pre-contract TC very similar. The same reason in lack of communication can be found for the post-contract TC where ones the project ends so does the partnership.

Furthermore, our interview study showed several signs of incompetence regarding partnering procurement with DB contracts. As previously mentioned, lack of communication is a major flaw in the procurement system but as the data have shown there exist some other bad regular behaviour when procuring

partnership contracts. The basis of this conclusion is that the interviewees working with DB contracts have expressed how the framework is too similar like DBB contracts and not enough focus on partnerships and early collaboration/procurement. Additionally, the standard contracts AB/ABT are the basis for the procurement frameworks which have led to a misconception regarding partnerships and coopeting contracts. This affects both clients and contractors as some partnership contracts have sticked to the wrong standard contracts for their project type. A clear visible example is not choosing standard contract ABK09 for partnership project with shared accountability. The result creates these similar results for both the framework DBB and DB when they are applied in the same way.

The conclusion is that DBB and DB models have the same project costs but vary in quality of end-product with an advantage to the latter. For DB framework to become the new norm it must go through some changes that puts focus on today's standard with a rise in partnering projects. Simultaneously, new digital software should be implemented to promote better communication between client and contractor both before, under and after the project is finished.

6.2 Procurement and Sub-Contractor

As of the question stated in the method chapter, the study was aiming to answer the question “How do the project delivery models affect the number of total procurements bids and sub-contractors in the value-chain? “

From first point of view investigating the data from the literature study Kraljs matrix would have suggested that the number of procurements offers would differ depending on the category of the purchase, but no further data was established to confirm this theory. Direct links between the project delivery models and the number of total procurements offers or sub-consultants in the value chain seem difficult to encounter in the current literature. It can be estimated that since The DBB methodology where the design and construction processes separated entirely, and the client's architect and engineer may provide the contractor with a fully developed design prior to the commencement of construction can lead to more sub consultants. Design-build on the other hand in which the owner enters a contract with a single organization responsible for providing both the architectural design and the construction services. The design-build company may perform all these tasks alone, or they may hire third subcontractors to do some of them, showing no clear difference between the two models. What really seems according to literature to make the difference is the procurement strategy when acquiring subcontractors. As some authors have contended that low-bid procurement selection may lead to more sub consultants and offers, at the same time a best-value method may lead to less procurement offers, due to higher transaction costs as the bidders must go through a pre-qualification phase before being able to leave tender. Transaction costs arise from things such as but not limited to preliminary design cost, negotiation and contracting costs, and feasibility study costs. Stronger requirements for qualifying your tender raise this cost and can result in fewer tenders being made by contractors. Also, a major factor as stated in the literature study was that the market conditions change how the bids are made. As high unpredictability in the

market and cyclicality have led construction firms to historically rely on temporary staff and subcontractors.

From interview study it is also said that high transaction costs are a challenge that affects the number of bids and tender a company can participate in, suggesting leading to less bids on the market. However, procurers don't think this is not a trend that they can see, as they usually get several bids anyway. What they do see is that not stronger requirements but more complex projects, usually receive fewer bids, with only 3-4 major players in the market capable of handling the demands.

As to the frameworks, some respondents believes that a more standardized approach to collaboration would be beneficial as this would reduce transaction costs. This would involve creating clear frameworks and guidelines for collaboration, which are currently lacking and create tedious processes. Design Build contracts are usually preferred, as they transfer responsibility for any issues to the contractor, freeing the client from needing extensive construction expertise. A common trend is increased number of partnerships due to the trend towards more complex buildings and high-end buildings, with more specific and complex requirements, demanding more collaborative projects where clients are more actively involved in the process. As such is difficult to entail which of the frameworks originally researched from the interview study since the market seem to be working mostly with either Design-Build or Partnership arrangements with more early involvement as well as framework agreements stretching over several projects, potentially a portfolio. Of these two, Design-Build is drawing more tender offers since the nature of a partnership leads to working with less, but supposedly more qualified partners. As of the number of levels of sub-consultants in the value chain, seem that even if partners are used, they also use sub-contractors, meaning no difference in this part.

A major factor that was entailed by the interview study was the fact that many major companies in the construction industry has rules but in place to use maximum of two subcontractor levels in the supply chain. As many other industries they are in the process of acquiring or developing an automated system for contractor control to enforce these rules. Reasons for having these rules are mentioned due to multiple layers of subcontractors can lead to safety risks and black-market labour. It's seen as essential to have control over subcontractor chains and ensure they meet the same requirements as the main contractor.

As also mentioned in literature the type of strategy for procurement can affect the number of bids, where the responders claim that the number of bids received can sometimes be too low due to high requirements as well as the opposite where setting the requirements too low, allows for unserious players to bid and be part of the project, leading to bad quality projects in the end. Finding a balance between this is a challenge and requires skilled buyers. From the survey it became clear that respondents think high costs of making bids stops them from making as many bids as they would have liked where the bidders seem to agree more strongly on this fact than the buyers, confirming the results from the

interview study. On average 4 offers were received for each project, at the same time to win a project from the contractor side, 5 had to be done. There seems to be tough competition on the market and a “buyer” -market these last years, even if it has been a boom market in the period researched.

As 82% of the Reponses from the survey was in favour of using a single contractor, also known as “generalentrepenad” and 62% was in favour of using “total entreprenerd” as a mean of handling responsibility, you could make the case that the design build is most common framework to use in the industry, and it's hard to compare the different models between each other when one major model is used. As said in the interviews other frameworks are less used as it increases the management required from the client, as well as make it harder to fault trace and hold contractors responsible for any errors or delays if responsibility is split in different way. However, a bit of this data is contradictory to the statements and suggestions that partnership projects are getting more increasingly popular and common in the industry today.

Another reason for making this a complex question to answer is the fact that on the Swedish market “design-build” or “design-bid-build" models does not seem to be common terms used in business context, but rather a framework discussed in academia, as was some feed received during interviews. There are a lot of factors discussed in procurement and construction, such as responsibility, number of actors involved, renumeration models, risk management, forms of evaluation of the tender as well as the level of collaboration between stakeholders. Especially risk management is a factor since companies as stated in the interviews don’t want to keep too workers on staff as they never at one time know exactly what staff they need and as such would be facing utilization problem of the available competence and workforce. So, to reduce costs in longer perspective they rely on sub-contractors to work on project basis. This was also the findings from the literature where high unpredictability and cyclicality in the business make construction firms to rely on temporary staff and subcontractors, which hampers productivity, limits economies of scale, and reduces output quality and customer satisfaction.

As a conclusion it can be said that the procurement methods are not the primary drivers for bidding, tendering and levels of sub-contractors in the value chain and as such is difficult to answer this question with the new findings that this study shows.

We propose that to more evaluate this questions, further research questions could be “What is the main driver and reasons for multi-level subcontracting in the construction industry” to fully understand this phenomenon.

6.3 Quality and Cost

As an answer to the question, does the number of total procurements offer, and sub-contractors then effect the result in terms of quality and end cost following can be concluded considering the data from survey, interviews, and literature study along with authors own reasoning in the question as such.

From the interview its said that an as a rule of thumb in the industry today, for each layer in the value chain you can expect a cost increase of at least 5-10%. As confirmed by several of the respondents. Reasons being it's a reasonable amount to cover both profit and overhead costs for the sub-contractors.

Also, from the interview study it was learned that direct costs relating to the production phase of the project are accounted for in a quite well manner. However, factors often not accounted for in projects are the total end costs including the property management phase relating to finding and solving faults as well as tracing which stakeholder is responsible and should bear costs for these issues. It is not a factor of the number of sub-contractors or tenders that cause issues in this stage, as its more of a fact of being able to

a) Find the responsible stakeholder for the issue.
b) Managing and initiating that this stakeholder solves the warranty claim by from the client.
c) That the contractor – and/or subcontractor solve this issue.

Lead times for these errands tend to get long due to legal battles and claims from both sides. Since larger companies do not have systems in place to handle these errands, and they are often handled on an ad-hoc basis, it is also difficult for companies to estimate costs tied to this problem. As a rule of thumb clients and contractors during the interviews add approximately 3% to cover costs for warranty issues to handle and mitigate these risks. However, in a market focused on low-bid procurement strategies this is most likely to be one of the things overlooked in this situation. Opening for even more difficult warranty issues, as neither the stakeholder wants nor can afford to be accountable for the costs. From the interviews it stated that these problems are even more frequent in partnering projects as if for one hand the business environment during production is very collaborative and some more forgiving in terms of how problems are being solved. Once the project is finished and handed over, neither stakeholder wants to be responsible for issues in the final product, and to trace which stakeholders who bear responsibility can be costly for the companies that get increased overhead costs.

This just confirms what was stated in the literature study that risks are often passed to other areas of the value chain instead of being addressed. This fact can make one think that collaboration model rather than creating a better model for collaboration just push the responsibility management from production to property management stage in the project life cycle. Players still make money from claims rather than from good delivery.

Based on the results provided from the survey there appears to be some agreement among respondents that a longer value chain of sub-contractors may lead to worse quality in projects, as indicated by a mean of 3.857 and a median of 4 in response to the question about sub-contractor steps and quality. However, there is surprisingly no clear consensus about whether more steps in the value chain for sub-contractors lead to overall higher costs in projects, as indicated by

a mean of 3.3 and median of 3 in response to the question about sub-contractor steps and costs. Therefore, while the number of total procurements offered and sub-consultants involved may impact the quality and end cost of a construction project, the specific impact may depend on a variety of factors beyond just the number of steps in the value chain.

Further research in aftermarket and property management stage of construction projects and how that is affected by initial decisions made in the projects such as ways of procurement and renumeration models is something that is suggested for future thesis projects.

6.4 Roadmap

As part of this project & thesis a roadmap was desired to be established to summarize the findings of the data of the study as well as to provide the reader with usable information that can be used for either project or further research. The idea of the road map is to act as a strategic plan that outlines the key steps and considerations required to achieve the specific goal and objective of a construction project. In this context, a roadmap can help project managers and stakeholders navigate the complexities of the project, identify potential challenges, and ensure that the project is completed on time and within budget. With ambition to ensure that all stakeholders are aligned and focused on the common goal, and that the project is executed efficiently and effectively.

In this roadmap some regular key moments and pathways, where specific decisions must be made in the procurement process of the project within the construction projects, was identified using the data from interviews, literature study and survey. This aims to have a standardized approach with a step-by-step process to take when considering procurement methods and different alternatives in this phase of the project.

Picture 6.4.1 Gant Diagram for a proposed higher-level method of handling procurement in construction projects.

As understood from the interviews, following considerations must be made to establish and determine the appropriate procurement strategy and correlating project deliver model, such as design-build, design-bid-build, or partnership models. The first step it's important to identify project requirements, as well as your organization's capacity and maturity to handle this project to determine

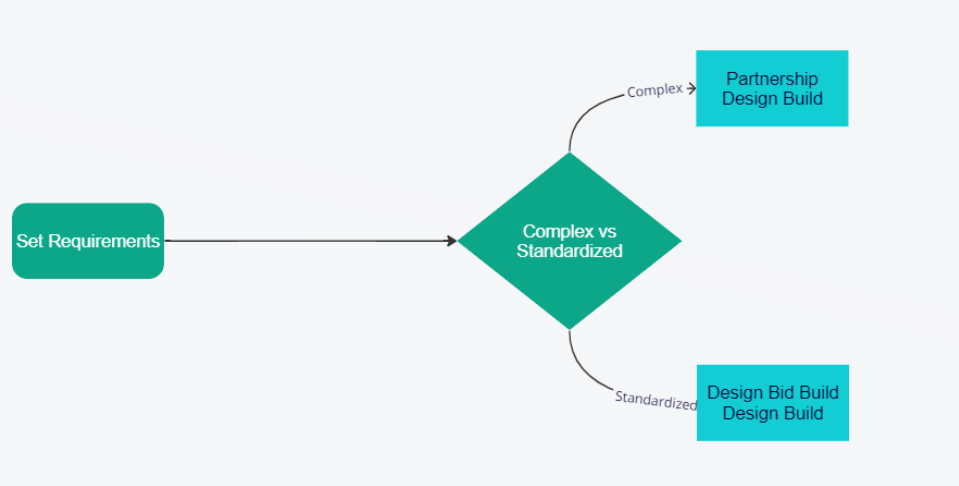
procurement strategy. Start by identifying your projects requirements and organization's capacity, as well as the specific needs of the projects. If not clearly visible take into consideration the ability to be agile and adaptable later in the project.

When setting requirements for the project this is in terms of complexity of project as well as how flexible you want to be to changes during the production phase. Risk management is also a factor to consider. Complex buildings are benefitted by high value bidding and collaborative working models, while standardized are favoured of having a low bid strategy combined with a design-build or design-bid-build approach.

Using the data received during interview study criteria for complex buildings in this case could be but not limited to attributes in geometry, site conditions, extra features and involvement from stakeholders. For example, but not limited to such as gym, garage, solar panel, commercial property, office space as well as integration with other projects or existing infrastructure. Extra elements require often more flexibility from contractor side to be successful. High level requirements for regarding Complex vs Standardized project can be seen below.

Requirements	**Complex**	**Standardized**
Design	Innovative architectural designs, unconventional building materials, complex structural systems	Replication of standard building designs or standardized building prototypes that have been previously executed with success
Technical Complexity	Advanced engineering solutions	Common building standards and practices with typical layouts and specifications
Size	Large Size or involved multiple phases	Smaller Buildings
Site Conditions	Difficult site accessibility, topography, soil conditions, environmental concerns, existing structures, that require careful planning and execution	Project with good accessibility, and overall good conditions
Stakeholder management	Many stakeholders with diverse interest, leading to complex communication, decision-making and coordination processes	Projects involving few stakeholders with similar interest
Flexibility and customization	Extensive customization or adaption to suit specific client requirement or late-stage changes	Clearly defined and standardized specification, materials, and construction methods, leaving little room for customization and deviation

Table 6.4.1. Explaining Different Requirements and conditions to determine complex versus standardized projects.



Picture 6.4.2. Setting Requirements and establishing if a complex or standardized project to choose method of procurement.

As next organization should access their available resources both financially to access the speed which project can be done but also the available expertise and workforce within the company. Will the capacity within the company enable cooperation with different stakeholders and partnerships or is the task too complex for the available capacity.

The next step in the Gant diagram is choosing strategy which is dependent on the parameters in previous steps. Depending on these parameters we have designed three different strategies that can be arranged to fit the specific project. Furthermore, it helps clarify and deepen the knowledge of the chosen strategy which may lead to a more correct procurement method and model being utilized at the last stage. Down below is the strategy table based on three basis of strategies which consists of contract form, compensation model, procurement method and evaluation and lastly what kind of cooperation the project would demand.

	Competition	**Coopetition**	**Collaboration**
Contract form	By the client (AB) or contractor (ABT)	Joint project planning in early collaboration with one liable actor, AB/ABT	Joint project planning in early collaboration with shared liability, ABK09
Compensation model	Fixed price	Running account with incentives	Running account with bonus opportunities
Procurement method	Open with many bids	Limited with few bids	Early procurement with one supplier
Evaluation	Focus on lowest price	Focus on both lowest price and soft parameters	Focus on soft parameters
Collaboration model	No collaboration	Collaboration with few joint activities	Collaboration with several joint activities

Table 6.4.2. Different methods of handling various aspects of the procurement process in construction industry.

	Competition	**Coopetition**	**Collaboration**

Contract form	By the client (AB) or contractor (ABT)	Joint project planning in early collaboration with one liable actor, AB/ABT	Joint project planning in early collaboration with shared liability, ABK09
Compensation model	Fixed price	Running account with incentives	Running account with bonus opportunities
Procurement method	Open with many bids	Limited with few bids	Early procurement with one supplier
Evaluation	Focus on lowest price	Focus on both lowest price and soft parameters	Focus on soft parameters
Collaboration model	No collaboration	Collaboration with few joint activities	Collaboration with several joint activities

Table 6.4.3. Project example 1 for simple project with low uncertainties: For example, buildings for student accommodation.

	Competition	**Coopetition**	**Collaboration**
Contract form	By the client (AB) or contractor (ABT)	Joint project planning in early collaboration with one liable actor, AB/ABT	Joint project planning in early collaboration with shared liability, ABK09
Compensation model	Fixed price	Running account with incentives	Running account with bonus opportunities
Procurement method	Open with many bids	Limited with few bids	Early procurement with one supplier
Evaluation	Focus on lowest price	Focus on both lowest price and soft parameters	Focus on soft parameters
Collaboration model	No collaboration	Collaboration with few joint activities	Collaboration with several joint activities

Table 6.4.3. Project example 2 for large complex projects with innovative solutions: For example, buildings with heavy technical solutions and many installation works.

	Competition	**Coopetition**	**Collaboration**
Contract form	By the client (AB) or contractor (ABT)	Joint project planning in early collaboration with one liable actor, AB/ABT	Joint project planning in early collaboration with shared liability, ABK09
Compensation model	Fixed price	Running account with incentives	Running account with bonus opportunities
Procurement method	Open with many bids	Limited with few bids	Early procurement with one supplier
Evaluation	Focus on lowest price	Focus on both lowest price and soft parameters	Focus on soft parameters
Collaboration model	No collaboration	Collaboration with few joint activities	Collaboration with several joint activities

Table 6.4.4. Project example 3 for large repetitive and complex projects with development needs: For example, a new neighborhood with several identical apartment buildings.

As of the final part in the procurement phase it is important to have processes in place to evaluate and chose partners to work with. Even if the strategy is great and well thought trough, is important to have organization with appropriate size as well as routines to evaluate the tender. According to our study this is the case for most companies if themselves are asked. However, since there are local differences suggest improvements still can be made.

Even if the formal criteria are met in the tender as set it strategy when evaluating the bids, it is important to do due diligence to make sure the supplier can deliver what was promised. Things considered here should be experience and record of accomplishment, technical expertise within their organization, financial stability, capacity, and resources. As if they do not reach this criterion, it's that they will either a) use another level of sub-contractors or b) not have the capacity to deliver the project. Issues also can arise with safety and compliance or fail to deliver the organizations sustainability goals.

6.5 New Findings

Long and complex value or supply chains are not a result of procurement frame works. While project delivery models and procurement frameworks contribute to shaping the structure of value chains, their complexity is influenced by a multitude of interrelated factors. Thus, it is imperative to consider a comprehensive range of elements beyond project delivery models and procurement frameworks to thoroughly comprehend and analyze the intricate nature of value chains. Although we have observed instances of when the whole value chain has strived for the same goal, it originated in procurement strategy. This approach is still in an early stage for the clients and would need a few more years of implementation to research the effect on the value chain rather than choosing the easy alternative of blaming policymakers for inadequate frameworks and models.

Partnerships and collaborations can solve some issues but also tend to push problems forward in the value chain instead of solving the issues if not the complete value chain is taken into consideration. The to address and resolve specific issues within a value chain. However, it is critical to acknowledge that when such alliances fail to encompass the entirety of the value chain, they may inadvertently displace problems instead of providing comprehensive solutions. By solely focusing on select segments or nodes of the value chain, there is a heightened risk of inefficiencies in other interconnected areas. To effectively tackle issues within a value chain, a holistic approach is indispensable, encompassing all stages and stakeholders involved. Such a comprehensive perspective facilitates an integrated and sustainable solution that duly considers the broader repercussions throughout the value chain. However due to the structure of the industry with multiple stakeholders accountable for each step of from cradle to grave in a construction projects.

This can be problematic and difficult to solve. Therefore, we would like to highlight again the collaborative models and the need for proper procurement

framework supporting all parts of the value chain throughout the project's lifetime.

6.6 Further Research

While this thesis has delved deep into the intricacies of procurement practices within the construction industry, there remains a plethora of avenues to be further explored. Advancements in technology, changing global supply chain dynamics, and evolving industry standards offer promising areas of study. Potential research directions to expand the body of knowledge in this domain would be for Aftermarket perspective, how evaluation of suppliers is made, IT-systems for quality control and overall lifecycle management.

Service and Support Post-Project Completion is sometimes overlooked in the construction industry with significance of aftermarket services. Yet, the longevity and sustainability of a construction project rely heavily on post-completion services. A comparative analysis of post-completion services in various industries can be carried out, highlighting best practices and benchmarking standards for the construction industry as well as collaborative models and their impact in construction projects.

Evaluation of Suppliers, A dynamic and rapidly evolving global market necessitates the continuous appraisal of suppliers to ensure quality, timeliness, and economic viability. A research initiative could delve into advanced evaluation metrics, incorporating environmental, social, and governance (ESG) criteria, alongside conventional metrics, to offer a holistic supplier evaluation framework.

IT-Systems for Quality Control and Overall Lifecycle Management, the digitization wave in the construction industry has predominantly revolved around design and execution, with a limited focus on procurement's quality control and lifecycle management through IT systems. Proposed Study could be too deep dive into IT platforms and tools that can seamlessly integrate with construction projects, enabling real-time monitoring, predictive analytics for quality control, and comprehensive lifecycle management and connecting this to the aftermarket services. Major actors in the market are creating such systems but are yet to be implemented at full scale.

Collaborative Models in an industry that heavily relies on a myriad of stakeholders, the potential of collaborative model and partnership is enormous, yet not entirely tapped. An exploration of collaborative partnership models from other industries can be undertaken, assessing their applicability in the construction realm. Furthermore, the study can involve designing pilot models, testing them in real-life scenarios, and gauging their impact on project efficiency and stakeholder satisfaction.

As the construction industry progresses, procurement practices need to evolve in tandem. Continuous research and proactive adaptation of new strategies, tools, models and frameworks will ensure that the sector remains resilient,

sustainable, and efficient. The above recommendations offer a strategic pathway to foster advancements in procurement practices within the construction landscape.

7 References

PMBOK® Guide (2021).

Bell, E., Bryman, A. and Harley, B. (2019). *Business research methods*, Oxford, New York, Oxford University Press.

Bröchner, J., Kadefors, A. (2010). *Värden och värdekedjor inom samhällsbyggnad.* KK-stiftelsen.

Erik Eriksson, P., Dickinson, M. and Khalfan, M.M.A. (2007), "The influence of partnering and procurement on subcontractor involvement and innovation". Emerald Group Publishing Limited

MGI. (2017). REINVENTING CONSTRUCTION: A ROUTE TO HIGHER PRODUCTIVITY. McKinsey & Company.

Sveriges Byggindustrier (2013). Fakta om byggandet. Stockholm: Sveriges Byggindustrier.

Harvard business review. (2020). The Future of Building Design Fostering Partnerships Between AEC Firms and Building Product Manufacturers. Autodesk.

PE Eriksson, O Pesämaa - Construction management and economics. (2007). Modelling procurement affects cooperation. Taylor & Francis.

M. Kornevs, J. B. Hauge och S. Meijer, "Perceptions of stakeholders in project procurement for road construction," Cogent Business and Management, vol. 5, no. 1, 2018.

Grenzfurtner, W. and Gronalt, M. (2021), "Developing a continuous improvement perspective for subcontractor involvement in the industrialised housebuilding supply chain", Supply Chain Management, Vol. 26 No. 2, pp. 174-191.

Porter, M.E. (2001) The Value Chain and Competitive Advantage. Understanding Business: Processes, 50-66.

Love, P.E.D., Irani, Z. and Edwards, D.J. (2004), "A seamless supply chain management model for construction", Supply Chain Management, Vol. 9 No. 1, pp. 43-56.

Eriksson, P-E. Dickinson, M. and Khalfan, M.M.A. (2007), "The influence of partnering and procurement on subcontractor involvement and innovation", Facilities, Vol. 25 No. 5/6, pp. 203-214.

Borg, L & Lind, H. Framework for Structuring Procurement Contracts. (2014). Royal Institute of Technology, Sweden.

Kadefors, A et al. (2019) Collaborative procurement strategies for infrastructure projects: a multiple-case study. Proceedings of the Institution of Civil Engineers – Management, Procurement and Law 172(5): 197–205.

Park, J. Kwak, Y-H.(2016). Design-Bid-Build (DBB) vs. Design-Build (DB) in the U.S. public transportation projects: The choice and consequences, International Journal of Project Management,
Volume 35, Issue 3.

Eriksson, P-E. Volker, L. Kadefors, A. Lingegård, S. Larsson, J. Rosander, L. (2019) Collaborative procurement strategies for infrastructure projects: A multiple-case study.

Lam, E. W. M., Chan, A. P. C., & Chan, D. W. M. (2008). Determinants of successful design-build projects. Journal of Construction Engineering and Management, 134(5), 333-341.

El Wardani Marwa, A. Messner, J. Horman, J. Comparing Procurement Methods for Design-Build Projects. (2008). Journal of Construction Engineering and Management. Volume 132, Issue 3.

Chan, P. C., Scott, D., & Lam, E. W. M. (2002). Framework of success criteria for design/build projects. Journal of Management in Engineering, 18(3), 120-128.
Eriksson, P-E. (2007). Efficient Governance of Construction Projects through Cooperative Procurement Procedures. Doctoral thesis.

Tadelis, S and Bajari, P. (2001). Incentives Versus Transaction Costs: A Theory of Procurement Contracts. Contracts & Commercial Law eJournal.
K. C. Lam, Tiesong Hu, S. Thomas Ng, Martin Skitmore & S. O. Cheung (2001) A fuzzy neural network approach for contractor prequalification, Construction Management and Economics, 19:2, 175-188.

Alexander Styhre, Per-Erik Josephson & Ingeborg Knauseder (2004) Learning capabilities in organizational networks: case studies of six construction projects, Construction Management and Economics, 22:9, 957-966.

Mandell, S. Brunes, F. Quantity Choice in Unit Price Contract Procurements. 2014. Journal of Transport Economics and Policy (JTEP), Volume 48, Number 3, September 2014, pp. 483-497(15).

Shehu, A S. Ibrahim, Y. Inuwa, I I. Knowledge requirement theoretical framework for construction procurement management. (2019). IOP Conference Series: Materials Science and Engineering, Volume 615. Stuttgart, Germany.

Eriksson, P-E. (2010). Partnering: what is it, when should it be used, and how should it be implemented? Construction management and economics Volume 28 issue 9.

Nordstrand A (2022) Allmännyttan och bostadsbyggandet Marknadsrapport. Allmännyttan och bostadsbyggandet (2022) | Sveriges Allmännytta (sverigesallmannytta.se)

Byggandets kontraktskommitté (BKK). Ersättningsformer för entreprenader. https://foreningenbkk.se/wp-content/uploads/2016/11/Ersattningsformer-for-entr.pdf

Riksvisionen. Trafikverkets upphandling av vägar och järnvägar - leder till hög produktivitet? (2012). https://www.riksrevisionen.se/download/18.78ae827d1605526e94b2ff78/1518435439364/Anpassad_12_14_Trafikverkets%20upphandling.pdf

Ketokivi, M., & Mahoney, J. Transaction Cost Economics as a Theory of the Firm, Management, and Governance. Oxford Research Encyclopedia of Business and Management. Retrieved 18 May. 2023, from https://oxfordre.com/business/view/10.1093/acrefore/9780190224851.001.0001/acrefore-9780190224851-e-6.

Sveriges Statistiska Centralbyrå (2022) Antal anställda inom näringslivet (KS), efter näringsgren SNI2007. Kvartal 2015K2 - 2022K4
Antal anställda efter kvartal och näringsgren SNI 2007. PxWeb (scb.se)

Sveriges Statistiska Centralbyrå (2022). Företag (FDB) efter näringsgren SNI2007 och storleksklass. År 2008 – 2022
Företag (FDB) efter näringsgren SNI2007 och storleksklass. År 2008 - 2021. PxWeb (scb.se)

Sveriges Statistiska Centralbyrå (2022) Sveriges BNP Sveriges BNP (scb.se)

Byggföretagen (2022). Antal företag i byggbranschen. Antal företag i byggbranschen | Byggföretagen (byggforetagen.se)

Byggföretagen (2020). Totala Bygginvesteringar. Totala bygginvesteringar | Byggföretagen (byggforetagen.se)

Byggföretagen (2020). *Sund konkurrens i byggbranchen.* *https://byggforetagen.se/app/uploads/2020/09/Sund-konkurrens-i-byggbranschen-En-forskningsantologi.pdf*

Josefson P.E (2018). Framgång och feltänk i förbättringsarbete. https://www.sverigesbygguniversitet.se/wp-content/uploads/sites/40/2018/07/byggsektorn_antologi.pdf

Statskontoret (2012). Den effektiva staten. https://www.statskontoret.se/siteassets/publikationer/2012/om-offentlig-sektor-15_effektivitet.pdf

Byggföretagen(2020). 30 största byggföretagen efter omsättning i Sverige. https://byggforetagen.se/app/uploads/2020/11/30-St%C3%B6rsta-2019.pdf

Byggföretagen (2020). Sveriges 30 största bygg- och anläggnings-företag https://byggforetagen.se/2020/11/hela-listan-sveriges-30-storsta-bygg-och-anlaggningsforetag/

Boverket (2023). Types of contracts and procurement. https://www.boverket.se/en/start/building-in-sweden/developer/rfq-documentation/types-of-contract/

Konkurrensverket (2019). Entreprenadupphandlingar - Hur kan byggherrar främja effektivitet och innovation genom lämpliga upphandlingsstrategier?. https://www.konkurrensverket.se/globalassets/dokument/informationsmaterial/rapporter-och-broschyrer/uppdragsforskning/forsk-rapport_2014-4_entreprenadupphandlingar.pdf

7.1 Appendix 1 – Survey study

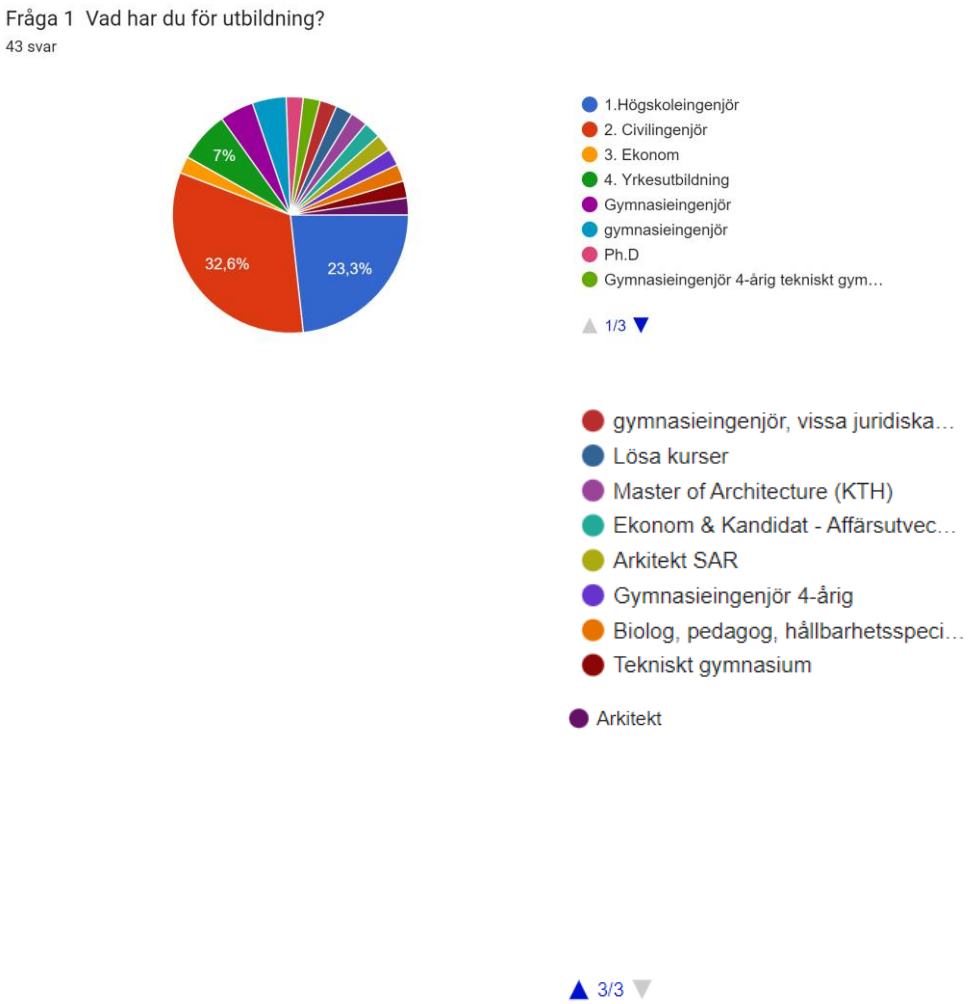


Chart 4.1. What is the education of the respondent? Most common results where bachelor's degree in engineering, master's degree in engineering or some

type of higher vocational engineering degree. Engineers where overrepresented in the survey.

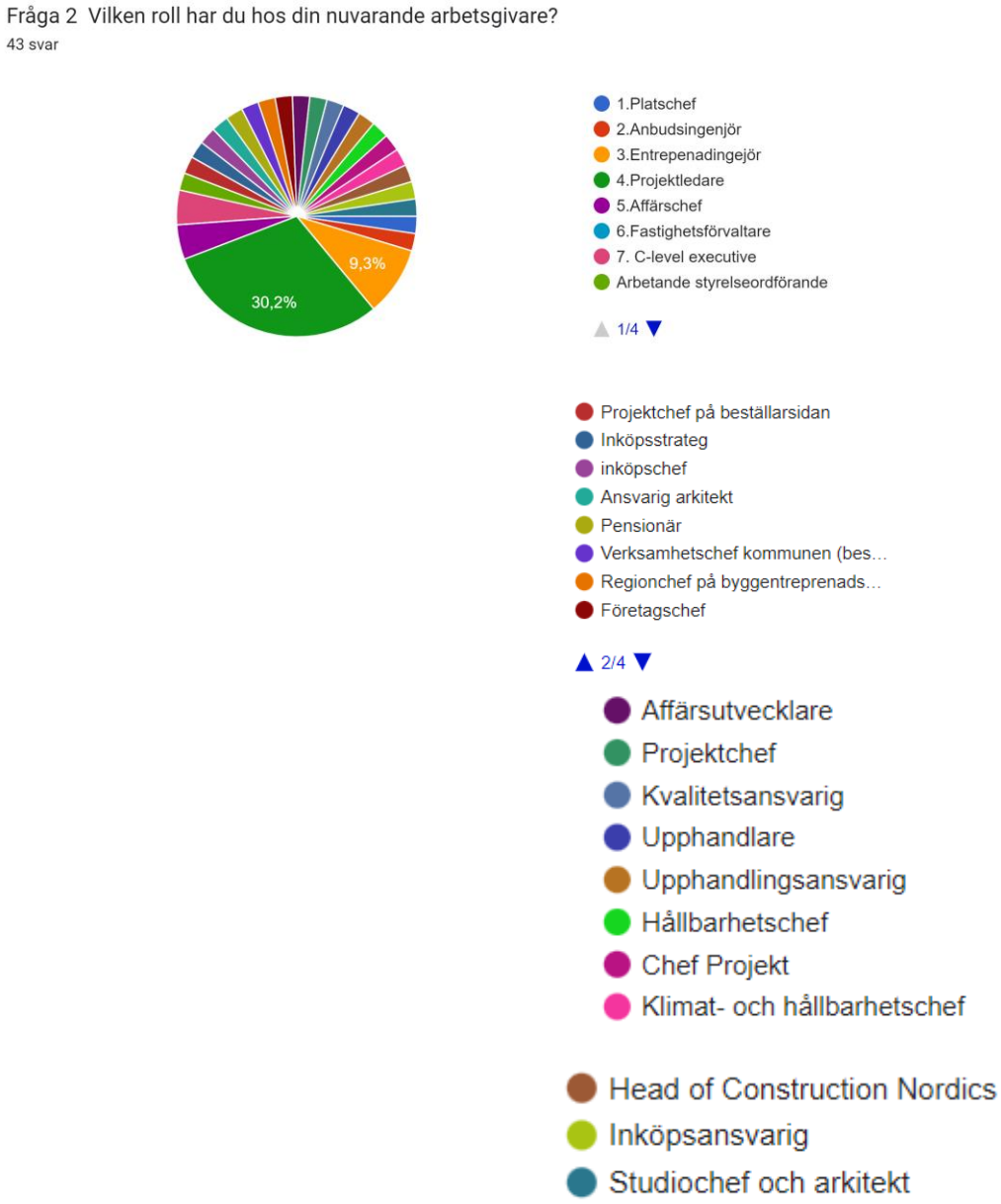


Chart 4.2. What is your current role within your company? The most common answer was project manager (30%) followed by contracting engineer (9% followed by a split between different types of procurement, architect, quality, business, environmental or management roles.

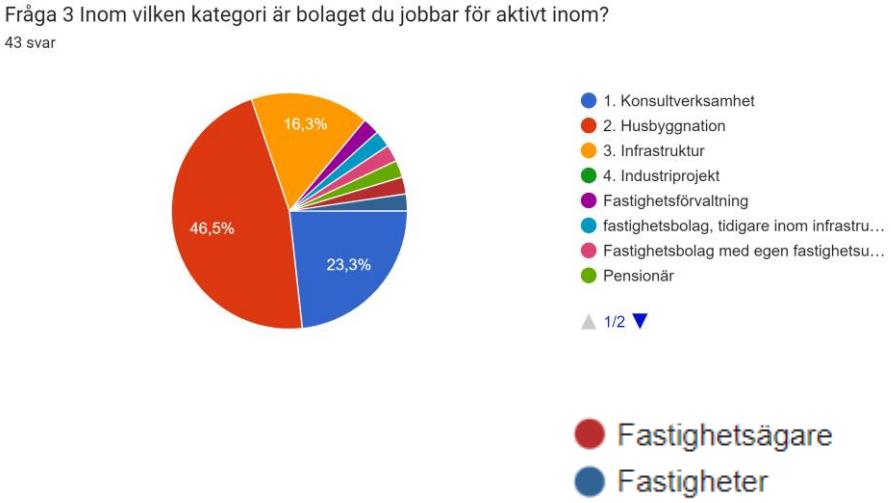


Chart 4.3 In what segment is your company active in? Most common answer was Construction of housing (46%), followed by consulting (24%), infrastructure (16%) and different types of real estate companies.

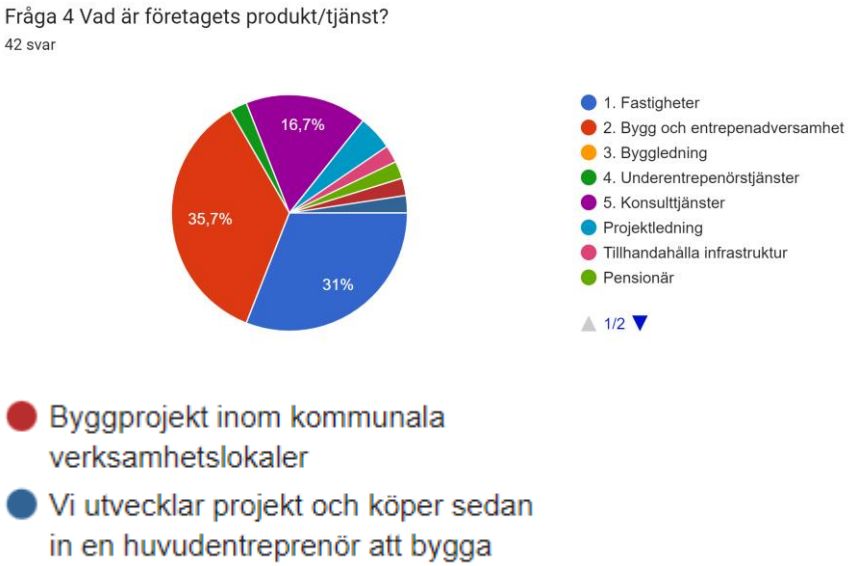


Chart 4.4 What is the product or service of the company? Most common answer was real estate (31%), Construction (36%) and Consulting (16%) followed by different type of sub-contractor services or project development.

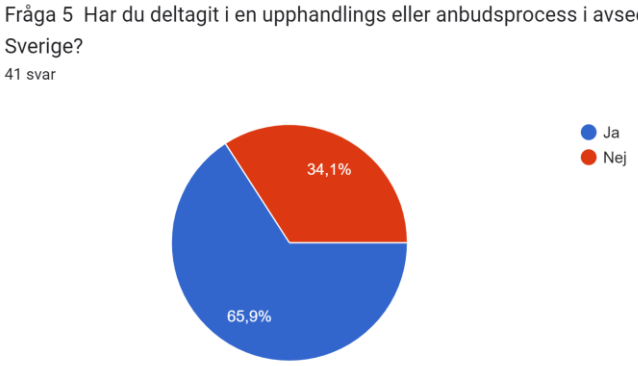


Chart 4.5. Have you ever participated in a procurement or bidding process for multiunit housing projects? 66% answers yes compared to 34% of participants never participated in the type of projects are looking into.

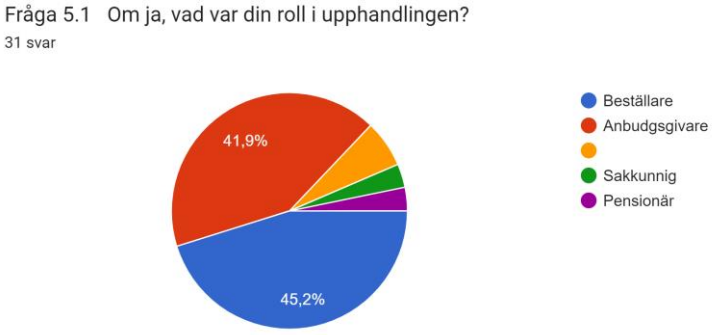


Chart 4.5.1 If yes, what was your role in the procurement process? 42 % where bidders, 45% procurement, while 13% percentage acted within other roles or experts.

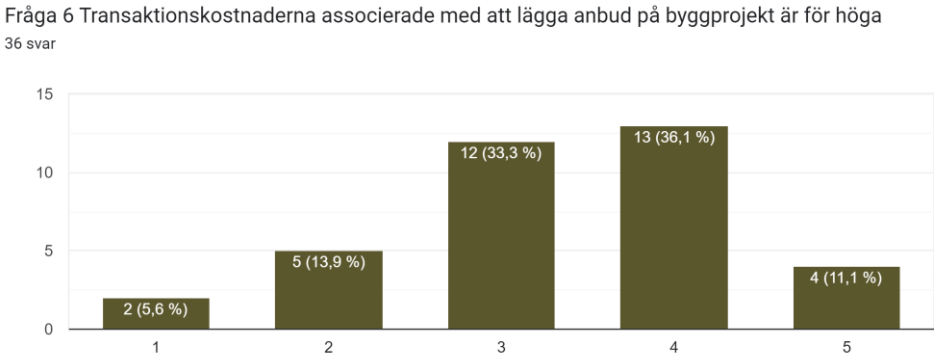
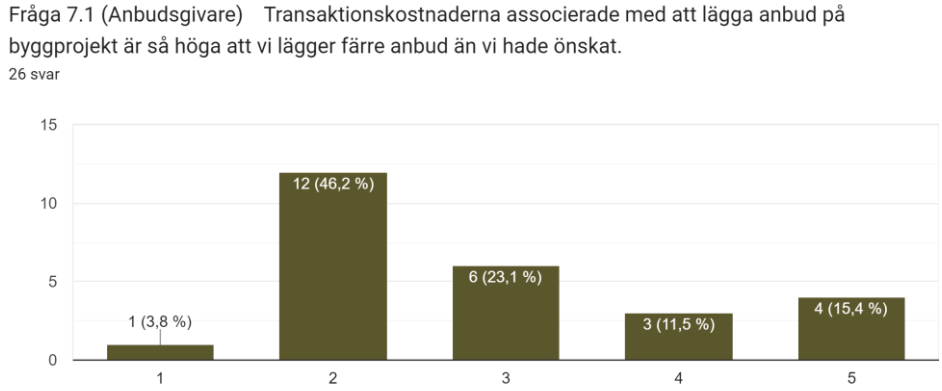


Chart 4.6 The transaction costs associated with making an offer in the bidding process for construction projects are too high. The data suggest that a small majority of the respondents agrees with the fact that making a bid is too expensive in today's industry with a mean value of 3,3 and a median of 3.



‘

Chart 4.7.1 The transaction costs associated with making an offer in the bidding process makes us make less offers than we would have wanted. The data suggest that the respondents do not think excessive costs of making bids stops them from making as many bids as they would have liked. Mean value 2,9 and median value of 2.5.

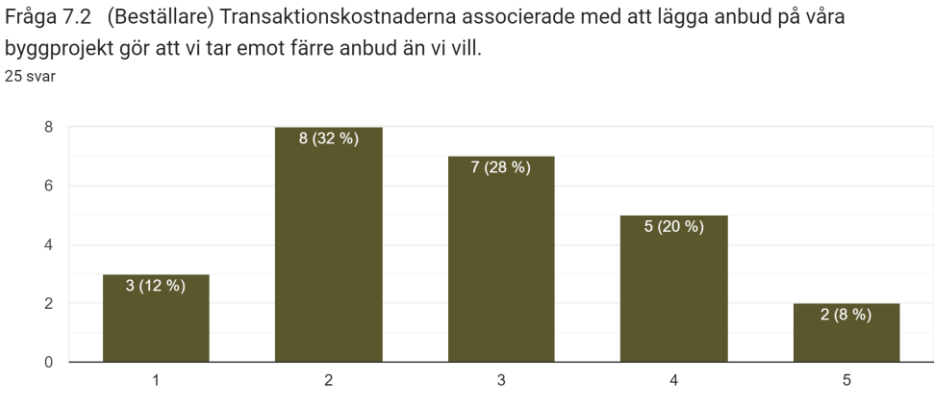


Chart 4.7.2 Transaction costs associated with making bids on our building projects makes us do less bids than we would have wanted to. Data suggest that buyers of projects do not seem to think they get to less numbers of bids, although the suggestion is not as strong as what the bidders thought on their end. Mean value of 2,8 and median value of 3.

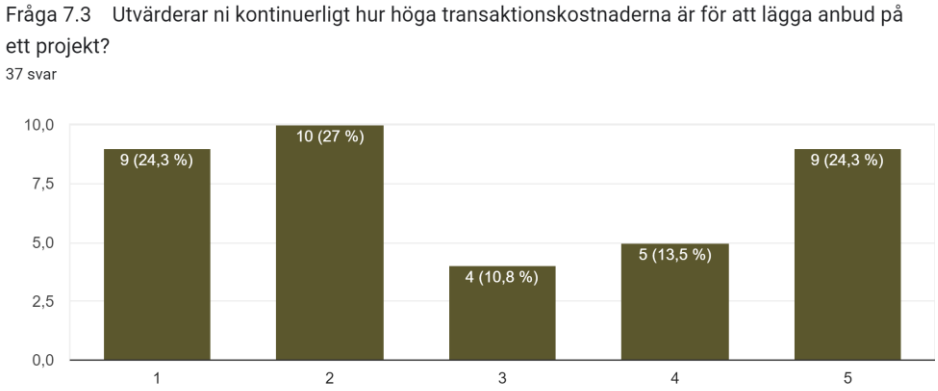


Chart 4.7.3 Are you continually evaluating how high the transaction costs are for making a bid on your projects? The data suggest that evaluation of transaction costs is done but not standard praxis yet and varies between companies. Mean value 2,9 and median value of 3.

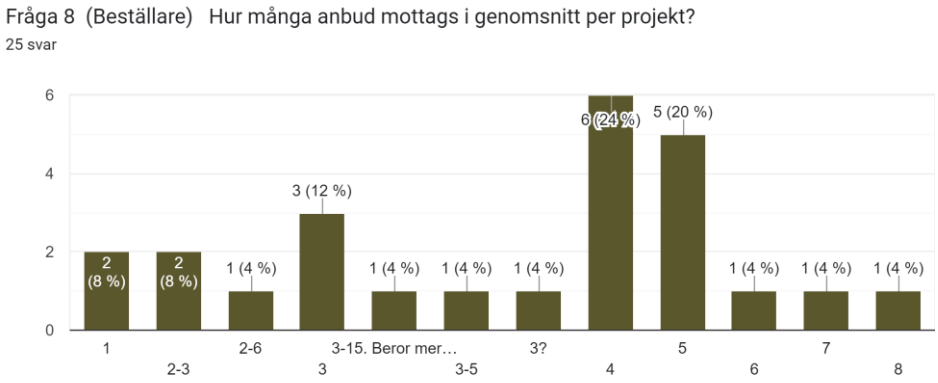


Chart 4.8 How many offers were done on an average for a project? (Procurement) The mean number of bids where 4.4 bids/ won project and the median were 4 projects.

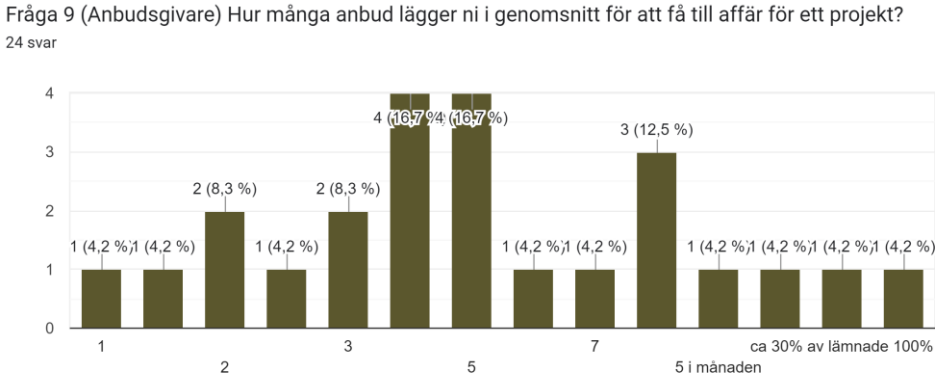


Chart 4.9 How many bids to you usually make to receive a deal for a project? (Bidder) In order to receive a deal for a project, on average amount was 4.9 and median 5 projects.

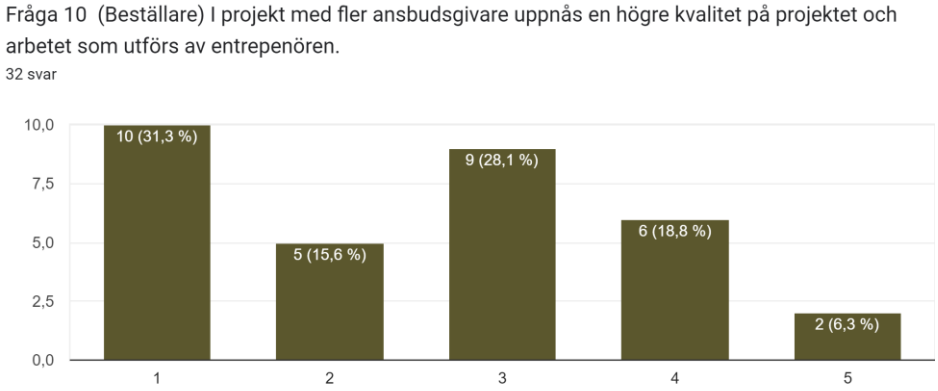


Chart 4.10 In a project with several bidders a higher quality is achieved in the projects completed by the contractor. Mean 2,5 and median 3. Suggestion a spread in opinion about regarding more bidders in the project meant better end quality.

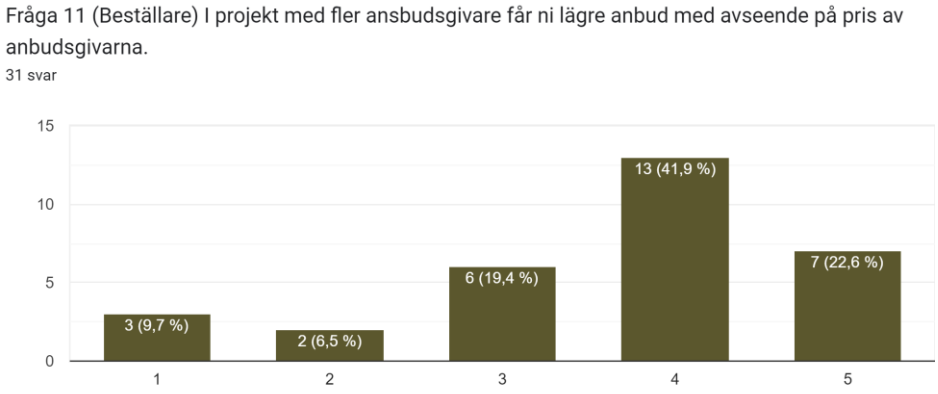


Chart 4.11 In projects with more bidders, lower prices are made by the bidders. A mean of 3,6 and a median of 4 suggest that procurement tend think they get a lower price if there are more bidders in the process.

Chart 4.12 What form of procurement is most common in projects. With a result of 82% of the respondents choosing "general entreprenad" it is the dominant type of contracting agreement on the market.

Chart 4.13 What form of contracting is made in the projects? With a result of 63% of the respondents choosing "total entrepenad" and 37% "utförande entrepenad" it suggests that "total entrepenad" be the dominant type of contracting agreement on the market.

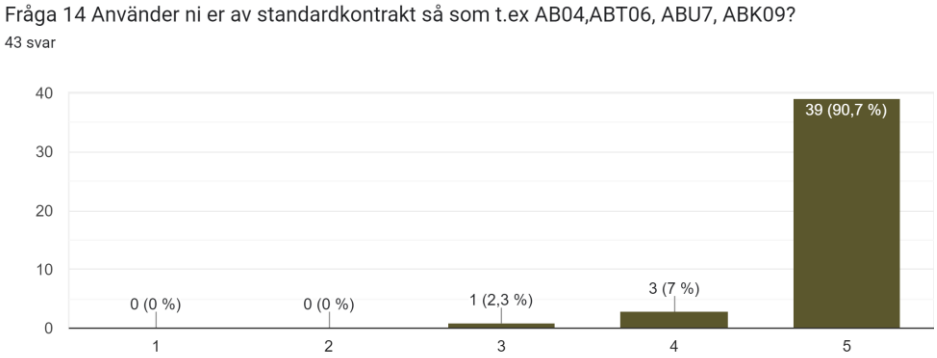


Chart 4.14 Do you use standard form of contracting such as AB04, ABT06, ABK09? 90% of the respondents answered that they strongly agree with that they use standard form of contracting in projects.

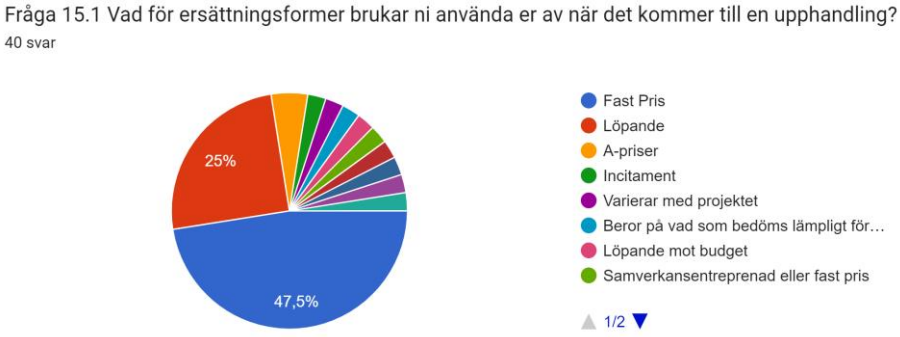


Chart 4.15.1 What form of reimbursement methods are most common in contracting? 48% of the respondents suggest that they used fixed price, 25% use on the current account billing and the rest use either incentives, collaboration or adapt strategy to the means and project as well as work to be done.

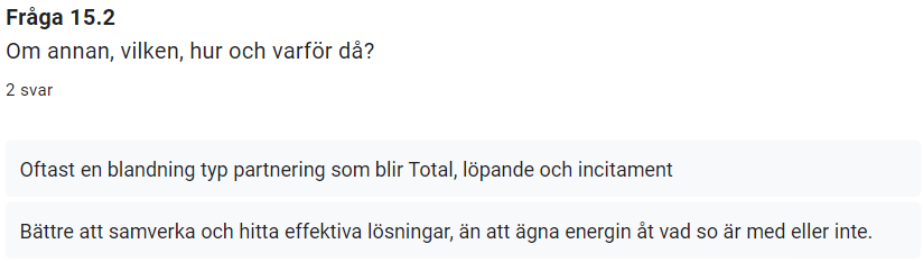


Chart 4.15.2 If other methods then the ones specified, which ones are used? Other forms of reimbursement periods where for example distinct types of partnering and collaboration.

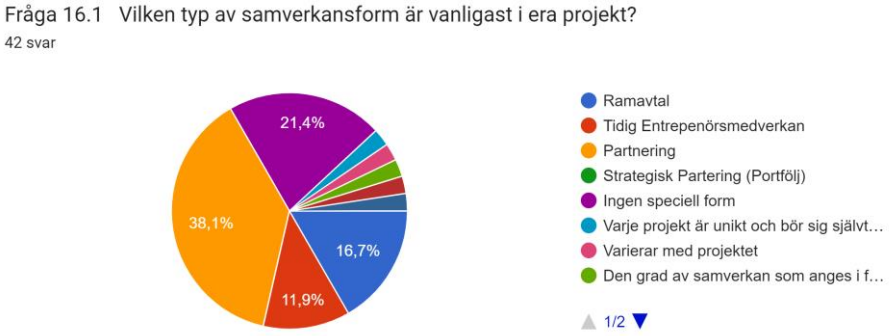


Chart 4.16.1 What form of collaboration is most common in your projects? 38% of the respondents answer that the most generic form of collaboration in a project is partnering, followed by 21% answering “no special type”, 17% answering framework agreement and 12% answering “early involvement”. The remaining percentage answer that it varies between projects.

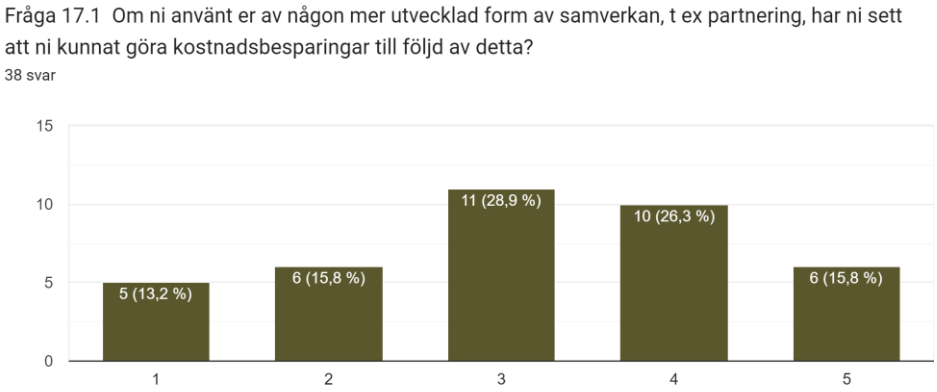


Chart 4.17.1 If you used any other type of collaborative method, f.g partnering, have you seen that you have been able to make cost optimization because of this? With a mean of 3,15 and median of 3,5 there seem to be disagreements from the respondents regarding if partnering leads to cost savings in projects. Seems to be no straightforward evidence supporting this theory.

Question 4.17.2 - What are these cost optimizations and saving made by?
The respondents were able to freely express their answers in text as why they could see that partnering or collaborative models for projects made them save time and resources. The results where then categorised according to similarities in their answers touching subjects as shared information flow, improved business, and work culture, opening for new kinds of solutions and technical innovations, better workflow and de-suboptimization to put more focus on solving problems from higher perspective as well as more early involvement from different stakeholders and expertise.

Sharing information
The right type of collaboration and partnering provides a platform to use cost efficient solutions with incentives for all parts to benefit from these frameworks. As result of this the stakeholders, make extra efforts to provide better results in project. Sharing of information, methods, tools, and resources as well as mutual supplier agreements enables continuous improvements for all stakeholders. Networks and competence are also better utilised and used and makes it in everyone's interest to cut costs. Not putting it to other stakeholders as what otherwise is common in the industry.

Culture
As some claim partnering models does create time and cost savings other respondents also claim it mostly create a better business and working environment with less conflicts and a cultural change within the organization.

Solutions & Innovation
Respondents express that solution driven mindset when collaborating provides framework for flexibility from all partners involved in projects made it possible to increase quality, saving additional work and enabling better workflow in projects. New innovations and solutions helpful for all parts involved, for example how to deal with problems related to flooding in construction projects.

Workflow and De- Suboptimization
By seeing projects workflows as a complete system enable to create better working environments and workflow as less focus had to be on suboptimization, argumentation and conflicts regarding costs between contractors and management. More quality, cost savings and smoother project journey.

Early Involvement

Collaborative models for projects give more visibility for all partners involved and key decisions can be made done earlier in process by involving different stakeholders with different expertise early in negotiations, procurement, and project planning with the clients, saving time and costs. Having discussions about what values should be created in the project early on improves over all workflow and end-result for the end user. Early involvement from the stakeholders also makes the forecast of the costs more visible and accurate since the stakeholders have more transparency and trust between each other.

Chart 4.17.3 If you used any other type of collaborative method, for example partnering, have you seen that you have been able to increase quality in the projects because of this? Referring to less errors in end projects and less costs due to additional work or alterations. With a mean of 3.5 and median of 4 there seem to be an agreement that collaborative partnering can lead to increase in quality, less error, alterations, and cost of additional work in projects.

Chart 4.17.4 Do you continuously evaluate your collaboration partners? With a mean of 3,775 and a median of 4 there seem to be agreement that most companies continuously evaluate their business partners.

Chart 4.18.1 Do you use sub-contractors to provide your services and products. With a mean of 3,75 and median of 4 there seem that most of the respondents agree that they use subcontractors to provide their services.

Chart 4.18.2 If yes, how many steps in the value chain do you see existing? With a both mean or 2,14 and median of 2 there seem to be a on average 2 steps of subcontractors in the value chain in construction projects according to the respondents.

Chart 4.18.3 Do you continuously evaluate your sub-contractors? With a mean of 4 and median of 4 the respondents seem to agree on the fact that they continuously assess and evaluate their sub-contractors.

Chart 4.19.1 Do you see that the number of steps of sub-contractors in the value chain leads to less quality in the projects. With a mean of 3,857 and a median of 4 there seem to be agreement from the respondents that a longer value chain of sub-contractors lead to worse quality in projects.

Chart 19.2 Do you see that the number of steps in the value chain leads to higher costs in the projects. With a mean of 3,3 and median of 3 there seem to be no clear consensus as wherever more steps in the value chain for sub-contractors lead to overall higher costs in projects.

Chart 20.1 Do you have time to go through all the offerings that you get from the bidders. With a mean of 4,6 and median of 5 there seem to be extraordinarily strong agreements that all the offers received are being evaluated thoroughly.

Chart 20.2 Are you transparent about this to your bidders?
With a mean of 4,6 and median of 5 there seem to be a strong agreement among respondents that they are transparent to with their bidders.

Chart 21 Do you have time, budget, and resources to make all the tenders that you would have wanted? With a mean of 2,47 and median of 2 there seem to be an agreement that the bidders cannot afford to lay a bid on as many projects as they would have wanted to.

Chart 22 Which criteria do you as a procurer use when it comes to choosing a supplier and evaluating a bid? The most common criteria for choosing a bid were Lowest Price (69%) followed by Earlier collaboration or existing relations (53%), reputation of the company (37,5%), Quality of the tender documents (25 %), recommendations (25 %) and different custom answers in similar categories rating parameters such as what makes most financially sense, reference and trust to the supplier.

Chart 23 What criteria's do you use to choose project when you are making an offering? Most common answer was probability of winning the project (67%) followed by strategic partners (63%), length and size of the project (41%), Reputation of the company (38%) followed by custom answers such as complexity, Risk Exposure and Organizational Fit.

Chart 24.1 Do you have a clearly defined procurement and/or bidding strategy? In this question the mean was 3,85 and the median was 4 indicating that the respondents agree that they have a clear formulated strategy when it comes to tendering and procurement.

Chart 24.2 Do you continuously evaluate your procurement or bidding strategy? The mean was 3,74 and the median was 4 indicating that they agree that they continuously evaluate their strategy when it comes to tendering and procurement.

Chart 25 Do you see that the market conditions are wholesome.
The mean was 3,4 and the median was 3 indicating that there is different opinion regarding if the market conditions are wholesome.

Question 26: What could be done differently in today's construction business?

As one of the final questions, the respondents answered the above question, and the answers were then categorized according to similarities. Some of the answers touched subjects such as increasing knowledge of procurement among contractors, price dumping and focus on lowest price, distrust and bias in business culture, change in LOU as it is creating unjust market conditions and bad practices in the business, too small number of suppliers in certain domains, too many changes from framework agreements and contracts as well as companies need to check their sub-suppliers better to have better visibility that they are following legal rules and regulations. Some of the respondents also claim the question could not be answered as it was misaligned and contained double meanings. As previously stated, after analyzing the responses to this question from the survey, the following categories emerged.

Transparency and fairness in the bidding process. Several respondents highlighted the need for transparency and fairness in the bidding process. This includes ensuring that all parties follow the same rules and regulations, avoiding price dumping, and preventing dishonest pricing strategies.

Better communication and collaboration. Some respondents emphasized the importance of better communication and collaboration between contractors and clients, starting with early dialogues before issuing requests for proposals. This could help to prevent misunderstandings and ensure that both parties are on the same page from the outset.

Greater competence among clients, where some respondents suggested that clients need to be more knowledgeable about the costs involved in construction projects and be more aware of contractors' needs for profitability. This would help to ensure that clients are not making unrealistic demands or setting prices that are too low.

More emphasis on quality than on price as several respondents highlighted the need to focus on quality rather than just on price. This would require clients to evaluate bids based on multiple criteria, rather than simply choosing the lowest bidder.

Problems with LOU (Public Procurement Laws) was mentioned by several respondents expressed concerns about the current legislation (LOU) governing public procurement. They suggested that it encourages price dumping and dishonest pricing strategies, and that it leads to inferior quality work and higher overall costs.

Finally, some respondents suggested that contractors need to take greater responsibility for ensuring that their subcontractors are operating legally and ethically, including paying fair wages and taxes.

In summary, respondents suggested that improvements are needed in transparency and fairness in the bidding process, communication and collaboration between contractors and clients, and greater competence among clients. They also emphasized the need to focus on quality rather than just price, and to address problems with the current LOU legislation.

Question 27: Which are the biggest trends when it comes to procurement in the period 2015–2022?

This section highlights some of the major trends that emerged during this period as claimed by the respondents.

Collaboration/partnering emerged as a significant trend with an increase in partnering projects. Respondents noted that this trend has been on the rise with more partnering projects. Economic cycles also impacted procurement trends, resulting in fluctuations in procurement trends.

The use of total contracts increased significantly, with a larger proportion of total contracts being used. Respondents noted that there was a trend towards using more total contracts. Additionally, the involvement of foreign actors in procurement increased during this period, highlighting the globalization of procurement practices.

Sustainability and environmental factors have also gained importance in procurement practices. Respondents noted an increased emphasis on these factors, indicating a shift towards more socially responsible procurement practices.

Bidding has become more complex with respondents claiming to face higher requirements and lower hourly rates. In addition, there has been a trend towards including more soft parameters and evaluating quality and value-added factors in procurement.

Respondents noted that there has been an increased use of dynamic purchasing. Framework agreements have also been increasingly used, as noted by one of the respondents.

However, one respondent noted that procurement during this period has become more price-based, with less emphasis on quality. It is important to note that some respondents mentioned that the period of 2015-2022 is too broad, and there were many fluctuations and events that affected procurement trends during this time.

Question 28 Which where the biggest issues when it came to Procurement Process in Construction during 2015–2022?

A total of 34 responses were provided by individuals familiar with the field, and these responses have been categorized according to their similarities. See below.

The first set of responses highlights the challenges in acquiring bids from vendors. These challenges include a lack of interested parties, unreasonably low bids, and unrealistic bids. The shortage of qualified vendors is another issue that was raised. The construction industry's limited capacity has made it difficult to receive bids on projects, which is a significant concern. Additionally, one response suggested that the high demand for skills has made it challenging to find competent workers to match the industry's requirements. The category of resources encompasses a range of challenges, including staffing shortages and capacity problems. These challenges make it difficult for organizations to deliver quality work on time.

The second category addresses issues with the procurement process itself. One response points out that there are too many requirements based on the person, which can be problematic when personnel change jobs. Another challenge is inadequate documentation, leading to ambiguities and conflicts in the procurement process. Additionally, the procurement process has become more complicated, with higher requirements and lower hourly rates. There is a risk that the need for multiple contractors for each phase will lead to more errors and lower quality work. Another response identified the lack of strict requirements

on the part of the public authorities as an issue, as it makes it easier for unserious vendors to secure contracts.

The third category pertains to external factors that impacted the procurement process during the period in question. These factors include high demand for construction services, low-quality procurement requests, time constraints, and the aftermath of the conflict in Ukraine. The COVID-19 pandemic has also presented numerous challenges, including supply chain disruptions, price increases, and inflation. The excessive cost of materials in 2021 and 2022 was identified as a significant issue.

The fourth category of responses deals with challenges in the construction industry more broadly. These challenges include unhealthy competition, which may result in low-quality work or unsustainably low bids. Additionally, high demand has led to an overheated construction market in which it is challenging to find appropriate contractors or delivery times.

7.2 Appendix 2 – Interview Guide

Contractor & Procurement Side

Introduktion

- Presentera oss och vad vi gör
    - Om Chalmers och programmet vi läser
        - *"The Design and construction project management master's programme aims at preparing technically qualified engineering students to the integrated management of the construction processes. "*
    - Om Varför vi valde att skriva om vad vi gör
        - Vi vill i framtiden jobba med affärsutveckling och upphandling inom byggbranschen. När vi pratade med bekanta i branschen fick vi reda på att det dels är en väldigt förenklad bild man lär sig i skolan och att det också finns ett stort kunskapsbrist i branschen, där man ofta gör som man alltid har gjort när det kommer till upphandlingar. Vi kände därför att vi ville gräva djupare i ämnet upphandlingar i byggbranschen.
    - Förklara kontextet och syftet med intervjun - Dvs vad vill vi åstadkomma med studien
        - Det vi vill undersöka i studien är rent konkret undersöka skillnader i slutresultat i avseende pris och kvalitet av

flerbostadshus byggen i Sverige mellan 2015-2022 med utgångspunkten om det är någon skillnad i de teoretiska modellerna design-bid-build eller design build metodik i ett svenskt kontext,

- Vi vill även se om antalet anbud till ett projekt eller antalet led i leverantörskedjan påverkar kvalitet och slutpris. Det är frågor som vi tror att många i branschen dels går och funderar kring men även har starka åsikter om.
- Om det blir så att vi allt eftersom vi lär oss mer av ämnet under studien när vi intervjuar personer och gör vår litteraturstudie samt survey till folk i branschen kan det bli att vi ändrar vårt scoop lite om det visar sig att frågeställningen i sig var något missriktat.
- Inom scoopet för studien kommer vi att anonymisera alla uppgifter då vi förstår att om en del av det vi pratar om idag kan vara affärshemligheter.
- Som en del av studien intervjuar vi relevanta personer som har jobbat mycket med den här typen av frågor.

Inledande frågor:

- Vem är du?
- Vad har du för utbildning?
- Vilken roll har du hos din nuvarande arbetsgivare?
- Vilket bolag jobbar du för?
- Vad är det för typ av verksamhet? Vad är deras produkt/tjänst?
- Vad har du tidigare jobbat med och för?

Kvalificerande frågor

Följande frågor som vi kommer ställa idag gäller flerbostadshus byggda i Sverige sedan 2015-2022. Alla svar som gäller utanför det scoopet kommer inte tas med i studien.

- Har du på något sätt deltagit i en upphandlingsprocess när det kommer till ett flerbostadshus i Sverige och kan du ge oss ett eller flera exempel på projekt där du varit delaktig?
- Vad var din roll i upphandlingen?
- Vad hade du gjort annorlunda i upphandlingen om du gjort den idag och varför?

Specifika frågor om strategier

- **Transaktionskostnader**

Byggbranschen är en industri där man generellt sett har ganska höga kostnader associerade med att lägga eller ta fram anbud. Hur resonerar ni kring kostnader kring kostnader för att skapa en upphandlingsprocess?

- Vad har ni för taktik och strategi när det kommer till att vinna / ta emot upphandlingar?
- Ser ni att det stora trösklar när det kommer till att lägga anbud?
- Ser ni att transaktionskostnaderna påverkar antalet anbudsgivare i processen?
- Hur många anbudsgivare har ni i genomsnitt per projekt?
- Ser ni att det finns en koppling mellan antal budgivare och resultatet i ett projekt? Då avseende kvalitet och pris.

- **Upphandlingsform** - delad entreprenad eller general entreprenad
    - I dem projekten du har varit delaktig i har man valt delad entreprenad eller generalentreprenad och varför?
    - Hur resonerar ni när ni väljer mellan upphandlings formerna?

- **Entreprenadform**
    - När det kommer till Entreprenadform för byggprojektet hur resonerar ni kring när ni måste välja mellan utförandeentreprenad eller totalentreprenad?
    - Använder ni er av standard kontrakten AB04, ABT06, ABTU07? Om inte vad använder ni för kontrakt då?
    - Påverkas pris eller kvalitet beroende på om ni använder er utav utförande eller totalentreprenad?

- **Ersättningsformer**
    - Vad för ersättningsformer brukar ni använda er av när det kommer till en upphandling och varför? Vi tänker främst på när det kommer till att välja mellan fast pris, A-pris, löpande räkning,

incitament system där man kan tjäna "bonusar" eller något annat sätt att resonera kring ersättning.
    - Finns det några ersättningsformer som är bättre än andra och isåfall varför?
    - Har du sett att kvalitet och pris påverkats av valet av ersättningsform i ett projekt?
    - Hur har det påverkats?
    - Vad har man lärt sig av det?
    - Har ni någon success stories eller lesson learned kring detta som ni vill dela med er av?

- **Samverkansform** – t.ex Ad hoc, ramavtal, Samverkan , Partnering, Strategisk Partnering
    - Använder ni eller har använt er utav någon samverkansform i era projekt?
    - Varför har ni gjort det? Hur har ni resonerat kring det?
    - Har resultatet blivit som önskat?
    - Ser ni att pris eller kvalitet i projektet har påverkats av samverkansform och isåfall på vilket sätt? Till det bättre eller sämre?

- **Underentreprenörer**
    - När ni lägger tar anbud på ett projekt, använder era leverantörer sig av underentreprenörer?
    - Vad är främsta anledningarna till att dom använder er av underentreprenörer?
    - Kan ni se att kostnad och kvalitet påverkas av valet att använda en underentreprenörer?
    - Har ni undersökt hur många led av underentreprenörer det varit i ett projekt och sett att det korrelerat med antingen kostnad eller kvalitet i projektet?
    - Vilka faktorer skulle du säga påverkar antalet led av underentreprenörer och antal anbud

- **Upphandlingsstrategi**
    - Hur formar ni er upphandlingsstrategi?
        - Vad är det ni vill uppnå i er upphandlingsstrategi?
        - Vilka kriterier har ni med och hur prioriterar ni dessa i er upphandlingsstrategi?
- **Urval av Anbud**
- Hur väljer ni vilket anbud ni går vidare med i en upphandlingsprocess?
    - Vilka kriterier använder ni er av och hur prioriterar ni dom?
- Får ni in för få eller för många anbud och hur påverkar det ert val av leverantör?
- Har ni tid att gå igenom alla anbud som kommer in?
- Ser du att antalet anbud ni får in i en upphandling påverkar?
    - Kvalitet i projektet

- Kostnaden i projekten
- Ge exempel på vilket sätt

- Hur hanterar ni eventuella jävsituationer i en upphandlingsprocess om det skulle förekomma?

- Sund konkurrens
  - Anser ni att det råder en sund eller osund konkurrens på marknaden och varför?
  - Vad hade kunnat göras bättre eller annorlunda?

Avslutande frågor:
- Är det något du skulle vilja tillägga till det vi pratat om idag?
- Är det något du tycker vi glömt att fråga eller skulle tänkt på innan intervjun?

Bidder & Subcontractor

Introduktion
- Presentera oss och vad vi gör
  - Om Chalmers och programmet vi läser
    - *"The Design and construction project management master's programme aims at preparing technically qualified engineering students to the integrated management of the construction processes. "*
    - Om Varför vi valde att skriva om vad vi gör
    - Vi vill i framtiden jobba med affärsutveckling och upphandling inom byggbranschen. När vi pratade med bekanta i branschen fick vi reda på att det dels är en väldigt förenklad bild man lär sig i skolan och att det också finns ett stort kunskapsbrist i branschen, där man ofta gör som man alltid har gjort när det kommer till upphandlingar. Vi kände därför att vi ville gräva djupare i ämnet upphandlingar i byggbranschen.
  - Förklara kontextet och syftet med intervjun - Dvs vad vill vi åstadkomma med studien
    - Det vi vill undersöka i studien är rent konkret undersöka skillnader i slutresultat i avseende pris och kvalitet av flerbostadshus byggen i Sverige mellan 2015-2022 med utgångspunkten om det är någon skillnad i design bid build eller design build metodik i ett svenskt kontext, samt om antalet anbud till ett projekt eller antalet led i leverantörskedjan påverkar kvalitet och slutpris. Det är frågor som vi tror att många i branschen dels går och funderar kring men även har starka åsikter om.

- Om det blir så att vi allt eftersom vi lär oss mer av ämnet under studien när vi intervjuar personer och gör vår litteraturstudie samt survey till folk i branschen kan det bli att vi ändrar vårt scoop lite om det visar sig att frågeställningen i sig var något missriktat.
- Inom scoopet för studien kommer vi att anonymisera alla uppgifter då vi förstår att om en del av det vi pratar om idag kan vara affärshemligheter.
- Som en del av studien intervjuar vi relevanta personer som har jobbat mycket med den här typen av frågor.

Inledande frågor:

- Vem är du?
- Vad har du för utbildning?
- Vilken roll har du hos din nuvarande arbetsgivare?
- Vilket bolag jobbar du för?
- Vad är det för typ av verksamhet? Vad är deras produkt/tjänst?
- Vad har du tidigare jobbat med och för?

Kvalificerande frågor

Följande frågor som vi kommer ställa idag gäller flerbostadshus byggda i Sverige sedan 2015-2022. Alla svar som gäller utanför det scoopet kommer inte tas med i studien.

- Har du på något sätt deltagit i en anbudsprocess när det kommer till ett flerbostadshus i Sverige och kan du ge oss ett eller flera exempel på projekt där du varit delaktig?
- Vad var din roll i anbudsgivningen?
- Vad hade du gjort annorlunda i projektet om du gjort den idag och varför?

Specifika frågor om strategier

- **Transaktionskostnader**

Byggbranschen är en industri där man generellt sett har ganska höga kostnader associerade med att lägga eller ta fram anbud.

- Hur resonerar ni kring kostnader kring att lägga anbud i en upphandlingsprocess?
- Vad har ni för taktik och strategi när det kommer till att vinna med ert anbud i upphandlingar?
- Ser ni att det stora trösklar när det kommer till att lägga anbud?
- Ser ni att transaktionskostnaderna påverkar antalet anbudsprocesser ni kan ta del av? Hade det kunnat förbättrat på något sätt?

- Ser ni att det finns en koppling mellan höga transaktionskostnader för att lägga bud på ett projekt och dess slutresultat i avseende på kvalitet och pris?

- **Upphandlingsform** - delad entreprenad eller general entreprenad
    - I dem projekten du har varit delaktig i har man valt delad entreprenad eller generalentreprenad och varför har man gjort det tror du?
    - Hur resonerar ni när ni lägger anbud? Föredrar ni delad eller generalentreprenad?
    - Påverkas kvalitet eller kostnad av upphandlingsformen och hur då?

- **Entreprenadform**
    - När det kommer till Entreprenadform för byggprojektet föredrar ni utförandeentreprenad eller totalentreprenad och varför?
    - Vad ser du för för - respektive nackdelar för respektive entreprenadform?
    - Använder ni er av standard kontrakten AB04, ABT06, ABTU07? Om inte vad använder ni för kontrakt då?
    - Påverkas kostnad eller kvalitet i projektet beroende på om ni jobbar utefter utförande eller totalentreprenad?

- **Ersättningsformer**
    - Vilka ersättningsformer föredrar ni och varför? Vi tänker främst på när det kommer till att välja mellan fast pris, A-pris, löpande räkning, incitament system där man kan tjäna "bonusar" eller något annat sätt att resonera ersättning.
    - Finns det några ersättningsformer som är bättre än andra och isåfall varför?
    - Success Stories - Lessons Learn
    - Hur har du sett att kvalitet och pris/kostnad påverkats av ersättningsformer i ett projekt?
    - Har ni möjlighet att påverka vilken ersättningsform som ges i ett projekt?

- **Samverkansform** – t.ex Ad hoc, ramavtal, Samverkan , Partnering, Strategisk Partnering
    - Använder ni eller har använt er utav någon samverkansform i era projekt ni deltagit i?
    - Varför har ni gjort det? Hur har ni resonerat kring det?
    - Har resultatet blivit som parterna önskat?

- Ser ni att pris eller kvalitet i projektet har påverkats av samverkansform och isåfall på vilket sätt? TIll det bättre eller sämre?

- **Underentreprenörer**
  - När ni lägger anbud på ett projekt, använder ni er av underentreprenörer?
  - Vad är främsta anledningarna till att ni använder er av underentreprenörer?
  - Vilka kriterier använder ni er av när ni väljer underentreprenörer?
  - Vilka faktorer skulle du säga påverkar antalet led av underentreprenörer och antal anbud
  - Hur påverkas kostnad och kvalitet utav valet att använda en underentreprenör? Hur påverkas kostnad och kvalitet utav antalet led av underentreprenörer?

- **Anbuds Strategi**
  - Hur formar ni er anbuds strategi?
    - Vad försöker ni uppnå och hur?
    - Har ni några särskilda taktik/strategi för att se till att ni vinner anbuden?
    - Vad har ni för kriterier och målbild i åtanke när ni skapar dessa strategier?
    - Påverkar dessa strategier/taktiker pris eller kvalitet för beställaren

- **Upphandlingar**
  - Ser du att antalet upphandlingar ni tar del av och lämnar anbud på påverkar
    - Antal projekt ni vinner?
    - Kvaliteten i projekten?
    - Kostnad för projektet?
    - Kan ni ge exempel på hur dessa faktorer påverkas av antalet upphandlingar
    - Hur hanterar ni eventuella jävsituationer i en anbudsprocess om det skulle förekomma?

- **Sund konkurrens**
  - Anser ni att det råder en sund eller osund konkurrens på marknaden och varför?
  - Vad hade kunnat göras bättre eller annorlunda?

Avslutande frågor:
Är det något du skulle vilja tillägga?
Är det något du tycker vi glömt att fråga eller skulle tänkt på innan intervjun?

7.3 Appendix 3 – Systematic literature review

Företagsnamn	Org-nr	Bransch	Antal anställda	Omsättning, tkr	Bokslut
Skanska Sverige AB	5560339086	Entrepren	6730	26708134	2020-12-31
NCC Sverige AB	5566134929	Entrepren	6107	25510060	2020-12-31
Peab Sverige AB	5560999202	Entrepren	3316	16737557	2020-12-31
Peab Anläggning AB	5565686721	Anläggnin	2854	10757967	2020-12-31
Infranord AB	5567933089	Anläggnin	1781	3536000	2020-12-31
JM AB	5560452103	Entrepren	1752	10790000	2020-12-31
Svevia AB	5567689848	Anläggnin	1686	7502000	2020-12-31
NCC Industry AB	5563023307	Anläggnin	1647	6549397	2020-12-31
Veidekke Entreprenad AB	5565086583	Entrepren	1482	7216318	2020-12-31
Serneke Sverige AB	5566216908	Entrepren	1011	6480490	2020-12-31
Strukton Rail AB	5565719449	Anläggnin	949	2242475	2020-12-31
Peab Byggservice AB	5560663675	Entrepren	914	2321985	2020-12-31
Peab Asfalt AB	5560988122	Anläggnin	910	3848028	2020-12-31
OBOS Bostadsutveckling AB	5560317702	Industri fö	788	2323180	2020-12-31
Implenia Sverige AB	5563825750	Anläggnin	514	1797089	2020-12-31
Lindbäcks Bygg AB	5561180836	Industri fö	486	1660881	2020-12-31
Brixly AB	5563519163	Entrepren	479	2148251	2020-12-31
Moelven ByggModul AB	5563107134	Industri fö	453	1267674	2020-12-31
BELSTROJ AB	5567777908	Firmor för	407	573743	2020-12-31
Åhlin & Ekeroth Byggnads AB	5566847926	Entrepren	406	1353464	2020-12-31
Derome Husproduktion AB	5562107069	Industri fö	379	1520068	2020-12-31
Sh bygg, sten och anläggning	5560519232	Firmor för	376	1592958	2020-12-31
JSB CONSTRUCTION AB	5564011756	Entrepren	331	1977795	2020-12-31
Bygg Partner i Dalarna AB	5565319984	Entrepren	319	1662247	2020-12-31
Bergnäset Ställningsmontage	5563932838	Diverse öv	297	386621	2020-12-31
SVEAB Anläggning AB	5564318458	Anläggnin	285	1267885	2020-12-31
Thage i Skåne AB	5560659145	Entrepren	284	785030	2020-08-31
MVB Syd AB	5560761214	Entrepren	277	1569680	2020-12-31
HMB Construction AB	5564830957	Entrepren	273	1435011	2020-12-31
JM Entreprenad AB	5560608837	Entrepren	271	1253153	2020-12-31
Anläggning & Kabel Entrepre	5567643498	Anläggnin	268	1184755	2020-12-31
BAB bygg AB	5566089669	Entrepren	238	1004710	2020-12-31
Nåiden Bygg AB	5563264216	Entrepren	231	1566883	2020-04-30
Peterson & Hansson Byggnad	5560891839	Entrepren	228	522459	2020-12-31
Kanonaden Entreprenad AB	5562312636	Firmor för	226	1090551	2020-12-31
Interoc Akustik AB	5568526080	Firmor för	221	344074	2020-12-31
Hercules Grundläggning AB	5561299800	Diverse öv	219	788810	2020-12-31
Sven Jinert AB	5563251528	Uthyrning	219	580246	2020-12-31
Nordic Railway Construction	5565808846	Firmor för	216	1175289	2020-12-31
Tommy Byggare AB	5566781943	Entrepren	214	784833	2020-12-31
Älvsbyhus AB	5565738811	Industri fö	211	891001	2020-12-31
Nordic Railway Construction	5568574205	Anläggnin	207	596880	2020-12-31
Bygg Dialog AB	5567056097	Entrepren	203	2292168	2020-12-31
Anebyhusgruppen AB	5563212793	Industri fö	202	757279	2020-12-31
Botrygg Bygg AB	5565026241	Entrepren	201	609029	2020-12-31
Götenehus AB	5562295138	Industri fö	199	973750	2020-12-31
BoKlok Byggsystem AB	5567683874	Industri fö	199	356965	2020-12-31
Billström Riemer Andersson E	5567245948	Entrepren	198	2221451	2020-12-31
YIT Sverige AB	5562975143	Anläggnin	197	1232652	2020-12-31
Wästbygg Entreprenad AB	5560830829	Entrepren	193	1911470	2020-12-31

Artikel	Source	Meets Criteria? (Yes /No)	Ahmed / Alvin	Fundamental/ New events
Bringing planning back into the picture	https://www.tandfonline.com/doi/full/10	NO	Alvin	Fundamental/ New events
The impact of recession on construction procurement routes	https://www.researchgate.net/profile/Ro	NO	Ahmed	New events
Construction procurement routes: re-defining the contours of construction procurement	https://www.emerald.com/insight/conten	Yes	Ahmed	Fundamental
Employment requirements in Swedish construction procurement – institutional perspectives	https://www.emerald.com/insight/conten	Yes	Ahmed	Fundamental
Allmännyttan och bostadsbyggandet	https://www.sverigesallmannytta.se/wp/	Yes	Ahmed	New events
Entreprenadupphandlingar Hur kan byggherrar främja effektivitet och innovation genom lämpliga upphandlingsstrategier?	https://www.konkurrensverket.se/globala	Yes	Ahmed	New events
Efficient governance of construction projects through cooperative procurement procedures	https://www.diva-portal.org/smash/get/d	Yes	Ahmed	Fundamental
Improving the inventory management	https://lutpub.lut.fi/handle/10024/90092	No	Ahmed	New events
Expanding the use of Contract Inspections in Construction	https://www.diva-portal.org/smash/get/d	NO	Ahmed	Fundamental
Critical Design Activities in House-Build	https://www.diva-portal.org/smash/get/d	Yes	Ahmed	Fundamental
Risk and cost assessment in supply ch	https://www.diva-portal.org/smash/recor	NO	Ahmed	New events
Collaborative Learning and Innovation	https://odr.chalmers.se/items/a0cf9eac-0	NO	Ahmed	New events
The Nordic Swan: Possibilities and	https://www.diva-portal.org/smash/recor	NO	Ahmed	New events
FÖRBÄTTRAD PRODUKTIVITET INOM ANLÄGGNINGSSEKTORN	https://vpp.sbuf.se/Public/Documents/Pr	Yes	Ahmed	Fundamental
Management Accounting in Small Con	https://helda.helsinki.fi/bitstream/handle	NO	Ahmed	Fundamental
Shorter Project Lead Times in Construction	https://www.diva-portal.org/smash/get/d	NO	Ahmed	New events
Categorising on-site problems A supply chain management perspective on construction projects	https://www.emerald.com/insight/conten	NO	Ahmed	Fundamental
Mitigating the health and safety influe	https://www.sciencedirect.com/science/a	NO	Ahmed	Fundamental
A seamless supply chain management	https://www.emerald.com/insight/conten	Yes	Ahmed	Fundamental
Present focuses and future directions	https://www.tandfonline.com/doi/full/10	NO	Ahmed	New events
Evaluation of Supply Chain Manageme	https://www.tandfonline.com/doi/full/10	NO	Ahmed	Fundamental
Supply chains in the construction indu	https://www.emerald.com/insight/conten	Yes	Ahmed	Fundamental
Sub-contracting or Co-contracting: Cor	https://www.researchgate.net/profile/Mu	Yes	Ahmed	Fundamental
A project management quality cost inf	https://www.sciencedirect.com/science/a	NO	Ahmed	New events
The influence of partnering andprocur	https://www.emerald.com/insight/conten	Yes	Ahmed	Fundamental
Relationship quality in construction pr	https://www.sciencedirect.com/science/a	maybe	Ahmed	Fundamental
Exploring the potentials of blockchain	https://www.tandfonline.com/doi/full/10	Maybe	Ahmed	New events
Developing a continuous improvemen	https://www.emerald.com/insight/conten	Yes	Ahmed	Fundamental
	https://books.google.se/books?hl=sv&lr=&	Yes	Ahmed	Fundamental
Swedish construction culture, manage	Swedish construction culture, managemen	yes	Alvin	Fundamental
	Exploring the implementation of Circular E	no	Alvin	Fundamental/ New events
	Sustainability | Free Full-Text | Stakeholde	no	Alvin	Fundamental/ New events
	Nordic Economic Policy Review 2021: Nord	Yes	Alvin	Fundamental/ New events
	Creating Value and Identifying Opportunit	yes	Alvin	Fundamental/ New events
	Market prospects of secondary constructio	no	Alvin	Fundamental/ New events
	Supply chains in the construction industry	yes	Alvin	Fundamental/ New events
	The logic of innovation in construction - Sc	no	Alvin	Fundamental/ New events
	The impact of labour productivity on the S	no	Alvin	Fundamental/ New events
	Environmental consideration in procurem	yes	Alvin	Fundamental/ New events
	Industrial Relations, Migration, and Neolib	no	Alvin	Fundamental/ New events
	Quality Change and Implications for Produ	no	Alvin	Fundamental/ New events
	9th proceedings_sp_nya (aau.dk)	yes	Alvin	Fundamental/ New events
			Alvin	Fundamental/ New events
			Alvin	Fundamental/ New events
			Alvin	Fundamental/ New events
	Let the Right Ones In? Employment Requir	no	Alvin	Fundamental/ New events
	Active buildings in smart grids—Exploring t	no	Alvin	Fundamental/ New events
	Interpretation and translation of industria	maybe	Alvin	Fundamental/ New events
	2012_33.content.03231.pdf (itcon.org)	Yes	Alvin	Fundamental/ New events
	Market prospects of secondary constructio	no	Alvin	
	Structures of subcontracting : Work organi	Yes	Alvin	
	Exploring the implementation of Circular E	conomy in the construction industry : A I	Alvin	
	Sustainability | Free Full-Text | Stakeholde	no	Alvin	
			Alvin	
	Creating Value and Identifying Opportunit	no	Alvin	
	Entreprenadupphandlingar Hur kan byggh	yes	Alvin	Fundamental
			Alvin	
	Purchasing and Supply Strategies for SMEs	no	Alvin	
	The next normal in construction	yes	Alvin	
	Least-improved Eciency eludes the constr	yes	Alvin	
	REINVENTING CONSTRUCTION: A ROUTE T	yes	Alvin	
	Bättre konkurrens i bostadsbyggandet En	uppföljning av utvecklingen 2015–2018 sa	Alvin	
	Subcontractor procurement in constructio	Yes	Alvin	
	https://byggforetagen.se/app/uploads/20	Yes	Alvin	
	https://byggforetagen.se/statistik/sveriges-storsta-byggforetag/			
	Purchasing Must Become Supply Management (hbr.org)			