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Administrative discrepancies in main contractor-subcontractor collaborations

Reducing contract deviations in HVAC and plumbing installations

Master's thesis in the Master's programme Design and Construction Project Management

Axel Lindblad

Halit Meri

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS

DIVISION OF SERVICE MANAGEMENT AND LOGISTICS

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Report no. E2020:066
Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Göteborg
Sweden
Telephone + 46 (0)31-772 1000

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ABSTRACT

In discussion with a major Swedish contractor, it was established that although construction contract documents are often written in detail, procured subcontractors many times do not meet the expectations of the main contractor on what is delivered. The aim of this report is to study the reasons why administrative contract discrepancies between main contractor and HVAC and plumbing subcontractors occur. The aim is also to analyse how the collaboration and work procedures, as well as organisational structure, between main contractor and subcontractor can be improved to reduce administrative contract discrepancies.

In the literature review, theories from research previously carried out in relevant areas were studied. Those areas included, among others, subcontractor coordination, collaboration, communication, and contract understanding. On some subjects covered in the literature review, such as contract understanding, little previous research had been carried out

To gather necessary data to reach the aim of this investigation, a literature review and interview study were conducted. Interviews were held with nine respondents, six of which were employees of HVAC and plumbing subcontractors, and three who were employees of NCC. The result showed that there is not a straightforward solution to the problem formulation of reducing discrepancies. However, the answers of the interviewees were similar in some cases. Trust, communication, collaboration are some of the results that are presented in this report and that can be considered key factors for reducing administrative discrepancies.

Some of the conclusions were that good communication, efficient collaboration, increased trust, and early subcontractor involvement are important factors to reduce administrative discrepancies. Further, main contractors are recommended more advanced use of ICT, revision of contracts for easier understanding, and the utilisation of installation coordinators. Subcontractors are recommended to be transparent in their communication, ask for support in administrative tasks and ensure understanding of responsibility demarcations.

Keywords: administrative discrepancies, contract deviations, collaboration, coordination, communication

Administrativa avvikelser i samarbetet mellan huvudentreprenör och underentreprenörer
Att minska kontraktsavvikelser i arbete med VVS-installationer

Axel Lindblad
Halit Meri

Teknikens ekonomi och organisation
Chalmers tekniska högskola

SAMMANFATTNING

I diskussion med en av de största svenska huvudentreprenörerna kunde det fastslås att även om kontraktsdokument i byggsektorn ofta är skrivna i detalj, så uppfyller inte alltid upphandlade underentreprenörer huvudentreprenörens förväntningar med det som levereras. Syftet med den här undersökningen är att studera anledningarna till att administrativa kontraktsavvikelser mellan huvudentreprenör och underentreprenörer inom VVS uppstår. Syftet är också att analysera hur samarbete, arbetsförfaranden och organisationsstruktur mellan huvudentreprenör och underentreprenörer kan förbättras för att minska antalet administrativa kontraktsavvikelser.

I litteraturgenomgången studerades teorier om relevanta ämnen, som tagits fram under tidigare forskning. I de ämnena inkluderas bland andra samordning av underentreprenörer, samarbete, kommunikation och kontraktsförståelse. Inom vissa av de områdena, till exempel kontraktsförståelse, hade förhållandevis lite tidigare forskning gjorts.

För att samla nödvändiga data för att nå syftet med undersökningen gjordes en litteraturgenomgång och hölls en intervjustudie. Intervjuer hölls med totalt nio respondenter, varav sex var anställda på underentreprenörföretag inom VVS och tre var anställda hos NCC. Resultatet visade att det inte finns en enkel lösning på forskningsfrågorna om att minska antalet avvikelser. Intervjupersonernas svar var dock liknande i vissa fall. Tillit, kommunikation och samarbete är några av resultaten från intervjustudien som kunde anses vara nyckelfaktorer för att minska avvikelser.

Några av de generella slutsatserna var att bra kommunikation, effektiva samarbeten, god tillit, och tidig involvering av underentreprenörer är viktiga faktorer för att minska antalet administrativa avvikelser. Huvudentreprenörer rekommenderas att använda mer av IT och kommunikationssystem, att omformulera kontrakt för att göra dem enklare att förstå, och använda installationssamordnare. Underentreprenörer rekommenderas att vara transparenta i sin kommunikation, be om hjälp med administrativa uppgifter, och försäkra sig om egen förståelse av ansvarsfördelningar.

Nyckelord: administrativa avvikelser, kontraktsavvikelser, samarbete, samordning, kommunikation.

CONTENTS

PREFACE

This master's thesis is the final step of our master's programme Design and Construction Project Management at Chalmers University of Technology. It has been carried out at the Department of Technology Management and Economics at Chalmers University of Technology between January 2020 and June 2020. Our supervisor and examiner in conducting this master's thesis has been Jan Bröchner.

Based on an initial literature review and an interview study, this master's thesis studies administrative discrepancies in collaborations between main contractors and subcontractors and how they can be reduced. Conclusions of this report cover both general aspects that need to be considered in collaborations, and recommendations to active professionals employed at main contractors and subcontractors.

We would like to thank Jan Bröchner very much for his continuous support and professional guidance during this master's thesis. It has been interesting and joyful to discuss matters with you. We would also like to warmly thank Mattias Andersson and NCC, who made the completion of this master's thesis possible. Thank you very much for your interest and support. We also like to thank our interview respondents, who despite the current situation with Covid-19 showed interest and willingness to participate in this research. Lastly, we want to thank our families and close ones who throughout the process of this study have shown endless support. Thank you all for your participation and support.

Gothenburg June 2020

Axel Lindblad & Halit Meri

1 Introduction

The following chapter is the introduction of the thesis and includes research background, purpose and aim, research questions, and research delimitations.

1.1 Background

In the construction industry, subcontractors are according to Mbachu (2008) responsible for about 85 percent of the production. For a project to be successful, continues the author, the effectiveness and quality of the subcontractor is key. The experience of contacted employees of the procurement department at one of the major main contractors in Sweden, is that subcontractors sometimes do not deliver what they have signed up for in a contract. This is described as a problem with many possible causes, where substandard collaboration and coordination between project participants could be two. Another reason, according to the contacted main contractor, could be the time between the contract signing and the procured service being carried out at the building site, which could sometimes be several months long. Subcontractors, as well as main contractors, fail to prioritise contract reading and understanding, and instead go by standard procedure which could also have a negative effect on what is delivered. To achieve an effective collaboration between subcontractors and main contractor, Akintan & Morledge (2013) established that there are key factors in the relationship between the main contractor and the subcontractor that needs to be improved. The authors state that competitive nature of the construction business, among other things, can make it hard to employ collaborative measures. Ottosson (2012, p.131) states that coordination issues are more common during work with, for example HVAC and plumbing installations. For this reason, but while also maintaining a degree of technology variety, this report will only include subcontractors in HVAC and plumbing.

The consequences of subcontractor deviations from contracts, according to the contacted main contractor, are added costs, worse atmosphere between subcontractor and main contractor employees and added work for main contractor managers and foremen. In the experience of the main contractor, a common problem in projects is poor subcontractor management, as subcontractors often lack the competence and resources to manage their own work, even if that service is included in the contract. In this report, this is an example of what is called an administrative discrepancy from the contract. Administrative discrepancies could also be caused by faulty building documents or misinterpretations of responsibility demarcations.

That the performance of subcontractors is important for successful projects is clear. The problem with administrative discrepancies can be described as one of the aspects that largely influences project success. In this master's thesis, reasons for administrative discrepancies are therefore investigated, specifically in the collaboration with HVAC and plumbing subcontractors. Possible measures to be taken to reduce administrative discrepancies in such co-operations are also presented. The study is carried out in collaboration with a major main contractor in Sweden and will provide viewpoints on the topic from both the main contractor and subcontractors.

1.2 Purpose & aim

The aim of this report is to study the reasons why administrative contract discrepancies between main contractor and HVAC and plumbing subcontractors occur. The aim is also to analyse how

the collaboration and work procedures, as well as organisational structure, between main contractor and subcontractor can be improved to reduce administrative contract discrepancies.

1.3 Research questions

Based on the purpose, the problem formulation of this thesis consists of the following research questions:

- What administrative contract discrepancies can be identified as reasons for contract deviations in projects, from procurement to completion, in the collaboration between main contractor and subcontractors within HVAC and plumbing?
- How can work processes between main contractor and subcontractors improve to reduce administrative contract discrepancies?
- How can organisational structure between main contractor and subcontractors be improved to reduce administrative contract discrepancies?

1.4 Delimitations

The thesis will focus mainly on the part in the construction process between the contract signing and the finished work by the procured subcontractor. Focus will also be on social aspects, such as communication and collaboration, as well as structural aspects of everyday work, including meetings and standard procedures. The report will only include subcontractors in HVAC and plumbing, and not subcontracting in general. The report should therefore not be referenced to about subcontracting of all disciplines. A geographical delimitation is that companies operating in the Göteborg region have been investigated.

1.5 Disposition of the thesis

This section presents the disposition of the thesis, for easier orientation for the reader. It also indicates what contents are found in which chapter.

1. Introduction

The introduction presents the background of the thesis, as well as purpose and aim. It also includes the research questions and delimitations of the master's thesis.

2. Method

The method chapter includes method choices and reasons for choices made. The chapter also includes interviewee and company selections of the thesis and why they were chosen.

3. Literature review

In the literature review chapter, information gathered in the literature review will be presented. The theoretical base from prior literature will be presented together with our analysis. The theory cover topics related to the research questions, which is used to analyse the empirical data.

4. Empirics

The empirics chapter present the opinions gathered from the interview study. The data is divided into sections which, in all sections except for the section covering the main contractor's

processes, directly correspond to the topics covered in the literature review chapter to increase clarity for the reader.

5. Discussion

The discussion part of the report is aimed to provide insight into problems related to the research questions, as well as proposing possible solutions for them. The theoretical base is here used to analyse the empirical data.

6. Conclusion

In the conclusion chapter, general conclusions of the research questions of this report are presented. Practice recommendations for main contractors and subcontractors are also part of the conclusion. Recommendations for further research topics is presented in the last part of the conclusion. There, future research topics based on the findings of this report, are suggested.

2 Method

In the following chapter, method choices of the thesis are presented and explained. Reasons for selected methods are also included in the chapter. In summary, the report is based on the qualitative research method, where empirics from semi-structured interviews are analysed with a framework from a literature review. The analysis is presented in the discussion chapter of the thesis. The conclusion chapter is the last part of the thesis, where conclusions are established based on the analysis of data.

2.1 Method disposition

The qualitative research method is applied in this report. First, a theoretical framework will be formed based on publications and results from earlier research. The information gathered in the literature study will originate from sources such as peer reviewed articles and textbooks. If necessary, due to a lack of previous research, some topics covered in the literature review could be based on sources from outside the construction sector. After the theoretical framework has been formed, empirical data will be gathered from semi-structured interviews. The theoretical framework will then be used to analyse the empirical data, to form a discussion between established theory and how work is carried out in practice. The initial literature study helps with founding an understanding for the researched subject in early stages of the process. The interview questions are based on the literature review, to make sure that the formulated questions are relevant to the topic and covers the right aspects. The interviewees included in this master's thesis will be chosen based on position and company, where positions are divided into three vertical levels on subcontractor and main contractor sides, to cover several different viewpoints. This is described further in the interviewee and company selection sections of this chapter.

2.2 The qualitative and quantitative research methods

When researching the quality or sort of a phenomenon, qualitative research is the method to use, as it aims to find underlying motives for human behaviour as well as motives and desires (Kothari, 2004, p. 3-5). The qualitative research approach, as explained by the author, aims to capture behaviour, opinions, and attitudes, which is why interviews are appropriate. To gather qualitative data, interviews are often used. The qualitative method enables respondents to reflect on the subject more deeply and opens up space for own opinions, which in turn adds detail to discussion, analysis, and results in the end of the report. Since the research questions and purpose of this report involves several factors related to human nature such as communication, trust, and collaboration, and since personal opinions are of great value, the qualitative research method has been chosen.

The quantitative approach to research is based on quantitative data (Kothari, 2004, p. 5) and often relies on data collection through questionnaires, which include only a limited number of answers available to the respondent (Sreejesh, Mohapatra, & Anusree, 2014, p. 46). The pre-set answers of questionnaires could increase risks of missing out on the opinions and personal views of the respondents, according to these authors, which is not optimal in the case of this report. The quantitative research method is therefore not applied here.

2.3 Interviews

Conducting interviews is a way of understanding how processes are carried out in practice today, by gathering information from different people in different positions in organisations. They also help with establishing a perception of the general experiences of the brought-up topics, and interviewees can give their opinion on what causes problems related to the problem formulation of administrative discrepancies.

There are three principal types of interviews, structured, unstructured, and focused (semi-structured) interviews according to Kothari (2004, p. 97-98). The author describes that structured interviews are where questions are set from the beginning, and the interview follows a fixed procedure where questions are asked in the same way on every occasion, leaving the interviewer with little flexibility. During structured interviews it is also common to use a standardized way of documenting the answers. Further, unstructured interviews are stated as being the opposite of structured, with no pre-set questions. Instead, this method permits the interviewer to ask supplementary questions for increased understanding or detail. During unstructured interviews, the interviewer also has increased possibilities to edit recordings to his liking, leaving out unwanted views. However, this way of conducting interviews make gathered data harder to analyse, as the flexibility of questions might result in disorganized responses, making them hard to compare to each other. The semi-structured interview, continues the author, aims to bring out the opinions of the interviewee about topics determined by the interviewer. The interviewer can ask about reasoning behind answers and has the opportunity to encourage discussion of the subjects presented by him.

The thoughts and opinions of the interviewees weigh heavily in this report, and therefore a choice was made to conduct semi-structured interviews. This to encourage discussion and to enable extraction of the personal opinions of the respondents, while still being able to steer the interview in the right direction. The data collected in the interviews will also be easily comparable thanks to the method choice, as the questions will be predetermined. There will be two different sets of predetermined questions, one for main contractor employees, and one for subcontractor employees. The questions are formed with the aim of covering the same subjects on both sides, to enable easy data comparison. The two sets of questions will be the same as far as possible, but to be able to cover corresponding subjects, some questions will have to be modified depending on the respondent. The questions will be sent to the interviewee two to three days beforehand, so that the interviewee can prepare if they wish to do so. Some of the more abstract questions will include suggestions of possible answers, to clarify what subject the question is meant to cover. The interview questions can be found in appendix 1 and 2. The interviews will be held face-to-face if possible, and if not over telephone. All interviews will be recorded and transcribed. The results of the interviews will then be presented in the empirics-section of the report.

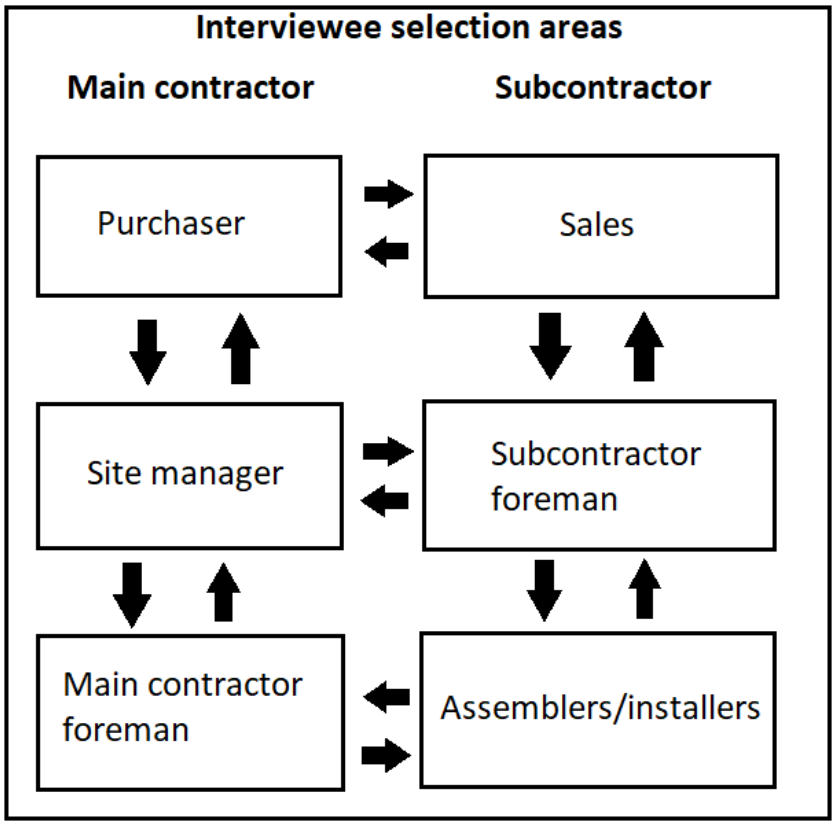
2.4 Interviewee selection

To capture data from several viewpoints, interviewees have been chosen to cover three levels or functions in the organisations, which are presented in Figure 1. All respondents on the subcontractor side will have recent experience of working for the large main contractor. One subcontractor employee on the assembler level will be interviewed and on the other levels two or three employees, from different companies, will be interviewed. From the main contractor, one employee per organisation level will be interviewed. The choice was made to interview

more people from the subcontractor side than main contractor side. This because viewpoints from more than one subcontractor with can be valuable since collaborations in different projects and between different actors can vary in style and level of success. Interviewing at least one employee per subcontractor level meant that opinions from all of the different levels would be extracted. This can help with determining if there are clear differences in opinions between the levels. For example, opinions shared by many subcontractor employees of organisational levels could imply that an issue is common in the construction sector in general, and HVAC and plumbing businesses in particular.

The three vertical levels of each side in Figure 1 have also been made to correspond to each other through common communication paths and collaboration in a project, as is illustrated by the arrows. The horisontal levels have been chosen in the same way. The natural connections of the interviewees could help with gathering comparable data, despite the fact that the data comes from interviewees of different positions.

Figure 1, Vertical and horizontal levels in organisations. All interviewees represented one of the areas on the side of the large main contractor or a subcontractor.



2.5 Subcontractor company selection

Company size is claimed by Maturana et al. (2007) to impact accessible knowledge in a company, as well as how much external support a subcontractor need in a project. Small companies generally needed more managerial support and had worse knowledge than large companies according to the authors. To answer our research questions as effectively as possible, it was therefore of interest to gather data from companies of different size. The decision was made to not restrict the research to a single trade, to increase the chance of finding fitting companies. However, a decision was made to limit the study to only include HVAC and

plumbing subcontractors. This to have a degree of technology variety and because coordination issues related to HVAC installations are common (Ottosson, 2012, p. 131). When a contact with a company was established, the goal was to interview at least two employees, to extract more than one viewpoint from each firm. This was achieved with all companies except the smallest. In Table 1, the anonymized participating subcontractor companies of this study are presented. They have been chosen to represent three different sizes and include one small to medium size company active in western Sweden, one larger company active in Sweden, Norway, and Denmark and one smaller company active locally in the Gothenburg area.

Table 1: Presentation of subcontractor companies, as well as interviewees of each company and their positions.

Firm	Specialisation	Year of establishment	Number of employees	Annual turnover	Number of interviewees	Position(s) of interviewees
Company A	HVAC installations, control systems and service of installations	1977	80	MSEK 300 in 2019	2	CEO and foreman
Company B	All kinds of installations within HVAC, as well as with service assignments	1964	Around 3000	Annual turnover of MSEK 1 300 in Sweden and MSEK 3 000 overall in 2018	3	Project manager, foreman and assembler
Company C	Planning, contracting and service of plumbing and HVAC installations	1961	12	MSEK 37 in 2019	1	CEO (Assembler background)

2.5 Data analysis

To establish that collected data are relevant to the research questions, they must be analysed based on the purpose of the research (Kothari, 2004. p. 122). It is also of importance to classify data that is gathered, to establish relationships that are significant to the subject. In the interviews conducted here, most of the mentioned subjects were directly or indirectly relatable to our research questions. This meant that relevancy of the empirical data in this study were easily established in most cases. The interview questions were divided into three subtopics during the interviews, which made for an initial classification of the empirical data. The data were then divided into narrower subtopics, which were based on the topics studied in literature review. The subtopics of the empirical data were matched with the subtopics of the literature review for all topics where that was possible. This was done in order to simplify the analysis of the discussion chapter, as well as to increase clarity for the reader.

2.6 Method limitations

There is a risk of gathered data losing quality due to the suggested topics of some of the abstract questions. Although the reason why the suggestions are there is clarified in the beginning of the interviews, the respondent might instead view the suggestions as topics for discussion. Further, interviewees might just agree with the suggestions that are included in some interview questions, rather than sharing their own opinion on topics.

2.7 The interviews

This section presents when and how the interviews of this study were conducted. In Table 2, information about what date and whether the interview was over phone or face-to-face is found. The interviews started with an introduction of the research, as well as clarification of some terms and questions that could be considered hard to interpret. This was done both in face-to-face interviews and interviews held over the phone. The questions were then asked in order, from one to fifteen, with complementary questions added where the interviewer felt was appropriate and beneficial for the quality of gathered data. When all questions had been covered, the interviewee was asked to share any other thoughts they had on the topic before the interview ended.

Table 2, Presentation of conducted interviews, interview dates (2020) and type.

Interviewee	Date	Type
Main contractor purchaser	5th of March	Face-to-face
Main contractor foreman	5th of March	Face-to-face
Subcontractor CEO	9th of March	Telephone
Subcontractor foreman	12th of March	Telephone
Subcontractor CEO	17th of March	Telephone
Subcontractor project manager	20th of March	Telephone
Subcontractor foreman	26th of March	Telephone
Subcontractor assembler	16th of April	Telephone
Main contractor site manager	22nd of April	Telephone

3 Literature review

The following chapter presents the data gathered in the literature review. It is divided into the sections Collaboration, Information management, Meetings, Time schedule and delays, Contractual documents, Understanding contracts, Competence and Trust. The section headings are broadly kept the same in the literature review, empirics, and discussion chapters to increase clarity and structure.

3.1 Collaboration

The following section covers the importance of collaboration between main contractor and subcontractors and partly highlights what can be done to improve them. The section starts with a part on subcontractor procurement evaluation.

3.1.1 Subcontractor evaluation in procurement

The first encounter a main contractor has with the subcontractor is during the procurement phase. If good relationships are established here, the working relationships of the rest of the project will improve (White & Marasini, 2014). Although subcontracting is a big part of today's construction business, the subcontractor evaluation and selection processes are sometimes undervalued (Kumaraswamy & Matthews, 2000). In a case study, the authors researched how relationships between subcontractors and main contractors could be improved by extracting opinions from both perspectives through questionnaires and interviews. It was found that additional reviewing of subcontractors could improve selection, and that more involvement of production in subcontractor selection could make for a better end result. In subcontractor evaluation, the general conclusion based on the conducted interviews was that main contractors put too much weight on price, and quality parameters were too few. It is surprising that despite the amount of responsibility subcontractors have and how much emphasis is put on the importance of collaboration, there are still little attention put into quality criteria during the procurement phase. Although quality and price might not always go hand in hand, surely there should be a way to implement more quality parameters into procurement, which would evidently be beneficial. In their research project applying a new subcontractor evaluation method to two case studies, Maturana et al. (2007) found that using other criteria than price when selecting subcontractors improved the performance and reduced uncertainty of subcontractor practices. That price criteria on subcontractor selection has more than one benefit is clear and could therefore seem like a fairly important part of successful procurement in construction.

Partnering relationships showed to be beneficial for main contractors in the study by Tan, Xue, & Cheung (2017) who used a questionnaire survey targeting experienced respondents employed at main contractor companies. The authors observed that functioning and effective relationships between subcontractors and main contractors amounted to bids from the subcontractor that were more precise than otherwise. This, in turn, resulted in less work with evaluating knowledge and quality of the subcontractor during procurement for the main contractor. Good relationships also had several other benefits, including good quality of craftmanship in general and an increased willingness to find solutions that benefits both sides during procurement short term and long term. Few main contractors establish collaborations with subcontractors that last more than one project at the time. While this could be because of an unwillingness from main

contractors to let go of competitive bidding, it seems like not only quality and performance improve from better relationships, but also pricing.

3.1.2 Collaboration

In two studies (Humphreys, Matthews, & Kumaraswamy, 2003; Kumaraswamy & Matthews, 2000) it was established that how management and supervision were handled, as well as being receptive to main contractor needs, were crucial factors for the main contractor when working with a subcontractor. Key factors for building relationships were found to be communication, teamwork, and a positive attitude. In a similar fashion, it was found that poor management by the main contractor affected the relationship negatively from a subcontractor perspective, while improved management allowed subcontractors to perform better. For better understanding of the project and improved main contractor collaboration performance, early involvement of subcontractors was suggested, as that enabled sharing of specialist knowledge otherwise only available to one side. It is probable that early subcontractor involvement has several benefits to it and should be implemented in more projects. It is worth noting that not only does the early involvement increase project performance, but likely also collaboration and communication efficiency, as relationships have more time to mature during the extended time of involvement that early involvement results in.

The study by Kumaraswamy & Matthews (2000) discovered a willingness from subcontractors to lower the price by 10 percent on average if subcontractors expected a good relationship with the main contractor in a project. This was a believed consequence of applied partnering principles, which would make production more efficient. Another consequence of increased collaboration were increased quality, time, and cost performance. That only the expectation of a good collaboration could reduce the price indicates the importance that collaboration has to subcontractors. Successful previous work experiences with a main contractor could possibly convince subcontractors to reduce the price even further during the purchasing stages.

3.1.3 Coordination

There are many factors to coordination that need consideration. Ottosson (2012, p. 103) suggests that coordination between subcontractors and specific technical solutions made by the subcontractor should be managed without involvement of the main contractor, and that this should be done through special subcontractor coordination meetings. Further, the main contractor needed to make sure that drawings are designed in collaboration between the subcontractors, with the help of tools like responsibility demarcation lists. Coordination of especially HVAC installations, electrical installations and similar, are extra sensitive as collisions of these installations are common. Produced drawings should be examined by each involved party before delivery by a person specifically assigned to that task, according to the author. The suggestion that the author makes about subcontractors being responsible for all coordination with no involvement of the main contractor is interesting. The competence in how to carry out a task lies with the subcontractors and so it should be them who not only produce, but also plan the work. However, maintaining some sort of supervision over subcontractors might be necessary for main contractors, to ensure that planned subcontractor work conform with the project plan.

Olsson (1998) thinks that having a person assigned specifically to coordinating is beneficial, as his case study about subcontractor coordinators concludes that there is a need for such a person in most projects. The tasks of the coordinator would stretch from early stages where meeting

scheduling and coordination of design are responsibilities. In the construction phase, the coordinator works as an assistant to the site manager with making sure milestones are achieved, making time schedules, and coordinating work forces. Further, during the last stages of construction, the coordinator could be testing performance and oversee document handling. The coordinator provides a comprehensive view of many parts of coordination in a building project and could be considered in projects in the future with complex or many installations. Surely, the installation coordinator could be a good way to go if competence in installation administration is lacking in a project. The fact that the position indirectly is a support to site managers, who generally have a very busy schedule, should be further incentive for main contractors to employ an installation coordinator.

3.2 Information management

Every firm regardless of size needs information from and about competitors, suppliers, and customers to operate successfully (Macdonald, 1992). There however exist difficulties with both gathering the information and processing it to make it usable according to Zeng, Lou, & Tam (2007). The authors state that underutilised information systems can be considered a technical barrier for information transfer in the construction sector, another is horizontal information barriers caused by organizational structures. These barriers need to be considered when analysing information management in the construction industry along with other aspects, which is done in this section.

3.2.1 Communication methods

An important factor for a successful construction project is effective information management, an area where the construction industry is considered behind, and slow in employing new communication technology according to Mak (2001). However, the author continues by stating that a system that helps dealing with the great amounts of information is often welcomed by contractors. Despite that new solutions for communication can enable companies to improve their information handling and distribution, many companies are stuck in old fashioned solutions with paper documents and face-to-face meetings (Stewart, 2007). In a survey study researching outcomes of implementation of web based project information communication systems (ICSs) in construction, Stewart (2007) found that firms that use of such software, which is simultaneously well supported and has a user-friendly interface, will result in increases in performance in aspects including coordination, communication and contract administration. The importance of a user-friendly interface and easy to use software could be key in the construction sector, as the amount of people involved is high and the learning process of the system need to be short. The implementation of a new ICS can of course have different outcomes depending on the participants but should increase information efficiency if done right.

In a case study involving three cases in the Australian construction industry, Fulford & Standing (2014) found that communication through IT systems increased vertical and horisontal flows between parties of the supply chain. Reduction of errors, time and cost overrun were also found benefits of using an IT communication system. The authors state that a standardisation of information processes could be one of the critical factors for productivity in the construction business, but broad standardisation could be problematic to carry out due to the project-based nature of the business.

3.2.2 Information loss

Horisontal communication barriers are caused by project departments having no natural economic or administrative contact with the corresponding department of the collaborating company (Zeng et al., 2007). The barriers, making the information path between departments complex, result in poor information flow and a general shortage of important information. This kind of barrier requires a restructuring of organizations with new communication paths to fix, as it causes difficulties acquiring needed information, according to the author.

The large amount of people involved in a project, paired with many time pressured complex tasks, result in the need of much information processing and coordination Olsson (1998). The author suggests, in his case study based on interviews with staff from different building projects, a method of helping the site manager gather information through a subcontractor coordinator. The coordinator monitors the subcontractors and works as a liaison in problem solving on site. The coordinator also gathers information and distributes it to the site manager in a concentrated form, to enable faster and more qualitative decision making. Through the coordinator, vital information reaches the correct person on time, reducing risks of further problems caused by information loss. The coordinator, similarly to the installation coordinator, could surely be of help in projects of all sizes. Many of the aspects mentioned by the author that benefit from the coordinator are all important for project success, and coordinators could possibly contribute more than they cost.

Information originating from sources outside of the own firm is much harder to use than information produced internally and information that has been produced under the circumstances of a specific firm, might be problematic to utilize for someone else (Macdonald, 1992). In terms of technology transfers, extra measures like know-how agreements and personal visits, must be used to ensure the understanding of transferred information. In construction this is applicable to for example building documents, which are often produced by consultants and delivered to the company responsible for construction. Insufficient information and support in the handover processes of those documents could, based on what the author states, be problematic and at risk for misunderstandings.

3.2.3 Informal agreements

As described by Merwin, Linley, & Steedman (2014) in their article on contract clauses, contract variations, meaning added work for subcontractors, normally need to be in writing for the main contractor to agree on payment. If this is the case, the subcontractor should also not be forced to continue work if the contract variation is not signed by the main contractor. It is, according to the author, not uncommon that although the main contractor has verbally agreed to a way of proceeding work for the subcontractor, the subcontractor would still need a written agreement and cannot rely on the verbal agreement of the main contractor to get paid. Ottosson (2012, p. 16) adds that verbal agreements should always be acknowledged through written documents, to ensure that disputes are avoided. The burden of proof of verbal agreements that have not been documented is on both parties, according to the author. The oral agreements, if sorted efficiently, could surely be a way of increasing workflow on a building site. However, if subcontractors risk not getting paid by agreeing to oral agreements, it should surely be a phenomenon approached carefully by many subcontractor employees.

3.3 Meetings

Meetings are often seen as the main method of coordination in construction projects, according to Chang & Shen (2014), who also state that meetings are expensive to organise, which in turn justifies analysis of their effectiveness and quality. Progress meetings in the construction business is commonly held to coordinate resources and monitor progress, but meetings also act as a forum for discussion, where it is possible to settle problems and disputes (Gorse & Emmitt, 2003). Research of what happens in progress meetings is limited, despite its importance in the construction industry, state the authors.

3.3.1 Meeting categories

According to an interview study by Chang & Shen (2014), main contractor managers and engineers on all organizational levels generally think that they attend too many meetings, which in turn can lead to reduced involvement despite the meeting being relevant to an individual. Questionnaires from the same report, where the interviewees graded effectiveness of coordination methods, showed that coordination quality and effectiveness of meetings differed depending on the meeting category. Progress meetings held on a weekly basis with subcontractors received the highest score, as the urgent matters discussed made attendees attentive and involved. In general, weekly meetings got higher scores than monthly because issues brought up there had already been dealt with during the weekly meetings. If weekly meetings are more efficient, which seems natural and is supported here, they should be prioritised above monthly meetings.

3.3.2 Meeting interaction

Foley & MacMillan (2004) found from on-site observations of team meetings in construction, that meetings have different character depending on the purpose. In meetings for problem-solving, held to consider future risks and possible disputes, discussion and integration were prominent. When many team members were a part of the discussion, it was also found that the feeling of team process increased. Meetings with a perceived risk of conflicts and that was led by a few dominating interests, instead showed limited integration. Dominant team members could reduce the efficiency of a meeting by bringing up off-topic subjects and reduce learning potential for other participants. The authors also conclude that successful communication partly relies on whether individuals regard themselves as part of a team or not. Possibly, main contractors should carefully review the who is chairing meetings in the future. Too dominant personalities evidently reduce efficiency of the meetings and thereby possibly also subcontractor performance.

A study based on Bales' (1950) interaction process analysis held by Gorse & Emmitt (2003) showed that while most interactions in construction meetings are task-based, emotional tantrums can still occur, and can have significant negative impact on the group. The study showed that during strictly task-related discussion, participants would sometimes pay less attention than during emotional outbursts, negative or positive, negative having the biggest impact on alertness. A similar study by Gorse & Emmitt (2007) showed that groups in construction projects would rarely reach a mature state, which resulted in difficulties with teamwork and establishing contracts of relational form. According to the authors, too much weight was put into avoiding conflicts, resulting in risks of group think and ineffective decisions. A requirement for managers to understand meeting dynamics and its effects on making decisions was also established, stating that knowing meeting behaviours was a crucial

aspect for those chairing and managing meetings. The project-based business that the construction sector is turns out to be problematic for meeting efficiency. Immature relationships between participants seem to hinder progress in many ways. Relationships between parties and people that would last longer than one project, could possibly increase efficiency of meetings as well as collaboration in general.

3.4 Time schedule and delays

Construction work, procurement, and structure of organization are examples of elements of construction projects that become increasingly more complex each day (Baldwin & Bordolli, 2014, p. 81). Planning should be carried out by every involved party of a construction project, continue the authors, including contractor, client, subcontractors, and designers. There are generally three types of delays in construction, delays caused by the contractor, which are usually not compensated for, delays caused by the employer, where the contractor is usually compensated, and neutral delays, where no one is at fault (Baldwin & Bordolli, 2014, p. 251). In this report we will focus on the types that are not neutral, and specifically those that are caused by administrative discrepancies such as errors or lack of detail in time schedules.

3.4.1 Who should plan and schedule?

The scheduling part of a construction project is where decisions about when an activity should take place, for how long, and what resources are needed are made (Baldwin & Bordolli, 2014, p. 8). All time schedules should be designed based on the needs of each involved actor, and it is important that the schedules correspond to the overall objectives of the project, the main project plan. Planning and scheduling are iterative processes, and schedules are going to be revised during the project as new information becomes available, concludes the author. A study by Zwikael (2009) based on data from a questionnaire answered by 555 managers showed that improved efficient planning can reduce schedule overrun significantly. The worst level of planning resulted in an average schedule overrun by 43 percent, while the best planning only had an expected overrun of 3 percent. The complex nature of the construction business makes planning difficult and new actors involved in every project makes competence utilisation and coordination important when designing the time schedule. However, when done right, it is obvious that time planning plays a very important role for reducing project delays.

3.4.2 Impacts of procurement methods on time schedule design

Procurement methods can be divided into different categories such as traditional procurement and design-build contracts (CIOB, 2014, p. 103-104). The procurement method chosen affects organisation and who will be doing what in the project. One aspect that is affected by the chosen procurement method is the amount of input personnel in construction have on time schedule design (CIOB, 2014, Table 3.07). In traditional procurement, expertise from construction has only moderate possibilities for input in the design phase. Whereas in design-build procurement, possibilities for design input by expertise from construction is considered good. This implies that if problems with accuracy of the time schedule occur, a better procurement method to choose is to use a design-build contract, as competence utilisation generally is better. That method of procurement can affect design involvement is clear. However, it is possible to implement collaboration and early involvement in other methods of procurement as well, for example by initiative of the main contractor. Although traditional procurement is used, partnering principles, for example, could still be applied.

3.4.3 Level of detail

The level of detail of an early time schedule is usually low and commonly contains errors, especially if the design of the project is completed (Baldwin & Bordolli, 2014, p. 261-262). The level of detail in early stage is dependent on the experience and skill of the planner, and what information is available at the time. Parts of the schedule will be left blank, to possibly be filled in later when more information is gathered. Some sections of the schedule might require help from the subcontractor who is responsible for carrying out the work conclude the authors. The not uncommon errors and missing pieces of the early time schedule should probably be corrected before the work is carried out to minimize problems with for example coordination, that a faulty time schedule can result in.

Usefulness of the time schedule in terms of managing the project is dependent on how detailed it is, and how links between subcontractor activities are shown (Baldwin & Bordolli, 2014, p. 261). The time schedule is used as a tool to demonstrate possible consequences of a delay in an element of production. However, if the time schedule is incorrectly designed, this way of analysing delays can prove devastating according to the authors, as decisions made to reduce delays that are based on faulty information from a time schedule, could result in further delays instead. The importance of a correct and detailed time schedule shows the significance of effort being put into it from the beginning of the project and prioritisation of time schedule design processes should be high in every project.

3.5 Contractual documents

Building documents are based on the design documents made by the architect and other consultants in collaboration with the client, as described by Ottosson (2012, p. 98-99). The design documents include information on general design, as well as where things like load-bearing walls, elevators and storages should be located. The design documents can be frozen to reduce future design changes and to give subcontractors a basis when they are planning installations. Regarding some sensitive parts of design, such as suspended ceilings where installation space is often limited, it is important for the project manager to consult concerned subcontractors before deciding to freeze the design. The project manager can control the frozen design documents, as they can only be changed at special meetings and after discussion with affected subcontractors.

Ottosson (2012, p. 103) suggests that installation subcontractors use building PMs. The PMs should contain information about how the building contractor should carry out work affecting installation, such as holes, slits, and walkways to plants, to make installation easier and more effective. All data should then be included in the structural and architectural documents.

A problem with building documents is that they are often changed during production due to either requests from subcontractors and clients, poor coordination, or inadequate information (Ottosson 2012, p. 103). Some information might even be missing entirely from the inquiry documents adds the author. Further, Semple, Hartman, & Jergeas (1994) state that subcontractor claims are most commonly related to delays and scheduling, as well as changes in design, errors and extra work. To reduce the number of claims, the authors suggest some necessary measures. These include ensuring constructability of drawings during several different project phases and making sure that project planners have enough time to complete accurate building documents.

A factor to consider about building documents is explained by Macdonald (1992), stating that information from sources outside of the own firm is harder to interpret and use compared to information produced internally. In the case of technological information transfer, know how agreements and personal visits should be used to ensure understanding and proper utilisation.

A construction contract not only need to include what is to be built and how, responsibility demarcations that in detail clarify who should do what, are important as well (Ottosson, 2012, p. 136). The complexity of the processes of drawing up contractual documents is clear. There are several suggestions by authors in this section on what should be done, but the literature includes few concrete guidelines or examples that could be applied directly by practitioners. Surely, such guidelines are needed to increase correctness, constructability and understanding of contractual documents.

3.6 Understanding contracts

Standardisation of contracts that originates from limited time in projects for contract preparation, can result in contractual gaps and misunderstandings in later stages of a project (Gaber et al., 2010). In a survey study researching implied obligations in contracts, the authors found that gaps exist between perceptions of what project parties feel is their obligation, and what is accomplished. Examples of highlighted obligations are the responsibility to coordinate that rests with contractors and subcontractors, and to not withhold critical information from other project participants. The implied obligations are according to the authors often covered by contracts in one way or another, but only vaguely, which makes misinterpretations of expectations probable. Further, these kinds of misinterpretations will most likely result in disruptions of work and poor project delivery, as well as in court cases in some circumstances. The authors conclude that to better understand contracts, and thereby reduce misinterpretations and cut the number of gaps in the contract, contract administrators should coordinate workshops at the start of projects during which participants in the project should present their expectations of project results. This could surely lead to a better understanding of what is supposed to be delivered, as well as increase collaboration between parties in early stages of the project.

Mohamad Ibrahim & Madon (2006) studied the understanding of contracts through interviewing and sending questionnaires to professionals with experience in the field in the United Arab Emirates. They found that good understanding of contracts is needed for contractors and subcontractors to effectively be able to deliver what has been agreed upon and that the understanding of contracts generally needs to improve. Further, it was established that factors that affected contract understanding the most included attitude, educational background, and experience. The authors also state that to ensure contracts are understood better, documents need to be read by qualified staff, contract text need to be made clearer and easier to read through simpler language and less legal phrases, and contractual documents need to be checked by all involved parties to ensure accuracy and understanding. Chong & Zin (2008) conclude, in their questionnaire study on clarity in construction contracts, that misinterpretations of contracts often lead to disputes. Further, the authors emphasise the use of plain language, to encourage understanding of contracts. It is surprising that the contracts, despite sources stating problems with understanding them, are not more adapted to a reader with no education on legal documents. It is clear that employees with little experience or education in reading contracts

and legal documents struggle. Craftsmen, who need to understand contract documents to carry out their work efficiently, often fall into at least one of those categories, and it would therefore likely be beneficial for production performance if the contracts were made easier to understand. An alternative could be to make two versions of a contract, one for legal purposes and one for production purposes, where the latter only contains data relevant to production in simple and concise language.

3.7 Competence

Humphreys, Matthews, & Kumaraswamy (2003) identified that early involvement of subcontractors in projects enables knowledge sharing and increases general understanding of the project. Maturana et al. (2007) concluded that small subcontractors with less resources might sometimes need help with solving problems from the main contractor. This was also due to less knowledge within the company compared to a bigger firm. Further, Akintan & Morledge (2013) discovered in their study on improving collaboration between subcontractors and main contractors, that perceived incompetence in management of subcontractors by main contractors can limit possibilities of collaboration. Further, the authors state that the poor faith in subcontractor management skills could be the reason why main contractors sometimes hesitate to consult subcontractors about problems on the building site. Early involvement is, once again, stated as a key factor for increased subcontractor project performance, and in this case regarding competence utilisation. Although faith in subcontractor abilities is sometimes low, extended collaboration time might be beneficial for that as well.

In their interview study, Newell et al. (2006) researched why knowledge gained through lessons learned processes is rarely utilised, in projects of companies with more than 30 years of experience in the business. Their conclusion was that the knowledge gained from one project could be considered hard to apply elsewhere, because it was project specific. They also found that even when this kind of information exists, it is often stored in an Information Communication System (ICS) used by the company and personnel might not be aware. The authors found that when the lessons-learned processes took place, it was between members of staff directly rather than through these ICSs. It was also discovered that data shared through the information communication system might not always be of help, as it contained information about mainly what had been done. Information about how the processes were carried out and why decisions were made to fulfil them were often not included in the information from lessons-learned processes. Interestingly, if the utilisation of ICSs does not improve, it is evidently better to invest in other solutions, such as open space offices, to encourage lessons learned processes in companies. However, the potential of ICSs is large, and they have more fields of application than just lessons learned processes, which likely makes it worthwhile to invest more time, money, and education of staff into increased exploitation of such systems.

3.8 Trust

A way of building a better relationship between main contractor and subcontractors is to employ a good attitude and trust towards the subcontractor, conclude Kumaraswamy & Matthews (2000). The study that was based on interviews and questionnaires aimed at main contractors and subcontractors, showed that when paying subcontractors, trust was particularly important. The authors stated that trusting that the subcontractor is asking the right price could be a difficult task for main contractors, considering possible experiences of overcharging from previous

subcontractors. That trust can relate to payment also showed in the study carried out by Dainty, Briscoe & Millett (2001), who researched subcontractors views on supply chain alliances in construction. It was found that subcontractors that do not get paid on time was a reason for decreased trust between parties. The authors also highlight that a lack of trust between parties is an obstacle for developing deeper understanding of the other part's needs.

The nature of the competitive bid system of construction can affect trust, as well as stall the procurement process, as is stated in the interview study of three different cases regarding construction productivity by Fulford & Standing (2014). Hartmann & Caerteling (2010) confirm that mistrust can be created through competitive bidding and add that although main contractors realise the positive factors of extended relationships with subcontractors, they still use competitive bidding where both known and unknown subcontractors are participating. This to ensure market conform prices while still enabling for relationship building. The authors state that offering competitive bids is a way for subcontractors to build trust toward the main contractor, regardless of being a previous working partner or not. The balancing of trust and price is proven difficult and needs to be addressed properly. At the same time, it is a two-way street, as both the asked price by a subcontractor, and payment from the main contractor, need to be handled carefully and professionally, to not create unnecessary arguments and discussion, which in turn could hinder project progress and success.

4 Empirics

The following chapter presents the data gathered in the interview study. The chapter also includes an introduction to the involved main contractor's processes, which briefly describes how they currently work with reducing administrative discrepancies between main contractor and subcontractors in their projects. The rest of the chapter is divided into subtopics which represent the different problem areas that were identified during the interviews.

The interviews were held with six employees of three different HVAC and plumbing subcontractors, as well as with three employees from the main contractor. The interviewees are anonymously presented in Table 3 together with their respective acronyms. The acronyms serve as a replacement for real names in the chapter and are named after the position of the interviewee, as well as if they represent a subcontractor (SC) or the main contractor (C). The acronym also states if the interviewee is from company A, B or C, which are represented by the numbers 1, 2 and 3, respectively. Representatives of the main contractor have no number in their acronym.

Table 3: Presentation of the interviewees, including company, role, and acronym in the text.

Company	Role	Acronym
A	CEO (Sales)	SCS1
A	Foreman	SCF1
B	Project manager (Sales)	SCS2
B	Foreman	SCF2
B	Assembler	A2
C	CEO (Sales)	SCS3
Main contractor	Purchaser	CP
Main contractor	Site manager	CSM
Main contractor	Foreman	CF

4.1 The main contractor's processes

The chosen main contractor works with several tools and procedures to ensure the quality of work and that procured subcontractor services are delivered as promised. This section presents a short overview of how handover from procurement to production, use of ICSs, and project planning is currently done. The data in this section is gathered from interviews with employees of the main contractor, meetings with an assigned contact person at the purchasing department, and a document on handover routines from the main contractor's database.

In the process of handing over purchased building services to production, the procurement department goes over what has been bought together with the site manager to ensure mutual understanding. Long time between this handover and start of construction is a problem highlighted by the main contractor themselves. Another related issue is that foremen are often not yet involved in the project during handover, meaning they will receive the information second hand after a potentially long period of time, which results in obvious risks of information loss. Start-up meetings are always held with the subcontractor at start of construction. It is the main contractor's wish to have attendees from the procurement department on these meetings as well. However, since purchasers often have started new projects at this stage, that is not always possible.

In mainly larger projects, the main contractor uses an ICS where documents, such as contracts and building designs, are shared between departments. The system is used in the handover process of purchased building services from procurement to production, to share necessary documents. Common types of information shared are responsibility demarcations between subcontractors, project specific deviations and principles of regulation. If the system cannot provide competent answers despite all information gathered inside, production is also encouraged to contact the procurement department during construction, with potential questions about contract details. Access to relevant documents in the ICS is given to subcontractors as well.

Project planning is made in collaboration with subcontractors in the main contractor's projects. It is the general conception that installation subcontractors take longer time planning than others and for this reason, the main contractor aims to involve installation subcontractors early in the process. The related collision detection is also carried out cooperatively by the main contractor and subcontractors, with the help of an installation coordinator. In larger projects, a subcontractor coordinator assists the site manager and foremen with planning and coordinating subcontracted services. Regarding the time schedule design, subcontractors are partially involved in the design process. During the procurement phase, the main contractor sets up the start and end dates in the time schedule, for subcontractors to approve of or provide feedback on. When procurement is finished, a more detailed time schedule is drawn up by the main contractor in consultation with the subcontractors.

A majority of the main contractor's projects is under design-build contracts, and the procurement department applies partnering principles in most of their purchases. The experience of partnering within the procurement department at the main contractor is that it amounts to better price, quality and working climate in projects. Purchasers use subcontractor evaluations in the procurement process and can contact staff with experience from working with a specific subcontractor to ask for additional information. The evaluation should be made by either the site manager or foreman at the construction site. Purchasers often have systems for consulting people about subcontractors, and it is included in their job to evaluate and consult relevant people before making a purchase.

4.2 Collaboration and coordination

This section presents the opinions of interviewees on collaboration and coordination between main contractors and subcontractors.

4.2.1 Collaboration

CSM (all acronyms as in Table 3) says that subcontractor collaboration is very important, especially within installation, and a close collaboration results in fewer administrative discrepancies and less errors when the project is finished. In improving collaboration, most of the interviewees agree that if they have worked with someone before, or if someone has knowledge of their trade from previous experience, that makes collaboration much easier in a project.

According to CF and SCS1, good collaboration between subcontractor and main contractor is mostly about achieving better productivity from subcontractors. An application of this is to make sure the subcontractor knows what is to be done and when it needs to be finished, which is easier to accomplish if subcontractors are included in the work, CF states. SCS1 adds that by

close collaboration, you enable efficient communication leading to better solutions by using each other's competencies for the good of the project. It also gives a sense of shared responsibility of the project, SCS1 says.

SCS1 and SCF1 feel that it is sometimes hard for subcontractors to demand things from the main contractors. Traditionally main contractors have told subcontractors what to do, no questions asked and that needs to change according to SCS1. To achieve a better result, she continues, subcontractors need to start questioning and demanding things from the main contractors without them getting annoyed. SCS1, SCS2 and SCF1 think that an important characteristic of the main contractor is humility, to make staff feel comfortable asking questions. You also need to give each other space to speak and try to understand each other's problems, SCS1 continues. SCF1 adds that both being humble and showing a will to listen is an important characteristic both for subcontractors and main contractors, stating that it is in everyone's interest to listen to those who have more experience, despite role in the project. Seeing the project from a neutral perspective, continues SCF1, can promote learning for everyone involved. Humility and showing will to listen seems to be hard for many people in the business, concludes SCF1. SCF1 continues by saying that it would be good if main contractors started asking subcontractors for advice on how to lead project tasks, requiring humility and a neutral attitude to one's role as a main contractor. Unfortunately, says SCF1, these kinds of discussion can become personal issues, as people do not want to admit their shortcomings.

It is obvious that all respondents think that good collaboration is necessary and that it brings several advantages. It is also clear that subcontractors think that collaboration needs to improve and that main contractors need to involve them more in decision making. Humility is brought up as an important characteristic by subcontractors, while it is not mentioned at all by main contractors although it should be a valuable characteristic in subcontractors as well.

4.2.2 Coordination

CP states that a reason for deviations from the time schedule is the many changes to the contract. In the project CP is currently involved in there are between 150 and 200 subcontractors and everyone wants a say in the scheduling process and that needs to be coordinated by the main contractor, who not always can be effective enough to handle that. A2 thinks that it is important for the main contractor to have the full picture of the project, or coordination of the different subcontractors suffers.

CF and SCS2 say that a common cause of discrepancies is poor responsibility demarcations between subcontractor and main contractor or between subcontractor and subcontractor. CF says that this is particularly frequent between electrical subcontractors, where the limits of responsibility are often ambiguous. SCS2 adds that misunderstandings regarding the responsibility distribution are common because information is interpreted differently by different parties. Problems with responsibility distribution are the second most common administrative discrepancy after time schedule issues, according to SCS2.

SCS3 mentions that unprepared building sites is a problem for subcontractors. This sometimes result in subcontractors showing up on the building site but then are unable to do their work because of unfinished preparation by the main contractor or other subcontractors, he says. SCS1

confirms this, stating that lacking quality of work can also result in problems with building site preparations. The necessary rescheduling that follows is tough says SCS3, as subcontractors often have a very busy schedule. SCS1 says that earlier involvement of subcontractors would help with making sure correct preparation for the next subcontractor is done on the building site. SCS2 agrees, adding that you can tell that a foreman of a main contractor is experienced based on if he consults subcontractors during construction or not. Often the subcontractor has knowledge of required preparations of say, a wall, and that knowledge should be used by the foreman, SCS2 concludes.

Regarding subcontractor supervision, CF and CP say that a common discrepancy is that subcontractors do not have their own foreman, despite that the supervision service is contracted. The main contractor then must contribute, causing delays and extra costs, says CF. Sometimes it is almost the other way around, says SCS2, they have sometimes asked to take over management of production tasks, due to the main contractor foreman not being competent enough.

It is clear that coordination is regarded as important by the interviewees and the views are somewhat similar of what areas are problematic. That coordination between subcontractors and main contractor, and between subcontractors, need to be improved is agreed upon by most of the interviewees. Responsibility demarcations and earlier involvement of subcontractors are parts of coordination that need improvement, as is stated by many, but the interviewees do however not agree on whether it is the managerial competence and responsibility taking of the subcontractor or of the main contractor that need improvement.

4.3 Information management

The following section includes opinions on communication flow, paths, and oral agreements, as seen by the interviewees.

4.3.1 Communication flow

CP says that communication flows are the hardest thing to coordinate in large projects, and both CF and CP agree that communication plays a large part in discrepancies, stating that communication channels and the right information to the right person at the right time, are key factors. The number of people involved in many projects is large, continues CP, resulting in many key persons who need to be included in every decision.

SCF1 states that coordinating communication is a tough problem to solve, and that misunderstandings are common. He thinks that competence and humility on every level of the organisation are the two most important factors to achieve good communication. SCS3 says that communication routines towards subcontractors are lacking, as information about unprepared building sites often does not reach the next subcontractor. SCF1 agrees, adding that communication paths are not always clearly established in the beginning of a project, instead they evolve over time.

4.3.2 Communication paths

CP thinks that in large projects, mail conversations are outdated as a technology. There is too much information to handle and mails are an inefficient way of handling that, he says. Main contractors usually work with software to handle all the information says CP, subcontractors

can access the data but rarely do so, as the competence is not there to handle the different softwares of different main contractors. In CP's current project, they use a communication software to share information about the project with the project planners, the system works very well in CP's experience, the only flaw being that mail conversations are still used by some subcontractors, and information from mail is not transferred to the communication software.

CP states that if the main contractor would receive all needed information, many discrepancies would disappear. However, that is not the case he says, as the information flow is too large, and it is impossible to gather it all. Experience of working in large projects and knowledge of the problems with communication are key factors to make communication work better says CP. Open surfaces in the office is a good way to increase communication within the department, CP thinks, as you can gather oral information from colleagues on the run. CF states that the communication paths are not always the same in projects. CP confirms this saying that sometimes software is used and sometimes not.

That information is a vital part for success is clearly stated by all respondents. That there is too much information is also clear. A problem highlighted by both main contractors and subcontractors is that communication paths are not easily established in new projects.

4.3.3 Oral agreements

Regarding oral agreements, SCS3 and SCS1 say that they are not as common as they used to be. The disadvantages of oral agreements, stated by SCS3 and SCF1, are that the person you agreed with might forget or have ended up quitting when the inspection is carried out, resulting in unnecessary disagreements about payment. The optimal way to go, according to SCS3, is to have every agreement on paper. SCF2, SCS2 and CF confirm this, and most of the interviewees experience that oral agreements are still common in production, but not in contract phases. SCF1 adds that misunderstandings in oral agreements are common, which could result in reduced trust.

CF and CP state that oral agreements can sometimes be necessary for the work to flow smoothly on site and that too much administrative paperwork can hinder the project from advancing. SCS1 confirms this, adding that the most important thing is to know which agreements can be done orally and which should be on paper. Oral agreements done right can increase trust, claims SCF1, as it shows you can count on someone. CP says that he never makes oral agreements himself, adding that in large projects it is even more important to not use oral agreements than in smaller.

It is apparent that the volume of oral agreements in construction is declining. Although the interviewees do not completely agree on whether they are necessary or not, or which is the optimal way to go regarding oral agreements on the building site.

4.4 Meetings

This section presents the meeting structure of the main contractor, explained by respondents from the company. It also includes opinions on how meetings could be made better and more efficient according to interviewed subcontractors.

4.4.1 Meetings according to the main contractor

CF tries to include subcontractors as much as possible in the project, mainly to make sure time schedules are fair and can be met. This is done by conducting foreman meetings attended by a foreman per trade. The meetings include scheduling and work planning of the upcoming week. The meetings are a way of including subcontractors in the decision making and cooperatively deal with potential problems before they occur, continues CF. Often however, problems are not dealt with until they appear on site, which is not good for productivity according to the interviewee.

On a higher level, CF thinks more meetings are necessary, the focus there, however, needs to be on making sure the meeting has a purpose and an agenda, to make it efficient. He also thinks that more meetings for contract briefings could be held in larger projects due to the high turnover of staff.

According to CSM, close collaboration especially with installation subcontractors is an important factor for communication. That can be accomplished through meetings for scheduling with a leading assembler from the subcontractor, and close contacts between involved parties. According to CF, the subcontractor lead assembler usually attends start-up meetings with smaller subcontractors, while with larger subcontractors, one or two persons with more responsibility for the project are present. From the main contractor, the site manager and responsible foreman should attend the start-up meeting, says CF.

4.4.2 Meetings according to subcontractors

SCS1 thinks that production meetings should be structured more to enable discussion rather than just briefings, in order to find possible future issues. It is also important that production staff should attend these meetings, she says. She adds that a dialogue with main contractors about what is expected of a contract would be good, so that main contractors can ask subcontractors about problems so that they can come up with a solution cooperatively. SCF1 thinks that contract discussions are important, where involved parties, by explaining their interpretation of the contract, can analyse possible issues together.

SCS3 states that although start-up meetings should be held in every project, that is not always the case as it rather depends on who is in charge and if there is time for a meeting at that time, he says. SCS3 does not, however, think that more meetings during the contract phase would help, instead he believes that those meetings should be held on the building site just before assembly. CP also disagrees with the idea of more meetings, saying that it occupies too much valuable work time. He thinks that especially foremen should have fewer meetings and spend more time, around 80 percent, on the building site. SCF1 and SCS1 think that more meetings are a good thing, if they stay within a reasonable amount. SCS1 adds that more meetings between subcontractors are necessary to coordinate their work, and that only a start-up meeting is not enough.

It is clear that meetings are a tool for subcontractor coordination by the main contractor as well as for increasing collaboration and communication. The general opinion is that more meetings are required, while only the subcontractors highlight that more discussion should be encouraged during the meetings, to improve subcontractor involvement.

4.5 Time schedule

Opinions on time schedule and delays as well as what interviewees think should be done to improve these aspects of construction projects are presented in this section.

4.5.1 Delays

According to all interviewees, deviation from the time schedule is very common. CP says that deviation from the time schedule often results in extra work through schedule contract variations. SCF1 states that the time schedule is not always correct regarding scheduled events and that it is not always applicable to practice. Sometimes, the subcontractor does not even get a start date, he says. SCS2 states that since the time schedule is designed theoretically and often tasks scheduled in theory take longer to finish on site.

SCS2 states that delays arise when subcontractors are unable to deliver what they promised on time. A2 agrees but adds that delays are often due to poor prior conditions given to the subcontractor by the main contractor. CP thinks a reason behind deviations in the time schedule is the many changes to the contract. In the project CP is currently involved in there are between 150 and 200 subcontractors and everyone wants a say in the scheduling process; he states that they as main contractor cannot be effective enough to handle that.

CP says that depending on how you adapt and relate to the time schedule and how detailed the monitoring work is, the better the time schedule is usually followed and the more you can reduce discrepancies. He continues by saying that the time schedule needs to be approved by both main contractor and subcontractors, and that sometimes contract variations and changes are necessary to achieve this. So, coordination of subcontractors is one cause of time schedule discrepancies, but also logistics, weather conditions and client requests according to CP.

4.5.2 Design responsibility for the time schedule

SCS1 says that work would be much easier if main contractors let subcontractors design their own time schedules, or that the main contractor asked subcontractors about required time and site preparations. Unfortunately, that is not the case today, according to SCS1. SCS1 says that earlier involvement of subcontractors in projects would result in a correct time schedule from the beginning and increase the level of detail in the time schedule, in turn making work planning easier for the subcontractor. SCS2 says that they are involved in the designing of the time schedule, but more effort should be put into correctness. Sometimes, he continues, the person responsible for designing the time schedule possesses little knowledge on how to construct a house but knows the scheduling software. At the same time, staff that do know how to build a house, do not know how to use said software, and often do not have time to go over the time schedule to ensure its quality either.

The level of involvement in time schedule design can differ depending on the contract form, SCS2 says. In complex partnering projects, you are more involved than in more basic projects such as schools. SCS2 prefers partnering projects, where parties work toward a common goal and subcontractors get involved early. SCS2 concludes that in design-build contracts without partnering, possibilities for subcontractors to affect the time schedule initially can be very limited. CSM confirms the importance of early involvement of especially subcontractors in installation and that is how the process looks under their design-build contracts in his company. SCS1 agrees that subcontractors need to be more involved in scheduling, in the ventilation

business for example, the time schedules often lack detail because the main contractor's knowledge about ventilation is poor, she says.

While it is apparent that all respondents agree that delays are common, the given reasons behind them are many and originate from clients, main contractors, and subcontractors. It is, however, agreed upon by the interviewees that a solution for the problem could be earlier and increased involvement of subcontractors, and closer collaboration.

4.6 Contractual documents

Since faulty contractual documents have been described as a large problem and a cause of administrative discrepancies by many interviewees, this section presents their opinions on the subject.

4.6.1 Correctness of contractual documents

SCS3 says the building documents are not always correct and sometimes need extra attention and time. SCF2 agrees with this and thinks the reasons behind the discrepancy are often long time between contract signing and assembly, and contractors having many contracts active at the time. CSM adds that building documents are not always finished by start of construction, often due to lack of information in the tender documents. CP says that a reason for the shortage of information is due to many client requests, making designing the basis for tendering a drawn-out process. SCF1 states that main contractors and clients can sometimes expect more than is possible for the subcontractor to deliver on certain projects.

CP says that it is the subcontractor or assembler who should design the building documents, since that is where the competence lies. However, the coordination required for that to happen is complex, he adds. SCS1 says that she would prefer her company to be involved sooner in the project planning, as knowledge about ventilation in many main contractor companies is poor. SCF1 adds that the steadily increasing access to 3D drawings simplifies internal communication of for example collisions, which reduces contract document discrepancies.

SCS3 says he thinks that assemblers attending meetings with contract signings could be a good idea, since the assemblers know their own trade better than the client. SCS3 says he thinks that that could enable them to adjust the building documents to their own liking, thereby increasing buildability and reducing possible disagreements at an early stage.

It is clear that, similarly to deviations from time schedules, the believed reasons for incorrect contractual documents are more than one. The interviewees however agree that competence utilisation is vital to increase accuracy of the contractual documents, including early involvement of subcontractors.

4.6.2 Building document briefings

SCS3, SCF1 and SCF2 think that increased briefings of the building documents could reduce contract discrepancies. CF also agrees, adding that another benefit is that meetings between main contractor and subcontractor also increase collaboration. SCS3 mentions that the consultant who makes the documents should attend the briefings to discuss what is to be done.

The consultant generally just hands over the documents after they are done, and then it is up to us, says SCS3.

Reconciliation meetings are good for increased understanding of the building documents during construction, says SCF1. He adds that during these meetings, it is important to be honest and transparent to keep them effective and that they also help with general understanding of the current processes. To conduct meetings with building document briefings closer to construction start could also help thinks SCF1.

A2 thinks that the building documents should be adapted to the user, so that each line of trade receives documents only with data relevant to them. He also says that it is hard to detect errors during building document briefings where subcontractors approve the drawings, and that many errors are found in assembly despite the document review.

Clearly the general opinion of the interviewees is that more briefings of the building documents would help, both with understanding and increased collaboration. However, if more briefings are held, less time is left for production, and vice versa. This obviously applies to many of the problems highlighted, and balance between the two is surely required for best performance

4.7 Contracts

This section presents contract design responsibilities and contract reading routines of interviewed staff of both subcontractors and the main contractor.

4.7.1 Contract design involvement

SCS1 states that especially in larger companies, contracts are designed by people not involved in production, resulting in misinterpretations in production about what has been agreed upon. She adds that the contracts should be made easier to interpret, but that she feels that the contracts get more and more complex.

CP says that due to for example many client requests, project planning often runs parallel to production because of the extended process of making the basis for tendering, and that is not optimal. Instead he would prefer that all planning was done before the project started, and that no changes to the contract could be made after that. During the contract negotiations, CP says, disagreements between subcontractor and main contractor are common. CP thinks this is because necessary information about the project is missing.

SCF2 does not think assemblers attending contract negotiations is a good idea, stating that assemblers rarely are interested in contract negotiations. He thinks a better solution could be to instead bring the most experienced people from the company and doing research beforehand.

4.7.2 Contract reading routines

According to CF and SCS1, an important factor in reducing discrepancies is the understanding of the contract, for both main contractor and subcontractor. If you do not know the contract, CF continues, there is a risk of being ripped off. CF states that many of the discrepancies he has experienced are due to misunderstandings and lack of competence and adds that the lessons-learned process is key to reduce future discrepancies when signing contracts. SCS1 says that

contracts often include unnecessary things that are irrelevant to the project, which suggests that the main contractor lacks project knowledge.

At CSM's company it is the foreman's responsibility to read the contract. They also work closely with the procurer during contract negotiations and discussions, the procurer in larger projects is on the building site, which makes discussions convenient says CSM.

At SCS3's small firm, he says he as an assembler also reads the contract, often with the leading assembler attending. SCS3 and CF think that if the project is not complex, the reading of the building documents might be assigned a low priority and not done sufficiently, which could result in technical discrepancies and time delays. In SCF2's company, it is the project manager and project leader, and rarely assemblers, who read the contracts.

SCS1 thinks subcontractors generally need to get better at reading the contracts on time, as they have become more and more complex and full of legal documents compared to earlier in Gothenburg, where actors would have more trust in each other. In SCS1's firm, they try to have different people, i.e. one from production, one consultant et cetera, to read the contract thereby receiving different viewpoints of it. In SCS2's company, it is the project manager's responsibility to read the contract. He adds that the project manager gets involved in projects three of four months before start of construction to be able to gather all information needed, which has worked out well for them.

CF and CP say that there should always be a contract briefing with purchaser and foreman attending, but that is not always the case and there are no routines regarding how it should be done. SCF1 states that communication of contract details between contract signers and production is poor in his company, as not all contract information reaches production. He adds that it is not easy to be entirely transparent in these cases. SCF1 has never experienced a meeting where sales go through the contract details with production but says that that would be beneficial for the staff on site. He says a problem could be that the responsibility demarcations are not effectively communicated from sales, resulting in irritation and conflict when contracted elements of work are not fulfilled. A more efficient flow of information between sales and production is needed, SCF1 concludes.

It is obvious that good understanding of the contract is important to both main contractor and subcontractors. However, while some companies have fixed routines for contract reading, others stated that it is sometimes assigned a low priority, or lack routines for how it should be done.

4.7.3 Design-build contracts and partnering

CF says that in design-build contracts (ABT06), where the main contractor does the project planning themselves, communication channels between planning and competence is shorter than when working with general contracts, where lead times are much longer. CF continues by mentioning that design-build contracts make him more involved in the process and the resolving of discrepancies. CP confirms this and states that in design-build contracts he has been involved in, the subcontractors design their own building documents if they are under a partnering contract, so do framework and facade subcontractors.

Partnering contracts are good in larger projects with many uncertainties and changes, says CF, the subcontractor forecasts are valuable and since you share profits, there is an incentive for subcontractors to work harder and more efficiently. In the project CP is active in, the five biggest subcontractors are under partnering contracts. He says this is a way to make these subcontractors work together with the main contractor, aiming for more cooperation. SCF1 thinks that in partnering contracts, you collaborate on a much closer level with the main contractor through more room for discussion. Everyone works toward the same goal in partnering projects and it is easier to see the big picture there, says SCF1.

4.8 Competence

The following section presents the opinions of the respondents on competence utilisation and deficits.

4.8.1 Competence utilisation and deficits

CSM says the best way to utilise internal competence is to include production in procurement as well as in project planning. It is important to make the best use of that kind of competence because there is a large difference between theory and practice. In the best case, procurers consult production when purchasing a subcontractor, but that is not always how it is done. In SCF1's company, there are monthly meetings involving staff from all levels of organisation to make sure existing internal competence is capitalised on.

SCF1 says that it is common that information from the main contractors lack quality and that the main contractor sometimes have difficulties understanding information from the subcontractor. This implies inadequate competence on the main contractor side, according to SCF1. Misunderstandings are related to the competence issues, continues SCF1, adding that main contractors sometimes expect more than is possible to deliver for the same reason.

The high turnover of staff is a problem since new foremen often lack competence, SCS3 says. SCS2 agrees that there the difference is significant between new and more experienced staff on the main contractor side. It is hard as a subcontractor to affect the main contractor's choice of foreman, says SCF2, even if the foreman does not have enough competence or cooperate well, you often have to cope with and make the best out of the situation instead.

CP says that he quickly notices if a subcontractor is not skilled enough to handle administrative work or supervise a project by engaging in conversation with them. However, high turnover of staff at the subcontractor can result in that purchased subcontractor might have changed supervising staff between the contract signing and start of assembly. On the main contractor side, CP says that they can sometimes negotiate with the subcontractor for a specific foreman, who they know works out for them. A key element in competence is the subcontractor's ability to handle contract variations CP says. That involves a lot of administrative work which the subcontractor might lack the competence to handle, CP continues.

It is obvious that the interviewees agree on the importance of effective competence utilisation. Although this is the case, some companies state that there are few or no routines in place to ensure it. Subcontractors also highlight that the main contractor often lacks competence in subcontractor trades.

4.8.2 Large versus small company competence in administration

SCS1 says that a large company generally is more aware of administrative parts of work and handles them more efficiently. SCF1 agrees, adding that larger companies have staff delegated to administrative work, while smaller companies do not have the same resources, routines, and processes. On the contrary, SCS2 implies that it is more about the competence of the staff in a company that matters, rather than the size. CSM states that larger companies are better at administrative work, and that smaller companies often have problems with things like self-monitoring and inspection plans or even wearing the correct clothes. SCS3 says that in his experience, working with smaller companies result in more frequent administrative discrepancies, as they often lack administrative competencies. Small businesses, according to SCS3, does not put much focus on administrative questions but rather production, and administration is seen as a necessary evil. In small projects, SCS3 says, the administrative parts are easier to handle, many people involved on the contrary results in more administrative difficulties with many people who want a say in things. SCF2 agrees, also stating that larger projects mean larger systems, which are harder to produce.

CP states that they sometimes work with very small companies, where there is one key person, usually the CEO. The CEO does most of the administrative work in the company, often resulting in lack of quality in some areas, CP says. If the key person of a subcontractor gets sick, and the work assigned to them is not finished, it can cost the project millions, he continues. CP implies that if a small company has more than one key person, it is a competitive advantage for them.

It is clear that most interviewees agree on the differences in knowledge and competence of administrative tasks between large and small companies. However, since the difference is acknowledged, willingness to cover possible inadequacies in subcontractor administration should be expressed by main contractors, to enable better collaboration and smoother project progress.

4.9 Trust

This section presents what the respondents thinks about trust, its importance and how it can be increased between main contractor and subcontractors.

4.9.1 The importance of trust

Trust improves communication both internally and externally, say SCS3, CSM and CF. SCS3 adds that if he knows and trusts the employees of the main contractor, arguments and discussions are more easily dealt with than otherwise. SCF2, CSM and SCS2 verify this, while also stating that a high level of trust often means that less communication and check-ups are needed between main contractor and subcontractor. CF and SCS2 continue by saying that trust is very important and that if there is no trust the project can be infected by unnecessary arguments. SCS2 adds that with high levels of trust, handling contract variations becomes easier as main contractors can be sure that the variation is accurate.

SCF1 and SCS2 think that if trust is high, transparency in communication increases, resulting in better collaboration and increased knowledge. SCS2 states that high trust result in less

discussion and arguments both externally and internally, which in turn makes work run smoother and more effectively. SCS3 states he thinks trust is very important and states that their company aims to practice good communication to show that they are an honest business.

4.9.2 How to increase trust

Trust between main contractor and subcontractor can be increased by having good communication, agrees a vast majority of the interviewees. SCF1 thinks that being open and transparent and being honest about your progress are all keys to increase trust. SCS2 adds that it is important for gaining trust to get to know each other in the project, both personally and professionally.

There is a significant difference in trust working with someone you have worked with before, according to SCS3, SCF1 and CF. SCS3 mentions that when they get to know each other, trust increases and as a result, the work runs smoother. CP confirms this, adding that chemistry with a person is the most important factor in cooperation. It is also a way for subcontractors to get more work in the future, SCS3 says, because the whoever buys their services knows that they are buying a good product. SCF2 agrees with his, adding that partnering projects require even higher levels of trust. Working with big, well-known companies automatically increases trust, says SCF2. CF adds that when you have worked together before, the phase of getting to know each other can be skipped, resulting in a more efficient project from the beginning.

CP states that there are two types of subcontractors, one who is willing to compromise for the better of the project and cooperation, and one who makes sure they get paid for every little detail through contract variations. The tendencies a subcontractor has of adding contract variations should be a criterion in the procurement evaluation, CP adds. SCS3 says it is important to them that the client knows that the price on the contract is the price they are going to pay, and that SCS3's company rarely adds work through contract variations which is a way of gaining trust. He mentions that sometimes they get a job despite being more expensive than competitors, thanks to their previously gained trust.

It is clearly stated in this section that all the interviewees agree that high levels of trust bring improvements in collaboration and communication. It is also stated that increased work experience with a specific actor, if successful, amounts to increased trust and likely more collaborations between the parties in the future. Still, trust is expressed to be undervalued during the subcontractor evaluations, and there are no mentions of potential long-term cooperation agreements which otherwise seem like a possible path to go down in order to increase trust.

5 Discussion

This chapter includes discussion and reflection upon the interview data relying on the literature review. Thus, the answers of the interviewees are compared to what is found in existing literature, in each subtopic. Although the interviewees hold different positions in different companies and have different backgrounds, similarity of opinions especially regarding importance of collaboration and trust, were apparent. When answering questions about where problems related to coordination and contractual documents originated from and whether it was the fault of subcontractors or main contractors, the answers were more divided, however.

5.1 The main contractor's processes

The handover process of the main contractor is stated to suffer from information loss due to long time between contract signing and start of construction. The main contractor's wish is to include purchasers in handover meetings ensure contract understanding. The importance of understanding of the contract is highlighted by Mohamad Ibrahim & Madon (2006) and Chong & Zin (2008), with the latter stating that it is important that staff with the right competence read the contracts, to hinder misinterpretations. Contract reading processes should perhaps be prioritised in the handover process at the main contractor, so that the contract is correctly interpreted by production staff. To expand the process even further, the suggestion made by Gaber et al. (2010) of contract reading workshops for all participating actors at the start of projects could be followed.

The use of ICSs is established in some projects at the main contractor, according to the interviewees. The systems are used to share information both internally and with subcontractors. As is stated in interviews by some subcontractors, however, such systems could be difficult to handle for unaccustomed subcontractor employees. Stewart (2007) suggests easy-to-use interfaces, since many people need to be taught to use the system, quickly. It might be necessary in the case of ICSs, that the main contractor educates subcontractors for more efficient utilisation in the future, something that is stated necessary by respondents employed by the main contractor.

That HVAC installations, plumbing, and similar disciplines require more efficient coordination is something that respondents at the main contractor, as well as Ottosson (2012, p. 98-99) agree on. The main contractor also regularly uses installation coordinators and subcontractor coordinators according to the interviewees, which are tools established by Ottosson (2012, p. 103) and Olsson (1998) respectively, to have beneficial effects on subcontractor coordination. Coordination of subcontractors is evidently not new to the main contractor, who actively shows efforts to improve. Having specifically assigned personnel to both subcontractor and installation coordination is obviously effective and is something that should be prioritised in the future as well.

Regarding time schedule design, some interviewees state that subcontractors should be more involved. Also, it was established by some that it would be better if the time schedule was entirely designed by subcontractors due to lack of competence in the discipline within some main contractors. At the main contractor, design-build contracts are often used, which is stated by CIOB (2014, Table 3.07) to generally enable more input from subcontractors than with traditional contracts. The level of collaboration in design-build contracts can of course differ depending on who is in charge. However, a dialogue with subcontractors in early stages of

projects, on who should design or be involved in the time schedule preparations, could be valuable for document quality.

The main contractor, NCC, believes that partnering principles applied to procurement bring several benefits, including better price and quality of work. Kumaraswamy & Matthews (2000) confirm that good relationships make subcontractors lower their prices, as well as increase quality of work. The partnering principles of the procurement department are surely beneficial and should, if anything, be encouraged and developed further in the future.

5.2 Collaboration and coordination

Crucial factors for good collaboration are stated in the literature as communication, teamwork, and a positive attitude (Humphreys et al., 2003; Kumaraswamy & Matthews, 2000). Similar aspects were highlighted by many interviewees as required for good collaboration, while also stating that previous working experience with a counterpart often increased collaboration significantly and that even better communication was enabled through closer collaboration. Productivity increase could also be achieved through improved collaboration according to the interviews, which is confirmed by Humphreys et al. (2003) and Kumaraswamy & Matthews (2000). The authors also state that early involvement is an important factor to increase subcontractor collaboration as well as project understanding. To include subcontractors in the work is stated as important by main contractor respondents to simplify coordination. Similarly, subcontractors thought that competence utilisation was easier with closer collaboration and better communication. It is clear that both subcontractors and main contractors think that good collaboration is a big factor for successful projects. Communication is a key factor for good collaboration, and when good collaboration is established it can, in turn, improve communication even further.

Some of the interviewees point out that it is sometimes hard to discuss things with the main contractor. This possibly because of the hierarchy that has existed historically in the construction industry where main contractors could do as they pleased. In this context, humility is brought up by subcontractor respondents as an important aspect for good collaboration, however, it is not mentioned by main contractors. Adopting a more collaborative approach while demonstrating an openness for discussion could also prove economically beneficial for main contractors, as Kumaraswamy & Matthews (2000) found that if a subcontractor expected good collaboration in a project during tendering, prices could come down by 10 per cent.

The interviewees present many different opinions on why coordination is hard, and what problems are most vital. In larger projects, some interviewees express problems with too many involved parties to handle. Too many requests then become problematic when producing schedules or other documents under a deadline which is a tough problem to solve. This can be related to information management, and what Mak (2001) says about large information flows, suggesting the use of ICSs. However, it is also a question of who needs to be involved in what, as not all subcontractors can expect to have a say in every decision made in larger projects. Here, main contractor's insight in the subcontractor trades, and experience from earlier projects, is valuable to be able to include the right people in the right decisions.

According to Olsson (1998), demarcation lists should be used as a tool in coordination, for example during coordination meetings between subcontractors, discussing technical solutions, as well as a tool used to making sure that everyone knows their areas of responsibility at start

of construction. That issues regarding responsibility demarcations are common is highlighted by the interviewees, and it is also stated that the demarcation lists that are used are often hard to interpret or contain errors. Ottosson (2012) concludes that coordination is extra sensitive for electrical, HVAC and similar installations. The importance of correct and easy-to-interpret demarcation lists is therefore clear, as well as increased coordination specifically between subcontractors.

Interviewed subcontractors state that building sites that are unprepared for subcontractors are a problem that causes delays and frustration and suggest that this a consequence of poor coordination. Main contractor respondents on the other hand say that a common problem is subcontractors who lack managerial competence, causing the main contractor to be forced to step in to cover services already payed for. Olsson (1998) confirms the need for improved coordination by suggesting the use of a subcontractor coordinator, who assists the site manager in coordinating subcontractor activities. The need for improved coordination is clearly stated by both sides, however, the opinions on the reasons behind the lack of administrative competence vary. This proves the need for more knowledge and insight about each other's trades, and possibly that understanding the different parts of a project is a crucial part of coordination.

5.3 Information management

Distributing the correct information to the right person is a difficult part of communication according to the interviewees. A large number of people involved and much information to share make the problems even harder to solve say main contractor respondents. Important factors for improved communication efficiency are identified by the respondents as humility, clearly established information paths early in the projects, and appropriate information management through for example ICSs. Stewart (2007) realised that an easy-to-use interface of information systems was important and saw improvements in communication after implementing it. Mak (2001) confirms the importance of effective information management and concludes that the construction sector is generally slow to adapt to new technology that could help with complex issues as such. Instead, the author states, construction companies stick to outdated communication methods. The respondents confirm that old communication methods are still in use, and that they cause problems since a larger number of information sources, such as mail, telephone, and information systems, often aggravates information management. It is clear that the use of ICSs needs to improve to enable more efficient information management. However, interviewees highlight problems of competence as subcontractors need to adapt not only to one, but to several different systems due to working with different main contractors. The importance of efficient information management is obvious and many of the problems brought up demand much determination and work to solve. It is therefore not surprising that communication still is a large issue in construction, despite the high awareness, as there are so many involved parties to coordinate, inform and educate in the ICSs.

Oral agreements are still common in production according to a majority of the interviewees, but usage is declining. Potential positive outcomes of oral agreements are identified by the respondents as increased workflow, reduced production standstills and increase in trust, if done correctly. However, the oral agreements can often result in unnecessary discussions and disputes. These kinds of disagreements are confirmed by Merwin, Linley, & Steedman (2014),

who state that engaging in oral agreements as a subcontractor carries a risk of not getting paid, as main contractors often demand written proof of the settlement in the end. It is understandable that the number of oral agreements used in construction is declining, considering the risks they bring. There are however also risks with removing them completely, including delays caused by waiting for approval of a contract variation.

5.4 Meetings

The opinion on meetings between main contractor and subcontractors of the main contractor respondents, is that they act not only as a tool for coordination but are also an important instrument for improving collaboration and communication. Involvement of subcontractors in planning is also highlighted by the interviewees as a benefit that these meetings bring. The importance of subcontractor meetings is confirmed by Chang & Shen (2014) who found that progress meetings with subcontractors were regarded as the most effective coordination tool. Further, weekly meetings were generally regarded more effective than monthly. Foley & MacMillan (2004) established that during meetings for problem solving, there were also more lively discussion and integration compared to other types. It is clear that most parties consider progress meetings and meetings about urgent matters are most effective for coordination, while other meetings are not deemed unnecessary, but less important.

Regarding collaboration, it was established by the interviewees that subcontractors find it difficult to present their opinion to the main contractor and would like to see a humbler approach to discussion. Discussion during meetings should be encouraged according to subcontractor respondents, to more efficiently identify possible future problems. Gorse & Emmitt (2007) stated that understanding meeting dynamics is crucial for effective management. Further, Foley & MacMillan (2004) established that when a meeting is chaired by a few dominating interests, a result was in fact limited integration from the other participants and thereby reduced effectivity of the meeting. It is not surprising that a meeting where the chairman is more inclusive can encourage discussion. It is still, however, the general view of the asked subcontractors that main contractors take too much space in such circumstances and strong wills of managers could possibly prevent further development in areas such as collaboration.

Gorse & Emmitt (2007) established that the relatively short time of a project is not long enough to establish mature relationships, which makes teamwork harder and decision making less effective. The interviewees do not agree whether more meetings are needed or not and making meetings more efficient could be an acceptable way to go. However, more efficient meetings require better chairing of meetings which might not have an obvious solution. More efficient meetings could mean that attendees need to know each other well and have worked together before. For that to be the case, well established relationships need to be prioritised in the main contractor to subcontractor collaboration.

5.5 Time schedule

Deviation from the time schedule is something that all interviewees agree is common. It is also established by many interviewees that the time schedule often contains errors and is designed too theoretically with little consultation of production departments. The interviewees also state that the time schedules often lack detail and are therefore hard to interpret and follow, which is confirmed by Baldwin & Bordolli (2014, p. 261-262), who also say that the level of detail is dependent on the skill of the planner. One interviewee established that the person responsible

for planning might not know anything about building a house. It is clear that if that is the case, detail and quality of the time schedule will suffer. It was also stated by the interviewee that production often does not have time to check the time schedule for errors. It is surprising that time schedule design is not always given the highest priority in the planning phase, since all the interviewees agree that time schedules are very often flawed and lack detail, and have experienced the problems that can occur because of it.

The interviewees think main contractors need to consult the subcontractors more in the design of the time schedule, through for example earlier involvement. One interviewees also think that the main contractors should let the subcontractor design their own time schedule, without involvement of the main contractor. Baldwin & Bordolli (2014, p. 8) confirm the importance of basing the time schedule on the needs of involved actors and suggests main contractors ask for help from the subcontractor responsible for carrying out the work. Baldwin & Bordolli (2014, p. 261) also highlight the importance of a correct and detailed time schedule when assessing possible consequences of delays. Misinformation gathered from time schedules could prove devastating for quality of decisions made on what actions should be taken to mitigate the damage, according to the authors. That more focus and expertise need to be put into time schedule design seems like the unanimous opinion, however, there are some issues to be solved. In order to consult the correct people in the time schedule design process, both coordination and priorities need to improve and be revised, possibly through change of tasks for existing staff or employing new personnel assigned specifically to time schedule design. This is a process that could require much effort and resources to make efficient, while also requiring a degree of flexibility because of the project-based nature of the business. Every project is different in terms of who needs to be involved where, which can prove challenging and could prevent a standardised process being implemented.

5.6 Contractual documents

It is established by the interviewees that building documents are often inaccurate. Long time between contract signing and assembly, as well as tendering documents that lack sufficient information, are both reasons for poor building document quality mentioned by the respondents. The shortage of information is often due to many client requests according to a respondent, which is confirmed by Ottosson (2012, p. 103). While client wishes and requests should not be disregarded, it might be required in some cases to limit the number of requests in order to ensure project progress. Freezing building documents, as suggested by Ottosson (2012, p. 98-99), could be a solution, but could perhaps be regarded as exclusion of the client. It seems like correctness and approval of contractual documents should be established as early as possible in the project, to limit changes and requests. This would surely mean that longer planning time is required, which of course is costly but might pay off if the goal of little to no contract changes is accomplished.

Ottosson (2012, p. 98-99) highlights that especially regarding complex installations, which are a sensitive part of planning, project managers should consult subcontractors about correctness of building documents. The interviewees agree, with some stating that it is the subcontractor or assembler who should design the building documents to ensure their quality, but also highlight that coordination required for that is complex and hard to make work. Ottosson (2012, p. 103) suggests the use of building PMs to help with coordination of complex installations, where specific information about installations and building site preparations is gathered and made

available to affected parties. That complex installations need extra effort put into coordination is not surprising. Neither is the fact that it has been found to be efficient with an employee assigned to that specific task. Good coordination of installation subcontractors is surely beneficial, not only for quality of work and timely finishes, but also for happiness and contentedness of involved subcontractors.

Semple et al. (1994) establish that a way of reducing claims made by subcontractors is to ensure buildability of drawings in several stages of a project. This is done by making sure that project planners have enough time to complete them. However, Ottosson (2012, p. 103) states that the many changes made to the building documents during construction because of requests by clients and subcontractors is a problem for correctness of building documents. One interviewee says that to improve quality of building documents and to ensure that they are designed with subcontractor desires in mind, it is a good idea for assemblers from the subcontractor to attend contract signings, where building documents are reviewed. Some interviewees state that the use of 3D drawings is key for ensuring correctness of the contractual documents. If the number of requests for changes could be limited, it is clear that many processes would flow smoother and with less interruptions. Perhaps 3D drawings could be used for not only ensuring drawing correctness, but also for presenting designs and solutions to clients before change requests are made.

5.7 Understanding contracts

It is stated by several of the interviewees that contract understanding is crucial, both for main contractors and subcontractors, to reduce the number of deviations from the contract. Misunderstandings of the contracts are common according to the respondents and are claimed to be caused by lack of competence of the contract reader. This is confirmed by Gaber et al. (2010) as well as Mohamad Ibrahim & Madon (2006). Some of the interviewees feel that it is a good idea to include production staff in contract reading processes, which become a kind of lessons-learned process and will extract several different viewpoints. However, not everyone of the respondents agrees with this, and one states that production staff rarely are interested in legal documents at all and should therefore not be included in the briefings. Mohamad Ibrahim & Madon (2006) state that experience, educational background, and attitude especially is vital for how well contracts are understood by different employees. It is interesting that while most interviewees, as well as authors, agree that experience plays an important role in contract understanding, there are still no clear routines or guidelines in place that ensure that production employees attend contract readings and discussions. It is also worth noting that while it is stated in literature that attitude towards reading the contracts is among the highest influencing aspects of understanding them, the contract reading process still seems to be assigned low priority in many cases, especially for production employees.

Contracts often include many legal documents, say some of the interviewees. This is confirmed by Mohamad Ibrahim & Madon (2006) who also established that language of the contracts need to be clearer, and less legal phrases should be used in general, to encourage contract understanding. Interviewed subcontractors think that contracts are often too complex and hard to understand for employees in production, which results in misinterpretations of the contract agreements. Chong & Zin (2008) and Gaber et al. (2010) confirm this, and the latter authors state that parties' obligations, such as for example coordination responsibilities, are often only vaguely described in the contracts, which makes misunderstandings plausible.

Misunderstandings of the contract will in turn often cause workflow disruptions and poor project delivery according to the authors, who suggests that contract reading workshops should be held in the beginning of projects to improve contract understanding. While involvement of production in contract reading is established above as a vital part of a successful projects, it is of little value if the contracts are too hard to comprehend. It seems obvious that parts of contracts intended for production employees should be adapted to the reader, both in terms of content and language used. Standardisation of contracts is considered by Gaber et al. (2010) to have a negative impact on the comprehensibility of contracts, and perhaps standardised contracts should be used for legal matters, while customised contracts and documents should be implemented for use in production.

5.8 Competence

It is the general understanding of interviewees that subcontractors need to be involved early in projects, in order to efficiently utilise project competencies. This is confirmed by Humphreys et al. (2003). However, it was found by Akintan & Morledge (2013) that supposed insufficient management skills of subcontractors could prevent main contractors from consulting them in decisions, despite availability to do so. It is therefore not only a problem of when subcontractors are involved in projects, but also how. If main contractors lack faith in a procured subcontractor, available competence might go unused and the project might suffer which is of course suboptimal. Relationships established during longer periods of time and possibly several different projects, could be a solution to the problem. Closer relationships should increase knowledge of each other's strengths, as well as weaknesses, which in turn could make competence utilisation easier and more effective. The assumption is therefore that although early involvement of subcontractors is established, other aspects also need to fall into place to enable optimal competence utilisation of subcontractors for main contractors.

That small companies struggle more with administrative tasks than larger companies due to less resources was stated by most interviewees. Maturana et al. (2007) similarly concluded that smaller companies often need help from main contractors with tasks, due to less available resources and knowledge. Smaller companies might therefore require support from main contractors with administrative tasks related to progress, such as coordination and planning, for the project to run smoothly. As established earlier, HVAC installations and similar might need more careful planning than other disciplines due to complexity, which implies that small HVAC companies could need extra help with administration. Nevertheless, it is stated by some interviewees that main contractors do not always possess the competence to manage subcontractor installations either, which makes for a general lack of competence in installation coordination in those circumstances. Competence in those cases could instead be acquired from consultants specialised in the area.

5.9 Trust

A majority of the interviewees agree that trust is important and is beneficial for a number of aspects, such as communication, coordination, knowledge sharing, and reduction of arguments and monitoring. The importance of trust is confirmed by Humphreys et al. (2003) who state that trust is a key factor for improving main contractor-subcontractor relationships and employing partnering principles. There is no doubt that trust is considered a very important aspect of collaboration and project success by the interviewees, as well as in literature. The interviewees

conclude that ways to increase trust between parties are good communication and a history of successful project collaborations.

It was stated by some of the interviewees that price and trust are correlated, and that while some subcontractors prioritise building trust toward the main contractor through collaboration and mutual compromises, others might rather focus mainly on getting paid. Kumaraswamy & Matthews (2000) state that the main contractor might sometimes doubt if subcontractors give reasonable prices, due to bad previous experiences. On the other hand, Dainty et al. (2001) state that if subcontractors do not receive payment on time, trust could decrease. In conclusion, trust regarding to price is a two-sided affair, where both parties need to trust each other for effective collaboration to be possible. If one part does not trust the other, mistrust might quickly spread, resulting in a decrease of trust and all benefits that comes with. It is difficult to pinpoint a specific solution in cases like this, other than stating that trust is built over time and that improved relationships must be established through working together. Relationship ranging over more than one project and longer periods of time, could perhaps be the solution if problems with payment and trust are often encountered. Competitive bidding processes might negatively affect trust between main contractors and subcontractors say Fulford & Standing (2014) and Hartmann & Caerteling (2010). The latter study highlights that although main contractors recognise the benefits of subcontractor collaborations over extended periods of time, they still want competitive bidding to ensure market prices. To handle this, contracts used in possible extended collaborations could include clauses to ensure market prices from the subcontractor. Even if there is no such clause, increased trust in such agreements could possibly outweigh the higher price of the deal.

6 Conclusion

The aim of our report was to study the reasons why administrative contract discrepancies between main contractor and HVAC and plumbing subcontractors occur. The aim also was to analyse how the collaboration and work procedures, as well as organisational structure, between main contractor and subcontractor can be improved to reduce administrative contract discrepancies. The conclusions of this report are presented in this chapter, as well as recommendations on further research. The relatively wide research questions of this report made it necessary to cover many different topics in the literature review and some of the topics were found to not have been researched much before this report.

In general, early involvement of subcontractors is concluded to be a key factor for effective collaboration and coordination, and especially in processes of designing time schedules and contractual documents. That communication, including transparency and openness for discussions, are important aspects for collaboration can also be concluded through this report. When possible, main contractors and subcontractors are recommended to engage in relationships that stretch over more than one project, as longer time in relationships has been suggested to increase trust, collaboration, and communication efficiency.

Knowledge and insight in the trades of project participants, for both main contractors and subcontractors, need to improve to increase coordination efficiency, and open discussion during meetings between main contractors and subcontractors should be encouraged by both parties. Both main contractors and subcontractors should increase the priority of reading and understanding the contracts through new contract reading routines. It is also recommended for both main contractors and subcontractors to revise their contract handover processes, from procurement departments or equivalent, to production. This to ensure that relevant information reaches production employees after the signing of a contract.

Main contractors are recommended to implement ICSs and specifically to ensure an easy-to-use interface of those systems. It is also recommended for main contractors to educate subcontractor employees as well as own employees in using such systems, for efficient utilisation. Further, main contractors are encouraged to employ installation coordinators in projects with complex installations and in projects where problems with installations can be expected for other reasons. Main contractors are also recommended to revise standardised contracts, especially those that are read by employees in production, to ensure that they are easier to understand and that they only contain information relevant to the reader.

Subcontractors are recommended to be transparent in their communication with the main contractor, both regarding project specific issues but also regarding collaboration and relationship statuses. In particular, subcontractors should make sure they understand responsibility demarcations before start of construction, as these demarcations have been shown in this study to be a common cause for deviations and unnecessary discussion. Further, smaller subcontractor companies should ask for support from main contractors when experiencing problems with administration.

Further research is recommended about how contracts can be designed to encourage understanding. Currently, little research has been done on contract clarity, an aspect of contracts which through this report can be established as a common problem for both main contractors and subcontractors. Further research should also be carried out on how to efficiently hand over

contracts from procurement departments to production, without losing vital information in the process.

The processes of drawing up building documents, as well as time schedules, have also been researched little previously, despite the common issues related to both documents. New research should be carried out in those areas, with the purpose of establishing an optimal, or at least better, draw up process.

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APPENDICES

Appendix 1. Interview questions for subcontractors

Initial questions

1. What are typical discrepancies for projects you have participated in?
    a. Deviations from time schedule
    b. Deviations in agreed areas of responsibility, for example in management
    c. Changes of technical building details that await approval
    d. Deficits in information flows
    e. Underutilised internal competence
    f. Other
2. What are the main reasons behind contract discrepancies in a project?
    a. Poor communication internally and externally
    b. Lack of competence or resources of subcontractors, because of company size
    c. Misinterpretations of contracts because companies have disregarded some details
    d. Other
3. What are the benefits of having close collaboration between main contractor and subcontractor?
    a. Fewer misunderstandings and discrepancies
    b. Increased efficiency
    c. Increased trust
    d. Other

Communication questions

4. What are important qualities for main contractors to have to enable effective communication?
    a. Understanding of difficulties in your trade
    b. To have employees with experience of working as a subcontractor
    c. Good information paths within the main contractor organisation after contract signing
    d. Other
5. How do you think contract and post-contract phases can be changed to increase communication efficiency?
    a. More meetings, for example start-up meetings
    b. Simplified building documents that are easier to understand
    c. More detailed documents
    d. Other
6. Would more building document briefings at the construction site mean fewer contract discrepancies?
    a. Do you think meetings held closer to start of construction would facilitate this?
    b. Other
7. Who reads contract documents in your company?

    a. Does the contract reader attend construction meetings, for example in start-up meetings and follow-up meetings?
    b. Do assemblers/installers participate when establishing contracts?
    c. How does the information flow look between sales and production in your company?
8. How do you think internal competence in your company can be utilised better during procurement?
    a. Assemblers attending contract signings
    b. Other
9. Are oral agreements common during contract negotiations?
    a. What are positive sides of oral agreements?
    b. What are negative sides of oral agreements?
    c. Other

Trust questions

10. If you think trust between the main contractor and your company is important, how would you say trust can be increased?
11. How much would you say that trust influences communication internally and externally?
12. Do complex services require more trust towards the main contractor?
13. Is there any difference in trust if the main contractor has hired you many times before, or if it is the first time?

Completive questions

14. How much do you think that problems with administrative discrepancies are affected depending on if the main contractor is a large or small company?
15. How can you notice that employees (for example new foremen) of the main contractor has understood the contract requirements set by his/her company and that they have the administrative skill required to lead the work?

Swedish below

Inledande frågor

1. Vad kan vara typiska avvikelser för projekt Du har medverkat i?
    a. Avvikelser från tidsplan
    b. Avvikelser i fråga om överenskomna ansvarsområden, till exempel arbetsledning
    c. Ändringar av byggtekniska detaljer som väntar på godkännande.
    d. Brister i informationsflöden
    e. Outnyttjad kompetens internt
    f. Övrigt
2. Vilka är huvudorsakerna till avvikelser från kontrakt i ett projekt?
    a. Dålig kommunikation internt och externt
    b. Brist på kompetens eller tillgångar hos UE, beroende på företagsstorlek

    c. Feltolkningar av kontrakt beroende på att företaget inte tagit hänsyn till alla detaljer
    d. Övrigt
3. Vad är fördelarna med att ha ett nära samarbete mellan huvudentreprenör och underentreprenör?
    a. Färre missuppfattningar och avvikelser
    b. Högre effektivitet
    c. Högre tillit
    d. Övrigt

Kommunikationsfrågor

4. Vilka egenskaper är viktiga för huvudentreprenörer att ha för att göra effektiv kommunikation möjlig?
    a. Förståelse för vilka svårigheter som finns i er bransch
    b. Att ha anställda som har erfarenhet från arbete som UE
    c. Bra kommunikationsvägar internt hos huvudentreprenör efter avtalsskrivning
    d. Övrigt
5. Hur tror Du att kontrakts- och efterkontraktsfaser kan förändras för att öka kommunikationens effektivitet?
    a. Fler möten, till exempel startmöten
    b. Förenklade bygghandlingar som är lättare att förstå
    c. Mer detaljerade handlingar
    d. Övrigt
6. Skulle fler genomgångar av bygghandlingarna på byggarbetsplatsen innebära färre avvikelser från kontraktet?
    a. Tror Du att möten närmre inpå montering/installation skulle underlätta detta
    b. Övrigt
7. Vem eller vilka läser kontraktshandlingarna i ert företag?
    a. Är kontraktsläsaren ute i produktionen, till exempel vid startmöten, uppföljningsmöten?
    b. Är montörer/installatörer med i upprättandet av kontrakten?
    c. Hur ser informationsflödet ut mellan försäljning och produktion i ert företag?
    d. Övrigt
8. Hur tror Du intern kompetens hos er skulle kunna användas bättre vid upphandlingar?
    a. Montörer med på kontraktsskrivning
    b. Övrigt
9. Är muntliga överenskommelser vanligt förekommande i kontraktsförhandlingar?
    a. Vad ser Du för nackdelar med muntliga överenskommelser?
    b. Vad ser Du för fördelar med muntliga överenskommelser?
    c. Övrigt?

Tillitsfrågor

10. Om Du tycker att tillit mellan huvudentreprenören och ert företag är viktigt, på vilka sätt skulle Du då säga att den tilliten kan ökas?
11. Hur mycket skulle Du säga att tillit påverkar kommunikation internt och externt?
12. Kräver komplexa tjänster högre tillit till huvudentreprenören?
13. Innebär det någon skillnad i tillit om huvudentreprenören har anlitat er flera gånger eller om det är första gången?

Avslutande frågor

14. Hur mycket tror Du det påverkar problem med administrativa avvikelser om huvudentreprenören är ett stort eller litet företag?
15. Hur kan Du se att anställda (till exempel nya arbetsledare) hos huvudentreprenören har förstått kontraktskraven som har ställts av det egna företaget, och att de har den administrativa förmåga som krävs för att leda arbete?

Appendix 2. Interview questions for NCC

Initial questions

1. What are typical discrepancies for projects you have participated in?
    a. Deviations from time schedule
    b. Deviations in agreed areas of responsibility, for example in management
    c. Changes of technical building details that await approval
    d. Deficits in information flows
    e. Underutilised internal competence
    f. Other
2. What are the main reasons behind contract discrepancies in a project?
    a. Poor communication internally and externally
    b. Lack of competence or resources of subcontractors, because of company size
    c. Misinterpretations of contracts because companies have disregarded some details
    d. Other
3. What are the benefits of having close collaboration between main contractor and subcontractor?
    a. Fewer misunderstandings and discrepancies
    b. Increased efficiency
    c. Increased trust
    d. Other

Communication questions

4. What are important qualities for subcontractors to have to enable effective communication?

    a. Understanding of difficulties in your trade
    b. To have employees with experience of working as a main contractor
    c. Good information paths within the subcontractor organisation
    d. Other
5. How do you think contract and post-contract phases can be changed to increase communication efficiency?
    a. More meetings, for example start-ups meetings
    b. Simplified building documents that are easier to understand
    c. More detailed documents
    d. Other
6. Would more building document briefings at the construction site mean fewer contract discrepancies?
    a. Do you think meetings held closer to start of construction would facilitate this?
    b. Other
7. Who reads contract documents in your company?
    a. Does the contract reader attend construction meetings, for example in start-up meetings and follow-up meetings?
    b. Do assemblers/installers (from the subcontractor) participate when establishing contracts?
    c. How does the information flow look between sales and production in your company?
8. How do you think internal competence at NCC can be utilised better during procurement?
    a. Staff with experience working with the subcontractor is consulted
    b. Other
9. Are oral agreements common during contract negotiations?
    a. What are positive sides of oral agreements?
    b. What are negative sides of oral agreements?
    c. Other

Trust questions

10. If you think trust between NCC and subcontractors is important, how would you say trust can be increased?
11. How much would you say that trust influences communication internally and externally?
12. Do complex services require more trust towards the main contractor?
13. Is there any difference in trust if the main contractor has hired you many times before, or if it is the first time?

Completive questions

14. How much do you think that problems with administrative discrepancies are affected depending on if the main contractor is a large or small company?
15. How can you ensure that employees of the subcontractor have understood the contract requirements and that they have the administrative skill required to lead the work?

Swedish below

Inledande frågor

1. Vad kan vara typiska avvikelser för projekt Du har medverkat i?
    a. Avvikelser från tidsplan
    b. Avvikelser i fråga om överenskomna ansvarsområden, till exempel arbetsledning
    c. Ändringar av byggtekniska detaljer som väntar på godkännande
    d. Brister i informationsflöden
    e. Outnyttjad kompetens internt
    f. Övrigt
2. Vilka är huvudorsakerna till avvikelser från kontrakt i ett projekt?
    a. Dålig kommunikation internt och externt
    b. Brist på kompetens eller tillgångar hos UE, beroende på företagsstorlek
    c. Feltolkningar av kontrakt beroende på att företaget inte tagit hänsyn till alla detaljer
    d. Övrigt
3. Vad är fördelarna med att ha ett nära samarbete mellan huvudentreprenör och underentreprenör?
    a. Färre missuppfattningar och avvikelser
    b. Högre effektivitet
    c. Högre tillit
    d. Övrigt

Kommunikationsfrågor

4. Vilka egenskaper är viktiga för underentreprenörer att ha för att göra effektiv kommunikation möjlig?
    a. Förståelse för vilka svårigheter som finns i er bransch
    b. Att ha anställda som har erfarenhet från arbete som huvudentreprenör
    c. Bra kommunikationsvägar internt hos underentreprenör
    d. Övrigt
5. Hur tror Du kontrakts- och efterkontraktsfaser kan förändras för att öka kommunikationens effektivitet?
    a. Fler möten, till exempel startmöten
    b. Förenklade bygghandlingar som är lättare att förstå
    c. Mer detaljerade handlingar
    d. Övrigt
6. Skulle fler genomgångar av bygghandlingarna på byggarbetsplatsen innebära färre avvikelser från kontraktet?
    a. Tror Du att möten närmre inpå montering/installation skulle underlätta detta?
    b. Övrigt
7. Vem eller vilka läser kontraktshandlingarna i ert företag på arbetsplatsen?
    a. Är kontraktsläsaren på ute i produktionen, till exempel vid startmöten,

uppföljningsmöten?
   b. Är montörer/installatörer (hos UE) med i upprättandet av kontrakten?
   c. Hur ser informationsflödet ut mellan inköp och produktion i ert företag?
   d. Övrigt
8. Hur tror Du intern kompetens hos NCC skulle kunna användas bättre vid upphandlingar?
   a. Personer med erfarenhet av affärer med UE konsulteras
   b. Övrigt
9. Är muntliga överenskommelser vanligt förekommande i kontraktsförhandlingar?
   a. Vad ser Du för nackdelar muntliga överenskommelser?
   b. Vad ser Du för fördelar med muntliga överenskommelser?
   c. Övrigt

Tillitsfrågor

10. Om Du tycker att tillit mellan NCC och UE är viktigt, på vilka sätt skulle Du då säga att den tilliten kan ökas?
11. Hur mycket skulle Du säga att tillit påverkar kommunikation internt och externt?
12. Kräver komplexa tjänster högre tillit till UE?
13. Innebär det någon skillnad i tillit om det är en UE som ni anlitat flera gånger eller om det är en ni anlitar första gången?

Avslutande frågor

14. Hur mycket tror Du det påverkar problem med administrativa avvikelser om huvudentreprenören är ett stort eller litet företag?
15. Hur kan Du säkerställa att anställda hos underentreprenören har förstått kontraktsenliga krav som har ställts på dem och att de har den administrativa förmågan som krävs för att leda arbete?

DEPARTMENT OF TECHNOLOGY MANAGEMEN AND ECONOMIC
Division of Service Management and Logistics
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden
www.chalmers.se

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