Stories from construction inspections

A case study of the challenges in the inspection process at a major construction company in Sweden

Master of science thesis in the master programme:
Design and Construction Project Management

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Abstract

This report, focusing on the Gothenburg region, maps the inspections process in a large construction company. Through an inductive and qualitative study, the employee's perspective and opinions on the process is described, as well as their views on where the issues in the process lies and why they arise. The report identifies the various success factors for the inspections process and offers suggestions of process improvements based on observed best practices and theoretical analyses.

Inspections in the case company are not a well-documented process, but nonetheless, the employees are familiar with it though learning by doing. It is however not only the inspection process in the case company that is poorly documented. In general, it is difficult to find documentation about how an inspection process is conducted practically, why this report offers a detailed description of how the inspection process is performed.

The inspection process is common practice in all construction companies in Sweden, and can be derived from the standard contracts used in the industry, AB 04 and ABT 06. The inspections serve as a quality control by which both the client and the contractor can get an objective judgement, by an inspector, on whether or not the contract between the has been fulfilled. This report can conclude that even though the inspectors are supposed to be objective, this is hard in practice, why the inspections become a situation of give and take.

From the empirical study, we could conclude that even though there are many things working well in the inspection process in the studied company, we could identify twenty challenges. These twenty challenges can be categorized under five symptoms: time, quality, motivation, trust and communication. By analyzing the challenges and symptoms from a theoretical perspective this report brings best practice and theory together and presents actions that the case company can implement to improve the inspection process.

Keywords: *Construction inspection, project management, stakeholder management, stakeholder salience, project success, success factors*

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Preface

This thesis was written in collaboration between the two of us, Dandanelle and Tomasson, with the help from the case company and Chalmers University of Technology. It was written in the spring of 2018 at the department of Construction Management at Chalmers, Gothenburg. We started to discuss potential subjects for this master thesis already in the spring of 2017 when we decided to work together, but it was not until the autumn of 2017, after Dandanelle had worked during the summer for the case company, that we decided that the inspection process would be a suitable subject. Dandanelles site manager, Christiansen, had expressed how he thought the inspections would be an interesting subject and how the process was susceptible for improvements. The research period started in the autumn with a site visit at Project A as to get a first insight into the inspection process. Then there was a break until the end of January 2018 when the work with the thesis formally resumed at Chalmers.

We would like to thank everyone at the case company who took their time and helped with the completing of the research. A big thank you also to everyone who have been a part of and who have supported the study, from professionals to close friends. Thank you Martine Buser, who served as our supervisor at Chalmers, for guiding us through the thesis. Lastly, Fredrik Christiansen, our supervisor at the case company, deserves a special thanks for being as enthusiastic about the subject as we and for reading all our drafts we sent him at strange hours.

Gothenburg May 2018

Karin Dandanelle and Martin Tomasson

1. Introduction

The construction industry is a complex industry with a lot of actors, from consultants and architects to subcontractors and suppliers. When comparing the construction industry to the consumer price index (CPI) in Sweden it shows that construction has become more expensive over the last 20 years (Josephson and Saukkoriipi, 2009). Already in 1986 Tucker argued that the productivity of the construction industry had declined for ten years. One of the more prominent authors on the Swedish construction industry was Per-Erik Josephson who produced a large quantity on the subject. He studied, amongst others, the subject of efficiency, waste and defects. In a report from 2005, Josephson estimated the waste in the construction industry to be in around 30-35 percent. The number can be broken down into four subcategories, where one of them is defects and controls, which stands for ten percent. Another category is the systems and structures, where one main issue is the handling of documents, which stands for five percent. Tucker (1986) argues that in order to improve productivity in the construction industry the management must be improved. He emphasizes that resources must be invested in management areas such as: planning, client involvement, communication, e.g.

In Sweden, it is common practice to use inspections in the final stage of construction as a quality control to clarify whether or not the contractor has delivered the right product with the right quality to the client. During the inspections, faults and defects are looked for. In a report published by Boverket in 2007, it was estimated that construction companies, building residential in the region of Skåne, spend fifteen percent of their working hours working with defects and shortcomings on already handed over projects. This time, amongst others, refers to work concerning remediation of defects remaining from the final inspection. The report also suggests that the period of remediation of defects is a bigger problem than the actual defects, indicating that there are severe shortcomings in the inspection process. Boverket (2007) also implies that the managerial questions are of highest importance for the problem.

From a report by Forcada et al (2016), we could conclude that the same problems that exists in Sweden, regarding defects in housing, also exists in Barcelona. This gives an indication that problems with inspections as a quality control and post handover work on construction is an international issue.

1.1. Purpose and goal

A purpose of this report has been to, without presumptions, examine the inspection process in the case company in order to find out where the employees experience shortcomings in the process. We have also set out four goals for the study. Firstly, a goal has been to give a real and fair description of the process from the perspective of the company. Secondly, an aim has been to analyze and understand the shortcomings through a theoretical framework, resulting in recommendations to make the process more successful. Thirdly, we hope that these recommendations will be of value to the company and to those who read the report. Lastly, a

goal has been to give a contribution to the academia of project management by presenting new research in an area which has not yet been academically well-documented, namely construction inspections in Sweden.

1.2. Problem formulation

During the fall of 2017, representatives from the case company expressed that there was room for improvement in their inspection process. After realizing that there was little research addressing the inspection process in the construction industry, we decided to investigate the process from an academic perspective. The research questions in this study have been:

Main question:
- *How is the inspection process conducted in the case company and what are the employees' evaluation on it?*

Sub-questions:
- *What characterizes a successful inspection process according to the employees?*
- *What challenges/issues exist in the inspection process?*
- *How can the inspections process become more successful?*

By analyzing the inspection process from a project management framework we hope to get a better understanding of the process. By going deeper into stakeholder management we also hope to understand how and why the case company interact with the different actors in the inspection process the way they do.

Scope

The research is limited to the inspection process of the case company, their commercial and housing department and projects in the Gothenburg region. It mainly considers the perspective of the employees of the case company, with only few exceptions. The study addresses the part of the inspection process that occurs during the production phase of construction and excludes thereby for example warranty inspections.

1.3. Background of the case company

The studied construction company is one of the major actors in the Swedish and Scandinavian market. The company works in most submarkets of construction. It was founded in the mid 20th century, have an estimated of 15 000 employees in total and their turnover is about 50 billion SEK (company website). They work with all sizes of projects, from small playgrounds to large arenas, most of which requires inspections.

1.4. Relations to the case company

The two authors have different relations to the company. Dandanelle have since the summer of 2017 been employed by at the commercial construction department. Until the end of 2017 she did an internship in Project B. The data presented about Project B comes from her

working there. She can therefore be regarded to have good insight into the company and be integrated with culture. Tomasson on the other hand have not been previously involved with the company.

1.5. Division of report

The report has been structured much the same way the research was conducted.

Introduction
> the background and the conditions for the report is presented.

Method
> a description of how the study was conducted.

Inspections in construction
> background research to inspections are presented.

Findings (result)
> the result of the empirical study is presented. This chapter answers the main research question regarding how inspections are conducted in the case company and also the two first sub-question regarding what characterizes a successful inspection process and what challenges exist in the process.

Theoretical framework
> the theoretical framework is presented.

Stakeholder analysis
> an stakeholder analysis of stakeholders in the inspection process is presented.

Discussion and Analysis
> the empirical result is discussed and analyzed with help from the theoretical framework and the stakeholder analysis. This chapter discuss the sub-question about how the inspection process can be improved.

Conclusion
> the conclusions of the study are presented. This chapter answers the last sub-question regarding the improvement of the inspection process.

2. Method

In an inductive and qualitative study, consisting of interviews and site visits, the construction inspection process of a case company has been studied, described, discussed and analyzed for potential improvements. The study was conducted from October 2017 until June 2018. It is important to note that the inductive nature of the study have permeated the research. Theoretical models were used to understand the inspection process on different levels. The study is arguably a case study, an approach which Crowe et al. (2011) describes as: useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context. This chapter describes how the research was conducted and what tools and techniques that were used. The chapter is divided after the different parts of the inductive research process as can be seen in the picture below (Figure 1).
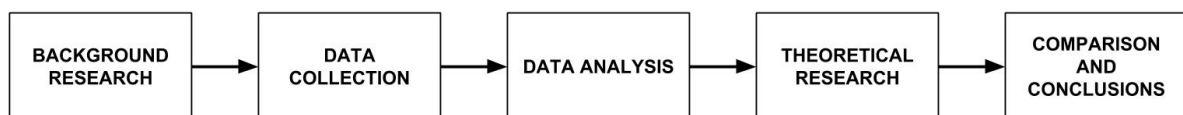
Figure 1: *The image depicts the inductive research process used in this thesis.*

2.1. Background research

To get an overview of the subject of inspections in construction, background research was conducted. The research focused mainly on the legal aspects of inspection, derived from the standard contracts. The purpose of the background is to give a frame of reference to what inspections in construction is about, where they originated from and what governs them.

2.2. Data collection

The empirical research was conducted from October 2017 until March 2018. The data was collected through two main ways; interviews and site visits. The interviews were held with employees of the case company and one inspector working for an external consultancy company. The interviews were scheduled in February and March 2018. The site visits meant visiting a construction site and participating in an inspection. In total, the study involved fourteen interviews, five site visits and six projects. The participants are presented in Table 1 and the projects in Table 2. During the site visits we meet over 75 people who more or less contributed to the data, some through small talk while others where only observed. During the site visits we spent a lot of time with subcontractors, inspectors and assistant inspectors, who contributed with a lot of material and insight. Apart from conversation and observations, documents from all projects visited where gathered as data. The documents were used as supporting data especially concerning hard facts. These data sources combined, resulted in a triangulation of the findings which strengthens the result.

Participants in the study	Participants in interviews
5 Head inspectors	*1 Head inspector*
12 Assistant inspector	*-*
8 Site managers	*7 Site managers*
9 Foreman	*2 Foreman*
1 Group manager	*-*
3 Clients	*1 Client*
1 Construction manager	*-*
10 Subcontractors	*-*
11 Pairs of buyers	*-*
1 Construction engineer	*-*
1 Planner	*1 Planner*
1 installation coordinator	*1 Installation coordinator*
1 BIM- coordinator	*1 BIM- coordinator*
Tot: 75 people	**Tot: 14 people**

Table 1: *A list of all people involved in the study*

Project	Type of project
Project A	*Industrial shop*
Project B	*Industrial building and office*
Project C	*School for the municipality*
Project D	*Condominiums*
Project E	*Condominiums*
Project F	*Rental apartments*
Tot: 6 projects	

Table 2: *A list of all the projects involved in the study.*

2.2.1. Interviews

All, except one, of the interviews were held at the construction sites of the case company, with no one present but us and the interviewee. The interviewees were chosen through what best can be described as purposeful sampling, meaning they were chosen because they had knowledge about inspections. Everyone we got in contact with had a positive attitude regarding the research and tried to contribute and help in any way they could. To start with it had not been decided how many interviews were going to be held, instead it was decided to keep interviewing until the data was saturated. Our initial intentions were to only interview site managers but as the study grew we decided to interview as many different professionals we had time for. For many groups there was only one or two persons represented why the

material cannot be considered saturated, but instead had the purpose of giving a new perspective (Kvale, 2014). For the site managers on the other hand we kept interviewing until we felt the interviews did not give us any new insights. The interviews varied in time between twenty minutes to one hour deepening on the interviewee. If the interviewee was talkative and had a lot to say about the subject, the interview took longer. To give structure to the interviews, which can be considered semi-structured, questions where prepared, which can be found in the appendix (appendix I). These questions were not sent to the interviewees in advance. Examples of questions asked were:

"Can you describe the inspections process, what are the parts included?"

"If you had to pinpoint a specific part of the inspections process that you think could be improved what would that be?"

"Is there anything else concerning the inspection process that you think we should know that we have not already asked about or discussed?"

The order of the question had no meaning since the researcher wanted to have a good flow in the dialogue which were full of small talk. It must be noted that the questions found in the appendix was a living document that changed after every interview as the interviewers got better on interviewing and got a better understanding of the inspection process. A downside of this was that, since the questions asked were different for different interviewee, the number of people having similar experiences can be greater than what is presented in this study simply because some was never asked the question. The purpose of the interviews was to understand what the inspection process actually looks like in the case company. During the interviews, notes where taken and the interviews were recorded, audio only. After each interview the researchers listened to the recording and wrote a summary which can be considered refined data.

2.2.2. Site visits
All site visits were participations in inspections. The sites to visit was selected through conversation with site managers and group managers at the case company. The choice mainly depended on which sites that had inspection during the studied period. After the first interviews the researchers had gotten the feeling that the inspection process might look different in different departments why it was chosen to visit projects from both the commercial department and housing. The projects visited resided in the municipality of Gothenburg, Kungsbacka and Stenungsund. Gold (1958) describes four stages of participant research: complete observer, observer as participant, participant as observer and complete participant. We place ourselves in the third stage, participant as observer.

We usually arrived at site half an hour before the inspection started, to be part of the small talk between the inspectors and the people on site. The inspections varied in time from half a day to several days. The site visits were documented through photos and notes. The data from the inspections is mainly made up from impressions and experience the researcher had, but

also the documents which were acquired during and after the inspections. These documents are for example inspections protocols and schedules over the final stage.

2.3. Data analysis

As the last part of the empirical research, the collected data was analyzed and reorganized. Georgiou (2010) argues that in order for conclusions to be drawn from data it sometimes has to be reorganized. The data to be reorganized was the recorded interviews, the summaries, the collected documents, the notes from the site visits and the impressions and experiences we had. The result of the data analysis is a story depicting the complexity of the inspection process. The first outline of the story was drafted through the data found in the interview summaries. Through this draft headlines could be derived. The story was then expanded with the data from the site visits. In retrospective the data used most from the inspections was predominantly memories the researcher had.

After the first part of the empirical study had been conducted we realized that we wanted material regarding perceived success in the inspection process. In order to obtain the data needed, a complementary question regarding success was sent out to all, except one, interviewees working for the case company. The participants were asked to spontaneously answer what characterizes a successful inspection process. Ten out of twelve interviewees answered the question. The answers from the survey was compiled as the last part of the empirical results called *A successful inspection process*.

2.4. Theoretical research

The theoretical research was conducted from February 2018 until May 2018. In order to cover most of the issues, we uncovered in our empirical research we choose to carry a broad theoretical research. We started looking at Project Management and the Project Management Body Of Knowledge (PMBOK) was used as an outline for the research, especially the knowledge areas presented. To get even deeper, we decided to focus on stakeholder management as we hoped it would help us understand the major issues of the inspection process better.

To start the theoretical research, a literature search was conducted. The following search engines were used:

- *Google search engine and Google scholar*
- *Chalmers library (a collection of data bases)*
- *Web of science*

An estimate of fifty articles under the subject of *stakeholder management, stakeholder salience, construction stakeholders, quality management, construction processes, project success*, etc. was studied as well as the PMBOK. After the literature research the most, from our perspective, appropriate models were selected and combined into the theoretical

framework used to analyse our empirical results. The selection was based on how other researchers had worked with the models and how they evaluated them.

2.5. Comparison and conclusions

The last part of the study was to compile all the material and to discuss and analyse the empirical data with help from the theoretical framework. The discussion included a stakeholder analysis based on the theoretical framework and the empirical data. We discuss how the different stakeholders were treated in reality compared to what the theoretical framework suggested.

2.6. Limitations

The report does only consider the project management perspective on the identified issues in the process. We have also chosen to limit the analysis to the management of time, quality, motivation, trust, communication and stakeholder management, and do not take into account, for example, the aspects of cost or budget.

The interviewees are limited to people who works with management, especially site management, and thus not craftsman or other roles. The inductive research methodology itself is also a limitation in the sense that we collected all data before we analyzed it and developed our theoretical framework. Had we worked the opposite way, theory first, the data collection could have been more specific to the theoretical framework.

2.7. Ethics

Ethics is an important factor to take into consideration in all research, this is especially true when the research method is interviews (Kvale, S and Brinkmann, S. 2014). Things such as confidentiality and consent play a role in the interviews. Generally, ethics in research can be boiled down to beneficence, meaning that we, the researchers, should have the welfare of the participants as a goal, and to not do harm, neither to the participant nor the company involved in the study.

In conversations with the case company, it was decided to leave the company name out of the thesis. The names of employees and people interviewed was also left out because it would not add any value or credibility, only expose the employer/employee which was not the purpose. Both the writers of this thesis also signed a non-disclosure contract with the company before the start of the research.

The purpose of the thesis is not to expose the company, certain individuals or even processes but to understand and in a constructive way discuss the process.

3. Inspections in construction

This chapter introduces the subject construction inspections and gives a summary of the legal background concerning inspections in Sweden.

Inspections come in many forms. You probably know a number of different ones, for example the car inspection. This report however deals with construction inspections, which take place at the end of the production phase of a construction project, see Figure 2. The inspection is an important part of a construction project because they serve the purpose to determine if the clients has gotten what they ordered.
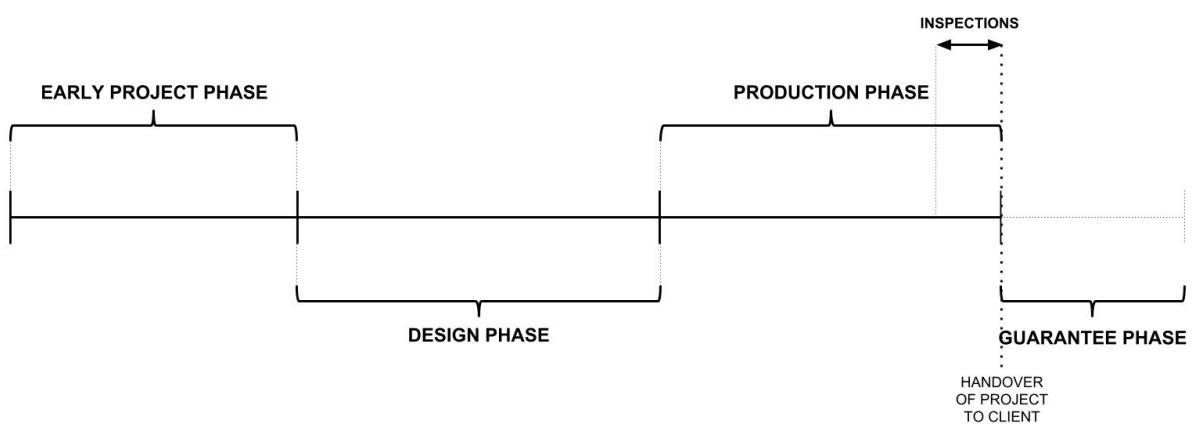
Figure 2: *The figure above illustrates a timeline over the construction process and when inspections take place.*

3.1. History of inspections
The history of construction inspections is not a well-documented process, there are a few literature writings which in a few sentences tries to give a brief history of them. The construction inspection handbook written by O'Brien is one. O'Brien (1997) describes the earliest documentation of construction inspectors as dating back to ancient Egypt and how the role of the inspector has changed from the inspector constantly being on site counting materials to what an inspector is today. O'Brien (1997) emphasizes that today, a major task of the inspector is to make sure that the materials is installed properly instead of making sure that the right materials is used, which has been the job historically.

3.2. Legal background to inspections
In Sweden, two main standard contracts dominate the construction industry AB 04 (Allmänna bestämmelser för byggnads-, anläggnings- och installationsentreprenader) and ABT 06 (Allmänna bestämmelser för totalentreprenader). From now on we will reference both this contracts by simply writing AB. These contracts are used in the case company. The contracts have derived from the lack of specific laws regulating construction and even though they are

widely used, they are often changed to fit the specific project better. Chapter seven of AB describes the inspections and the surrounding conditions such as the inspector.

The purpose of construction inspections are to ensure to the client that the contractor has fulfilled the contract to the decided quality, i.e. making sure that the right product with the right quality is delivered to the client. The way this is done is through an inspection where the inspector ocularly evaluates the construction, looking for defects. The inspector is also the person who evaluates whether or not the contract requirements is met. There are six types of inspections which both the client and construction companies have legal right to call upon in different scenarios. These are shortly described below and visualized in Figure 3.
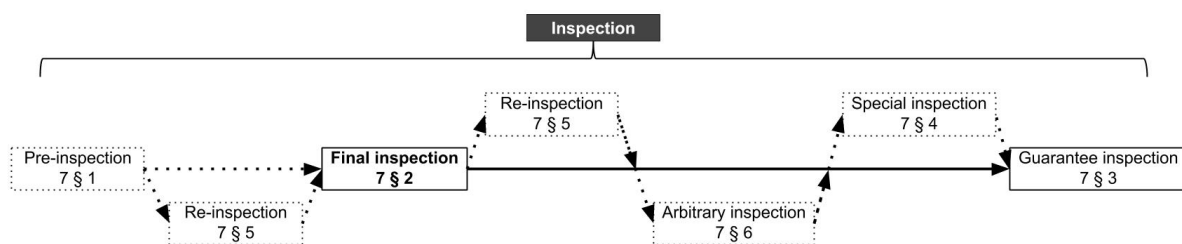
Figure 3: *The image above illustrates how the different types of inspections are chronologically connected to each other. The two main inspections from AB are the final inspection and the guarantee inspection, they are demanded by the contracts. The dotted lines represent steps and inspections that are optional.*

Below the six different types of inspections from AB is described.

Pre-inspection, 7 § 1
Pre-inspection is performed before the whole construction is finished and before the final inspection. The main difference between the pre-inspection and the final inspection is that after the final inspection, when the construction is approved, the legal responsibility is transferred to the client while after a pre-inspection, the responsibility stays with the contractor. Pre-inspections can be performed on only part of the whole construction.

Under the headline pre-inspection, normative inspections are also shortly described (it can be noted that it is not named normative inspection in AB). A normative inspection is performed on a smaller part of the construction to serve as a norm for how the rest of the construction should be built.

Re-inspection, 7 § 5
The re-inspections exist to control if the defects from previous inspection have been remedied.

Final inspection, 7 § 2

Final inspection will always take place when the construction is completed since it is obligatory by the standard contracts. At the final inspection, the inspector decides if the construction is approved. The construction can be approved even if there still are minor defects. After an approved final inspection, the legal responsibilities of the construction are transferred to the client already at 24.00 the same day. These responsibilities include for example the insurance of the building. If the construction is not completed or if it does not live up to the right quality, the decision of approval can be postponed by the inspector.

In the last paragraph of AB, main sections are described. This means that a construction can be divided into several main parts where each part is inspected with its own final inspection.

Arbitration inspection, 7 § 6

If any party, the client or the contractor, is dissatisfied with the result of the final inspection they can call upon an arbitration inspection. The arbitration inspection replaces the result of the final inspection, meaning that the protocol of the arbitration inspection is the one the contractor is legally obliged to follow. This inspection is performed by a new inspector who is appointed through a process where the client and contractor appoint one inspector each and these two inspectors in turn appoint a third one who performs the arbitration inspection.

Special Inspection, 7 § 4

The special inspection can be called upon after the time of completion if any of the parties suspect that something might be incorrect that needs to be investigated further.

Guarantee inspection, 7 § 3

Guarantee inspection has to do with the warranty of the construction. It is an inspection that is held a certain time after the final inspection is approved. If the warranty period is two years then the warranty inspection will be two years after the final inspection. During the warranty inspection the inspector looks for new defects that could have come up after the construction was approved and that the contractor can be held reliable for. Normally constructions have a two year and a five year guarantee inspection.

Cost of inspections

It is the client who have the right to appoint the inspector, and it is also generally the client who pays for the preliminary, final, and guarantee inspection. Regarding the other types of inspections, it depends on the type and outcome of the inspection and who, the client or the contractor, calls for the inspection. For example, if the clients call for a special inspection because they believe that the contractor has not corrected a specific defect it depends on the turnout who pays. The contractor pays if they have not corrected the defect but if it turns out that the contractor has in fact corrected the defect, the clients have to pay. Questions regarding who pays for what is a job for lawyers but because the standard contracts are widely used, there are many precedents to follow.

3.3. Role of the inspector

The inspector is the person appointed by the client to perform the inspections and to objectively decide if the contract between the contractor and the client has been fulfilled. To be objective means that the inspector is not biased to any of the parts. Officially, there are no specific requirements to become an inspector, mening anyone could (SBR, 2018). If the inspectors do not consider themselves to have all the technical knowledge required for an inspection, they can appoint assistant inspectors, see Figure 4. Assistant inspectors can for example be appointed for inspecting electrics and ventilation. In Sweden, there is a shortfall of inspectors, why they are usually booked several years in advance. Approximately 2 600 persons work as inspectors, where only 80 of them are female (Fredriksson, 2008). Generally, the inspectors are men over 50 years old who have worked in the construction industry for many years.

Certificates

Svenska Byggingenjörers Riksförbund (SBR) has worked with Research Institute of Sweden (RISE) to develop certificates for inspectors since 1998. The purpose of the certificates is to guarantee that the inspectors have a certain knowledge and experience. There are no official requirements to be certified as an inspector. (SBR, 2018)

Defects

A defect in the context of inspections is defined as "not according to contract". It is up to the inspector to determine if there is, and if so, what defects there are in the construction. To assist the inspector in determining defects there are many guidelines, one of them is AMA (Allmänna material och arbetsbeskrivningar). AMA is a set of references that dictates a generally accepted quality in materials and works in the Swedish construction industry. AMA is published by Svensk Byggtjänst and is the standard used in AB 04 and ABT 06. It is invoked by using the references presented in the AMA texts in the technical description and the administrative regulations of the project (Svensk Byggtjänst, 2018).

3.4. Role of the inspection manager

The inspection manager is by the Swedish Planning and Building Act (PBL) required on most projects. A rule of thumb is that all projects that require a construction permit will require an inspection manager. In difference to the inspector, the inspection manager is the municipalities representative on site and is there to make sure that the construction follows Swedish law. The inspector on the other hand only inspects that the contract between the contractor and the client is fulfilled. An example of this could be the railing on a balcony. If the railing is specified to be 900 mm tall in the contract and constructed accordingly, the inspector will approve it. The inspection manager would however not, because according to Swedish law, the railing on a balcony has to be 1 100 mm tall.

Apart from the approval of the inspector and the inspection manager, the construction needs a final notice given by the building committee in order to be put into use. The building

committee base their decision mainly on verification documents, certification documents and the recommendations of the inspection manager (Boverket, 2013).

3.5. Actors in construction

In addition to the contractor and the client, there are many other actors who are bound by contracts in a construction project, see Figure 4. These contracts create a strict framework for the organizations involved, especially strict is the communication (Wackling, 2018). Wackling (2018) argues that commands must go between the actors who have a contract with each other. If the client wants to make a change that has to do with the supplier, in the example of Figure 4, information must first go through the contractor and subcontractor 1 and then sub-subcontractor 1 before it reaches the supplier. The different actors have different relations to inspections, which is described in Table 3.
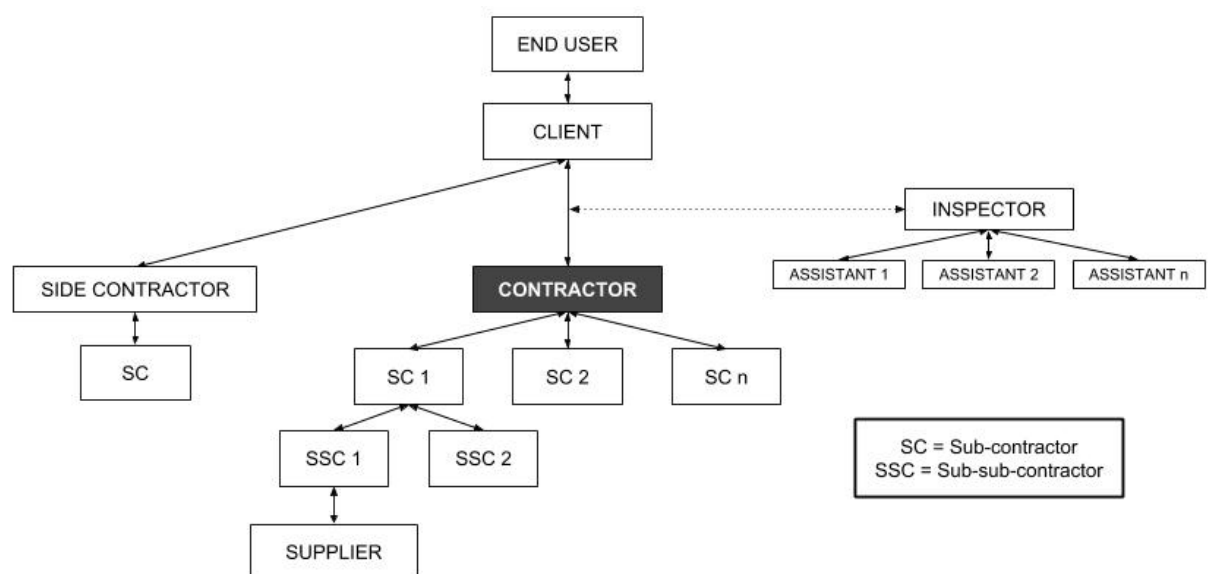
Figure 4: *The image above illustrates a general construction project and the actors involved, where one arrow represents one contract.*

Actor	Contractual relation to inspections
Contractor	*The contractor has by contract agreed to build what the client order. If the inspector assesses that the construction does not fulfil the contract, it is up to the contractor to redress it.*
Client	*The client has a contract with the contractor that defines the construction that the contractor is to build. It is this contract in relation to the finished product (the building) the inspector inspects.*
Inspector	*The task of the inspector is to inspect the building compared to the contract between the client and the contractor.*
Assistant inspector	*The assistant inspectors have a contract with the main inspectors set up when the inspectors do not have enough knowledge to inspect. The assistant inspector has the same role in inspections as the main inspector, only in a different disciplinary area.*
End user	*The end user can for example be a tenant. Contractually, the end user have no part or claim in the inspections.*
Subcontractor	*The subcontractor has a contract with the contractor to perform a specific task or to build a*

	specific part of what the client has ordered from the contractor. They are responsible for the work they have performed, meaning, if a defect is discovered at an inspection by the inspector and reported to the contractor, the contractor will pass it on to the corresponding subcontractor.
Supplier	The supplier provides material to the construction site. They have no contractual part in inspections but it is their material that is being inspected.
Side contractor	The side contractor has the same relationship to inspections as the main contractor. They have a parallel contract with the client and can actually be seen as actors in another project even though they work at the same site.
Inspection manager (KA)	The inspection manager has nothing to do with inspections. The inspection manager is the municipalities extended hand on site, there to make sure that the construction is built according to laws and regulations.

Table 3: *The table describes different actors involved in construction and their contractual relation to inspections.*

4. Findings

In this chapter, the results from the empirical study are presented. Everything that is described, evaluated or discussed is based on observations, personal interviews and small talk. The participants practical relation to inspections is summarized in Table 6. Below, we describe how the inspection process in the case company is conducted today [2018] and includes the point of views that have emerged when the participants have evaluated the process. It addresses the various elements of inspections, the practicalities and the different roles involved. The studied projects are presented in Table 4 and Table 5. This chapter answers the three research questions:

- *How is the inspection process conducted in the case company and what are the employees' evaluation on it?*
- *What characterizes a successful inspection process according to the employees?*
- *What challenges exist in the inspection process?*

Based on the empirical study, we have defined the inspection process as: *starting with the first inspection, regardless of whether it is internal or external, and ending when all defects have been resolved and the last protocol is empty*. An internal inspection is defined as an inspection without an inspector present and an external inspection is defined as an inspection performed by an inspector.

Project	Participants connected to project	Project duration	Cost of project
Project A	*Site manager A* *Inspector A*	7 months	24 M SEK
Project B	*Site manager C* *Foreman A*	10 months	128 M SEK
Project C	*Site manager B* *Assistant inspector A* *Assistant inspector B* *Plumber*	18,5 months	130 M SEK
Project D	*Inspector E* *Painter D*	12 months	19 M SEK
Project E	*Foreman B* *Internal client* *Inspector D* *Inspector C* *Painter A*	-	-
Project F	*Site manager F* *Foreman C* *Inspector B* *Painter B* *Painter C*	27 months	200 M SEK

Table 4: *The table describes the studied projects in the case company*

	Internal inspection	Pre-inspection	**Normative inspection**	Re-inspection	Internal inspection	Pre-inspection	Re-inspection	Re-inspection with end user	**Final Inspection**	Re-inspection	Pre-inspection	Special inspection	Re-inspection	**Arbitrary Inspection**	Guarantee inspection
Project A								■ *	■						■
Project B				■					■						■
Project C			■	■	■ *				■						■
Project D								■ *	■						■
Project E		■	■	■			■ *	■	■						■
Project F	■	■	■	■			■ *		■						■

Figure 5: *The table shows what kinds of inspections that were performed in the investigated projects. The inspections are presented in a chronological order from left to right. Generally, the more complex the project the more inspections. There is also a difference between commercial buildings and housing, where housing tend to have more inspections.*
* Marks an inspection that we attended.

The inspection process is part of the final stage of the production phase. In Figure 6, a timeline is presented that gives a visual representation over the inspection process and how it exists within the project timeframe. It shows an example of an inspection process but does not represent the inspection process in all project, instead it serves the purpose of giving an overview of the different features of the inspection process. Inspector A told how the AB contracts used in Sweden are unique. From his experience there is nowhere else in the world where inspections are such a well-defined and common practice. He also gave an example of how IKEA always added chapter seven from AB (the chapter regarding inspections) to their construction contracts abroad. Inspector A had experience from working with IKEA in Moscow.

Below, in Table 4, is a chart listing all the participants to the study and their functions in the inspection process.

Participants	Practical relation to inspections
Case company (contractor)	
Site managers	*Site managers are responsible for time and deadlines of the project. This means that the site managers set, or recommend, dates for the different elements of the inspection process. They decide upon and control the internal inspections and make recommendations about the external inspections to the client. Site managers work out on site.*
Site manager A	*Commercial department*
Site manager B	*Commercial department*
Site manager C	*Commercial department*
Site manager D	*First housing department, now commercial department*
Site manager E	*Commercial department*
Site manager F	*Housing department*
Formen	*Formen perform the internal inspections and are active in the administrative work around inspections. It is primarily the formen that communicate with subcontractors and the craftsmen. Formen work out on site.*

Forman A	*Commercial department*
Forman B	*Housing department*
Forman C	*Housing department*
Installation coordinator	*The installation coordinator works with coordinating the work at site concerning the installations, ventilation and plumbing for example. They follow the assistant inspector when participating in inspections and support the formen in the work to correct defects. It can be noted that the installation coordinator is usually only present on large projects.*
Development manager	*The development manager works at the Gothenburg headquarter and specializes in digital development. He supports projects that choose to use digital tools in production, and have been involved in and evaluated digital use in the case company during the inspection process.*
Planner	*The planner supports projects in matter concerning time, deadlines and schedules. He helps to plan and put deadlines for the final stage.*

Client	*It is the client who appoints the inspector. It is also the client who pays for the inspections and decide in consultation with the site manager which elements that should be included in the inspection process for the specific project.*
Internal client	*The internal client works at the housing development department. We have chosen to call her internal because she works at the case company and because her department mainly orders work from the housing department of the case company. The internal client has been working for a long time with the final stages of projects and places often her own demands on what activities she wants the site manager to work with before inspections.*
External client	*We have understood that the involvement of the external clients in inspections often depend on the experience of the clients and how much they know about the construction industry.*

Inspector team	*The inspectors perform the external inspections and have been the ones who have decided which tool to use during the inspection in five out of six projects.*
Inspectors	
Inspector A	*Commercial project*
Inspector B	*Housing project*
Inspector C	*Housing project*
Inspector D	*Housing project*
Inspector E	*Housing project*
Assistant inspectors	
Assistant inspector A	*Commercial project, inspecting plumbing*
Assistant inspector B	*Commercial project, inspecting ventilation*

End user	*The end users are often invited by the client to attend an inspection in order to give them an opportunity to comment on the completed construction.*
Tenant	*Commercial project*
Apartment buyer	*Housing project*

Subcontractor	*Subcontractors are procured by the case company to perform to perform a particular job. Today, the case company only has woodworkers in-house, which means that all other types of work and installations are carried out by subcontractors. When a defect is detected at an inspection on a work performed by a subcontractor, the case company transfer the work to the responsible subcontractor to resolve. A majority of the defects from an inspection end up at the subcontractors to resolve. They are also responsible for handing over documents about operation and maintenance before handing over the building to the client.*
Painters	*Painter is the discipline with most number of defects from inspections. It is also the discipline that most often attends the inspections.*
Painter A	*Housing project*
Painter B	*Housing project*
Painter C	*Housing project*
Painter D	*Housing project*
Plumbers	*Plumber is one of the disciplines that has always had an inspector of their own, an assistant inspector.*
Plumber	*Commercial project*

Table 5: *The table describes everyone involved in the study and their relation to the inspection process.*
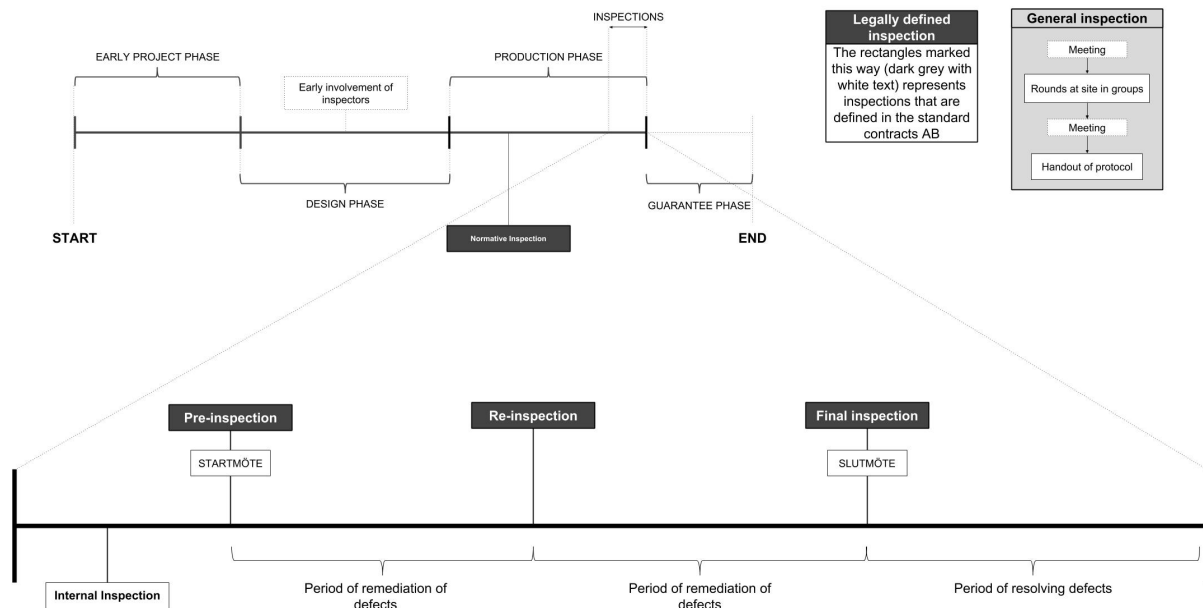
Figure 6: *The timeline depicts how a "typical" inspection process would look like in the case company. By typical we mean an inspection process consisting of the most common elements.*

4.1. Learning the process

From interviews and observations, we could conclude that the inspection process at the case company in general look the same throughout the different projects. It can be described as a series of elements that can be added or taken away, depending on the size of the project. How this process looks like however can differs between the two investigated departments, housing and commercial buildings. Only one of the interviewed working with commercial buildings was aware of the formalities that the organization provide on how to carry out the inspection process (we also found it hard to find any formalities even with access to the company's internal IT system). Instead the interviewees in this department said that the process is taught from colleagues and through experience. The housing department on the other hand has developed a routine description for the final stage of a project, including the inspection process. The routine serves as a support to learn the process.

"I have learned from my previous site managers how they have worked with inspections. It is absolutely possible that others do it in completely different ways. But the way I'm taught, how to handle it, usually works very well."

Site manager A

Both the employees at the case company and the inspectors say that the process of inspections has looked that same for a long time even though some of the tools to perform it have changed over time.

4.2. The inspection process

This chapter describes how the inspection process is performed at the case company as perceived by the employees and experienced on site visits. The description mentions the elements that the employees consider to be relevant in the process.

The names of the different elements of the inspections process is chosen after how the majority of the interviewees have chosen to call them. We have however encountered situations where different people have called the same phenomena different things and as well as where they have had different names for the same thing, causing confusion.

The chapter deals with the following sections:
- Involving inspectors in early phases
- Coordinated performance test
- Internal inspections
- External inspections
- Defects
- Normative inspections
- Pre-inspections
- Re-inspections on pre- or re-inspections
- Final inspections
- Final meeting
- Re-inspection on final inspections
- Correcting defects from inspections
- Summary of the elements of the inspections process
- Projects without inspections

Involving inspectors in early phases

The inspection team is appointed by the client. Even though the site managers at the case company tells that the team is often selected at the beginning of the project, they are rarely involved in the early phases. Ten interviewees, five of them working as site managers, have worked with inspectors as early as in the design phase of a project, but this is more likely to occur in larger projects. In early phases, they have the role of a consultant or an expert and can be part of the design team as an adviser. Site manager E tells that if it is discovered during construction that it is not possible to build as planned, it is better to take the matter directly with the inspector instead of going back to the original consultant and redesign it. The employees who have experience from early involvement are positive, since it increases the knowledge for, and creates a commitment to, the project. The internal client believes that inspectors are important for the project and that it is important that they are involved early. She thinks that it is good that, by the time of inspections, the inspector knows the history of the construction and what have been discussed between the parties. Early involvement also made the five site managers feel safe about the building progress because they know that the substrate is approved. Because inspectors judge differently, everyone agrees that if someone has been consulted during the design phase, it is desirable that the same person also inspects

the end product. Otherwise, advises may have been misleading and cause changes that will end up not being approved anyway.

"The work with inspections begins on day one. You decide in consultation with the client when the inspections will be."

<div align="right">Site manager A</div>

Site manager B explains that inexperienced clients often work with controllers, someone who has been assigned by the client to control that the case company delivers what the documents say. This is performed as some kind of ongoing inspection during the construction phase. In some cases, Site manager B has experienced that the controller is the same person as the inspector, which he thinks is a great advantage. Since they are visiting the site regularly, they will get a better overall impression of the project.

When we talked to inspectors, it became clear that they would like to be more involved early in the projects. They say that that is when they have the greatest opportunity to steer the project in the right direction and to increase quality without having great effect on time or money. Inspector B claims that the defects would be reduced if more preventive work was done through collaboration. Our perception is that everyone interviewed would like inspectors to be involved as early as possible in a project, but as usual, it is a matter of money. Who would pay for the inspectors involvement?

"I think it is good if we [the inspectors] can be more involved early in projects. That's when we can be the most useful."

<div align="right">Inspector B</div>

Coordinated performance test
All site managers tell that they perform a coordinated performance test in their project. Site manager E says that the test is normally inscribed in the contract. He also describes the formal way this is supposed to be performed according to guidelines from the case company, called "3P". Already after the design phase, a testing program is put together over what is supposed to be tested - 1P. This could be for example door automation. After that, a theoretical test is done where the design team sit together and ensure that nothing is forgotten - 2P. Later, when everything is in place in the building, the practical test will be performed - 3P. The test is described as a way to discover eventual installations defects before the external inspection, in order to have time to correct them. The installation coordinator explains that even if the intention is to perform a coordinated performance test as early as possible, it is many times squeezed into the end of a project. The simple explanation is that many of the system that need to be tested is not installed until the very end, making earlier testing impossible. In order to prevent that time-consuming defects are discovered late, he thinks that the subcontractors must do self-controls to ensure that their part of the system is working isolated. The self-control is a document that the craftsman signs to ensure that they have installed or built the right thing in the right way and to ensure the function. Site manager

G says that the 3P-test should be done in time to do a protocol over the results to show at the final inspection.

Internal inspections

The internal inspection is a way for the construction company to get prepared for the legal inspections. It does not involve an independent inspector, but is performed only by the employees at the case company that work on the site. It is not included in the contract or required from the client but is instead planned and controlled by the site manager. The site managers think that the building needs to be relatively finished and cleaned for the purpose of doing an internal inspection. Nor is it worthwhile to carry out the inspection if the time is too short until the next inspection and therefore not enough time to fix the defects that appear. For this reason, the internal inspection is the element in the inspections process that is first taken away by the site managers when facing a stressed timeline, even though everyone agrees that internal inspection probably minimizes the potential defects on the external inspection. Foreman A says, however, that in his project they did an internal inspection before the project was completed and that it gave them an overview of what needed to be prioritized before the external inspection. Site manager C declares that there is an advantage in making several internal inspections if the time is available.

We understood from interviews that it is the formen that perform the internal inspections. The site manager only participated in cases where the forman was inexperienced. During the inspection, the formen systematically walked through the area to be inspected, noting defects. They are instructed to look for obvious flaws such as missing elements or stains on the walls. Site manager E and F does not expect the internal inspection to be as comprehensive as the external inspections since the quality is dependent on the experience and knowledge of the formen and does not consider issues that need to be assessed. They also point out that some defects will not be discovered because the person is too familiar with the site in order to be able to see them. If a normative inspection has been performed, the formen used that as a reference tool. Normative inspections are further described on page in the section *Normative inspections*. When the whole area has been checked, the defects are gathered in a protocol and then handed out to the discipline responsible. When the defects are remedied, the subcontractors inform the formen, who controls the work if they have time to prioritize it. In some projects, signed protocols were also required, while at other projects the follow-up was more arbitrary.

Formen B and C also see the internal inspections as an opportunity to gather quality checklists. Site manager C and the internal client see it as a way to explain what quality that is required from the subcontractors so they know what to deliver onwards in the project.

External inspections

The internal client tells that both the clients and contractors appreciate external inspections. Clients because they get an objective evaluation and contractors because they can move on from the project when they have completed the inspections. Even if different external inspections have been observed in the study, they are all performed in the same way on site.

In this section, the procedure is described and after that are the differences between the inspections further explained.

Depending on the project and the type of external inspection, there are different people present. The inspection team can vary in size depending on the skills required for the specific project, but there has always been an inspector for construction, ventilation, plumbing and electricity present. In the projects where it is required, there are also inspectors in, for example, control systems and elevators etc. At all occasions, there has also always been formen and representatives from the subcontractors present. Site manager C have experienced that the bigger the company, the better the attendance. The formen explain that the painter is the discipline that is most often present. As we experienced during site visits, the contractor has the opportunity to correct defects during the inspections as a way to keep them out of the protocol. This is also one of the main reasons behind having a painter attending, since this is the discipline with the most defects that also has the possibility to correct the defects instantly. The painters themselves had different views on whether or not they should participate in inspections. Painter A was tired of the fact that the majority of the defects from an inspection ended up for him to resolve, especially as many of the defects were caused by other subcontractors. He also said that he felt compelled to participate in even if he believed it was not included in his contract. Painter B and C, on the other hand, understood why they should participate and also believed that it was a good thing. They were active during the inspection and either corrected defects directly or made their own notes of the defects that need to be addressed later. Painter D was present but was not active. He did not fix any defects directly and did not make any notes. When half the inspection remained, he left. This did however not seem to be a problem for the rest of the group.

The external inspections always started with a meeting at the site office. During the meeting, people was introduced to each other, the plan for the day was presented and the status of the construction was briefly discussed. After the meeting, out on site, the group broke up because they were going inspect different things. During the rounds, the inspectors walk through the building systematically in a way that is logic for the specific project, looking for defects. At all sites visited, the site manager or the formen followed the main inspector, i.e. the inspector for construction. Site manager A explains that this is because site management do usually not have that much technical knowledge about the specific installations. Instead they invite the subcontractor from the different disciplines to follow the assistant inspectors. The plumber that followed the assistant inspector for plumbing, thinks that it is of highest importance for him to attend inspections. This is because changes might have been made that need to be explained, or sometimes it might be difficult for the inspector to see exactly how it has been installed. He prefers be present and explain rather than getting a long protocol full of points about which there have been uncertainties. Subcontractors who did not participate in the inspection have not been interviewed. The installation coordinator explains that he also always follows the assistant inspectors when he participates in inspections.

Inspectors have an informal rule of going from the top down and clockwise when performing inspections. This serves an important purpose for the labelling of walls and rooms where the

defects are detected. If a wall is called three, one familiar with the systematic would know that it is the third wall encountered when going clockwise from the entrance. All formen have however, at some point, experienced difficulties with this system in buildings where the rooms are open and irregular. Several entrances to a room can also disturb the system. This means that formen and subcontractors sometimes find it hard to discover where the defect is located in the room. Inspector A has instead chosen to designate the walls as "bedroom wall to kitchen", which he believes reduces the risk of misconceptions. Site manager B and Foreman B tell that they sometimes help the inspector to formulate the notes connected to the remark to facilitate for themselves to remember where the defect is and what the defect is about. Foreman C explains that even if they find the right wall it can still be hard to find the defect since it can be small and at any height or side of the wall. Therefore, the formen also labels the defect with tape so that they can be found more easily when addressed, see image 7,8 and 9. When participating in re-inspections, it was discovered that a couple of tapes had been falling off, and the formen confirmed that it easily happens. This means that they need to double-check with the protocol that they have not forgotten any defects. When using an iPad together with a software for inspections, the defects was noted with a dot on a drawing, making it easier to find the defect according to Foreman B. If the defect was hard to explain in words, a photo was added. Tape was however used as a complement also at the site using this software.

Figure 7: *A box containing the tape used to mark defects during inspection. The tape can be bought at material stores (Maskin och Verktyg, 2018).*

Figure 8 and 9: *The black and yellow tape consider defects for the contractor, the case company. In this case the list needs to be replaced. The white and blue tape consider defects for the painter. In this case, a screw head protrudes.*

During the inspections, four different ways of noting defects were used:
- a dictaphone   (Inspector A and G)
- an iPad used as a notepad   (Inspector B)
- an iPad with BIM 360   (Inspector D)
- pen and paper   (Inspector E and F)

In all the cases, except when using BIM 360, after-work was required to transcribe the protocol. In the case where BIM 360 was used, which is a digital tool for, amongst other, inspections, the protocol was completed at the same time as the inspection. However, this is the only project at the case company in the Gothenburg region that used this technology at the moment.

Inspector A tells that he has to study the documents and drawings for the project before the inspection so that he can check that the right things are built. He also says that, when inspecting construction, it is mainly about controlling the surface layers. He inspects the surfaces so that they are not damaged or stained and that there are no gaps in the floor for example. He also considers if the rooms can be used as intended and that all the required documents are in place, such as the documentation of operation and maintenance.

"The inspection process is such that you know that the inspector mostly assesses cosmetics."

Inspector A

Assistant inspector A (plumbing) says that she is controlling that everything that is shown in the drawings exist and is placed right (pipes, washbasins, scuttle etc.) and that everything is labelled. She does not measure the dimensions but trusts that it is done correctly. She believes that it will be discovered when testing the system anyway. Assistant inspector B (ventilation)

explains that is important to control the tests made on the different systems to ensure the correct function. However, he rarely performs the test himself but evaluate instead the results.

According to all site managers, formen and clients, the quality of the inspection and the types of defects can vary broadly, depending on the person who performs the inspection. Ten out of eleven of the interviewees that has practical experience from inspections argue that it is crucial to have a "good" inspector. Their overall perception of a good inspector is an objective person who has a holistic perspective, that does not get hung up on certain types of problems and that does not value whether they personally think something is bad or ugly. They all agree that inspectors have different focus areas that they attach extra importance to, which means that the inspector is not entirely objective and that the defects will differ depending the person.

Some areas appear however to be more problematic than others. Site manager B argues that some disciplines have a clearer regulatory framework that governs the execution of building components, fire safety for example, while others, such as the accessibility framework, are vaguer and open for interpretations. Inspector C has the same view on the matter and points out the accessibility framework and playground safety as areas where issues can be judged differently. This inspector thinks that this can be due to the fact that they are relatively new frameworks that can be vague and hard to interpret. When it comes to accessibility, he explains that the framework often gives minimum dimensions. The design team uses these dimensions without calculating with building tolerances or without calculating with that tiles, for example, can be added in a bathroom, making the room smaller than expected. This can result in a room cannot be used as intended, and then the inspector must note it in the protocol. In terms of security, he believes that even if something is built in a legal manner, it can still be perceived as dangerous under certain circumstances. Then it becomes an assessment question for the inspector if he can approve it or not. An example of this that was found at a visited residential project where large windows could be opened high up in the building. When closing the windows, people had to lean far out of the windows. At the same time, he believes that the people who uses the building must also take some responsibility for how they act in it. Inspector C and D express that they are aware of this issue of assessment, but they believe that they are working with it by keeping the discussion about it alive. Another attempt to address the issue is through the certificates for inspectors, that Inspector C and D are cautiously positive towards. When talking to Inspector A and B, they think that the knowledge level to take the certificates is so low that he does not want to be associated with it. Inspector F is the only one that regularly updates her certification, mainly because her company and clients require it. Even though there are areas perceived as ambiguous, we have observed that other areas have a clear framework of what is within the tolerance or not. For a certain decided standard, there are for example rules for how big gaps that are allowed in wooden floors or how many pores per square meters that are allowed on a painted surface. These standards often refer to AMA, described in chapter 3.3. and are controlled ocularly or are measured with small measuring tools by the inspectors.

"An inspector or expert may think one thing and another may think something completely different, which means that the outcome depends entirely on who the person is that is here."

<div align="right">Site manager B</div>

Four interviewees, Site managers A, D and F and the internal client, claimed that some inspectors have been notorious for being strict. The internal client thought however that inspectors have become more objective over time and argued that the case company rarely, if ever, encountered biased inspectors. She argued that the inspectors themselves also has a reputation to maintain. The installation coordinator has however experience from a project where the case company did not agree with the inspector. In that case, the case company requested an arbitration inspection, explained in chapter 3.2. Often the statement from such inspection is accepted, but not in this particular project. Instead they chose to go to court. The installation coordinator tells that the only reason that it got this far was because it involved a great amount of money. In this case it ended with settlement.

Five of the interviewed site managers believe that the numbers of defects from an inspection can be affected by other factors than the state of the construction. They experience that the numbers of points go down if the overall impression of the building is good, meaning that the inspector become more lenient. The same goes for the opposite, that the inspector becomes pickier if the overall impression is bad. Site manager F even experienced problems with an inspector that was being too oblivious and relaxed. The site manager had higher expectations on quality than the inspector had. This created a problem because he had difficulty getting subcontractors to fix small defects when they were not included in the inspection protocol. Site manager C tells that he has sometimes asked the inspector to enter defects in the protocol because he himself felt that it should have been a remark. Client A believes that the building must be in good condition so that the inspector can focus on what they are supposed to without getting disturbed by a messy site.

Sometimes, the inspection is divided into several days because the inspection took longer than expected or because it was not possible to inspect everything in one day. Although an inspection is divided into several days, it can still be considered as one inspection. Two interviews, Site manager B and Forman C, have experienced that people get tired and lose interest after a couple of hour of inspection. Site manager B never books inspections for longer than half a day, arguing that the work will not be as good when you have been going for a long time. Inspector D have the same view on the matter, but usually sets a limit by numbers of square meter or number of apartments. Inspector B does not have a problem inspecting a whole day with just a few short breaks. The duration of the inspections on visited sites have varied.

Project	Duration of inspection
Project A	*3h*
Project B	*-*
Project C	*3h*
Project D	*8h*
Project E	*4h*
Project F	*5h day one, 8h day two*

Table 6: *Duration of inspections in each project*

Defects

There are different types of defects identified during an inspection that are also treated differently. Even though the inspectors will control that the ordered quality has been delivered, which can mean both a high and a low quality, Inspector A tells says that he is more lenient when discovering a defect in a dressing room compared to one discovered in a living room. He also believes that one must consider the consequences when noting a defect. If the defect is not proportional to the action, he believes that one might have to live with it. He gives an example of when he finds a small cosmetic defect in a bathroom, then he does not think it is reasonable to rebuild the whole bathroom to fix it. When we participated in inspections, it also became clear for us that the inspector was more meticulous in residential projects compared to industrial buildings. When asking about what kind of defects that are common, it is often small things like steins or scores in the surface layers or labelling on installations.

Before the construction can be approved, the required documents such as operation and maintenance documents have to be collected and updated. If they are missing, it becomes a remark in the protocol. Legally the AB contracts does not demand any documents but in practise the documents are always required.

When it comes to installations, we have observed that changes made to the drawings that inspector uses to inspect are not rare. This is usually changes that have been encountered on site and discussed between the subcontractor, the case company and the client, but which has not been changed in the drawings yet. These deviations are handled as defects and therefore also marked in the protocol. The case company is responsible for delivering correct drawing to the client, but follow-ups are often only made at those deviations that entered the protocol.

In table 7 are the different types of defects, that have been identified in protocols, described and exemplified.

| Defect	Description and example
E - Contractor remark	*The contractor is considered liable.*
	The majority of the contractor remarks are blemishes on the surface layer. An example from Project F is an irregularity in the painting on the wall. Site manager C explains that the case company is responsible to fix all E-remark even if the work of fixing it is often transferred to the subcontractor who performed the work originally. In this case will the painter fix the defect but the case company still has the final responsibility toward the client and the inspector. The site managers argue therefore that it is the reputation of the case company that is hurting if their subcontractors do not deliver. If, in turn, the material supplied is wrong, the defect will be transferred to the supplier. In Project F, the inspector discovered dirt between the glass of a window. As this was a factory defect made by the supplier, they were given the responsibility for replacing the window.
B - Client remark	*The inspector does not consider the contractor liable. The client decides on remediation and regulation of cost.*
	In project A, the electrical installations were not completed because installation of the cash register in the store was not in place. Since the client wanted their own cash registration system, it was noted as a B remark.
SE - Defect by side contractor	*The inspector does not consider the contractor liable. Defect made by side contractor. The client decides on remediation and regulation of cost.*
	In Project F was the glazing of balconies procured by another company, a prime contractor. On the inspection it turned out that these were leaking and ended therefore up as a SE remark.
S - Monitoring remark	*Defect requires no immediate action but should be finally assessed at later inspection.*
	In project D and F, cracks in the angle between the wall and ceiling were discovered in several places. Because they would probably crack immediately if they were repainted, they were instead noted as an S remark. They are therefore remedied later when the house no longer moves as much.
U - Investigation remark	*Indicates that an investigation shall be conducted jointly by the parties if nothing else stated in the protocol.*
	In Project A, a wall fixture in the bathroom had a colour that differed from others in the office environment. Site manager B explains that when it comes to investigation remarks, one needs to find out who is responsible for the defect - "has the job been executed in the wrong way or has the wrong job been ordered?" Assistant inspector A says that investigation remarks are often more common when inspecting installations compared to construction. This is because it is often harder to determine what is causing the problem. She explains that after investigating the problem it either turns into an E-remark or is deleted in the protocol if it turned out not to be a defect.
V or N- Value reduction	*Defect shall not be rectified, financial regulation between the parties.*
	Inspector A gave an example of a project where he used a V-remark. In the project was a building ordered that was supposed to have a yellow brick facade, but when the facade was completed it looked brown instead. The deviation from the colour ordered was not within the tolerances, meaning that Inspector A could determine that it was a defect. Since it was not reasonable to rebuild the whole facade, cost reductions were made.
M, X or A- By the client observed defect	*By the client observed defect that the inspector does not consider a defect (dissent).*
	No example of this defect was registered in the studied protocols.

O - Defect observed, left without action	*Defect observed, left without action.*
	In Project F, a row of tiles in the bathroom was considered to be too narrow, but it was left without a remark since the tiles were placed with regards to the mirror and the washbasin.
UA - Without defect	*Without defect, however, general defects still apply.*
	This remark is used when a whole room is inspected without finding any defect. At Project D, a kitchen was inspected without finding any remarks, but there was still a general remark, that the white goods were not yet installed anywhere, that also applied to this kitchen.

Table 7. List of different categories of defects.

Just like different defects can be classified under different categories, they can also be categorized under different disciplines. These disciplines usually match with the inspectors and the assistant inspectors that participate, see Figure 10, 11 and 12. There are major differences between housing projects and industrial projects, where housing projects have considerably more defects classified under the discipline of construction. This is because the defects of the painter are classified as construction defects and that the majority of the defects in housing projects belong to the painters.
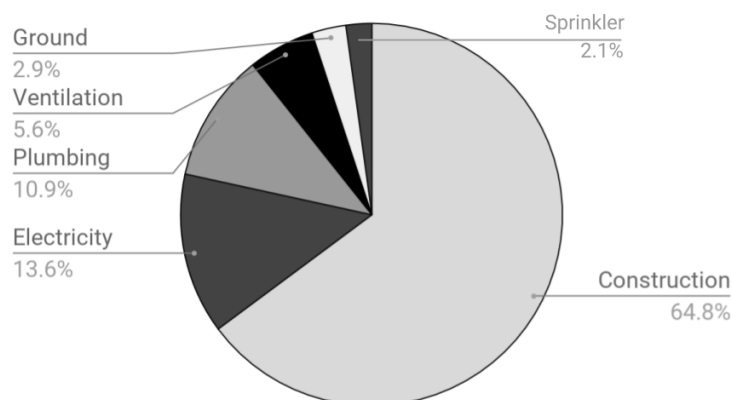
Figure 10: *Charts over the defects from final inspection at Project B (industrial project).*
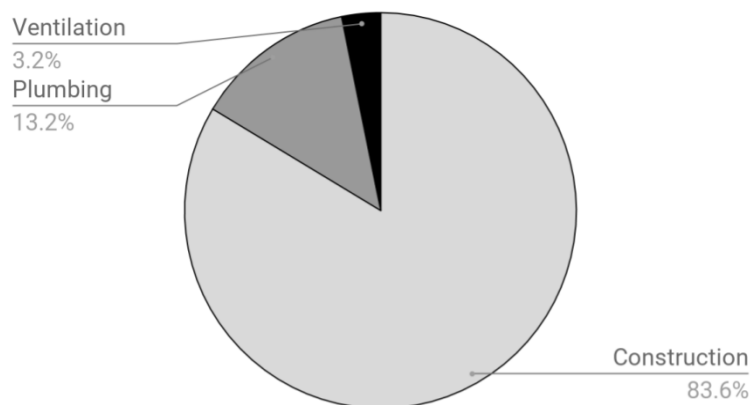
Figure 11: *Charts over the defects from pre-inspection at Project B(industrial project).*
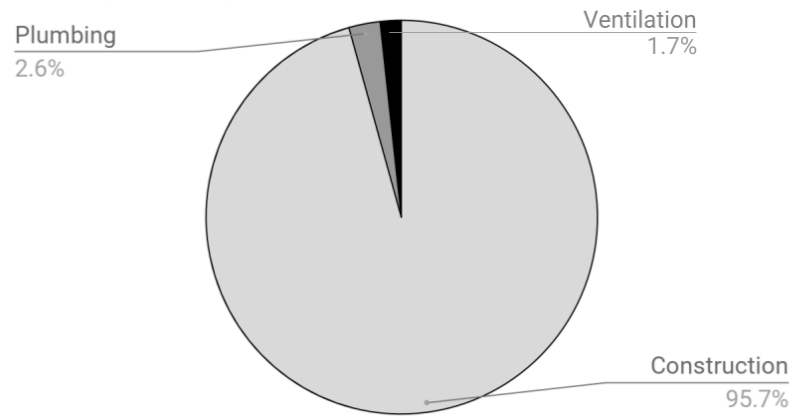
Figure 12: *Charts over the defects from final inspections at Project D (housing project).*

Normative inspections

When talking about projects that are repetitive, such as residential buildings and offices, normative inspections are mentioned. In these projects, a room or an apartment is forced to completion and then immediately inspected as early as possible. We understood that what is addressed at this inspection should be applicable for a large parts of the project and is also described as a way to align expectations of quality with the client. Everyone who mentioned this type of inspection thinks that it is useful and believes that it prevents deviations to be repeated in the rest of the project. Site manager B and F have also used it on a smaller scale to approve prefabricated elements of great volume or to set the standard for the labelling of installations. Site manager E argued that the only reason not to use normative inspections in repetitive projects is if the cost of forcing a part to completion is higher than the possible saving that it enables. The internal client tells that another advantage of this is that the completed and inspected apartment can also be used as a showroom for potential buyers.

Pre-inspections

Inspector A explains that main difference between pre-inspections and final inspections is that during pre-inspections, the inspector does not decide whether the construction is approved or not. A pre-inspection is always followed by a re-inspection or a final inspection. When the interviewees from the housing department think of inspections, the perception is that they associate it with the activities connected to the pre-inspections. The internal client describes it as "the big inspection". In those projects, this is also the first occasion when the inspector visits the site. In the best case, all the defects from the internal inspection have been fixed when the pre-inspection takes place. The site managers also stress that it is important to have enough time before the final inspection (or next re-inspection) and that the project is completed and cleaned when it is time for the pre-inspection. This is however not always the case. If the time is pressed, the project may be too unfinished until the preliminary inspection and there might be no point in doing a pre-inspection, since the site management is already aware of that is left to complete. Site manager E explains that if there is no time to do pre-inspections, he must instead allocate more time after the final inspection to correct the defects.

On all projects that had pre-inspections, they were divided into several parts. The reason for this has been that the large projects have been divided into smaller parts with different deadlines, that the customer wanted to have access to certain parts of the building before the whole project has been completed or that all the assistant inspectors could not be present at the same occasion. If the customer wants to use part of the building earlier then the final inspection, Inspector B stresses that it is important to add that to the standard contracts so that all the legal rights are transferred to the clients at the same time. Inspector A expresses that he always thinks that it is a hassle legally to hand over part of the construction before the final inspection. Another reason to do pre-inspections of parts of the building is because they will be inaccessible later in the project. Assistant inspector A explains however that the inspectors do not always have time to look at everything before it becomes inaccessible. When that happens must the inspector trust the self-controls that are made.

In the project of the installation coordinator, inspections will be performed continuously. This means that as soon as something is completed, it is inspected during a pre-inspection. Inspector A, that has experience of this, stresses that it is important to keep the deadlines when doing continuous inspections. He takes an example from a project where he was supposed to do an inspection of the steel structure, but when he arrived, there were only three pillars in place, arguing that there is no purpose in inspecting something that is so unfinished. Both Inspector A and the installation coordinator think however it is good with continuous inspections and pre-inspections as it avoids the appearance of surprises at the end of a project.

Re-inspections on pre- or re-inspections
Inspector A explains that on the same building component, there can only be one pre-inspection and one final inspection. There can however be several re-inspections (re-inspection on pre-inspection and then re-inspections on re-inspections). When we participated on re-inspections it become clear that the inspector mainly controls if the defects from the pre-inspection (or previously re-inspection) have been fixed or not. If the old defects are not fixed they are put in the new protocol and if new defects are discovered they are included in as well. When looking at the different inspections in project A-F we could conclude that residential buildings have more inspections, where re-inspections are a common feature. Foreman C and Site manager F says that this is due to the high demands on the finish in residential projects.

In the two visited condominium projects, the client had invited the final buyers of the apartment to the last re-inspection. The internal client explains that this is not somethings that they are required to do, but something they chose to do in order to get a higher NKI (happy client index). Since the buyer only has a contract with the client, they do not have the right to have opinions on defects for the case company, see Figure 4. If the buyer discover something that they consider a defect three things can happen: One, neither the inspector nor the client think it is a defect, it is ignored and kept out of the protocol, two, the inspector agrees that it is a legitimate defect and adds it to the protocol as an E-remark, three, the inspector does not agree that it is a defect but the client wants to satisfy the buyer and ask the inspector to note it as a B-remark, described in Table 7, in the protocol. This means that the client will buy

additional work (ÄTA-arbete) from the case company to fix the remark. The reason that the client does this is also because of the NKI. The internal client also says that, sometimes it can be difficult to handle that buyers expect everything to be perfect. For example, the customers usually expect a whole wall to be repainted when there is a small mark on it, not just improving the damaged part (which might result in small structural differences on the wall). She then compares it to buying a new car that has a small scratch. Then, the entire car is not repainted, only the scratch. When inviting the buyers to an inspection, the internal client expresses that it is important that all the defects from previous inspections are fixed. She means that the buyer, that usually has no experience of construction, do not understand the gravity of different defects. If she presents a protocol with defects, even though they are few and minor, the buyer will interpret it as if the apartment is unfinished and in a bad condition. This can make the buyer suspicion and keen to point out things that they believe are wrong. The buyer does not usually understand that they are not entitled to influence the inspection, which causes them to get a bad impression of the case company (since they are the one building their apartment), even if it is the client who decides whether to take their wishes into account or not. The internal client continues and explains also the issues of having to correct defect after the buyers have moved in. If one apartment has two defects, one considering the painter and one considering the floor-layer, it means that two different subcontractors have to fix the defects in order to not compromise the warranty. The buyer does not understand why the same person cannot fix both defects and gets irritated. Since it is important for internal client that all defects are fixed when inviting the buyer to the inspection, she prefer to call on an addition re-inspections first if she does not feel confident that everything is fixed. Both Site manager E and Foreman A also point out that it can be problematic to correct defects after the tenant has taken the building in use, both because they have to share the space but also because shelves and other furnishings may be in the way. Site manager C says that if the case company is still at site when the tenant moves in, they will be asked to help with all sort of things, like assemble their furnitures, that is beyond their responsibility.

Final inspections

Inspector A explains that the main difference between the final inspection and the previous inspections is that the final inspection is followed by a meeting where is it decided whether the construction is approved or not. Just as during the re-inspection does the inspector mainly controls if the defects from the pre-inspection (or re-inspection) have been fixed or not. If the old defects are not fixed, they are put in the new protocol and if new defects are discovered they are included in as well. After the final inspections it is not possible to add more or point out new defects. In the two visited projects with industrial buildings, the only inspection performed was the final inspection as it was considered sufficient.

Final meeting

At the final meeting, which is just a formal meeting, it is decided whether the construction is approved or not. If the construction is approved this will be the start of the warranty period. Several of the interviewees call this meeting final inspection as it often happens on the same occasion. The installation coordinator explains that the aim is that the protocols from the previous inspection should be cleared before the final meeting, but says also that it rarely

happens. The inspectors explains that if these defects are few and minor, they can still approve the construction. Inspector A says that during his 30 years of inspecting he has only encountered one project where the protocol was empty at the final meeting. None of the interviewees have experienced that a project does not pass the final inspection. Site manager B and the installation coordinator also tell that some remarks remain because they cannot be controlled yet, such as tests that require a winter climate outdoors.

Re-inspection on final inspection
At Project A a re-inspection of the final inspection was performed. Site manager A describes this as a way, both for him and the client, to ensure that the defects still remaining at the final inspection has been taken care of. Inspector A explains that no new defects can be considered at this inspection. In Project B it was decided that signed protocols from the case company and the subcontractors could replace the re-inspection. Site manager E tells that it is the size of the defect that determines whether signatures are sufficient or if a re-inspection is required.

Correcting defects from inspections
After an inspection, protocols are sent to the contractor who has to make sure that all of them are addressed and fixed. Each defect on its own does not mean a lot of work, but together they take a lot of time and energy. When the protocols arrive, it is the task of the foremen to decide who is responsible for what defect and also to mark it in the protocol. Site manger A argues that the reason to mark the protocol is to clarify for the subcontractors but also make sure that all defects are addressed by somebody. The defects are arranged by the rooms, which means that the remarks for the different disciplines are mixed. The different disciplines are marked either with text or with colors. Site manager A says that it is not always easy to decide who is responsible for a defect. Site manager F explains that for the defects where it cannot be decided, it is always the responsible of the case company to fix it anyway. When the protocol is marked, it is mailed out and physically distributed, together with a deadline, to the subcontractors, who has to fix the defect that falls under their responsibility. Since some disciplines has their own inspector, plumbing and ventilation for example, Site manager F explains that these protocols are often sent directly to the subcontractor responsible.

> *"Simple things [defects], that it gets very much of in a big house. It is not complex, but it takes time anyway, since they are many."*
>
> Foreman A

When the defects are resolved, the subcontractor signs the protocol and give it back to the case company or directly to the inspector, as the official statement that the defects is fixed. The formen then randomly pick some defects to verify. In case of poor performance they feel obligated to control the rest of the defects as well. Both Site manager C and D wish that all the defects could be controlled, but that there are not always enough resources to do it. Site manager D continues and says that it is a difficult balance because he wants to make sure that everything is fixed while he also wants to trust that people have done what they should. He

also argues that it is hard to control everything because the formen does not always have enough knowledge to know if it is fixed correctly.

Seven out of seven site managers recognize that the time it takes to receive the protocol from the inspector is varied. Four out of seven have experienced obstacles because it has taken too long, up to two weeks, a time during which not much progress is made at site. Site manager B argues that this can be extra problematic in small projects that may only last a few months. Even though the project time is short, you still have the same waiting time on the protocol and the same delivery times in case a defected item needs to be replaced. To prevent this, four site managers (F, D, C and E) and Foreman A, have started to produce their own protocols, internal protocols. This has proven to be useful in some cases but not for everyone. There are three reasons to why it has not been working. The first is that the own protocol does not always match the final protocol of the inspector. This means that subcontractors have had to come back on several occasions in order to correct all the defects identified in the protocol by the inspector, which has led to the fact that they do not trust the internal protocols. The other reason is that it does not have the same authority as the protocol of the inspector which can make it more difficult to make the subcontractors to take measures. The third reason arose when a defect was complicated, an issue with an installation. Then the subcontractor wanted to wait for the protocol to see exactly what was wrong before he fixed it. Site manager C says however that it has worked well with internal protocols in his projects. The protocols tend to almost completely correspond to the protocols from the inspector and the subcontractors do not oppose the internal protocols. In Project C and F, construction managers get the work started by working with the defects that they recall from their memory and according to what is marked with tape until the protocols arrive. Site manager E and Forman B also recognize this way of working. Their experience is that it works because the employees know the project well.

Ten out of ten of the interviewed that have practical experience of handling the defects from an inspection have expressed that it involves heavy administrative work. This work can be divided into two parts, both the part where the case company is handling the inspection protocols and the part where they are gathering the documents that will be handed over to the client.

Managing the protocol from inspections involves a lot of paperwork. From each inspection, protocols from the different disciplines are produced. If the project is extensive, these can be very long. If it is a residential project, a protocol for each apartment is set up, making it hard to keep track of the different papers belonging to different locations. After the protocols is distributed to the subcontractors and then returned with signatures, there are two sets of protocols - the signed and the unsigned ones. For each inspection another pair of protocols will be produced, which can be extensive, see Figure 13. Since the procolos are stored digitally, it is a time consuming work to scan all the papers and to keep them organized in different folders. If the papers are not scanned and saved digitally for some reason, the system becomes fragile, since paper can easily disappear or become dependent on one person who is responsible for a specific document. Except for the heavy administrative work,

another big disadvantage of this system is that it is difficult to get an overview of how much work is done and how much remains. To understand what is done and what remains, the construction managers have to look into every protocol to see what is signed or not. Everyone agrees upon that the management and control of defects is one the most time consuming parts of the inspection process.
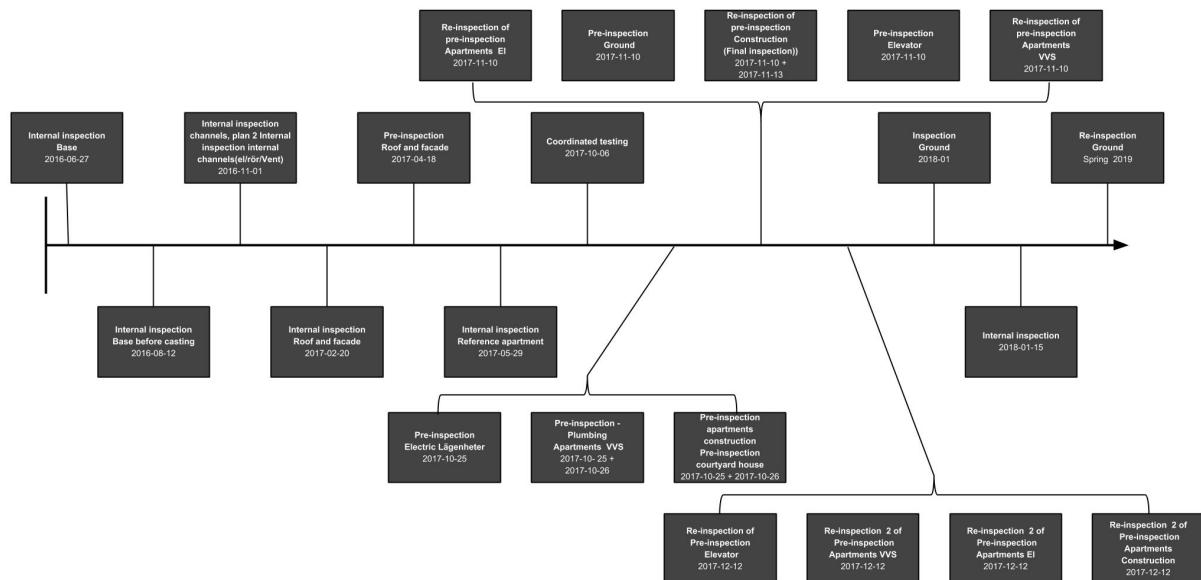
Figure 13: *The figure depicts the different inspections for one apartment building in Project F (out of three identical), each house consisting of about 40 apartments. Looking at the dates, it shows that the inspections process is ongoing for almost three years.*

The other heavy part of the administrative work is when gathering the operation and maintenance document concerning the building that will be handed over to the client. Both the site managers and the foremen have experience that the administrative work and the paperwork have increased over time, compared to a timeframe going back twenty years. The number of documents that needs to be presented and submitted as part of the inspection have increased, which they believe is due to higher demands from clients and sometimes to meet the requirements of certifications. Foreman B says that she had 60 binders only for operation and maintenance in her last project, which was a small residential project. The task of collecting this documents from subcontractors is tedious and time consuming. Site manager D explains that several of the subcontractors, small companies with only a few employees, do not have enough resources or the routines required to handle the documentation in a satisfactory way. Site manager B also say that the documentation sometimes needs to be adapted to the client's systems and routines, which may require extra work.

"The work itself is probably easier to do than the documentation that follows, that's almost the biggest part."

Site manager D

Ten out of ten of the interviewed that have practical experience of handling the defects from an inspection raises the issues that a lot of work has to be redone during this period when fixing the defects. The same calls have to be made over and over to remind people to complete their remaining work at the site. Also controls of defects might have to be done several times if they are not fixed properly or forgotten. Foreman A admits that he have sometimes failed in communicating what quality he expects when fixing a defect. Because the protocol is distributed in its full version, Foreman B says that subcontractors sometimes miss defects because they do not find their defects among everyone else's. The installation coordinator has experienced that subcontractor has said that they have fixed a defect even if they have not, because they feel that they "should have" fixed it by the time. During this period, trust between the parties plays a major role. Site manager D says that when the case company can rely on a subcontractor to do a good job, they do not have the same need to control their work. If the trust is good, they do not need to nag to make sure that things are being done. Foreman B says that she can tell quite early in a project which of the subcontractors that she can trust. The formen also experiences that new defects arise when old defects are corrected. A carpenter who fixes something may scratch a painted wall along the way, creating a new point of action. All interviewees experience problems with getting the defects remedied within the desired timeframe, this is especially true for the defects handled by the subcontractors.

"It never works well. It's very strange, it should be easy to only have lists to tick off but it's not easy at all."

Site manager D

Four of the interviewed, Site manager C, D and E and Foreman A, expresses that it can be hard to find motivation in the last stage of the project, both for the case company and for the subcontractors. Many has already moved on to the next project, both mentally and physically. For the subcontractors who have already moved to the next project, it takes a lot of effort to come back to correct often few and small things. Foreman A explains that some companies only send out a "service-guy" who previously never worked on the project. This means a lot of extra work since that new person must be enrolled with the workplace rules and procedures and also needs help finding and addressing the problem. Site manager B explains that it is harder to make the subcontractor that has only done a small job on the site to fix the defects then to make the big subcontractors to fix things.

"When everyone is packing up and everything is quite done, then there is a lot of extra work to get people back here and maybe people who have not been here before, but instead send a service guy trying to do it as fast as he can but who does not find his way and who needs help."

Foreman A

The installation coordinator explains that at his previous project they used fines when a subcontractor did not fix a defect within the deadline. This motivated some of the subcontractor but not all of them. He continues and says that it is important not only to

purchase subcontractors based on price but also consider how they have delivered in previous projects. The site managers tell that they withhold the money before the defects are fixed, but most of them also say that is does not make the subcontractors more motivated. The internal client argues instead that it is important to clarify early in the process for the subcontractor what is expected of them during the period of work with defects. She means that they need to understand that they will be given protocol after protocol and that it is important to keep the deadlines. She thinks that they should be prepared to allocate resources to deal with defects.

Summary of the elements of the inspection process
Figure 14 shows a compiled flowchart over the inspection process as understood by the empirical study. The START in the figure is the occasion just before the start of the inspection process at a project. The END in the figure is when all defects in all protocols have been remedied, i.e. when all defects from the protocol of the final inspection are resolved. The left column in Figure 14 depicts tasks conducted in preparation for the final inspection. The right column depicts all the task conducted to reach the end, i.e. have a clear protocol from the final inspection.
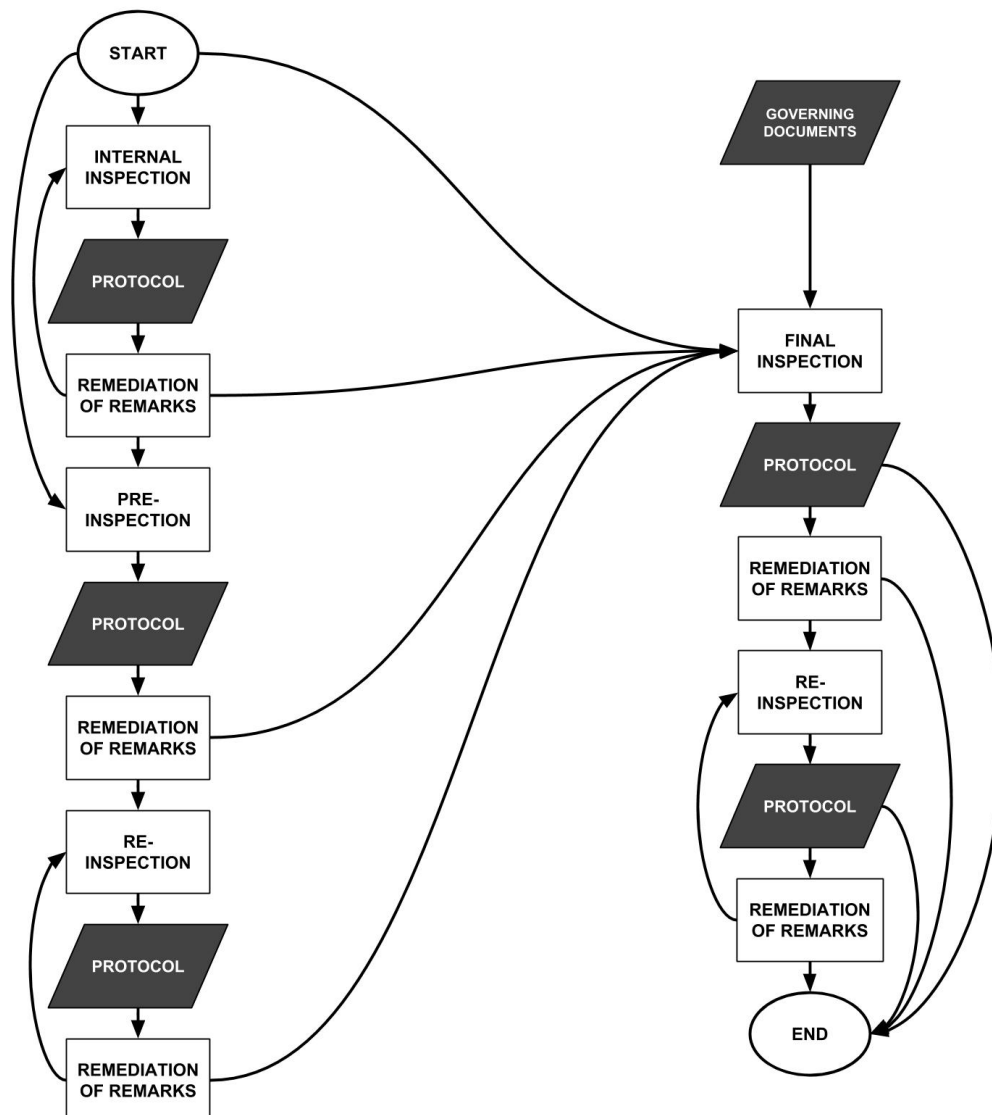
Figure 14: *Flowchart of the inspection process.*

Projects without inspections

It is however important not to forget why we do inspections - to control that the contract is fulfilled. But there are other ways than through inspections to make sure of this. Site manager G tells that on some of his projects, there is no inspection. This is projects where he works with clients he knows well, that he has worked with for a long time and where the trust between the parties it good. Instead of an inspection, the site managers takes a walk around the building together with the client. He says that this requires that the client has a background in construction and why his clients often are facility managers. If the client thinks that everything looks good, the building is handed over. If the client is unsatisfied with anything, they have a discussion about it. The site managers have never experiences that they cannot come to an agreement. This perspective on inspection is shared with Inspector A who have had projects where he acted as both inspector and project managers and where there have been no external inspection. He says that the important thing is that the parties have a common understanding of what is supposed to be build and that they trust each other to honour that agreement.

"On some of my projects, there is simply no inspection."

Site manager G

Foreman A has also worked on a project without external inspections where the project manager instead made a quick control himself of the building. He experienced however that he then only got vague information of what should be fixed and improved. For this reason he prefers regular inspections, arguing that the information is clearer, much because of the protocols from the inspector.

4.3. Digital solutions

Today, the inspection process at the case company is predominantly analogue. Files and protocols are gathered and stored digitally but the handling of documents are mainly analogue. Protocols are marked, scanned, printed, signed, and then scanned again etc, making it an administrative demanding task. Although there are digital tools out on the market specialising on inspections, there is only one project, Project E, in the Gothenburg region that uses it. Site manager A, B and E expressed that they find it difficult to control how the inspections are conducted and argue instead that it is up to the inspector to decide. In Project E is it however Forman B who has been driving the use of digital solutions and has included both the client, the inspectors and the subcontractors in the work. During interviews it was concluded that there exist a demand for digital solutions in general among the younger generation of staff. Among the interviewees in total, it was only Inspector A (the only interviewee who does not work at the case company) who was explicitly against digitizing the signing of protocols and to enable uploading of pictures of corrections of defects onto a common platform. He commented however only on the use during the inspection itself, not the aftermath, and argued then that a dictaphone works just as fast as a digital tool.

The development manager, who works with development in the Gothenburg region at the case company, believes that digital tools are perfect to apply at inspections. He explains that

the tools offers an overview that is lacking when working with paper copies and that it is easy to use the tool to sort information. It can be used to see how many defects that are not resolved or how many defects a particular subcontractor has left for example. He goes on to say that there is technology today that is far ahead but that the usage has not followed at the same rate out on site. He therefore believes that one should initially choose to work with only a few functions and suggests that the tool could facilitate the administrative work of inspectors. The tool can replace paper documentation by handling all the documents from self-controls, the protocols from inspections and documents relating to operation and maintenance on a digital platform. He thinks that a lot of rework can be cut down by avoiding having multiple copies of a document and instead have all documents gathered in one place that everyone can access. In addition to providing better order, it also improves traceability among the documents.

Foreman B, the internal client, Inspector C and Inspector D, all connected to project E, are all positive towards the use of digital tools. Forman B explains that the biggest difference when using digital tools is that the case company gets the protocol directly after the inspection and that the subcontractors only receive their own remarks, instead of the whole protocol. She also believes that it is a great advantage to get rid of all paper copies to be distributed and collected. Instead can the subcontractor themselves login and change the status of the remark when it is resolved.

The development manager has conducted surveys on pilot projects using digital tools for inspection. He then saw that both the time for documenting defects at internal inspections and the time to resolve it decreased by fifty percent. When looking at the time consumed at inspection in an entire project, he saw that it decreased by sixty percent. He clarifies that the figures are not scientific, but can be seen as indications.

4.4. A successful inspection process

When independently asking the interviewees in the case company with experience of inspections the direct question about what they associate with a successful inspection process, we could identify nine different success factors. These are all presented in table 8 and we can conclude that success in the inspection process is primarily associated with time and deadlines.

Success factor	Description
(a) Time and deadlines - 8 out of 10	*The inspection process is successful if protocols and defects are handled fast. Seven out of eight also mentions that success is associated to the subcontractors keeping their deadlines.*
(b) No/few defects - 5 out of 10	*The inspection process is successful if there are only few and minor defects at the time of external inspections or no defects at the time when handing over the construction to the client.*

(c) Management - 4 out of 10	*The inspection process is successful if internal inspections are performed and that it exist a clear division of responsibility during the process.*
(d) Administration - 3 out of 10	*The inspection process is successful if the documents connected to inspections are updated and in order.*
(e) Good inspector - 2 out of 10	*The inspection process is successful if the inspectors are knowledgeable and consistent when evaluating the construction during inspections.*
(f) Planning - 2 out of 10	*The inspection process is successful if the schedule for the process is well planned and realistic.*
(g) No repeated mistakes - 2 out of 10	*The inspection process is successful if the protocol for each inspection becomes shorter, i.e. the defects are not repeated.*
(h) No surprises - 2 out of 10	*The inspection process is successful if the case company has not forget to deliver anything that would not be detected until the inspection.*
(i) Digital tools - 1 out of 10	*The inspection process is successful if the inspection process is performed using digital tools and solutions.*

Table 8: *List of the success factors in the inspection process*

4.5. Challenges in the inspection process

Although there are a lot of things that work well in the inspection process in the case company we have, based on the empirical material, been able to identify twenty issues concerning the inspection process which we have categorized under five challenge areas.

1. **Time**
    1.1.   Construction work remaining at the time of inspection.
    1.2.   Defects are not resolved in time.
    1.3.   Difficulties to resolve defects after the end user have taken the building into use.

2. **Quality**
    2.1.   Defects detected during an inspection are mainly esthetical.
    2.2.   Quality checklists are not performed as intended.
    2.3.   New defects occur when fixing old ones.
    2.4.   New staff who is not familiar with the project is sent to fix defects.
    2.5.   Different inspectors give different judgements.
    2.6.   Judgement of inspectors is influenced by other factors than the state of the construction, for example if it is cleaned.
    2.7.   Inspectors tend to pay particular attention to the areas within which they have an extra interest or competence.

3. **Motivation**
    3.1.   Lack of motivation in the period of resolving defects.

4. Trust
    4.1. Rework regarding controls of resolved/unresolved defects.
    4.2. The case company lacks authority towards the subcontractors in comparison to the inspector, for example with the internal protocols.

5. Communication
    5.1. Information has to be repeated.
    5.2. Insufficient communication to the subcontractors regarding the required quality.
    5.3. Inspector takes too long to complete the protocol after an inspection.
    5.4. The way the inspector labels the rooms and walls in the protocol can make it difficult to find the defect.
    5.5. Heavy paperwork and administrative work. Information can be limited to a particular paper or a particular person.
    5.6. Small firms have difficulties coping with the extensive documentation.
    5.7. Difficult to determine who is responsible for which defect.

5. Theoretical framework

From the empirical research, we have identified five areas, under which the twenty identified issues has been categorized. The five areas are: time, quality, motivation, trust, and communication. Because the issues involve other actors and stakeholder to the process, we have chosen to look at these areas prom the perspective of stakeholder management. Since a purpose of this report has been to give recommendations that will make the inspection process more successful, we must first understand what success means and what it is. Below we give a theoretical perspective on project success, the five challenge areas, and stakeholder management.

5.1. Success

Project success is a well-considered topic within the academic field of project management (Pinto & Slevin, 1988). However, that does not mean that it is easy to define what project success is or how to achieve it. Munns & Bjeirmi (1996) argues that it is important to distinguish between project success and project management success, because the goals and success factors differs. For the project there are long-term success factors that includes, among others, the utility of the project over time after the project team has handed it over, while successful project management instead is oriented towards the short term goals of the project such as on-time delivery, within-budget and appropriate performance standards. Munns & Bjeirmi (1996) mean thus that a project can be successful even if the project management fail and vice versa.

Although Pinto & Selvin (1988) identifies the project team and the client as two main parties when it comes to project success, there are many other actors and stakeholders involved in a project. According to Davis (2014), it is also important to consider multiple stakeholders involved in a project when discussing project success since these might have different perceptions of what success is, see Table 7. Pinto & Selvin (1988) believes that, in order to even make an attempt on evaluating the success of a project, it is important to have agreed upon what constitutes success. Turner (2004) argues that there are four necessary condition for project success, one of them being that *"success criteria should be agreed with the stakeholders before the start of the project, and repeatedly at configuration review points throughout the project"*. He means that different stakeholder might have different perception of what is supposed to be done in the project and that different priorities risk to result in substantially different outcomes. Different stakeholder will also have different orientations towards the final outcome, which makes their view of success varied (Munns & Bjeirmi, 1996). According to Jergeas et. al (2000) is the communication within the project crucial in order to create alignment between the project team and the stakeholders. They argue that communication *"is they only way expectations can be managed, hidden agendas brought to the forefront, and project priorities establishe*d" (p. 4). Furthermore they argue that communication and stakeholder alignment is part of achieving project success. Stakeholder management is thus an important key to project success (Jergeas et. al, 2000; Retfalvi, 2014).

5.2. Time

Project management as a subject originated from the construction industry and from the heavy defence industry, from their needs to plan projects in a rapidly changing environment (Project Management Institute, 2013). The dynamic nature of the construction industry makes planning essential, because of this nature the planning needs to be continuously updated (Project Management institute, 2013). Munns & Bjeirmi (1996) argues that, one thing that can cause a project to fail is inadequately defined and planned tasks. In order to successfully plan a project the different tasks needs to be properly understood, otherwise it will be impossible to allocate an appropriate time and deadline for the corresponding tasks (Project Management institute, 2013). Josephson (1998), who studied defect in seven construction projects in Sweden concluded that time pressure was one of the root causes to the defects.

Extensive research have been made in the subject of construction delays. Adam (2017) classifies one type of scheduling delays as non-excusable delay. There have been many studies investigating non-excusable delays; delays that are caused by an action or lack of action by the contractor (Adam, 2017). Reasons behind this delays can for example be: poor planning, late deliveries and damaged goods. Adam (2017) argues that today, the best measure to prevail time overruns is to understand the underlying reasons, which often are different risks.

5.3. Quality

In a study by Xiao and Proverbs (2002), USA, UK and Japan was compared regarding quality in construction. They study revealed that the number of defects were far less in the Japanese projects. This is explained by the fact that quality is deeply rooted in the Japanese culture and the managers in Japan regard quality and delivery on time as the highest success factors in order to satisfy the client. In USA and the UK on the other hand delivery on time and money was preferred. Xiao and Proverbs (2002) concludes that the Japanese work with their contractors for longer periods (some for decades), they have more planning and monitoring meetings and the relationships is overall more stable and close which can explain their superior quality.

In 2007, Boverket conducted a study trying to understand how defects and shortcomings occur in housing. Boverket concluded that quality processes, such as inspections, are a bigger issue than the defects. One of the major reason behind this quality issue is motivation, Boverket (2007) suggested that by giving the workers more responsibility for the process and project the motivation would increase. Forcada et al (2016) analysed over 50 000 defects in apartments in Barcelona and could conclude that 64.5 percent of the defects where surface appearances, *"defects include colour, type, uneven surfaces, hits and scratches, peeling and cracks"* (p. 281). They also give suggestions as to why so many defects are recorded after handover by the customers. One suggestion is that there is a high level of inexperienced workers on the market, another suggestion is that the contractor and the client/end users have not aligned their expectations and priorities of the project which is described as a gap between the technical quality and the customer satisfaction (Forcada et al, 2016).

Choi et al. (2009) has conducted a study on the objectives of construction inspections and on outsourcing inspection. They come to the conclusion that outsourcing, in the sense of bringing more people and opinions into the inspections, increases the objectiveness. By bringing in people that are not connected to the prime contractor the objectivity of the inspections was far greater than if the contractor had performed them internally. Choi et al. (2009) also argue that the construction inspections must be separated from the general quality control of the construction.

5.4. Motivation

Munns & Bjeirmi (1996) argues that one thing that can cause a project to fail is the lack of commitment to the project. Another problem can be the lack of motivation in the termination of a project (Avots, 1969). Avots (1969) also means that the project organization is constantly changing during the end of a project, depending on the staff required, and that this affects the operating procedures and the motivation negatively. Raoufi and Fayek (2018) argues that an important factor for motivation is identification, whether one identify with the project or not. Jergeas et. al (2000) argues that the project manager must constantly sell and resell the project to the stakeholders in order to make them commit to the project. If they do not experience that it is in their interest to support the project, they are unlikely to do so. Smithers and Walker (2000) believe that motivation among people working in the construction industry can be improved through increasing planning effectiveness and decreasing the chaotic nature of a project. In a study conducted by Jarkas and Radosavljevic (2013), addressing motivational factors impacting the productivity of construction craftsmen in Kuwait, they found that the two factors that had the biggest influence on motivation were payment delay and rework.

5.5. Trust

In the relationship between team motivation and performance, trust is the strongest influencing factors (Raoufi and Fayek, 2018). Therefore, if trust is lacking in an alliance, it can pose a risk to the project performance. Das and Teng (2001) argues that there exist two different types of trust, goodwill trust and competence trust, that has to be treated differently. Goodwill trust is about relationships and if whether one party trust the other party to fulfil their part of the agreement, while competence trust is about whether one party trust the other party to perform according to the agreement. They also mean that trust and control are closely linked, where both, in different ways, deals with risk reduction. In order to reduce control, trust must be increased. By finding mutual interests, which can be created with the help of motivation, and by building trust on an individual level, goodwill trust can build between organizations (Das and Teng, 2001). Trust can also be built through collaboration and participation (Phelps and Reddy, 2009). Lui and Ngo (2004) argues that, where it does not exist goodwill trust, it is important to consider contractual safeguards as they have the same effect. Contractual safeguards, in this context, means that the contract includes penalties that makes it costly to breach the contract. They further argues that monitoring costs can be reduced by clarifying the objects of monitoring.

5.6. Communication

It was estimated by PMI (Project Management Institute) that at least 20% of projects are unsuccessful due to insufficient communication. Tucker (1986) argues that in order to increase productivity in the construction industry focus must be on promoting communication. Because of the increasing size and complexity of construction project, communication becomes more and more essential (Tucker, 1986). A major task for communication management is to develop and plan appropriate communication approaches for the stakeholder of the project (Project Management Institute, 2013). Apart from stakeholder communication, communicating management deals with the management of the project information and the monitoring of communication throughout the whole project life cycle.

Crowley (1998) describes the construction industry as predominantly analogue, *"laden down with paperwork"*. He emphasizes that there are many benefits in implementing digital systems that will lead to overall improvement in the industry. However, he notes that simply converting the paperwork to digital files will not solve the underlying issues of heavy paperwork and duplicate data neither does it take full advantage of the flexible solutions the IT-systems offers. Hardin and McCool (2015) argues that, during the construction phase of a project, information and the number of documents increase rapidly. They believe that how this information is managed and distributed is directly affecting the success of the project. They also suggest that the traditional way of using paper copies should be replaced with the use of digital tools, since that would make the handling of documents more efficient and ensure that information is continuously updated.
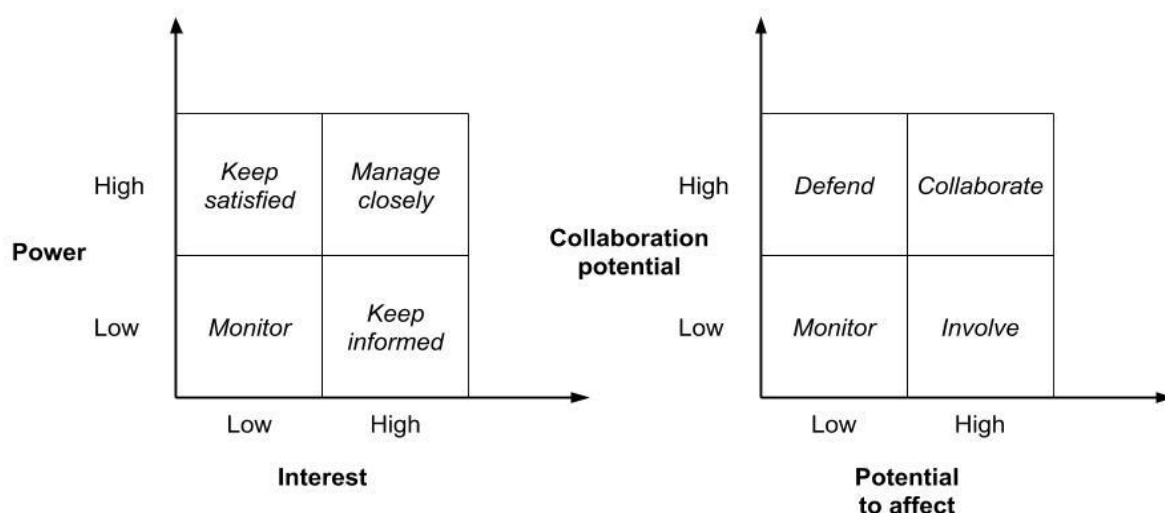
5.7. Stakeholders

The Cambridge dictionary (2018) a stakeholder as: an employee, an investor, a customer, etc. who is involved in or buys from a business and has an interest in its success. Freeman (2009) argues that stakeholders are living, breathing human beings and most be treated as such compared to other definitions which may include more abstract stakeholders like nature. Just as there are stakeholders in organisations there are stakeholders in projects. Examples of stakeholders in projects are the client and the project manager e.g.

Jergeas et. al (2000) argue that even though stakeholder management is closely connected to project success it is often not handled in an effective way. Karlsen (2002) even declares that stakeholder management is often characterized by spontaneity and casual actions that lacks planning or a strategy. Stakeholder management consists of, amongst others, stakeholder identification, planning, and analysis. (Association for project management, 2018). Karlsen (2002) suggest that, in order to address and improve stakeholder management in a project, a formalized process for identifying stakeholder should be developed. This will clarify who the stakeholders are in the particular project, what their interests are and how to handle them. Even though some stakeholders are recurring in most projects, their interests may vary from project to project.

Previous research regarding stakeholders in construction have been conducted, but the combination of stakeholder management in the inspection process seems to be missing. Aapaoja et. al. (2013) conducted a study on the finish construction market where they tried to map stakeholder in construction project. In the conclusion of the study Aapaoja et. al. (2013) suggest that a major problem in the Finish construction industry is that the importance of the external stakeholders have been underestimated and that the core team, the internal stakeholders, are formed in the planning phase while external stakeholders such as subcontractors come into the picture first when construction starts. They argue that this could create situations where the stakeholders does not have an aligned goal of the project. Olander (2007) wrote an article evaluating the stakeholder management in the Swedish construction industry. He argues that the stakeholder possessing the attribute of power are the most important to take into consideration though stakeholders possessing the attribute of legitimacy are the ones invested in the project and therefore the ones who bears the biggest risk. Lastly the urgent stakeholders must be taken into consideration simply because of the urgent nature of their claims.
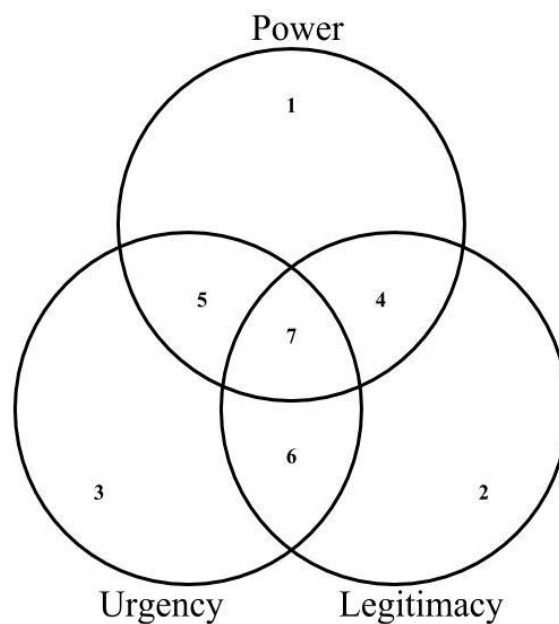
Stakeholder models

Many authors have developed their own stakeholder models or adapted existing ones. One of the most recognized models was developed by Mendelow (1991) who presented the power interest grid, see Figure 15. The model by Mendelow is a simple model for stakeholder management where the factors power and interest determine how to handle a specific stakeholder. Karlsen (2002) presented his grid model for stakeholder identification handling, see Figure 16. Instead of using power and interest as factors the potential to collaborate and the potential to affect is investigated. Note that on neither of the models the scale is only low or high, no inbetween.

Figure 15 and 16: *(to the left) The power-interest graph as suggested by Mendelow (1991). (to the right) Karlsen's (2002) model of stakeholder strategy.*

In 1997. Mitchell et al. developed a stakeholder salience model, see Figure 17. The salience of a stakeholder says to which extent the stakeholder can influence an organization / project /

process. Mitchell et. al. (1997) have recognized that salience can vary during project's lifetime. The model focuses on three attributes: Power, Legitimacy and Urgency. Power refers to the power the stakeholder have over influencing the organisation/project. Legitimacy is about the appropriateness of the stakeholders involvement. Lastly urgency defines how immediate the stakeholder needs attentions. Before the salience model was presented stakeholder models had mainly focused on power as the main factor. Mitchell et al. (1997) argued that it was not enough to only take one factor into account. These three factors have different characteristics and are graphically represented as three overlapping circles. From the model can 7+1 types of stakeholders be derived which has different strong features of the different attributes. The model is visualized in figure 17.

Figure 17: *A model of stakeholders described by Mitchell, Agle and Wood (1997).*

1. Dormant stakeholders - possess power to impose their will, but do not have any legitimate relationship or urgent claim. Their power remains unused.

2. Discretionary stakeholders - possess the attribute of legitimacy, but they have no power or urgent claim. There is no absolute pressure for managers to engage in an active relationship, although they may choose to do so.

3. Demanding stakeholders - possess an urgent claim, but have no power or legitimate relationship. This is bothersome, but does not warrant more than passing management attention.

4. Dominant stakeholders - are both powerful and legitimate. It seems clear that the expectations of any stakeholders perceived by managers to have power and legitimacy will matter.

5. Dangerous stakeholders - lack legitimacy, but possess power and urgency. They will be coercive and possibly violent, making the stakeholder 'dangerous'.

6. Dependent stakeholders have urgent and legitimate claims, but possess no power. These stakeholders depend upon others for the power necessary to carry out their will.

7. Definitive stakeholders are those that possess both power, urgency and legitimacy. They will already be members of an organization's dominant coalition. When such a stakeholder's claim is urgent, managers have a clear and immediate mandate to attend to and give priority to that claim.
8. Nonstakeholder

<div align="right">Mitchell et. al. (1997)</div>

There have been attempts to combine the salience model with the power-interest grid (see Collins, 2018 for example) but it seem to be hard to map the stakeholders correctly when they are not applied to a specific project. Which is why we have decided to leave them as two separate models and not combined them.

6. Stakeholder analysis

In this chapter we identify and analyse the stakeholders connected to the inspection process.

When we studied the case company we found many examples of stakeholder management. The whole inspection process as such, as seen from the perspective of the case company, can be considered stakeholder management towards the client. Karlsen (2002) have found that the clients and the end users are the most important stakeholder in a project, but that the client, the end users and the contractors are equal when it comes to causing problems and uncertainty for the project. We interpret this as though everyone has the same potential to cause problems, most attention is paid to the clients and the end users, which supports what we have seen in the case company. This inconsistent success regarding stakeholder management is also supported by the arguments from Karlsen (2002) states that stakeholder management is often characterized by spontaneity and casual actions that lacks planning or a strategy, in other words ad hoc.

Based on the empirical studies, we have identified five stakeholders to the inspection process, the case company, the client, the inspector, the subcontractors and the end users, see Figure 20. This is people that participate in or that are directly influenced by the inspection process. Since we believe that the case company shows a united front towards its stakeholders, we have chosen to merge the different roles in the company and treat them as an individual party, without considering that they may be internal stakeholders to each other. When we discuss the company in relation to other stakeholders, we have chosen to merge their overall characteristics. This means that, if one person in the company, the site manager for example, has power, the case company as a whole has power. The case company in this context mainly focus on the site management.
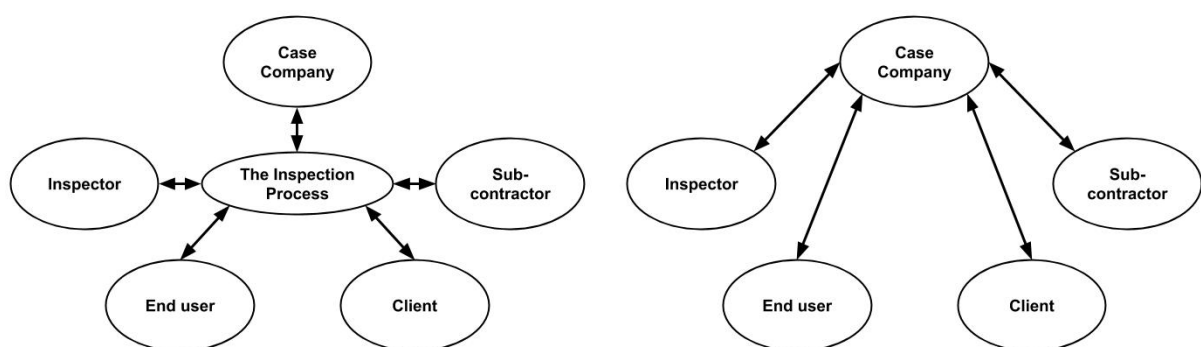
Figure 18 and 19: *(left picture) Shows the stakeholders to the inspection process as identified through the empirical study. (right picture) Shows how the stakeholders will be analysed, from the perspective of the case company.*

The stakeholders and their characteristics are analysed in three different parts, all from the perspective of the case company, see Figure 21. As Karlsen (2002) emphasizes, the salience of stakeholders can change during a projects, or in this case a process. The first part concerns

the planning of the inspection process. The second part concerns the performance of the external inspections at site, how the inspections is carried out and what tools are used. The third part concerns what influence the stakeholders have on the outcome of inspections. The outcome refers to the level of quality the building has when approved and handed over to the client and later the end user. It therefore also concerns the content in the protocols from the inspection, i.e. what kind of defects need to be adjusted and resolved before handing over the building. We argue that the end user is only concerned with the outcome of the process, why we treat them as non stakeholders in the first two parts. This is supported by Munns (1996) who argues that the end user is unaware of the management processes and whether these have been successful or not.

6.1. Process

Since it is the case company and the client who in collaboration decides what types of inspections should be performed in the project we claim that they both possess power over the planning of the process. The case company is also the one to set the timeframes for the different elements, both internal and external, making them the stakeholder with the most power. Since the case company needs time indications from the subcontractors to be able to set dates, we argue that the subcontractor has indirect power over the process. If the subcontractors are running late for example, it can cause the whole process to be delayed or extended. From what we have seen, the inspectors do not have any power to affect the planning of the process even if they can give their input on it.

The case company, subcontractors and the inspector possess legitimacy because of their experience of inspection processes. The level of legitimacy can however vary depending on the person. More experience and authority means more legitimacy. The case company and the subcontractors also have legitimacy because of their knowledge of the specific project. The clients possess legitimacy because they finance the inspections in the process.

Urgency defines how immediate the stakeholder needs attentions (Mitchell et. al., 1997). We believe that the case company, the subcontractors and the client possess urgency. The case company because they perform the planning of the process, if they change anything in the schedule, it needs immediate attention. Same if the client wants to add or take away an element of the inspection, a re-inspection for example, which is also their right by the AB contract. The subcontractor possess urgency because a change in their time frame needs immediate attention since it can have great effect on the process deadlines. Since inspectors are very busy people, the case company has to immediately react to any claims from the inspector since it is important to be able to perform the inspection when decided. Otherwise, it might have major consequences for the progress of the inspections process. This means that the inspectors also possess urgency.

The client: *Definitive stakeholders (power, legitimacy, urgency)*
The inspector: *Dependent stakeholder (legitimacy, urgency)*
Subcontractors: *Definitive stakeholder (power, legitimacy, urgency),*
but treated as Dependent stakeholder (legitimacy, urgency)

End user: *Non stakeholder*

Definitive stakeholder will already be members of an organization's dominant coalition, which is consistent with the position of the client when planning the inspection process. When placing the client in the strategy models by Mendelow (1991) and Karlsen (2002), we believe that the client should be managed closely and collaborated with. Because the case company is planning the inspections process in collaboration with the client, because the client is invited to attend the inspections and because the client is informed of the status of the remaining defects we believe that the stakeholder management towards the client follow what is proposed by the theoretical framework.

The inspectors are dependent stakeholders that depend upon others for the power necessary to carry out their will. This corresponds to how inspectors are treated in relation to the planning of the process. They can act as advisors but they cannot decide on how to plan the whole process. Even though the inspectors power over the whole process is low, their power to affect specific dates (the dates for inspections), are high. We also argue that their interest for when the dates are set for inspections is low. This means that they should be kept satisfied in order to not cause an urgent claim on moving inspection dates. The case company do this by keeping the deadlines for the construction and by have a clean and presentable building for the inspector to inspect.

The subcontractors is a definite stakeholder. When a definite stakeholder's claim is urgent, managers have a clear and immediate mandate to attend to and give priority. Delays from subcontractors when fixing defects are recurring issues that affect the planning of the process. Since subcontractors are definite stakeholders, actions should be taken immediately when these delays occur. The actions taken by the case company is then either to repeatedly remind the subcontractors of the deadlines or by monetary sanctions like withholding money or imposing a fine for delays. When looking at the model by Karlsen (2002), we believe that subcontractors both have high potential for collaboration and also to affect the process. This means that collaborative actions should be taken towards the subcontractors. Since they are only kept informed about the process, the case company does not act on the power attribute of the subcontractors. From what we can conclude from the empirical study, subcontractors are part of the process but they are not invited to be a part of designing or influencing it. Subcontractors should consequently be invited to help plan the inspection process, they should be continuously updated and a collaborative relationship should be built.

6.2. External inspection

We claim that the client is the only one who possess power over how, and with what tools, the inspection is performed. It is the client who procure the inspector, and can therefore decide how they want them to carry out the inspection. However, from what we have experienced, the client often gives this power away to the inspector. Since the way the protocols from the inspection is done is affecting the effectiveness of the work of fixing the defects, we have also seen that, in Project E, the case company have decided that digital tools should be used for the inspections. A tool that was new to the inspectors in the project. This

means that the case company also can be given power over how the inspection is performed. This contradict the perception that the case company has no power to influence what tools are used during the inspection perceived by some employees. From what we have seen, subcontractors do not have any power over how to perform the inspection.

The inspector definitely possess legitimacy since they work with performing inspections. We believe that the client, the case company and the subcontractors have legitimacy, at least if they have previous experience of inspections. The client has legitimacy, again because they procure the inspector.

Since it is the inspectors that perform the inspections, it is only them who possess urgency towards the case company.

The client:	*Dominant stakeholder (power, legitimacy)*
The inspector:	*Dependent stakeholder (legitimacy, urgency),*
	but treated as Definitive stakeholder (power, legitimacy, urgency)
Subcontractors:	*Discretionary stakeholder (legitimacy)*
End user:	*Non stakeholder*

Since the client is a dominant stakeholder, their expectations will matter. This is obvious, as it is the client who procures the inspector and can therefore put demands on how to perform the inspection. Because the client has high potential both to collaborate and to affect, the case company should collaborate with the client if they want to increase their power over the way the inspection is performed.

Even though the inspectors are dependent stakeholders, we have experienced that they are often regarded as definite stakeholder, possessing both power, legitimacy and urgency. When placing the inspector in the model by Mendelow (1991), be believe that they have low power, but high interest in how the inspection is performed. They should thus be kept informed.

The subcontractors are a discretionary stakeholder. There is no absolute pressure for managers to engage in an active relationship, which the case company usually does not do when it comes to deciding how to perform the inspections.

6.3. Outcome

When looking at the contracts, we argue that the inspector should not have any power over the outcome of the process. If they are entirely objective, the outcome should only be depending on the state of the construction. From the empirical study we could however see that the outcome is highly dependent on the inspector, which means that the they do possess power. They also possess power both to add and to take away defects in the protocol. The case company and the client also possess power, although not as much as the inspector. The company because they have power to add defects in the protocol that they believe should be fixed, and the client because they have power to take away defects in the protocol if they consider the defect acceptable. The subcontractors have indirect power since they can

recommend the case company to add defects in the protocol concerning their discipline. The client gives the end user the feeling of having power by inviting them to inspections, even though they keep the power to decide which of the remarks from the end users that they want to address and put in the protocol.

All five stakeholders possess legitimacy to the outcome of inspections. The case company and the client possess legitimacy since they are the ones who have legal rights for claims during inspection. The legitimacy of the inspector is obvious. The subcontractor because is it their job being inspected and judged. The end user because they are the one who will use the finished building and are therefore affected by the outcome.

The inspectors possess urgency since their claim on the outcome has immediate effect on the following work on site. If a defect is noted by the inspector, actions will be taken within the near future. Because the subcontractors usually have the most knowledge of what is being inspected, their claim should be treated urgently because it has direct impact on the outcome. The client does only possess urgency in an indirect way from the perspective of the case company. Their claim has to be assessed by the inspector, and it is only if the inspector considers it to be a defect that it becomes urgent also for the case company. Similarly does the end user also possess urgency in an indirect way. The claim from the end user has to be assessed by the client and then by the inspector, and only thereafter it becomes urgent for the case company.

The client: *Dominant stakeholder (power, legitimacy)*
The inspector: *Definitive stakeholder (power, legitimacy, urgency)*
Subcontractors: *Dependent stakeholder (legitimacy, urgency)*
End user: *Discretionary (legitimacy),*
but sometimes treated as Definitive stakeholder
(power, legitimacy, urgency)

The clients are dominant stakeholders and from what we have seen the claims concerning the outcome from the client matter to the case company, in line with what theory says. When placing the clients in the model by Mendelow (1991), we argue that they both have high interest as well as a lot of power, meaning that they should be managed closely. One example of this is when the case company performs normative inspections, which is a way for the parties to early agree on the outcome of the inspections process.

The inspectors are definitive stakeholders. This is confirmed by the employees who express that the words of the inspector is definite, even though in practice there is room for discussion. It is ultimately also the inspector who sets the level of quality that the building needs in order to be handed over to the client. If the inspector is engaged early in the process, we believe them to have high potential to affect the outcome because of their specific competence. In order for them to stay objective we believe however that they should not collaborate closely. This means that the case company should keep the inspectors involved.

Our perception is that the inspectors themselves want to be involved early, because they consider themselves possessing knowledge that would benefit of the process and its outcome.

Subcontractors are dependent stakeholders since they possess legitimacy and urgency but lacks the power to decide whether what they have built lives up to the accepted outcome. Even though their power is low, we argue that their interest, at least on the outcome of their own work, is high, why the case company should keep them informed. This is something they do since the subcontractor is informed both about what defects the inspector has found on their work. We would also argue that their potential to affect the outcome is high, but that their potential to collaborate is low, since the agreed level of quality is a question between the client, the case company and the inspector. They should therefore only be involved, which they become when the case company invites them to attend the inspections. It is a way for the case company to give their subcontractors the opportunity to have a dialogue with the inspector about the expected performance of their work.

The end users, that have been a non stakeholder up until now, is considered a discretionary stakeholder in relation to the outcome. This means that there is no absolute pressure for managers to engage in an active relationship, although they may choose to do so. And often the client chose to engage them. When inviting the end users to inspections, the client shows them that they are important and that they consider their opinions. By inviting the end users, the client increases their power and urgency to the outcome. This is however only indirect characteristics from the perspective of the case company. We would however argue that, since the end user is an important stakeholder for the client, they also become important to the case company since the client is an important stakeholder for the case company. This would explain why the case company, in Project D, had one person appointed to take responsibility for the communication with the end users, both to keep them informed but also to listen to them. This meant that the end users had a personal contact with someone directly at the case company without having to go through the client. Formally the end user is not entitled to this direct contact to the case company but in this case the contact served as stakeholder management towards the client and the end user as a way to keep the client satisfied and the end user informed.

6.4. Summary

In the chart below, Table 9, a summary of the identified stakeholders, and how they should be handled in the three parts of inspection, is presented.

Stakeholder	Type of stakeholder	Action
The inspection process		
Client	Definitive stakeholders	Managed closely, collaborative actions
Inspector	Dependent stakeholder	Keep satisfied

Subcontractor	*Definitive stakeholder*	*Collaborate, immediate action to claims. The subcontractors power to affect the process is often underestimated.*
End user	*Non stakeholder*	*No action*
External inspection		
Client	*Dominant stakeholder*	*Collaborate*
Inspector	*Dependent stakeholder*	*Keep informed. Inspectors are often given more power than they are entitled to.*
Subcontractor	*Discretionary stakeholder*	*No pressure to engage in an active relationship*
End user	*Non stakeholder*	*No action*
Outcome of inspections		
Client	*Dominant stakeholder*	*Managed closely*
Inspector	*Definitive stakeholder*	*Involve*
Subcontractor	*Dependent stakeholder*	*Keep them informed, involve*
End user	*Discretionary stakeholder*	*No pressure to engage in an active relationship, although they may choose to do so. End users are often given more attention than they are entitled to in order to keep the stakeholder satisfied.*

Table 9: *Suggested actions for each stakeholder in the three parts of the inspection process.*

7. Discussion and Analysis

In this chapter we will discuss and analyse how the inspections process can be improved based on our empirical findings, the theoretical framework, and the stakeholder analysis.

7.1. Process success

When looking at the identified success factors, we can see that although some of them is similar to success factors for project management, just as many are specific to the inspection process, such as (b) no/few defects. Just like Munns & Bjeirmi (1996) distinguish between a successful project and successful project management, we would argue that the inspection process can be successful even if the project or the project management is not and vice versa, because their success factors differ.

7.2. Time

Just like the Project Management Institute (2013) describes planning of time to be essential, a lot of effort is spent on planning also in the case company. Based on our empirical studies, we have understood that the company works a lot with the planning to achieve the right quality while at the same time being able to hand over the project on time. This is mainly about making a stakeholder, the client, satisfied. Site manager B expresses that it is important to have a well planned final stage in order to obtain the best possible quality of the project. He means that it takes time not only to perform the inspections but also a lot of time to fix the defects - often more time than expected. This is also something that Site mager F have experience, why he always adds a time buffer after each inspection. The site managers also confirm Adam's (2017) conclusion that one underlying reason for time delays can be late deliveries and damaged goods. Site manager B had experiences time delays because of a faulty fitted carpet. The acoustic properties of the installed carpet was wrong so a new one had to be ordered. The delivery time for the new carpet was however several weeks. Site Manager B therefore insists that it is important to carefully study the drawings and documents from the client in order to avoid similar mistakes. When setting times for the different inspections, the site managers need to take into account when different parts of the building are completed, when the building components are accessible and if there is any part of the building that the customer wants to access earlier than at the end of the project. The site managers also stress that it is important to schedule the time between inspections. If there is no time to fix the majority of the defects between the inspections, it is better to move or remove an inspection.

> *"The planning of the inspections begins on day one. You decide in consultation with the client when the inspections will be."*
>
> Site manager A

The internal client, who has specialized on the final stages of projects, argues that also the deadlines before the inspection process begins are important. All work must be completed in

order to get started with inspections. It is important to highlight the final stage in the schedule as well and to show the different inspections and all the activities connected to it, cleaning for example. This is primarily to provide the best conditions for a stakeholder, the inspector. Site manager C and Forman A says however that they have experience from projects where there are work remaining at the time for inspections. This have been confirmed at site visits as well. A delay like this may however present a problem, a risk, since the number of defects from an inspection tends to increase if the construction is not completed, in bad condition or untidy at the time of inspection.

Munns & Bjeirmi (1996) argues that one factors that can cause a project to fail is inadequately defined tasks. This could explain why problems arise at the end of the inspection process, as the number and character of defects can be unpredictable and therefore difficult to plan for. All interviewees confirm that a major part of the issues concerning defects not resolved in time, is connected to a stakeholder, the subcontractors. It takes them an unreasonable amount of resources to fix the defects. This kind of time delay can, as suggested by Adam (2017), be categorized as non-excusable delay caused by the lack of an action by the subcontractor. The planner argues that even though it can be hard to plan for the period of resolving defects, deadlines can be based on experience and key numbers. We believe that, using this key numbers would provide the time necessary for the subcontractors to complete within the time frame. Although deadlines are schematically set, the planner insists that it is important that they are kept. This is partly due to the fact that inspectors are busy, but also because the company have counted on the people to be able to move on and work on other projects where they are needed. Just as the defects can be difficult to plan for, we think, in accordance with Josephson (1998), that a reason that defects might have occurred initially could have been because the subcontractors have experienced time pressure, maybe because of insufficient planning in the first place.

The issue of delays when fixing defects also shows that the success factors in the process have not been aligned since time and deadline have not been a priority for the subcontractors. Turner (2004) argues that different priorities might jeopardize the success and suggest that success factors should be aligned before the start of the project. According to Jergeas et. al (2000), communication is the key to reach this alignment of success.

Lastly it is suggested that, in order to successfully plan a process, the process must be understood (Project management institute, 2013). We believe that the case company does not always have enough technical competence to fully understand the subcontractors process of resolving defects. For example, Site manager A explained to us that since he does not have all the technical knowledge for the installations on the project, he is not being part of the inspection for installations. In order to better understand the process of resolving defects, we suggest the subcontractors to be more involved with the planning and allocation of time for fixing defects.

7.3. Quality

The inspection process is in general about quality control, and therefore also about project quality management. Both internal and external inspections are part of this, just like the quality checklists collected during the process. Although everyone seems to agree upon that inspections are a good tool for quality control, there seems to be a problem in the actual assessment, where it was discovered that different inspectors judge the same quality differently. From the empirical study we learned that, to get to know each other, during for example pre-inspections, seems to reduce this problem. To have several inspections is however not possible in all projects, especially not smaller ones. As suggested by Choi et al. (2009), more people should attend the inspections in order to make them more objective.

The quality management through quality checklists do not always work as intended. The plumber admits that they sometimes fail to perform the quality checklists properly. Instead of controlling that everything is correct when installing, the quality checklist if filled afterwards, based on the memory of how it was built, which reduces the reliability. He also expressed that he thought it was better before, twenty years ago, when he experienced that the inspector inspected each step. It appears that more and more responsibility is placed on the subcontractor to ensure the quality of the construction since the inspections primarily deal with the cosmetic. Continuous inspections, by a third party, would cause responsibility to be partially recovered by the inspector. This would however not solve the root problem of the quality checklists not working as intended.

Verifying that defects that occurred during inspections are fixed is also a part of the quality control. Usually, this is only partially done because of a shortage of resources. Instead of making internal controls, the housing projects have chosen to do the re-inspections, which means that it is instead the external inspector that controls if the defects have been resolved compared to doing the inspection internally. By outsourcing the control, it will also become more objective, as supported by Choi et al. (2009).

Both our empirical study and the study made by Forcada et al (2016) have observed that even though the defects from an inspection can be numerous, they are mainly about superficial defects. Forcada et al (2016) suggestion that this can be caused by a high level of inexperienced workers on the market. This is not something we have confirmed in the case company, but because there is a boom in the industry right now [2018] and a lack of labour, we would think that the inexperienced workforce might increases. Forcada et al (2016) also suggest that the contractor and the client/end users have not aligned their expectations of quality in the project. The case company is working with the alignment of quality by performing normative and internal inspection.

Xiao and Proverbs (2002) concluded that a better overall relationship with subcontractors and a common understanding of success was the main reason behind the successful project execution in Japan. We suggest therefore that the case company should have more meetings (planning and follow up) with the subcontractors before an in connections to the process and

that they should try to build a long lasting relationship. Boverket (2007) suggests that by giving the subcontractors more responsibility their motivation also increased, which in turn renders fewer defects. Secondly, the Japanese managers had quality and delivery in time as their main success factor and argued that money will come if the preceding two are managed (Xiao and Proverbs, 2002). This is something that is good to keep in mind when working with inspections.

Another risk in the inspection process is to be overwhelmed by the number of defects from inspections. To prevent and minimise this risk, the case company works with internal and normative inspections. An element of the inspection process that everyone agree minimizes the potential defects on the external inspection. Both Inspector A and the installation coordinator also believe that continuous inspections and pre-inspections is a tool for avoiding surprises at the final inspection. Early and more numbers of inspections are a preventive measure to minimize the risks connected to inspection defects. Another way to address the risk is through a best practice observed at site - to ensure that the construction is completed and cleaned at the time of inspection. We believe that an orderly construction can help the case company to achieve less defects. From the empirical study we could also see that the interviewees agreed that involving inspectors early in the process was beneficial and could make the inspection process smother. This can serve as a response to the risk of having numerous defects as well. We believe that early involvement can, just like normative and pre-inspections, give the case company an opinion about the inspectors and how they assess quality in order to adjust to that.

7.4. Motivation

From the empirical study it was concluded that it was hard to find motivation in the end of the process, which, according to Avots (1969), can be caused by the organisational changes in the termination of a project. Since a lot of people consider their work to be done at the time of inspection, many leave the site and move on to new projects, both people from the case company and among the subcontractors. This probably affects the morale negatively. The loss of staff in combination with the fact that the planning of resolving defects is unpredictable can result in a chaotic phase of the project, which will, according to Smithers and Walker (2000), result in lowered motivation as well. Jarkas and Radosavljevic (2013) identify rework as a motivation reducing factor, something that the inspection process is full of.

"Generally the 95 percent rule applies"

Site manager D

The 95 percent rule in this context means that the last five percent of the project is the hardest. As described above the motivation in the last part is low.

As concluded in the stakeholder analysis, collaborative action should be taken towards the subcontractors. Collaboration and participation is something that, according to Phelps and Reddy (2009), will increase the motivation of the subcontractors. We believe that

collaboration would also make the subcontractors more likely to identify themselves with the process and the project and that their motivation would therefore increase, as supported by Raoufi and Fayek (2018). When they are given more responsibility over the process, another factor is added that increases motivation according to Boverket (2017).

Even though Jarkas and Radosavljevic (2013) concluded that payment delays was the factor that influenced the motivation of the craftsmen the most, we could however conclude that withholding money did not seem to have any effect on the motivation in the case company. This only suggests that the issue of motivation is complex and that is no one-fit-all solution. We therefore believe that the success factors of various actors need to be taken into account, as supported by Davis (2014). Since success factors will vary from project to project and from company to company (Karlsen, 2002), communication management must try to understand the stakeholders positions. For example a meeting/workshop in the beginning of the project can be held, with the aim of understanding the different success factors. In order to better understand what motivates different actors and how to work towards it, we also suggest that the case company should evaluate the process in the end of the project in order to find best practices. This can help to understanding the success factors in retrospective and to identify lessons learned for the next project.

7.5. Trust

Even though the case company spends a lot of time to control if defects have been resolved, they do not have the time to do it as thorough as desired. Das and Teng (2001) argues that trust and control are closely linked, where both deals with risk reduction. In the inspection process there is a risk that the subcontractor do not resolve a defect in time or maybe not at all. Since the subcontractors sometimes miss to resolve defects or because they say they are resolved even though they are not, we would argue there are problems with goodwill trust, defined by Das and Teng (2001) as whether one party trust the other party to fulfil their part of the agreement. But if the case company wants to reduce the need for control, they must start building trust. We believe that they can do this in two different ways, either by building trust for real or by replacing trust with something else.

To, as proposed by the stakeholder analysis, cooperate with the subcontractors is one ways of building trust, supported by Phelps and Reddy (2009). Hopefully, this also leads to the establishment of trust at an individual level between collaborative colleagues in the project, which is Das and Tengs (2001) proposal for building trust. Working with different success factors for the stakeholders also helps to find mutual interests, which in turn can also lead to trust (Das and Tengs, 2001). If the case company instead choose to replace trust with something else, Lui and Ngo (2004) suggest implementation of contractual safeguards. The fact that the case company withholds money cannot be considered a contractual safeguard because it will not become a costly measure for the subcontractors, as the definition of says, but only a delayed payment. This has also proven not to be successful. When using fines as a contractual safeguard on the subcontractors it seems however to work better, albeit not quite perfect. This may either be due to the fact that the subcontractors did not consider the fine to be costly enough to take action or because cost was not a success factor for them. Where the

monetary sanctions has worked, money has probably been a success factor for the subcontractor. This supports Karlsens (2002) argument that recurring stakeholders may have varying interests in different projects. The case company should also consider how to formulate these contractual safeguards. In the one project where contractual safeguards had been used, each unresolved defect was punished with a fine. This was a powerful action against the subcontractors with numerous defects, but did not have the same effect on those with few defects. It can become costly for the painters, even though their defects are minor, while other subcontractors, with only few defects, might not be affected. Although contractual safeguards may feel like an easier way to go short-term, there are many other benefits of building trust in addition to the risk reduction. It is, inter alia, the strongest influencing factor on motivation, supported by (Raoufi and Fayek, 2018).

7.6. Communication

In the inspection process there are some challenges regarding insufficient communication. Since at least 20% of projects are unsuccessful due to scarce communication (PMBOK, 2013), the case company needs to work more with project communication management to not risk failure. Foreman A admits for example that he have sometimes failed when communicating what quality he expects from subcontractors when fixing defects and in some project the follow up of an internal inspection have been unclear. It has also not always been possible to communicate to the subcontractors why it may be of value for them to attend an inspection. Some painters thought it was good for them to participate in inspections while others questioned the presence. This can also be linked to the fact that one painter did not think that it was in his contract to be present during the inspection process. A good example of communication, on the other hand, has been the internal and normative inspections where it was possible to communicate what quality that is expected in the project. Another example is when the internal client invites the subcontractors to a meeting early in the project, concerning what is expected of them during the inspection process. During this meeting, she also explains that it is crucial for them to understand that the deadline for completing installations and construction is when the final stage is initiated, not when handing the building over. She argues that all work must be completed in order to get started with inspections. This is also an example of how to identify information needs and take action to ensure that it reaches the concerned stakeholders, similar to the process suggested by PMBOK (2013).

The case company have successfully started to work with digital tools during inspections, used in Project E, and the indications we have seen during the study suggest this to be a suitable solution to the issues concerning protocols and heavy paperwork. When using digital tools, only one of each inspection protocol exist, which significantly reduces the paperwork in the process. The protocol is also received at the same moment the inspection is completed. By using a common digital platform that everyone can access the dependence on a single person in a project is also reduced. Hardin and McCool (2015) argues that the implementation of digital systems will make the distribution of information more efficient and ensure that information will be updated regularly. From the stakeholder analysis we can

conclude that the inspectors are treated as if they possess more power than they in reality do over the tools used during inspections. This means that the case company, after all, has the opportunity to influence with which tools the inspection is to be performed.

For the challenge concerning the repetition of information, we suggest that the case company demands that the subcontractors attend inspections. This allows them to get qualitative first-hand information while allowing them to question and discuss the defects directly with the inspector without having to communicate through the case company. This will also give the subcontractors an idea of what, how much and where their defects are. Having subcontractors attending the inspections will also, as Choi et al. (2009) suggest, add opinions that will make inspection more objective. For the repetition of information we also suggest that the case company produces a communication plan for how and to whom information is distributed.

8. Conclusion

In this chapter we present our conclusions, final thoughts and recommendations for improving the inspection process at the case company. We will briefly summarize the three questions previously answered in the report and also answer the last research question *"How can the inspections process at the case company be improved?"*. Lastly the study will be evaluated and we will give suggestions for further research.

Our main research question was *"How is the inspection process conducted in the case company and what are the employees' evaluation on it?"*. We have come to the conclusion that even though the process may be more or less extensive, it follows the same principles in all projects, with inspections that can be added or taken away. Housing projects tend to have more inspections than other projects. The different inspections are performed in a similar way and the process have the same activities connected to it. We could also conclude that all processes, big or small, faced the same challenges. In chapter 4, *Findings*, we describe the inspections process in more detail, mixed with opinions and perspectives of the participants in the study.

From the empirical study we can conclude that the inspection process, in practice, is a process of finding a common agreement between the client and the contractor of whether or not the product is according to contract. As an objective judge, inspectors are hired to perform the inspections. Even though it should be defined in the contract what the client has ordered, and to what quality, there is room for variations and interpretations, why the inspections become a matter of give and take, see Figure 22. Because of inspections, both the client and contractor can get an end to the project and avoid later discussions on whether or not the contract was fulfilled and the right product delivered.
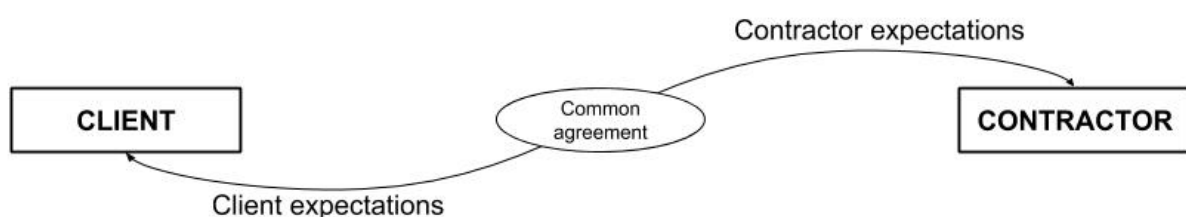

Figure 20: *A graphical representation of the inspection process in which the inspector acts as a judge to where the common agreement is. The common agreement can be more to the left or right in the picture depending on the client, the contractor and the inspector. Note that it is not necessary so that the client and the contractor have different expectations.*

The second research question was *"What characterizes a successful inspection process according to the employees?",* which resulted in nine success factors, presented in Figure 21 and further defined in the end of chapter 4, *Findings*. We concluded that the inspection

process can be successful even if the project or the project management is not and vice versa. This is based on the fact that their success factors differ.
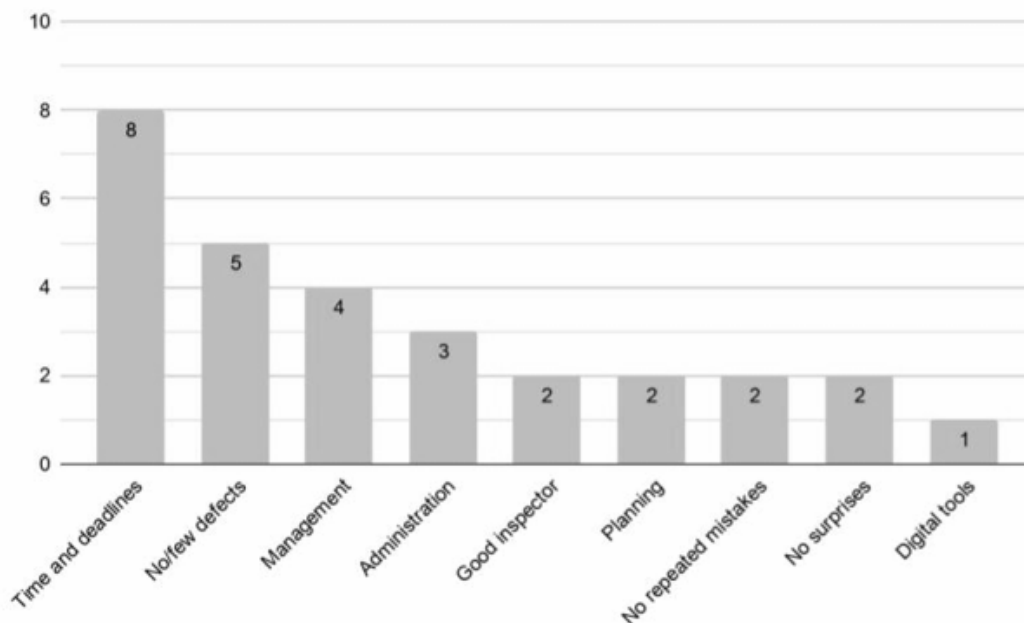
Figure 21: Success factors in the inspection process according to the employees.

In the end of chapter 4, *Findings*, we also answered the question *"What challenges exist in the inspection process?"*. We were able to identify twenty issues concerning the inspection process which we have categorized under five challenge areas; time, quality, motivation, trust and communication. These problems are intertwined and affecting each other, where, for example, several issues can lead to a new issue which, in turn, affects another issue and so on. Figures 22 shows how the issues of the inspections process are linked together and which issues that are consequences of which problems. With help from this figure, we can conclude that Motivation (4.1.), Paperwork (5.5.) and Defects not resolved in time (1.2.) are the major issues. We can also see that there are vicious circles of issues in the process. For example: heavy paperwork has a negative impact on motivation, which causes defects not to be resolved in time, this requires rework of controls which creates more paperwork, which in turn reduces motivation, etc.
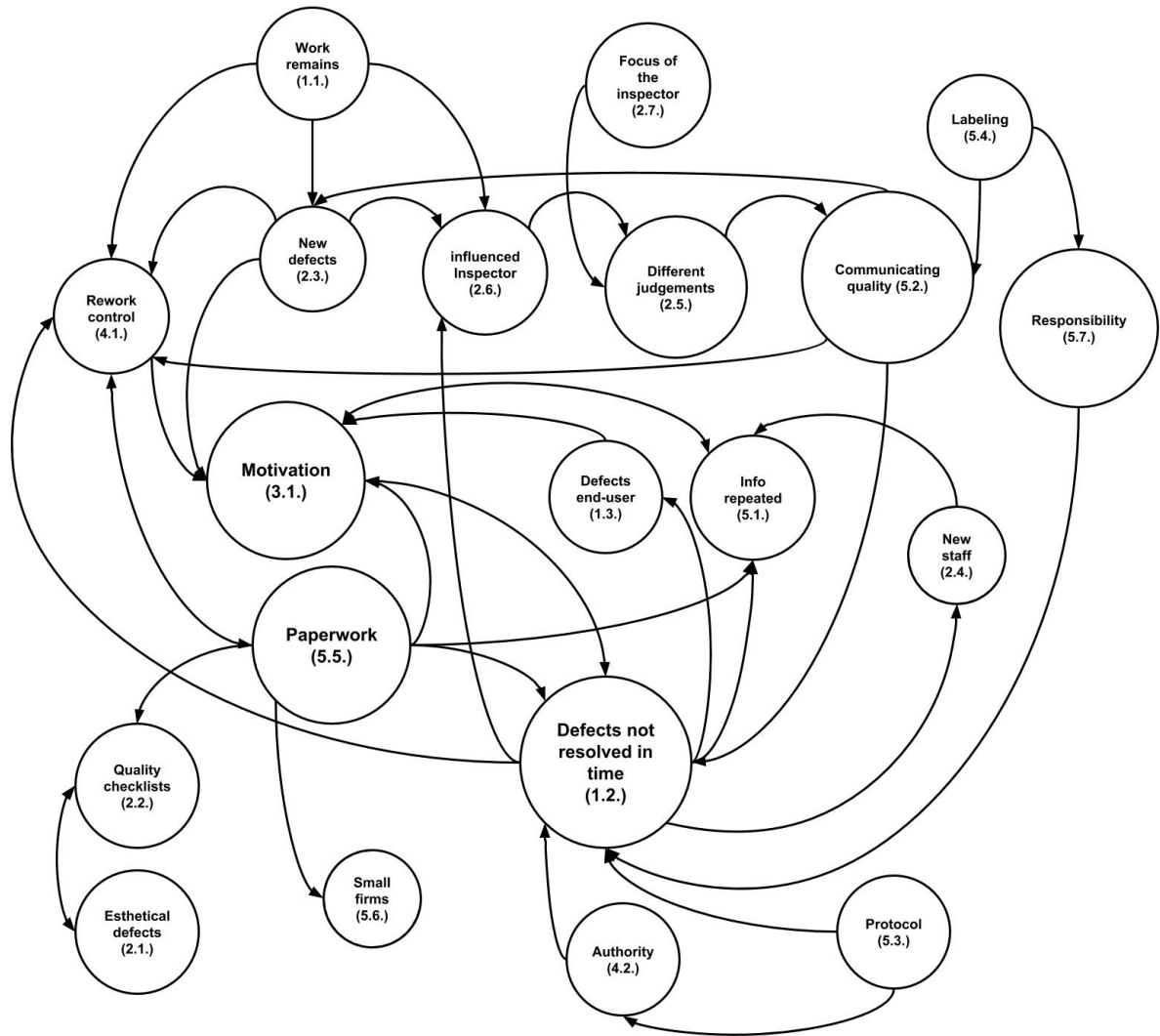
Figure 22: The picture shows how the various issues affect each other. Some issues has a double arrow; for example; repeating information causes motivation to fall and when motivation decreases it often increases the need for information to be repeated.

8.1. Recommendations for improvement

In this section we will answer the last research question "*How can the inspections process at the case company be improved?* by giving 19 recommendations of action. The recommendations are based on best practices already observed in the case company, on our stakeholder analysis of the inspections process and on the theoretical framework. They are listed below along with the issues that the action resolve and the success factor that is associated with the action. How these recommendations are supported are described in chapter 7, *Discussion and Analysis*.

Based on the theoretical framework and the stakeholder analysis:
- *Take collaborative actions toward the subcontractors.*
  Collaboration will improve motivation (3.1.) and trust, related to issue (4.1.). Close collaboration with subcontractors and inspectors can also help the case company to achieve success factor (h) No surprises.

- *Make sure that employees from the case company stay at the site during the period of resolving defects.*
  This prevents motivation from being lowered at the end of the process (3.1.)
- *Give the subcontractors more responsibility over the process and the deadlines.*
  This will make the subcontractors keener to keep their deadlines (1.2.), helping the case company to achieve success factor (a) Time and deadlines.
- *Hold workshop in the beginning of projects to understand the success factors of the different actors involved.*
  Understanding the success factors for different actors will help to motivate them (3.1.).
- *Implementation of contractual safeguards.*
  Contractual safeguards have the same effect as building trust which reduces the need for control (4.1.).
- *Produces a communication plan for how and to whom information is distributed.*
  The plan should include how the expectations of quality will be conveyed (5.2), and will also reduce the risk of the information being repeated (5.1.).
- *Evaluate the process in the end of the project in order to find more best practices.*

Based on best practice:
- *Perform inspections with digital tools.*
  Performing inspections digitally means that the protocols are provided directly (5.1.), paperwork decreases and thus also administrative work (5.5.) and reduces the need to repeat information (5.1.) as more people have access to comprehensive information. Handling the protocol fast helps the case company to achieve success factor (a) Time and deadlines. Digital tools help the company to achieve success factor (d) Administration. It also means that the company achieves success factor (i) Digital tools.
- *Define the activities of the final stage in the planning.*
  Visualizing what happens during the final stage will clarify that construction work should not remain at the time of inspection (1.1.). Communicating what happens during this period will also reduce the need to repeat certain information (5.1.). Defining activities help the company to achieve success factor (f) Planning.
- *Use key figures from previous projects when planning and possibly add a time buffer at the end of the process.*
  Planning well will help the company reach success factor (a) Time and Deadlines and (f) Planning.
- *Clarify what is expected of the subcontractors during the period of resolving defects.*
  This can prevent that information must be repeated (5.1.) and also provides the conditions for the subcontractors to be able to resolve the defects in time (1.2.).
- *Involve inspectors early in the process.*
  This facilitates early communication of the expected quality (5.2.) and helps the company to achieve success factor (b) No/few defects.

- *Perform normative and/or internal inspections.*
    This is a way to align expectations of quality (5.2.) and also helps the company to achieve success factor (b) No/few defects, (c) Management and (h) No surprises.
- *Make sure that the construction is cleaned at the time of inspection.*
    This makes the inspector focus only on the construction (2.6) and also helps the company to achieve success factor (b) No/few defects.
- *Make sure that the subcontractors attend and are active during inspections.*
    When the subcontractors are present, they get a better understanding of what quality that is expected after the inspection (5.2.). It also reduces the need for information to be repeated (5.1.). The fact that more people are present during inspections also increases the chance that it becomes more objective (2.5.).
- *Help the inspector to formulate the text connected to complex defects.*
    This makes it easier to remember what the defect was about, where it was located (5.4.) and what it takes to fix it (5.2.). It gives the opportunity to formulate the remark so that it will be clearer whose responsibility it will become (5.7.). By clarifying responsibilities, chances of achieving success factor (c) Management are improved.
- *Make sure the drawing are updated at the time of inspection.*
    This allows the inspector to focus on the right things (2.6.) and also helps the company to achieve success factor (d) Administration.
- *Do not book inspections for longer time than half a day.*
    This improves the quality of the inspection and keeps the motivation up (3.1.).
- *Evaluate how many and what kind of inspections that are required for the specific project.*
    To perform several inspections (pre- and re-inspections) helps the company to achieve success factor (b) No/few defects.

Since the issues of the inspection process are intertwined and complex, there is not one action that will solve all the problems. In order to solve the problem of motivation for example, measures that will directly improve motivation must be taken (collaboration), but measures to prevent the problems that cause motivation to be lowered must also be considered, such as reducing controls (4.1.). By solving the problem of motivation, chances are that issues that are affected by motivation, such as defects not resolved in time (1.2.), are solved or improved as well etc.

Even if the recommendations do not offer a solution to all issues, by solving some of them, others become non-issues.
- By using digital tools that prevent the protocol from being delayed (5.3.), we can also see that, according to Figure 22, the issue of authority (4.2.) disappears when there is no longer need for internal protocols for example.
- Communicating what quality that is expected (5.2.) makes the subcontractors more aware of how they perform their work, hopefully making them more careful when fixing old defects in order not to cause new ones (2.3.).

- By solving the issue of defects not resolved in time (1.2.), the issue of fixing defects after the end user has taken the building into use (1.3.) disappears and hopefully also the problem of new staff being sent to the project (2.4.).

The recommendations do not offer a solution to the issue of small businesses having difficulties coping with heavy documentation (5.6.). Instead, we propose that, in projects where the client has high requirements on documentation, the case company should take into account if the firm is able to handle this before procuring it.

The recommendations do not offer any solutions for (2.1) and (2.2.). These issues are related to how inspections work. The fact that inspections primarily assess esthetics and do not inspect the validity of the quality checklists, means that the checklists are not performed as carefully. But the quality checklists are at the same time a reason why inspectors mainly look at the esthetic, the issues are thus a consequence of each other.

The issue that different inspectors give different judgements (2.5.) is a consequence of that different persons are focusing on and becomes influenced by various things. This provoke us to think about how objective the inspections really are and if they fulfil the intended purpose.

8.2. Evaluation of research and chosen methods

From our literature study we can conclude that there is a limited amount of material on the Swedish construction inspection. The material we present and the conclusions we draw is well rooted in the industry, why we argue that both the empirical description and the proposed suggestions are useful in practice, especially at the investigated case company.

8.3. Further research

The report has offered suggestions on how to achieve seven out of nine success factors. How to achieve the success factors about a good inspector (when the inspectors are knowledgeable and consistent when evaluating the construction during inspections) and no repeated mistakes (when the protocol for each inspection becomes shorter, i.e. the defects are not repeated) is therefore a subject proposed for further research. We also suggest that the study should be broadened and more companies investigated. In this study we have mainly researched the inspection process from the perspective of the case company, a major construction company. The perspective of the subcontractors is of high interest as we have identified the management of them in the inspection process as an issue. We would also have wanted want to study the communication within the process further, as well as the issue of objectivity connected to the inspector. The international perspective on inspections would be interesting to look at. How does the "Swedish way" work compared to other countries where inspections is not part of the standard contracts?

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9. Appendix

Ordlista (*English - Swedish):*

Controllers - Kontrollanter
Side contractor - Sidoentreprenad
Construction inspections - Entreprenadbesiktningar
Head inspectors - Huvudbesiktningsman
Site managers - Platschefer
Foreman - Arbetsledare
Group manager - Arbetschef
Construction manager - Byggledare
Construction engineer - Entreprenadingenjör
Inspection manager - Kontrollansvarig (KA)
Final notice - Slutbesked
Building committee - Byggnadsnämnden
Control systems - Styr

Appendix I - Interview template

As a first milestone of the thesis, the current inspection process was to be understood and mapped. Basic questions regarding the inspection process where formulated beforehand and used as a template when performing the interview. As the understanding of the inspection process grew more questions were added to narrow down the information we needed. The order of the questions as presented below is not necessarily the order the questions were asked during the interviews.

PEAB

Information: ███████████████████

Position på Peab: #####   Datum för intervju: ##-##-2018

Antal år på Peab: ##
████████████████████

Hur har besiktningsprocessen sett ut under tiden då du jobbat på Peab?

Svar:

Vi har börjat göra en "karta" över besiktningsprocessen, kan du hjälpa oss fylla på den?

Svar:

Kan du mer specifikt berätta hur det går till under slutbesikning? Vad händer under dagen? Vilka dokument behöver man?

Svar:

När sker den officiella överlämningen till kunden? Är det när alla fel är åtgärdade eller kan det ske tidigare?

Svar:

Hur lång tid brukar det ta att få protokollen från slutbesiktningen?

Svar:

Om du tittar tillbaka på besiktningar, har du varit med om att något riktigt stort dykt upp? Vad och hade du kunnat förhindra det? Vad har anmärkningarna berott på, hade ni kunnat förebygga dem?

Svar:

Hur tycker du det brukar fungera? Vad är bra vad är dåligt? Bra/dåligt på vilket sätt? (Vad är det som brister, kvalitet, ineffektivt…?)

Svar:

Hur stor del av besiktningsprocessen upplever du är administrativt arbete?

Svar:

Om du måste peka ut en del av besiktningsprocessen som du hade velat hoppa över, vilket hade det varit och varför?

Svar:

Hur viktigt är det att ha en "bra" besiktningsman?

Svar:

Har du någonsin varit med om att man involverat en besiktningsman tidigare än vid slutbesikningen?

Svar:

Jobbar ni med att underlätta slutbesikningen på något sätt, i så fall hur?

Svar:

Har ni arbetat med några digitala verktyg för att underlätta processen? Om inte skulle ni vilja göra det?

Svar:

Vad ser du själv för förbättringsmöjligheter?

Svar:

Finns det någon vinning för Peab att förändra hur man arbetar med inspektionerna?

Svar: