



CHALMERS
UNIVERSITY OF TECHNOLOGY



Sharing of information, knowledge and experiences from the warranty phase

A case study at a construction company

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

NELLIE ERIKSSON
KAJSA NYDAHL

DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2020
www.chalmers.se

MASTER THESIS ACEX30

Sharing of information, knowledge and experiences from the
warranty phase

A case study at a construction company

*Master's Thesis in the Master Programme Design and Construction Project
Management*

NELLIE ERIKSSON
KAJSA NYDAHL

Department of Architecture and Civil Engineering
Division of Construction Management
CHALMERS UNIVERSITY OF TECHNOLOGY

Göteborg, Sweden 2020

Sharing of information, knowledge and experiences from the warranty phase
A case study at a construction company

*Master's Thesis in the Master Programme Design and Construction
Project Management*

NELLIE ERIKSSON
KAJSA NYDAHL

© NELLIE ERIKSSON & KAJSA NYDAHL, 2020

Examensarbete ACEx30 / Institutionen för Arkitektur och
Samhällsbyggnadsteknik
Chalmers tekniska högskola 2020

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

Department of Architecture and Civil Engineering
Göteborg, Sweden, 2020

Sharing of information, knowledge and experiences from the warranty phase
A case study at a construction company

*Master's thesis in the Master Programme Design and Construction
Project Management*

NELLIE ERIKSSON
KAJSA NYDAHL

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

ABSTRACT

Sharing of information, knowledge and experiences between projects in the construction industry is today a problem for many organisations and therefore it needs to be worked with in order for organisations to improve their projects. Faults and rework are also big problems in the construction industry, which could be improved by better management of information, knowledge and experiences. This study aims to determine how the sharing of information, knowledge and experiences could be improved in a project-based organisation from the late phase of a project to the early phase of a new project. Hence, the sharing process at a Swedish construction company was examined to see how the sharing of information, knowledge and experiences from the department that handles warranty issues to the department that designs the projects is done today and how it could be developed in the future.

Through a qualitative research, a theoretical framework was formed and several employees at the Swedish construction company were interviewed in two interview sets, with the focus on how it works today and how future systems could look like. The empirical data showed that there today is a poor relationship between the Warranty and Design department at the company. Neither the information, knowledge nor experiences that the Warranty department has are utilised by the Design department. Several barriers were also identified to why the information, knowledge and experiences are not shared today in the company, where the lack of time, low prioritisation of sharing and the lack of structured systems were identified as the main ones. This indicated that the Case Company needs new systems for the sharing. The research resulted in three suggestions to the Case Company which we conclude should be implemented in the organisation in order for them to improve their sharing of information, knowledge and experiences.

Key words: Experience feedback, Information sharing, Knowledge management, Knowledge sharing, Warranty

Delning av information, kunskap och erfarenheter från garantifasen
En fallstudie på ett byggföretag

*Examensarbete inom mastersprogrammet Organisering och ledning i
bygg och fastighetssektorn*

NELLIE ERIKSSON
KAJSA NYDAHL

Institutionen för arkitektur och samhällsbyggnadsteknik
Avdelningen för Construction Management
Chalmers Tekniska Högskola

SAMMANFATTNING

Att dela information, kunskap och erfarenheter mellan projekt inom byggbranschen är idag ett problem för många organisationer och måste därför jobbas med för att dessa organisationer ska kunna förbättra sina projekt. Fel och omarbete är också stora problem i byggsektorn och hade kunnat förbättrats med bättre hantering av information, kunskap och erfarenheter. Den här studien syftar till att utreda hur delandet av information, kunskap och erfarenheter kan förbättras i en projektbaserad organisation från sent skede av ett färdigställt projekt till tidigt skede i ett nytt projekt. Därav undersöktes delningsprocessen hos ett svenskt byggföretag för att se hur delandet av information, kunskap och erfarenheter från avdelningen som hanterar garantifel till avdelningen som projekterar projektet görs idag och hur denna process skulle kunna utvecklas i framtiden.

Genom en kvalitativ studie formades ett teoretiskt ramverk och flera anställda på det svenska byggföretaget intervjuades i två intervjuomgångar med fokus på hur det fungerar idag och hur framtida system skulle kunna se ut. Den empiriska data visade att relationen idag mellan garanti- och projekteringsavdelningen är bristfällig. Varken information, kunskap eller erfarenheter som garantiavdelningen har utnyttjas idag av projekteringsavdelningen. Flera barriärer identifierades också som hindrar informationen, kunskapen och erfarenheterna från att delas, där tidsbrist, låg prioritering av delandet och brist på strukturerade system identifierades som de huvudsakliga hindren. Detta indikerade att det undersökta företaget behöver nya system för delningen. Studien resulterade i tre förslag till företaget som vi anser ska implementeras för att förbättra deras delning av information, kunskap och erfarenheter.

Nyckelord: Erfarenhetsåterföring, Garanti, Informationsdelning, Kunskapshantering,
Kunskapsöverföring

Table of Content

ABSTRACT	I
SAMMANFATTNING	II
TABLE OF CONTENT	III
PREFACE	V
GLOSSARY	VI

1 INTRODUCTION	1
1.1 Background	1
1.2 Aim	2
1.3 Research questions	3
1.4 Delimitations	3
1.5 Outline of the report	3
2 METHODOLOGY	4
2.1 Research process	4
2.2 Research approach	5
2.3 Research strategy	5
2.4 Interview strategy	6
2.4.1 Selection of interviewees	6
2.5 Participant observation	8
2.6 Research quality	8
2.7 Ethical and sustainable perspectives	9
2.8 Method criticism	9
3 THEORETICAL FRAMEWORK	11
3.1 Information, Knowledge and Experience	11
3.2 Knowledge management	12
3.2.1 Information sharing, knowledge sharing and experience feedback	12
3.3 Sharing information, knowledge and experiences in project-based organisations	14
3.4 Systems and models for sharing information, knowledge and experiences	16
4 EMPIRICS	20
4.1 Organisational structure	20

4.1.1	The Warranty department	20
4.1.2	The Design department	21
4.2	Information sharing, knowledge sharing and experience feedback	22
4.2.1	Existing collaboration and systems	22
4.2.2	Sharing and benefits	28
4.2.3	Barriers for collaboration	29
4.3	Future systems	31
4.3.1	Suggestions for future solutions	32
5	ANALYSIS	41
5.1	Existing collaboration and systems	41
5.2	Sharing and benefits	43
5.3	Barriers for collaboration	45
5.4	Applicable future systems	48
6	CONCLUSION	58
6.1	Recommendations to the Case Company	59
6.2	Future research	60
7	BIBLIOGRAPHY	62
8	APPENDIX	66

Preface

This master thesis of 30 credits is a part of the master programme Design and Construction Project Management, at Chalmers University of Technology. The report was conducted during the spring 2020 at the department of Architecture and Civil Engineering, the division Construction Management. The study has been executed in collaboration with a large construction company in Sweden, who have acted as a Case Company.

During the spring 2020, the disease Covid-19 hit the world with massive effects on how to socialise with people. Therefore, our method in the thesis had to be reformulated in order to follow the governments guidelines. We hope and think that this however not has affected our result of the thesis too much, but we want to be open with the fact that the method had been a bit differently if the world had not been turned upside down during the process of this thesis.

We would like to give our supervisor at Chalmers University of Technology, Associate Professor Martine Buser, a big thank you, for the support and invaluable input during the process of the thesis. We would also like to thank the Case Company and our supervisor at the company who have given us helpful feedback and guiding throughout the project. Further, thanks to all the interviewees who have participated and contributed with great knowledge and thoughts. Without your time, this study had not been possible to execute.

Gothenburg, May 2020
Nellie Eriksson & Kajsa Nydahl

Glossary

Construction document

Experience feedback

Fault report

Floor plan

Knowledge sharing

Programme document

Project planning document

Bygghandling

Erfarenhetsåterföring

Felanmälan

Planlösning

Kunskapsöverföring

Programhandling

Systemhandling

1 Introduction

To get an organisation to learn from its own projects, is a problem for many companies (Swan, Scarbrough, & Newell, 2010; Gerth, Boqvist, Bjelkemyr, & Lindberg, 2013; Josephson, Styhre, & Wasif, 2008; Dave & Koskela, 2009). Gurteen (1999) describes that sharing knowledge with each other in an organisation is important for the survival of the business. Therefore, this study investigates how systematic work with sharing of information, knowledge and experiences could be designed to fit a project-based organisation in the construction industry. The report is built on one theoretical and one empirical part, where the empirical part is executed at a large construction company in Sweden, henceforth called the Case Company. The research reviews how information, knowledge and experiences are feedbacked from one department to another at the Case Company and how this transmission can be improved.

1.1 Background

In the construction sector, experience feedback is something that has been worked with on a project-level for a long time (Lundkvist, Magnusson, & Meiling, 2011). However, a need for a more systematic work with information, knowledge and experiences exists for companies to be more successful. By not transferring information, knowledge and experiences, an organisation can be affected negatively in several ways (Gurteen, 1999). Poor collaboration between different stages in a construction project can lead to designers not having enough knowledge in how their way of designing can affect later phases (Jergeas & Van der Put, 2001). This can eventually lead to higher costs in construction projects. An insufficient knowledge transferring from previous projects to the design phase of new ones can also result in poor quality (Gerth et al., 2013). This can hinder the development and improvement of projects in a construction organisation. According to Josephson et al. (2008), one of the biggest challenges in the construction industry is the poor knowledge sharing in construction organisations. The complex nature of the construction industry, with time pressure and several different phases, makes it difficult to transfer knowledge back to earlier stages (Josephson et al., 2008). Lundkvist et al. (2011) describe that the work with experience feedback is something that needs to be done more systematic than today in many project-based organisations. To make the experience feedback more effective is an important part of many construction companies' development strategies. If an efficient system for experience feedback could be found and implemented in a company, unnecessary costs can be eliminated according to Lundkvist et al. (2011).

Further, Lundkvist et al. (2011) describe that experiences that are gained from warranty inspections in the construction sector have the potential to be developed. The knowledge and experiences that the person who does the inspection gains, is hard to transfer to another person or back to the organisation. To ensure that the knowledge is recycled in the organisation, a standardised process of feedback is important, according to Lundkvist et al. (2011). If a company uses an industrialised construction method, it will gain advantages with the sharing process.

Across the world, a large problem for the construction industry is the defects in residential buildings (Alves, Paliari, & Milion, 2017). This leads to a need of rework, which is consequently also a common problem in the industry (Love, Edwards, & Smith, 2016). This rework results in extra costs and the defects can impact customer satisfaction negatively as well (Alves et al., 2017). According to Alves et al. (2017), customers see faults in their homes as a concern, especially if there are multiple occurrences. It is important for construction companies to ensure customer satisfaction since it is connected to the successfulness of the company (Othman, 2015). Thus, it should be an important part for a construction company to lower their warranty faults.

The Case Company in this study, does not have any official system for how the knowledge, information and experience from the department which takes care of warranty issues, henceforth called the Warranty department, is transferred to the department that designs the projects, henceforth called the Design department, in the organisation today. The departments seldom exchange information, knowledge or experiences with each other. Most of the knowledge, information and experiences that the Warranty department has is thereby not used by the Design department in future projects. The Warranty department holds a lot of information, knowledge and experiences from what has gone wrong before in projects and if this does not get shared, important information, knowledge and experiences are lost. To repeat the same faults in the projects over and over again is a big cost for the company which could be a consequence from that the information, knowledge and experiences that already exist in the Warranty department are not being shared with other departments. Today, about a quarter of the warranty issues that the Case Company has, have its roots in the design phase. The company uses a systemised and industrialised way of building, which means that they have the mindset of systemisation in the organisation. The Case Company also has the goal to halve the number of fault reports until 2021.

To develop the cooperation between the Warranty and the Design department, was a request from the Case Company which was a motive to execute this study. This request is the base to which this study focuses on only the experience feedback from the Warranty department to the Design department. The warranty-to-design-focus also aligns with the fact that the earlier adjustments in the construction process are made, the cheaper it is to make changes. If the feedback from warranty comes in too late in the process, it can be too costly to adjust the project to it. Therefore, this research mainly concentrates on the sharing from the warranty phase to design phase in the construction sector. The production phases, that are the phases that are located between the design and the warranty phase, are not included in the study. This is partly because of the fact that it is cheaper to do changes earlier in the process, and partly because that the Case Company wanted the main focus to be from the Warranty department to Design department. The reason why the Warranty and the Design departments do not have any special communication today is according to the top management of the Case Company that they are working far away from each other in the process and that their phases never crosses each other. Further, the study could be seen to contribute to a more sustainable industry since if the rework could be reduced, less material is used.

1.2 Aim

The purpose of this research is to describe how information, knowledge and experiences from the Warranty department at the Case Company are shared to the Design department today, and how it could be improved. The goal of the research is to contribute to the knowledge management literature by giving a better understanding of why information, knowledge and experiences are not always shared and how the sharing of information, knowledge and experiences can be improved in project-based organisations. The research is aiming to result in recommendations to the Case Company and other project-based organisations on how to work with the sharing of information, knowledge and experiences.

1.3 Research questions

Following, the study's research questions are listed.

- RQ1: What are the existing exchanges between the Warranty and Design department?
- RQ2: What information, knowledge and experiences are there to share from the Warranty department to the Design department?
- RQ3: What barriers exist, that hinder the sharing of information, knowledge and experiences from the Warranty department to the Design department?
- RQ4: How can the collaboration between the Warranty department and Design department develop and which systems could be used to share the Warranty department's information, knowledge and experiences?

1.4 Delimitations

All the interviewees are employees at the same company, the Case Company. No other company or region than the region around Gothenburg were involved in the study. Only the departments of Warranty and Design have been included in the research.

1.5 Outline of the report

The report contains eight chapters where six of them are the main part of the text. The report starts with an introduction to the subject and a description of the problem that the study aims to find solutions to. Further, the report describes how the research has been executed in the methodology chapter. The report then contains two chapters with data, one with theoretical data retrieved from a literature review, and one with empirical data collected from the Case Company. The data from the chapter's theoretical framework and empirics are analysed in the fifth chapter called analysis, which then has led to conclusions presented in the sixth chapter. Continued, the report's references are presented in the bibliography and lastly, the appendix to the report are presented in the eight chapter.

2 Methodology

The methodology describes how the study has been executed. Both the method and methodology choices that have been done in the study are described. The aim with the methodology chapter is to show how the research process has been executed and which tools that have been used to get the result that the study has achieved. By describing the methodology, an increased transparency of the study is gained.

2.1 Research process

The research started with a literature review that ran parallel with a first round of interviews. Chalmers Library and Google Scholar were the main search engines that were used to find literature. The key search words that were used when searching for literature were: *Information, Knowledge, Experience, Knowledge Management, Knowledge sharing* and *Experience feedback*. We mainly searched for literature that had been looking at project-based and construction organisations. The first set of interviews focused on how the information sharing, knowledge sharing, and experience feedback worked before this research in the Case Company. After the initial interviews, we complemented with additional literature that was based on the empirical data that the first interviews generated. Then a second set of interviews were held with the same people as in the first interview set. In the second interview, the focus was on testing solutions to the problem with lack of information sharing, knowledge sharing and experience feedback. Six suggestions for solutions were presented to the interviewees. The suggestions were inspired by what the interviewees had said during the first interview and then developed with help of the theoretical framework. Some of the suggestions had been mentioned by several interviews in different ways and some of the suggestions were based on only one interviewee's thoughts. However, some additional questions to the first interview were also asked during the second interview. Two more interviews were held with two of the top managers at the Case Company after the second round of interviews. In these interviews, similar questions were asked as to the employees in the second interview set. After the literature review and the interviews were done, the theoretical framework and the empirical information were analysed and compared. The analysis then led us to a conclusion which answers the study's research questions.

Throughout the first period of the research process, participant observation was done at the Case Company. The empirical data in the research consists of the interviews, observations from the Case Company's meetings and daily work, and a review of the Case Company's internal systems and documents. However, due to the outbreak of the coronavirus during the spring 2020, when this research was made, where social distancing was recommended by the world health organisation, we had to stop the participant observation halfway into the process.

The answers to the four research questions that the report has is based on different methodological parts of the study. Which part that answers which question is shown in figure 1.

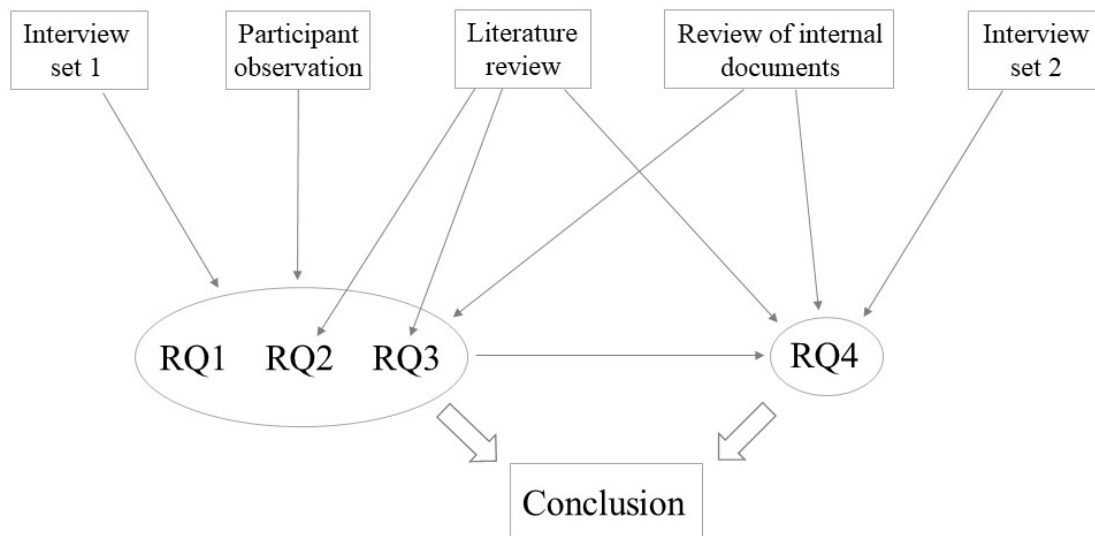


Figure 1: Analytic visualisation of which methodological parts in the research that have contributed to which research question. The figure is created by the authors of the report.

2.2 Research approach

There are mainly three possible research approaches that are common to use in an academic report, these are deductive, inductive and abductive (Bryman & Bell, 2015). With a deductive approach, the empirics is built on theory, and with an inductive research, the theory is built on empirical data. The deductive research usually starts with a literature review where a hypothesis is formed, and then an empirical study is used to see if the hypothesis is right or wrong. An inductive approach starts with an empirical study with the goal to come up with a new theory, later the literature is reviewed with the aim to place in the new theory that the empirical data has given. The abductive approach is a combination between the deductive and inductive approach (Bryman & Bell, 2015).

The research approach in this project was abductive, which means that the process was iterating between the empirical findings and the theoretical framework (Dubois & Gadde, 2002). Using an abductive approach is a way to get a deeper understanding of the theoretical and empirical data. The understanding of the theory can be complemented by the empirical observations but also the other way around. This is done by alternating between theory and empirics and thereby finding new literature and interesting empirical aspects throughout the research process that can be examined. Since this study had two sets of interviews with a literature review running parallel to them, it can be classified as a research with an abductive approach. Because of the iterating between theory and empirics, both the theoretical framework and the research issue were changed throughout the research. This is common in an abductive approach since new empirical or theoretical findings can be found later in the study (Dubois & Gadde, 2002).

2.3 Research strategy

The report is based on a qualitative case study where interviews and participant observation were the main empirical sources of information. The qualitative research strategy is based on words and not on quantitative measures as numbers and experiments (Backman, 2016). The quantitative research builds on a lot of basic empirical answers rather than a few but deep empirical answers as a qualitative research. Interviews, observations and reviewing of documents are the most common methods in a qualitative research (Bryman & Bell, 2015). Bryman & Bell (2015)

describe the qualitative research as a strategy that investigates and analyses social context. In a qualitative research, the research questions are often something that develop and specifies during the study period and are not pin pointed at the start of the study, according to Backman (2016). This allows the study to change if new information comes up during its way. However, a qualitative research also has a higher risk of error sources than a quantitative research. Also, Bryman & Bell (2015) explain that there are more occasions where biases can affect the project in a qualitative research than in a quantitative research. Therefore, these risks are something that we have considered throughout the study.

According to Bryman & Bell (2015), a qualitative research strategy often has the goal to understand or explain a given situation rather than testing an existing theory. In a quantitative research, the goal is often the opposite, to test an already existing theory. In this research, the aim has been to describe and possibly develop a process of how information, knowledge and experiences can be shared, which has been based on experiences and feelings rather than statistics, therefore a qualitative research has been well suited for this project.

2.4 Interview strategy

The interviews were thought to be face to face interviews, which the first interview set also were. However, the second interview set had to be held as video interviews over internet because of the Covid-19 pandemic. There are benefits of doing interviews face to face, which was the reason to that the interviews first were planned to be face to face-interviews. Some benefits are that many questions can be asked, and the interviewee can easier explain their answer if it is a difficult question (Dahmström, 2011). This was something that we tried to fulfil even though the second interview set was video interviews. The choice of doing the interview with video instead of over phone made it more similar to a face to face interview.

The interviews were built as semi-structured interviews which means that questions were prepared, but there was also time left for the interviewee to speak freely (Bryman & Bell, 2015). Questions that are open-ended, as questions in a semi-structured interview should be, tends to give answers that are long and unique (Walle, 2014). If the researcher avoids interrupting the interviewee, the interviewee gets time to think throughout the chain of thought which will result in rich answers with important information, according to Walle (2014). A semi-structured interview strategy helps to compare the data via the structured part, the prepared questions, but still gives the interviewee the possibility to show their competence and add what they think is important via the unstructured part (Tracy, 2019). Due to its ability to be compared but still give much information, the semi-structured interview strategy was selected for this research. The semi-structured interview also gave us the opportunity to ask supplementary questions in those interviews where it was needed. The interview questions are attached in the appendix A-E.

2.4.1 Selection of interviewees

Interviewees were chosen in consultation with the supervisor at the Case Company to get a variety of people from relevant positions to interview. The interviewees were chosen through purposive sampling, meaning that the persons who were selected were people who we have considered can give us relevant information to answer our research questions (Maxwell, 2013). By using purposive sampling, better representativeness was reached even though the sampling size was small. To get the best possible results, both the interviewee's role and background were taken into consideration when choosing interviewees. Which role the interviewee had, was important to get a variety of perspectives for the result. The interviewee's background was important for the result to be representing for a broad group. We therefore interviewed at least one employee from each

main role that the departments provide and tried to choose interviewees with different backgrounds. In total, 22 interviews were held with 12 different employees at the Case Company, where 10 interviewees were working at the Warranty or the Design departments. Totally, the two departments contain about 25 employees. The roles that we interviewed were design manager, head of Design department, warranty supervisor, warranty craftsman and head of Warranty department. The last two interviews were held with two top managers to ensure that the suggestions for solutions were doable in the Case Company. To ensure anonymity, all interviewees are just mention as design employee, warranty employee or top manager in the report.

Below, in table 1, the date and the length of the interviews are presented.

Interviewees role	Date of first interview	Length of first interview	Date of second interview	Length of second interview
Design employee A	2020-02-13	40 min	2020-03-24	80 min
Design employee B	2020-02-17	35 min	2020-03-25	45 min
Design employee C	2020-02-17	30 min	2020-04-03	45 min
Design employee D	2020-02-19	45 min	2020-04-01	70 min
Design employee E	2020-03-02	40 min	2020-04-02	60 min
Warranty employee A	2020-02-12	30 min	2020-04-02	50 min
Warranty employee B	2020-02-13	20 min	2020-04-06	55 min
Warranty employee C	2020-02-18	40 min	2020-03-31	55 min
Warranty employee D	2020-02-25	50 min	2020-03-26	60 min
Warranty employee E	2020-02-26	45 min	2020-03-27	75 min
Top manager A	-	-	2020-04-16	55 min
Top manager B	-	-	2020-04-20	50 min

Table 1: A table over the interviews in the study.

2.5 Participant observation

In this research, participant observation has been used as one way to collect empirical data. Participant observation is a qualitative research method where the researchers get involved in the organisation that they study (Walle, 2014). According to Walle (2014), participant observation can give invaluable information to the researchers that would be hard to get in any other way. Deep understanding of how the organisation is built and of the culture in the organisation is one of the main benefits with participant observation (Mack, Woodsong, MacQueen, Guest, & Namey, 2005). The data that comes from participant observation are in the forms of field notes, recordings and photographs.

We have chosen to use participant observation since it gave us the chance to observe the interviewees in another setting than in the interviews but also to see the daily work of the Case Company. It gave us the opportunity to observe informal conversations between the different departments to see how they communicate today. It also gave us the possibility to attend meetings that the different departments had during the research and to review internal documents from the Case Company. This gave us a broader view of how the Case Company works today. The participant observation took place at the Case Company's office during the first two months of the research period. It was supposed to continue the whole period but due to the Corona pandemic the last two months of the research were done by distance and no participant observation was performed.

2.6 Research quality

To get a research with a good quality, validity and reliability must be considered throughout the study (Bryman & Bell, 2015). The validity in this research was considered in various ways. One way was to consider our biases by thinking about what our biases could possibly be and how we could avoid them. We did this by avoiding asking leading questions that were affected by our opinions and by interviewing several persons to get more variation, even though the first interviewees gave us good answers. In this research we used three types of data collection methods: participant observation, interviews and reviewing of internal documents. By using multiple data collection methods, a *triangulation* was done, meaning that the different methods can strengthen each other (Maxwell, 2013). This can help to eliminate the weak sides of the different methods and provide a deeper understanding of the research issue and thereby strengthen the validity of the research. In our research, we were able to check if the things said in the interviews also happened in the daily work at the Case Company. The three empirical research methods also helped us to get a richer understanding of the culture today in the Case Company, since we both was able to observe the daily work but also ask questions about it in a non-formal setting. Respondent validation is another way to consider the validity (Maxwell, 2013). In our case, this was done by letting the people that were interviewed give feedback on the data and thereby reducing the risk of misunderstanding the interviewees. The interviewee was therefore asked if it was satisfied with its answers or if it is something that needs to be rephrased. The interviewee was given the chance to rephrase after both interviews that it participated in. We also gave the interviewees the opportunity to read the finished report before it was published to ensure that we had interpreted them right. By this, the validity of the research was considered and increased. A threat to the validity of the research can be that the interviewees have the same perspectives and are therefore not representative. We considered this by selecting interviewees with different backgrounds and roles which gave us a broader view of how it looks in the Case Company. Thereby, the threat was minimised.

Participant observation is a method that comes with some criticism. The method has been criticised for being too subjective and non-rigorous because of that the researcher is involved with the studied group (Walle, 2014). It is a risk that the researcher gets too close to the organisation and therefore lose a critical distance to the group that is studied. This can be avoided somehow by comparing the data found from participant observation to other data. We did this through having more than one data collection method and thereby we were able to see if the findings from them matched.

Reliability and replicability are two similar concepts which both ensures that a study can achieve the same results as an earlier study if it is executed in the same way (Bryman & Bell, 2015). Even though replication of a business research with a qualitative method is rare, the research must have a transparency so that it is possible to replicate it. The replicability was increased in this study by an open and detailed method chapter. The reliability was increased by the fact that we were two researchers that could intercept what we saw and heard during both the participant observation and the interviews.

Lastly, the research quality was raised with the two interviews with top managers at the Case Company. Those two interviews gave us information in how doable the final recommendations to the company were. The more likely it is to implement the recommendations, the higher quality the study has.

2.7 Ethical and sustainable perspectives

When interviews are chosen as the main empirical technique, it is important to ensure that the interviewee understand that the answers that he or she gives are going to be used in a report that will be published. To ensure that we have gotten honest and fair answers, the interviewees are not mentioned by name in the report. Only which department the interviewee belongs to is mentioned in the report. The anonymity is important so that the interviewees feel that they can say what they think even though their answers may not reflect the company's values. However, which department the interviewee works in was important for the study's result and therefore this is mentioned. How the information from the interviews is managed has been this study's main ethical issue.

As with the interviews, it was important to inform the people we observed through participant observation, that our observations are used in this research. The privacy of the people observed was considered by not linking the data to a specific person and in this way the person's anonymity was kept.

This study contributes to a more sustainable business since the fewer faults a project has, the less new material and resources are needed to fix warranty issues. If the information, knowledge and experiences are shared, recurrent problems could be eliminated in future projects. This can, as mentioned, reduce the material and make the business both more ecological and economical sustainable.

2.8 Method criticism

Throughout the research we tried to use as relevant sources as possible for literature. This was done by considering the publication year of the sources. When describing how the construction industry works today, we strived to use sources that were updated. However, when describing theories or models, the original source was used if possible and, in that case, the publication year was not considered. We also had a critical approach when searching for literature to ensure that

the sources were valid. One way was to mainly use sources found on Chalmers library or Google Scholar, which are widely recognised data bases.

This study has been carried out as a qualitative research and we have been looking at only one region in one company. Because of this, the study cannot be seen as representative for more than this part of the Case Company and the study may not be seen as general for the industry. The result of a qualitative research cannot be representative and generalised, and it is not meant to be either (Bryman & Bell, 2015). However, the study's goal was still to get results that can be applied in other organisations but maybe with some adjustments and further investigations.

3 Theoretical framework

In the forthcoming chapter, a theoretical framework is shaped. The framework is based on previous literature on the subject. The theoretical framework is in the analysis used to compare theory and empirics. The chapter starts with a description of what information, knowledge and experience are and continues with the concepts: knowledge management, information sharing, knowledge sharing and experience feedback. Further, the chapter touches how knowledge sharing and experience feedback work in project-based organisations today. Lastly, the chapter presents some systems and models that can be used for sharing of information, knowledge and experiences.

3.1 Information, Knowledge and Experience

To understand how information, knowledge and experiences can be shared and transferred, there is a need to learn what the three concepts mean, and what the differences between them are (Lundkvist et al., 2011). Knowledge can be divided into two different types, *tacit* and *explicit* knowledge (Nonaka & Takeuchi, 1995). Another name of those two types are *epistemology of practice* and *epistemology of possession* (Newell, Robertson, Scarbrough, & Swan, 2009). As those two types need different ways of managing, it is needed to know what they mean.

Tacit knowledge, or epistemology of practice, can be described as the knowledge that cannot be learned by only reading a paper or listening to an explanation (Nonaka & Takeuchi, 1995). It is the knowledge that we learn with our minds and bodies, as Nonaka & Takeuchi (1995) explain it. Tacit knowledge is something that is hard to express and communicate, hard to teach and hard to share with others. According to Nonaka & Takeuchi (1995), tacit knowledge is very personal. To earn tacit knowledge, a need for trial-and-error is required (Fagerberg, Mowery, & Nelson, 2005). “Knowing more than we can tell” is a definition of tacit knowledge that was uttered by Polanyi (1966). This definition has been well-used in literature about knowledge management after Polanyi’s publication (Grandinetti, 2014). An example of tacit knowledge is how to ride a bicycle, you can do it, but it is hard to explain how to do it to someone else that wants to learn to ride a bicycle. Explicit knowledge, or epistemology of possession, is the opposite of tacit knowledge. Explicit knowledge is something that can be expressed, and also be stored and transmitted by being written down (Nonaka & Takeuchi, 1995). It is possible to earn explicit knowledge by reading a document or listening to a lecture. Explicit knowledge is the type of knowledge that can be verbalised. Manuals, reports and blueprints are examples of documents that transfer explicit knowledge from one person to another (Wong & Radcliffe, 2000). Explicit knowledge is something people have, while tacit knowledge is something people do (Newell et al., 2009).

The two types of knowledge explained here, tacit and explicit, are however two extremes of knowledge (Wallin & von Krogh, 2010). Nonaka, Kodama, Hirose & Kohlbacher (2013) explain that most knowledge are a combination between the tacit and the explicit knowledge, either with a higher tacit part or with a higher explicit part. Further, Nonaka et al. (2013) explain that all knowledge has its base in tacit knowledge which means that even the most extreme part of explicit knowledge is influenced with tacit knowledge.

The difference between knowledge and information is similar to the difference between tacit and explicit knowledge (Lundkvist et al., 2011). The base of both knowledge and information is data (Sharratt & Usoro, 2003). The difference between the two concepts are that information is data that give us some kind of meaning while knowledge comes from interpreting the information. Knowledge is thereby how the information is interpreted by a person, based on this person’s earlier knowledge. The same documents can be seen as either information or insignificant data

depending on who reads it (Sharratt & Usoro, 2003). Moreover, information is easy to spread and independent of the surroundings, while knowledge, regardless if it is tacit or explicit, needs to be appropriated by the receiver to be called knowledge. Information does not need to be attached to the receiver to be called information. Information can be spread out without knowing if the receiver assimilates the information and are still called information. Information is created by data, and information creates knowledge (Lundkvist et al., 2011; Newell et al., 2009). According to Lundkvist et al. (2011), information needs already existing knowledge to produce new knowledge. Thus, a person needs to have some basic knowledge in a subject to be able to understand and receive the information that are supposed to produce new knowledge to the person.

What difference there is between knowledge and experience can be hard to tell, but according to Ruiz, Foguem & Grabot (2014), experience can be seen as a specialisation of knowledge. Nationalencyklopedin (n.d.) defines the concept experiences in several different ways. Commonly for the definitions is that it is a skill which is built up during repeated times, thus experiences are gained first after repeated occasions. The explanation of the definitions also includes a difference from knowledge in the fact that knowledge is more theoretical than experiences that are more of a trained discernment.

As mentioned before, tacit knowledge needs to be managed in another way than explicit knowledge since people cannot describe the tacit knowledge by words (Holste & Fields, 2010). Furthermore, information and experiences also need different ways of managing. Therefore, the following subchapters will be about the concept of knowledge management and how information, knowledge and experiences are shared in different contexts.

3.2 Knowledge management

To be able to know how information, knowledge and experiences can be shared in an organisation, there exists a need to learn what knowledge management is. The research field of knowledge management has the last decades been a popular concept to investigate in, with many results saying that knowledge management is a complicated management area that companies struggle with (Newell et al., 2009).

Knowledge management is defined by many authors in different ways (Cummings, 2003). However, most of the definitions say that knowledge management is about how knowledge is created, shared, implemented and retained in an organisation (Cummings, 2003; Okere, 2017). Liebowitz (2001) describes knowledge management as a process where organisations are creating value from its own assets. Knowledge management also includes systems, procedures, models and techniques that an organisation uses to achieve the processes mentioned above (Cummings, 2003). Knowledge management can thus simply be explained as how an organisation is working with its own internal knowledge.

3.2.1 Information sharing, knowledge sharing and experience feedback

When something is shared, an exchange between one party and another one is occurring (Sharratt & Usoro, 2003). There must be one part who is a source and one part who is a receiver in a sharing process, and beyond this, a recourse must be transferred. This is confirmed by Gagné (2009), who describes knowledge sharing as a process of exchanging and creating new knowledge. However, to share knowledge is not easy. According to Koch & Thuesen (2013), it cannot be ensured that knowledge is automatically transferred between two parties, but to increase the probability, it is important to involve people in the process. Thus, if people are involved in the process of

knowledge sharing, it will higher the chances for knowledge actually being shared. Lundkvist et al. (2011) explain that if tacit knowledge should be shared, people need to meet. Explicit knowledge, on the other hand, can be shared via written words. Senaratne & Sexton (2008) argue that tacit knowledge easy disappears from an organisation when people with much knowledge leave the organisation. Therefore, it is important to share this knowledge between the employees in an organisation before it is lost. Senaratne & Sexton (2008) describe that the tacit knowledge should be transformed into explicit knowledge to be ensured that it can stay in the organisation. However, this is a hard task that may even be impossible.

Sharratt & Usoro (2003) describe the difference between information sharing and knowledge sharing. The difference is that information sharing does not need to be received by anyone and must not lead to new knowledge at the receiver. Knowledge sharing on the other hand must have a receiver and must lead to the creation of new knowledge at the receiving part. Information can be shared via messages, both verbal and written (Braf, 2000). How to share information is very similar as to share explicit knowledge, but as mentioned before information could be shared even though the receiver does not assimilate the information.

Further, experience feedback is explained by Ruiz et al. (2014) as a structured path, where knowledge from both positive and negative events is capitalised, processed and explored. Experience feedback is thus including that the knowledge is stored, evaluated and maintained in the organisation (Ruiz et al., 2014). This is the big difference between knowledge sharing and experience feedback. Knowledge sharing does not include any storage or exploration of the knowledge in the organisation.

Knowledge diffusion and knowledge transfer are also two common concepts that are mentioned in the literature about knowledge, knowledge management and knowledge sharing. Knowledge diffusion is how knowledge is adapted in the scientific research (Chen & Hicks, 2004). Knowledge diffusion will not be discussed further in this report. Knowledge transfer, however, is defined by Inkpen & Tsang (2005) as the process where experiences from one network member is affecting another network member. Knowledge transfer is thus closely related to knowledge sharing and experience feedback. Henceforth, knowledge transfer will not be discussed deeper, but the paper will discuss contexts that are similar to the concept of knowledge transfer.

To clarify the differences between information, knowledge and experiences, we, the authors of the report, have set up a table to present the main differences. This is presented in table 2.

	Information	Explicit Knowledge	Tacit Knowledge	Experiences
<i>Can it be explained with words?</i>	Yes	Yes	No	No
<i>Do it need to be attached to someone?</i>	No	Yes	Yes	Yes
<i>Do it need a receiver when shared?</i>	No	Yes	Yes	Yes
<i>How could it be shared?</i>	Verbal and written	Verbal and written	Interaction between people	Interaction between people
<i>How do you gain it?</i>	Reading or listening	Reading or listening	Listening and practicing	Practicing repeated times

Table 2: Differences between information, explicit knowledge, tacit knowledge and experiences.

3.3 Sharing information, knowledge and experiences in project-based organisations

A project-based organisation is an organisation which only or primarily executes its work in projects (Hobday, 2000). Project-based organisations have, because of their temporary projects, a different way of working than many other organisations (Bakker, Cambré, Korlaar, & Raab, 2011). The project-based way of working could make it easier to create knowledge within the projects, but it also makes it more difficult to transfer the created knowledge from the projects to the continuous work of the organisation. This depends on the fact that when a project is finished, the members of it moves on to different new projects and thereby the knowledge is spread out, which can hinder the sharing of knowledge (Bakker et al., 2011). Bresnen, Goussevskaia & Swan (2004) describe that many previous researches have shown that project-based organisations have problems with knowledge sharing, knowledge diffusion and learning between projects. The project-based organisation can also be a barrier for sharing knowledge since short-term project specific goals often are prioritised before the long-term organisational goals. A construction company is often organised as a project-based organisation (Josephson et al., 2008).

With better knowledge sharing in construction organisations, several improvements can be made, as decreased building costs and better buildings in general (Josephson et al., 2008). There are many benefits of using knowledge management in the construction industry (Anumba, 2009). By managing the knowledge in a good way, important knowledge, especially tacit, can be utilised instead of being lost. Transferring and sharing knowledge between projects, can help to reduce mistakes that have already been made in earlier projects and thereby improve the projects. Innovation is also better supported in organisations that are using knowledge management (Anumba, 2009). By categorising and presenting knowledge and experiences to the designers of a project, faults can be decreased (Harris & Scott, 1998). According to Dave & Koskela (2009), a good way to share tacit knowledge in a construction organisation is the social interactions between the individuals. In order to improve projects continuously in construction companies, it is also important to transfer knowledge between projects, and not only within them (Gerth et al., 2013).

Josephson et al. (2008) have identified several obstacles that hinder the knowledge sharing and experience feedback in the construction industry. In their research, people from six different construction organisations in Sweden were interviewed about learning. Lack of time and that the learning is low prioritised were two of the obstacles. The shortage of time can lead to the employees doing the same bad solutions as they have done before, because it takes less time to do as you always have done than trying to find a better way to do it. The lack of time is something that the researchers Harris & Scott (1998) also conclude to be a reason to why knowledge and experiences are not utilised and transferred to others in the construction organisation. In a study on how knowledge is managed in construction engineering projects made by Gannon & Banham (2011), they identified that no structure on how knowledge should be managed was an obstacle for effective knowledge management. The individuals in the organisation wanted to manage the knowledge more effectively but because of the lack of structure, this did not happen. Gannon & Banham (2011) thereby concluded that there is a need for a structure on how to manage knowledge in order to improve it. Also, Dave & Koskela (2009) write that this is a problem and mean that there is a need for a system for capturing knowledge that is integrated in the organisation's business strategy. This could, for example, be in the form of a platform, where knowledge can be shared throughout the whole organisation. It is important for the system to be easy to use but also that it is prioritised in the organisation in order for it to be successful (Dave & Koskela, 2009). Okere (2017) also agrees on that a system is important to improve the knowledge sharing in an organisation. To succeed with such a knowledge management system, it is important that it is supported by the top management in the organisation (Okere, 2017).

Another obstacle for knowledge sharing is that key persons in a project often are exchanged during the process, which leads to both lost knowledge within the project, but also to that knowledge from the project is not transferred back to earlier stages in new projects in the organisation (Josephson et al., 2008). The problem with individuals being moved from projects is something that a study by Gannon & Banham (2011) also identified. The individuals in the organisation can also be an obstacle for the experience feedback, if they are not interested in taking time to do it, it will not be done. There exists an old view in the construction industry that can hinder the knowledge sharing, which is that the individuals in the organisation are used to always solving problems as they appear, instead of finding a solution that can work in future situations (Josephson et al., 2008). However, today there exists a will to manage the knowledge more efficient in many construction companies (Gannon & Banham, 2011).

Evaluations and experience feedback-meetings are sometimes held in Swedish construction organisations, but the experiences that have been gathered are often not shared to the wider organisation and no measures are taken to improve future projects (Josephson et al., 2008). There is a need to use the experiences that are gathered in a more systematic way in order for them to lead to improvements in the organisation. Another interesting finding made by Josephson et al. (2008), is that feedback that is received in the construction industry, is often negative, any positive feedback is rarely given.

In a research made by Lundkvist, Meiling & Vennström (2010), they asked managers through surveys, in medium and large-sized construction organisations in Sweden, about warranty inspections in construction projects. They concluded that warranty inspections provide important experience, but most construction companies in Sweden do not use it properly. The information from the inspections is only used for correcting faults and is not analysed or reused. Most companies do not have a system for this knowledge to be shared to the organisation and then used in other projects (Lundkvist et al., 2010).

3.4 Systems and models for sharing information, knowledge and experiences

There are many theoretical models and systems for how knowledge and experiences should be shared from a source to a receiver. Below, some models that the literature provide are presented.

SECI model

One model for how knowledge should be shared, that are well used in literature about knowledge management, is Nonaka's (1994) SECI model. The SECI model describes how knowledge are created, shared and converted in an organisation. The model is structured as a grid with four fields where tacit and explicit knowledge are interacting. Every field contains a process of conversion where knowledge can be created. The four processes of knowledge creation are called: *socialisation*, *externalisation*, *combination* and *internalisation*. According to the SECI model, knowledge creation is a process that is spiralling, starting in the field of socialisation (Nonaka, 1994). The model is presented in figure 2.

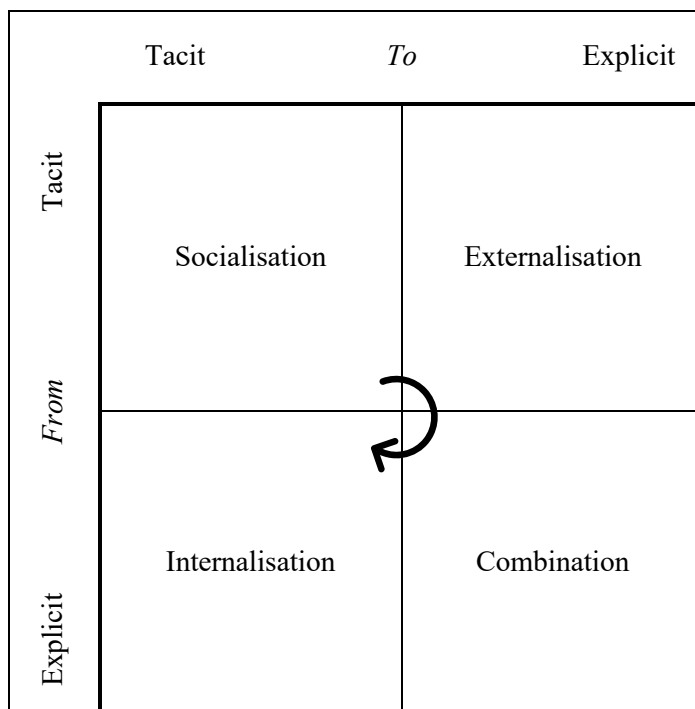


Figure 2: The SECI model that describes knowledge creation. The figure is created by the authors of the report, based on Nonaka's (1994) figure.

Socialisation focuses on sharing tacit knowledge between two individuals (Nonaka, 1994). The transfer of tacit knowledge can, according to Nonaka & Konno (1998), be done by spending time together or living in the same environment. Externalisation has its focus on how tacit knowledge could be expressed and translated into a form that others can understand. The tacit knowledge is then becoming explicit and the individuals that learn this transferred knowledge can create a group where everybody has the knowledge. The externalisation process, where tacit knowledge is transferred to explicit knowledge, can be supported by techniques that helps an individual to express one's images and ideas (Nonaka & Konno, 1998). Continuing, combination takes it one step further and focuses on organisational learning where a group's knowledge could be transferred to another group in the same organisation. The more every group in the organisation learn, the more knowledge the organisation has. Internalisation finally transfers an organisations explicit knowledge into tacit knowledge to an individual. Nonaka & Konno (1998) describe that

this requires that the individual find the knowledge in the organisation that is relevant for only him or her.

Furthermore, Nonaka & Konno (1998) complemented the SECI-model with the concept *ba*. *Ba*, which is Japanese for place, complements the SECI-model with four platforms that correspond to each process in the SECI. The complemented SECI-model with *ba* is shown in figure 3. The four *ba* are *originating*, *interacting*, *cyber* and *exercising*. *Ba*'s support to SECI results in an up speeded knowledge creating process that never ends. Starting with *socialisation* and its corresponding *originating*, continuing with *externalisation* with its *interacting*, third comes *combination* that has *cyber* as its *ba*, and lastly *internalisation* that are supported by *exercising*, and then it starts over again. Nonaka & Konno (1998) explain with the SECI model and *ba* that tacit knowledge to tacit knowledge is shared face to face between two individuals, tacit knowledge to explicit knowledge is shared peer to peer that creates a group, explicit knowledge to explicit knowledge is shared group to group that creates an organisation, and explicit knowledge to tacit knowledge is created on the site.

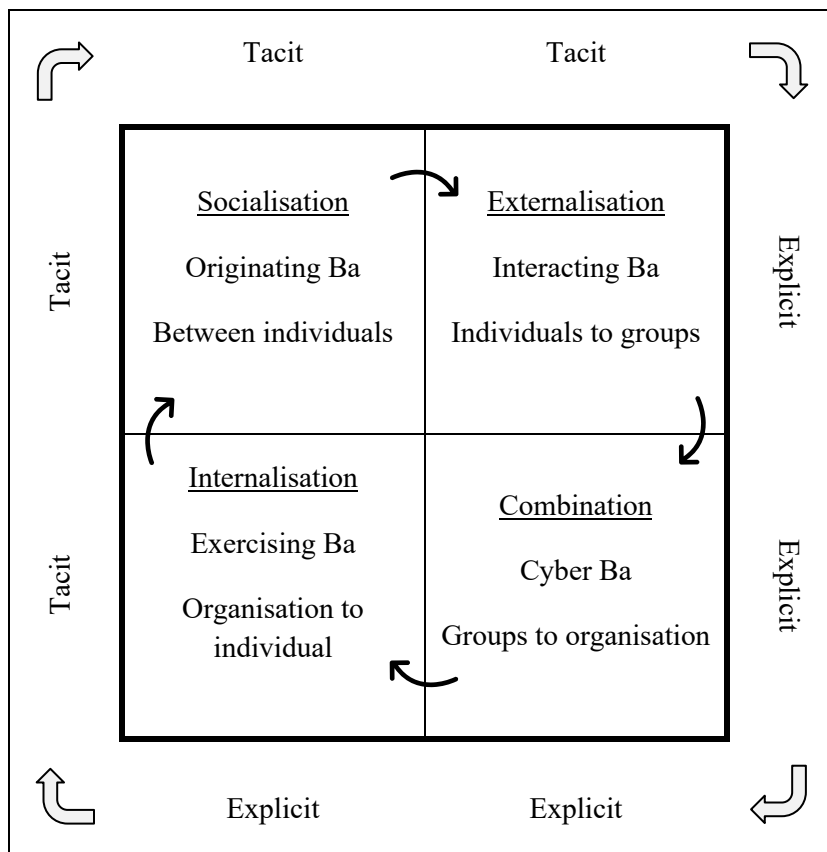


Figure 3: The SECI model with its complementation of *Ba*. The figure is created by the authors of the report, based on Nonaka & Konno's (1998) model.

Knowledge sharing mechanisms

Another framework is one made by Boh (2007), who identified two dimensions of knowledge-sharing mechanisms. This framework complements Nonaka's (1994) SECI model but also includes propositions about for which types of organisations the different combinations of dimensions fits. The two dimensions that Boh (2007) brings up are codification versus personalisation, and individualisation versus institutionalisation. Codification means that the knowledge that is shared is codified while personalisation instead processes tacit knowledge. Individualisation means that the knowledge is shared at an individual level while

institutionalisation is shared on a collective level. The two dimensions together form a framework consisting of four classes of knowledge sharing mechanisms, which are; *individualised-personalisation mechanisms*, *individualised-codification mechanisms*, *institutionalised-codification mechanisms* and *institutionalised-personalisation mechanisms*.

Also Boh's (2007) framework is, as Nonaka's (1994) model, built up by a grid with four quadrants. The first class (quadrant 1), individualised-personalisation mechanisms, describes the knowledge sharing done on an individual level in an informal way (Boh, 2007). For example, this can be individuals in an organisation, conversing at a workplace or through social networks. Individual personal knowledge sharing can be a good mechanism for the transfer of tacit knowledge. However, there is also a risk that the individuals do not know who to talk to about different areas, which can hinder an effective use of the knowledge-sharing mechanism. The second class (quadrant 2) of knowledge-sharing mechanisms is the individualised-codification mechanisms (Boh, 2007). In these mechanisms, the knowledge is shared through documents on an individual level in an informal way. This can enable knowledge from one project to be transferred to another by documents, as project plans, from one individual to another. Since much knowledge are stored in an individual's or a project's own space in a project-based organisation, this can be a good way to transfer the knowledge. Even if the documents are placed in a shared space for the whole organisation, it can still help to use these individual mechanisms, since it can be hard to find the right documents.

Further, in the third class (quadrant 3), the institutionalised-codification mechanisms, the knowledge can be shared through codified information that are institutionalised (Boh, 2007). This means that the codified knowledge is shared in an organisation wide context which makes it accessible for everyone. The last class (quadrant 4) is the institutionalised-personalisation mechanisms, which describe when the knowledge is shared through interaction between individuals but still is institutionalised (Boh, 2007). When people interact, other knowledge than codified can be shared which is helpful. This kind of knowledge sharing can be institutionalised by creating mechanisms that helps the individual to share their knowledge in person. The framework by Boh (2007) is summarised in figure 4.

	Individualised	Institutionalised
Personalisation	<i>Quadrant 1: Individualised-personalisation</i> Suitable for small organisation with unique projects	<i>Quadrant 4: Institutionalised-personalisation</i> Suitable for large organisations with unique projects
Codification	<i>Quadrant 2: Individualised-codification</i> Suitable for small organisation with standardised projects	<i>Quadrant 3: Institutionalised-codification</i> Suitable for large organisations with standardised projects

Figure 4: Four classes of knowledge-sharing mechanisms. The figure is created by the authors of the report, based on the framework by Boh (2007).

Boh (2007) also makes two propositions about how to use these different knowledge-sharing mechanisms. The first one is that codification knowledge-sharing mechanisms in organisations work better for organisations where the projects are standardised, and personalisation knowledge-sharing mechanisms work better in organisations with unique projects. The second proposition is that institutionalised knowledge-sharing mechanisms work better for large organisations that have

business in geographically spread locations, and individualised knowledge-sharing mechanisms work better for small organisations that only have their business in a few geographically spread locations.

Platforms

Having a platform is a way of managing information and knowledge in a construction organisation (Styhre & Gluch, 2010). A platform can be defined as a number of assets that are divided into: components, processes, knowledge, and people & relationships (Robertson & Ulrich, 1998). Components are the parts of a product and the tools that are needed to make them. The processes are the ways to make the components into products. The knowledge are techniques, models and methods. The people and relationships are the people who are working in the organisation and their relationships both within the organisation but also with suppliers (Robertson & Ulrich, 1998).

From the beginning, platforms have been used mainly in industries with a make-to-order strategy which means that platforms in the construction industry, where the engineer-to-order strategy is used, need to be used in combination with the unique parts of a project (Jansson, Johnsson, & Engström, 2014). Therefore, the platform cannot be completely parameterised. Design support methods for the daily engineering work, are thereby needed in the engineer-to-order strategy to be able to meet both project requirements, but also the platform parameters (Jansson et al., 2014).

Using a platform can help construction organisations to share knowledge and experiences across projects (Styhre & Gluch, 2010). To utilise a platform in a successful way in the construction sector, it is required to update and improve the platform regularly (Jansson, Lundkvist, & Olofsson, 2015). This can be done by using feedback channels which can gather knowledge and experiences from projects and transfer it to the platform. Examples on feedback channels that can be used are either to have improvement meetings where people from different departments discuss improvements that can be made, or by letting the individuals in the organisation send in their individual reflections. It is also important that the individuals in the organisation use the platform as the source of organisational knowledge for it to work successfully (Jansson et al., 2015).

However, there are some critics against working with systems where the knowledge sharing is made via information and communication technology. According to Newell, Bresnen, Edelman, Scarbrough & Swan (2006), knowledge transmitted through information and communication strategies are not that useful. Often the knowledge is better transferred through personalisation mechanisms instead, since things can be described more in detail. The focus when sharing knowledge through information and communication technology is on what has been achieved in a project rather than how and why, which would make the knowledge more useful for other future scenarios (Newell et al., 2006).

4 Empirics

This chapter presents the study's empirical findings. The empirical findings are later used in the analysis to compare what the theory says with what the empirics shows. The information in this chapter is based on internal documents from the Case Company, interviews with employees at the Case Company and participant observation that has been made at the Case Company's office. The results from the first interview set are mainly presented in the subchapter about existing collaboration, and the results from the second interview set are mainly presented in the subchapter about future systems. How the company is organised and how the departments of Warranty and Design work, are presented in the subchapter organisational structure.

4.1 Organisational structure

The Case Company is one of Sweden's largest construction companies that builds residential buildings. Organisationally, the Case Company is structured with a common limited company business structure where an annual meeting of shareholders is the organisation's highest decision-making body. The shareholders select a board which sets the company's orientation. Further, the company is run by a management team who are responsible of several business units. Geographically, the company has its base in Stockholm, but has regional operations around Sweden and Scandinavia.

This study is limited to only look at the region around Gothenburg. The region around Gothenburg is run by a regional manager which together with the heads of the departments in the region, create the regional management. Two of the departments are the Construction and the Design department. The heads of those departments are thus members in the regional management. Under the Construction department, a smaller sub department deals with warranty issues. This Warranty department, together with the Design department, are the main focus of this research. Further, the organisation contains a project management department which the project managers belongs to. In the Case Company, a project manager has the responsibility over a project from the first drawings to the last day of the responsibility time of the projects which are described later on. Thus, the project manager has responsibility for the project in every phase of the project. The region around Gothenburg runs its own projects, but the whole Case Company works in the same systems and basically works after the same routines.

4.1.1 The Warranty department

The Warranty department consists of supervisors and a few craftsmen. It is run by a head of the department that directly reports to the head of construction. The Warranty department is responsible for warranty inspections and for fault reports regarding the property that the customers, who have bought the accommodations, have sent in. The responsibility of the project shifts from the Construction department to the Warranty department when the construction phase in the project is finished, normally when the inspection report has zero faults. Warranty inspections are done two respectively five years after the construction finish in the most common type of accommodations that the Case Company builds, to control faults that may need to be fixed in the building. After the last warranty inspection, after five years, the warranty time merges to a responsibility time where the main difference from the warranty time is that property owners now have the burden to prove faults. The responsibility time lasts for further five years. It is not until after those altogether ten years, that the Case Company and the Warranty department can let go of the project completely.

The supervisors in the Warranty department have the responsibility for the projects that they get assigned from the head of the department. This responsibility means that the supervisors evaluate every fault report that comes in from the customers and take the decision of what must be done to fix the issue. The supervisor in turn assigns what must be fixed to the department's craftsmen or to subcontractors. Sometimes the supervisors must do a visit at the building or the accommodation where the issue is to evaluate what has to be done. Normally, the fault reports are just managed by the warranty supervisor, and not seen by anyone else in the project, but if the issue has a bigger economical character, the project manager is informed and is the one that takes the decision what to do. According to several interviews with employees from the Warranty department, the supervisors think that a big part of their job is to make the customers happy with the service that they get from the Case Company. The smoother the reparation goes, the happier is the customer. This is important for the Case Company's reputation which the supervisors understand and work hard for.

The Warranty department works with a system where fault reports are managed. In this system, the fault reports from the customers are registered. Every fault report needs to be connected to a root cause in order to categorise them. This system is used mainly by the warranty supervisors to see which faults that are reported in their projects. Another system can be used to extract information about the fault reports from the first system, as what kind of problem it is, which root cause it has and which project it belongs to. These statistics can be summarised in reports which can be used to see which faults that are common and what they are caused by. This second system is mainly used by the head of the Warranty department who then can present or share the information with others. However, none of these systems are accessible by other departments.

4.1.2 The Design department

The Design department consists of several design managers and one BIM leader, which are run by a head of the Design department. The department is organised in the way that the head of the department assigns projects to the design managers and makes sure that the regional time plan, which the regional management sets up, is followed. The Design department is responsible for designing buildings so that they can be built in a good and safe way, provide a good environment for the customer and also that the buildings will be profitable for the company. This includes guiding and coordination of consultants and the architect, who are experts in their own areas, in order for the building to turn out as good as possible and match the Case Company's business. The design managers role is thus to coordinate the consultant group who are the one that designs the building.

The Design department is involved in the project already when the Case Company is buying land to build on. At this point, an architect is involved to produce sketches to see what kind of building that could suit for the land and if the land is something that could fit the Case Company's business idea. After the land is bought, the process of designing the building begins. The Design department is then supposed to produce documents that are going to be used in the construction phase of the project, which involves project planning documents, programme documents and construction documents. The design process can last for several years depending on the process of the detailed development plan, the size of the project, which type of building it is, and how long it takes to get the building permission. After the design phase, the construction phase begins.

The Case Company are working with instructions that the Design department must follow when they design a building. The design instructions regulate, inter alia, which construction framework that can be used, how a detail of a part should look like and where an installation in the building

should be placed. Depending on the conditions for the project, different instructions apply. The instructions are built on experiences from the employees at the company and are updated every year. They ensure that the company builds in the same way in every project which in turn ensures the quality of the building. There is a possibility to design in another way than the design instructions say, but then the design manager must have good arguments in order for the change to be accepted.

To clarify how the organisation looks, figure 5 shows an organisational chart where the Warranty department and the Design department are marked. The chart also shows the members of the regional management, which the two interviewed top managers belongs to.

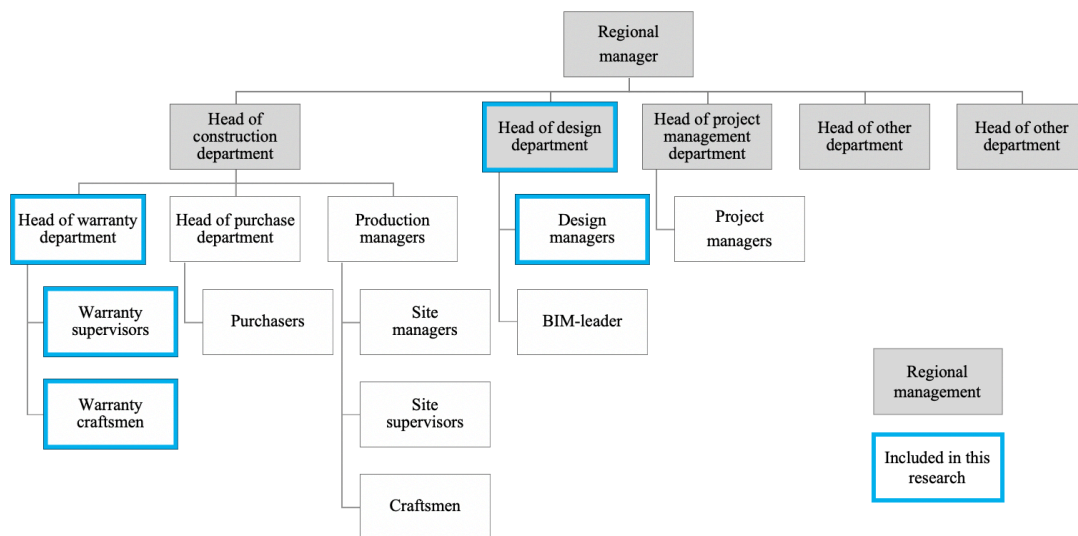


Figure 5: Organisational chart over the Gothenburg region in the Case Company. The chart shows the relationship between the Warranty and the Design departments and on which level they are in the organisation. The two interviewed top managers are two members from the regional management. The figure is created by the authors of the report, based on the Case Company's internal documents.

4.2 Information sharing, knowledge sharing and experience feedback

Today, the Case Company does not have any official system for how information, knowledge or experiences from the Warranty department is feedbacked to the Design department. However, from the interviews with the employees, some general systems and routines that the Case Company is using were identified. Two systems that were identified have the purpose of knowledge sharing and experience feedback. The Case Company also has a well-established business system where it is described how a project should be run and completed. They also have a platform where every project has its shared documents. Those systems are the base for how the company works. The business system provides a systemised plan so that every project is executed in the same way, but with opportunity for project specific variations. A deeper description of the Case Company's existing systems and what the interviewees thought about them is given in this subchapter. The subchapter also describes what barriers there are for collaboration between the Warranty department and the Design department. Lastly, ideas for future systems are presented.

4.2.1 Existing collaboration and systems

This subchapter aims to describe what existing collaboration there is between the Warranty and Design department. The Case Company has some systems that they work with today, which are also presented in this subchapter.

Business system

As mentioned before, the Case Company has a well-established business system that everyone in the organisation is working against. The business system describes how a project should be executed, from the first idea of buying land, to how the accommodations should be sold and how the company should manage warranty issues. Both governing and advisory documents are provided to the employees through the business system. Beyond the description of how projects should be executed, the business systems comprise supporting documents for, inter alia, human resources, legal issues and how the company should communicate.

Almost all interviewees mentioned that they are unsure if the business system provides information about how knowledge sharing and experience feedback should be worked with in their department. Many of the warranty employees described that they feel that experience feedback is something that everybody talks about, but nothing really happens in the area. After a review of the business system, it could be stated that the Warranty department has a chapter in the business system that are about experience feedback. However, the chapter does not contain any specific method or system of how the department should work with experience feedback, it just tells that experience feedback is something that should be worked with. The chapters in the business system that the Design department are affected by, does not provide any models or documents that describe how to work with knowledge sharing or experience feedback, neither between the employees in the Design department nor between other departments that are involved in the project.

The only way the business system takes up experience feedback as something governing is a meeting that should be held when the construction phase of a project is finished. This meeting is aiming to gather and document which tasks that have worked well and which tasks that have not worked in the project. This meeting should according to the regulations include, inter alia, the project's design manager, site manager and project manager. However, the Warranty department is not invited to this meeting. Both warranty employee D and E think that it would be good if a representative from the Warranty department is invited to this meeting. Warranty employee A although has an opinion that differs from warranty employee D and E and thinks that it would not be necessary for the Warranty department to be involved in those meetings.

Improvement proposals

The Case Company has one system where improvement proposals can be sent in by anyone in the organisation. These proposals are a way to improve how to do things in the organisation and how to improve the structural capital. The system works in the way that if someone in the organisation has an idea about how to improve something, based on what they have seen in their everyday work, they can send this in through the intranet of the Case Company. Thus, the improvement proposals are based on the employee's knowledge and experiences. In the improvement proposal system, a problem should be described and a solution to it should be presented. When the proposal is sent in, an initial analyse is made by the Development department, which is a central department at the Case Company, to see if it is something worth further investigation and to see if any additional information is needed from the sender of the proposal. If the proposal is accepted in the initial analyse, it is taken further to a group of people, consisting of both officials and craftsmen. This group investigates through meetings with people from different areas if the improvement proposal is something that should be implemented in the company. If the improvement proposal is accepted, it is then implemented in the structural capital of the Case Company, for example in the design instructions.

The employees at the Warranty department all had similar opinions of the improvement proposals. Both warranty employee A and C talked about the lack of time they have. They already have a high workload, and it is therefore difficult for them to find the time to write an improvement proposal. Warranty employee A said that it took much time to write and send in an improvement proposal, about 1-2 hours, and therefore felt that a problem needed to be comprehensive if doing an improvement proposal should be worth it. Warranty employee C mentioned that it is easy to forget to send in improvement proposals that you have been thinking about since it requires much time and is not always possible to do during the workday. Therefore, warranty employee C wanted a better way to send in the improvement proposals which will take less time and can be done from other places than the office, for example in an app. Another problem, according to warranty employee A, is the time it takes for the improvement proposal to be managed and then, if accepted, the time for it to be implemented. It also takes much time before the people working at the Warranty department see any changes in the projects they work with, due to long lead times in the construction industry. The design employees also agreed that the process of sending in improvement proposals is long. Design employee B said that they sometimes forget what they have sent in because of this. Warranty employee C explained that sometimes when they send in improvement proposals, it feels like the group that analyses it does not understand what the sender means and therefore rejects the proposals. Warranty employee C also felt that they only look at documents in the organisation and not how it works for real, and therefore, they do not believe that the proposal that has been sent in is a problem at all, even though it is. This is something that warranty employee E had similar thoughts to, the improvement proposals are sent to another region where the same problems as in Gothenburg do not exist, and therefore the investigation group does not understand it and rejects the proposal. It feels like their proposals are not taken care of enough according to warranty employee E. Another critic about the improvement proposal system according to warranty employee A, is that it is up to each of the employees to send in them and therefore they rarely send in any.

Almost all the warranty employees, mentioned that they always receive feedback on their improvement proposals that they have sent in. However, warranty employee D often hear that other employees in the department feel that they do not get enough of feedback and want more feedback on their proposals. Warranty employee A wished to be more involved in the process of improvement proposals. Some of the design employees, A and D, also believed that they do not get enough feedback. Design employee D agreed with warranty employee A on that they should be more involved. Several of the warranty employees had a wish that the improvement proposal system should be easier to use. Warranty employee A wanted the system for improvement proposals to be more integrated in the system that they already use. This would help the warranty employees to remember to send in them and also make it easier to access it. Both warranty employee B and C also mentioned that they want an easier system to use for the improvement proposals.

The top manager A thought that improvement proposals is a good way to feed back experiences and that it is important that the Warranty department gathers their experiences in a better way in order to improve the design instructions. Top manager B believed that the improvement proposals are good for changing the design instructions but also thought that the design instructions does not cover everything in a project. Therefore, the improvement proposals are sometimes not enough, the Case Company needs another system for other comments to be transferred between the departments.

All employees that were interviewed during the research said that it does not say anywhere that they have to send in improvement proposals. However, warranty employee A, C and D said that they have it as a goal. Warranty employee D also said that in the business system it says that the employees should contribute to the company's and their own development, which can be done through the improvement proposals. Top manager A confirmed that it is up to every individual to take the decision if an improvement proposal should be sent in or not.

Supplier comments

The employees at the Case Company can also leave comments on suppliers that the company use via another system which is also available on the intranet. The comments are read by a purchaser that is working at a central position within the company. The purchaser uses the information that the comments provide both in dialogues with the supplier and to make demands in negotiation with the supplier. The supplier comments that an employee sends in should contain which supplier the comment affects and a description of in what way the supplier needs to improve. The comments can for instance be about a supplier that has a contact that misbehaves, a product from a supplier that has issues or if the supplier has systems that are incomprehensible. The supplier comments are not open for everyone to see, which means that the design employees do not have access to see what comments there are about a supplier when they select which products to use in a new project. The supplier comments are of a more informative character, where only information from an employee is sent to the purchasing department. The employees do not need to have any knowledge about the supplier or any experience in how the Case Company work to be able to write a supplier comment. Just as with the improvement proposals, the supplier comments are not mandatory to write for the employees.

When it comes to how the employees feel about the supplier comments there are some divided thoughts. All the employees at the Warranty department understand that it is important to write a supplier comment if a change should happen. Warranty employee A even sees the supplier comment as a type of information sharing to the organisation. Although, warranty employee A described that it sometimes can take too much effort to write a supplier comment. The problem needs to be quite big if warranty employee A should write a supplier comment. What warranty employee C and B described is similar, the system must be more accessible so that it is easier to send in comments. This could for example be solved with an app where employees from the Case Company could send in supplier comments and improvement proposals. Warranty employee D did however not agree with this. Warranty employee D described that it is easy to write a supplier comment. For warranty employee B, also good things about products are something that can be reported in the supplier comments. Just as with the improvement proposals, warranty employee D mentioned that response on what is written in the supplier comments comes rarely, or never. Sometimes a follow up question can come from the purchaser that reads the supplier comment, but this does not happen often. Warranty employee E did not agree with that and instead described that they always get an answer on what they report.

Meetings and communication

During the interviews, the only channel of communication that were mentioned for how the Warranty department and the Design department exchange information, knowledge and experiences with each other was via sporadic verbal communication between individuals in the office. The employees from the different departments had different opinions regarding how well this communication channel works today. According to the design employees, the communication that exists consists of mainly informal talk but also questions about issues in projects. Design employee B and E sometimes ask employees at the Warranty department about different design

issues to hear their knowledge and experiences about it, but it does not happen very often, only a few times a year. This communication mainly happens when there are questions that the design instructions cannot answer, or if someone hears something in the office that have led to problems for the Warranty department, according to design employee B. According to the warranty employees, the contact that exists between the departments is mostly informal. Warranty employee A, B and E mentioned that most of the conversations with the Design department happen when they accidentally meet, for example in the corridor or in the break room.

In general, the design employees think that the relationship between the departments is good. Most of them believe that they do not have any problems with the Warranty department. Design employee E however, experiences that the contact between the departments is almost non-existent, but when it happens, the communication is good. How often the departments are in contact differs according to the different interviewees, some of the design employees are only in contact with the Warranty department a few times a year, while others are in contact with them on a daily basis. However, design employee B, C and D experience that they seldom have work-related contact, the conversations they have are more about other, collegiate, topics. According to design employee E, there is no structured contact between the departments which is something that a review of the business system confirms. There is also more of a communication from the Warranty department to the Design department than the other way around, it is more common that the warranty employees ask the design employees things according to design employee A. Design employee A and E believed that this depends on the fact that they work in completely different stages of the projects. Design employee C felt that the Warranty department work with their own things and rarely comes to the Design department to inform about repeated faults.

In general, the Warranty department had a more negative view of the relationship between the departments. All the warranty employees believed that there is not much communication between the departments, and warranty employee A and C believed that the relationship is poor. Warranty employee B said that the relationship is good but that there is no work-related talk, exactly as some of the design employees stated. According to most of the warranty employees, the communication happens a few times a month between the departments. The work-related communication that happens between the departments, mainly consist of questions about how the design employees have done when designing parts that there is a problem with during the warranty time, according to all warranty employees. The warranty employees are then often searching for blueprints on how something has been designed, to be able to fix the warranty issue, and ask the design managers for help to find the blueprints. According to warranty employee D, most of the time it is the warranty employees that ask the Design department questions and not the other way around, which design employee A also stated. Warranty employee E experienced that the Design department is not that interested in what the Warranty department works with. Further, warranty employee E described it as they were the “appendix” of the organisation that others do not care about. That there is not much communication between the departments, is also something that the participant observation at the Case Company’s office can confirm. The employees from the Warranty and Design department rarely talked to each other in any way during the observations at the company, even though they are sitting in the same, activity based, office, in the same building and on the same floor, often just some desks away from each other. Additionally, almost every interviewee, from both the Warranty and the Design department stated that they are not completely sure about how or with what the other department works with. This means that they were not sure about who works with what and what their work implies.

Within the Warranty and Design departments, they have both sporadic verbal communication between the employees and structured meetings. Both the departments have regular department meetings. The Design department has, beyond monthly department meetings, weekly catch ups within the department where everyone gets a few minutes to brief what they are working with right now as a permanent issue on the agenda. This is something that the design employees see as an experience feedback occasion. The Warranty department has monthly department meetings where experience feedback is a permanent issue, this is however not brought up by any interviewees except warranty employee D. The employees working at the Warranty department have however also some informal experience feedback meetings within their department. All the warranty employees stated that they on a daily basis share their knowledge with each other. Warranty employee A said that they also share their knowledge to the project manager which is their closest contact in the projects. Other than the informal talk and the department meetings, there is no way the Warranty department works with experience feedback. There are also meetings that are held in the earlier stages of a project, during the design of the programme document and the project planning document, which have the aim to inspect and review the documents so that the project turns out as good as possible. Those meetings are held by the design manager and include, inter alia, a representative from the construction phase and a representative from the purchase department. No representative from the Warranty department is however invited. This is something that the warranty employees felt is a bit strange. They felt that they have experiences that could help in those stages that are not used today. For example, they know what kind of materials and equipment that have not worked in earlier projects.

During the research time, a meeting was observed where one employee from the Warranty department took part of a department meeting for the design employees. This was a one-time thing and had never been done before. The warranty employee presented what the Warranty department does and also what the most common fault reports were in recent projects. During the meeting, the design employees asked a lot of questions about the information that the warranty employee presented. The design employees expressed that they wanted to receive more feedback about which faults that have been caused by them and why they have caused them. They also said that the departments do not have much contact with each other. They also discussed that there is nothing that says that the departments should communicate.

In general, the design employees believed that they have enough knowledge in the Design department to do their work in a good way. According to design employee A it depends a bit on how long you have worked within the industry. Design employee B meant that no one knows everything but that the knowledge exists somewhere in the department. The design employees expressed that they do not have any major problems with finding information, knowledge or experiences generally within the company. They most often know where to turn to when facing a problem. For example, they mentioned that they can turn to the business system, design instructions, consultants or co-workers depending on the type of problem or question. However, there can be some difficulties when searching for information, knowledge or experiences. For example, design employee B said that it sometimes takes much time before receiving answers on questions. This is something that design employee D also agrees upon. Another problem is that since there are a lot of information, knowledge and experiences in the company, it can be difficult for the employees to find what they need, according to design employee B and D. Design employee C stated that there is no easy way to find information and that they need to search actively to find it. The information, knowledge and experiences are not always found within the company, but then the design employees turn to the consultants instead since they are experts in their own areas.

4.2.2 Sharing and benefits

There were varying opinions from the employees about which benefits a better knowledge sharing and experience feedback from the Warranty department to the Design department could generate. Design employee A did not know if the Design department would benefit from the Warranty department's knowledge and experiences at all. Design employee C also thought something similar, that the Warranty department does not have that much knowledge that could help them. However, design employee A, later mentioned that the Warranty department knows much about the customers and their input on what has not been working after the project is finished, and this could be something that could help the Design department. Design employee E agreed on this and gave the example that the design employees do not meet the customers and therefore they do not know what the customers think about the floor plans and other solutions.

Both design employee B, C and D, thought that they could benefit from the information that the Warranty department has about which problems and challenges that are the most common in projects. If the fault is caused by the design employees, it could help them to avoid repeating the same faults. Another thing that the Design department could benefit from, is that the Warranty department can improve the design instructions with their experiences through the improvement proposals, according to design employee B. Design employee D stated that the Warranty department has much experience from the practical things which the design employees do not have. The design employees work in a theoretical world and it is not always that their theoretical solutions work, and then the Warranty department can help.

All the warranty employees believed that they have information, knowledge and experiences that can help the design employees in some way. The warranty employees stated that they see the same faults being reported repeatedly in several project and that their experiences from what these problems are and what the cause of them are, could benefit the Design department's work in future projects. They have information about which warranty faults there actually are in a project, and as warranty employee A described, they know much about what happens with the buildings after they are finished. Warranty employee A thought that their experiences about the materials and equipment are something that could help the Design department. Warranty employee A also thought that the design employees could benefit from seeing the information in the fault reports that the customers have sent in. Warranty employee E had some similar thoughts as design employee D, that the warranty employees have experience from "the reality" and can therefore help the design employees who do not have this experience. Warranty employee E believed that since they meet the customers on a regular basis, they have a better understanding of the needs and wants from them. According to warranty employee B, the warranty employees see the projects in a longer perspective which gives them other aspects of things, this means that they have the ability to contribute with things that the others in the projects do not think about.

Design employee A stated that some problems that cause fault reports for the Warranty department are purchasing questions, and not design questions. Even if the design employees design something that is supposed to work, it is not sure that the products which are purchased work. This is something that design employee C agreed upon and thought that the purchasing department would benefit from the knowledge from the Warranty department. Also, warranty employee A expressed that the knowledge from their department should be transferred to the purchasing department too. Design employee B mentioned that the Construction department also could benefit from the knowledge from the Warranty department. However, several of the employees still thought that knowledge sharing and experience feedback are something that should happen between the Warranty and the Design department and are an important part. Most

of the design employees expressed a wish to get to see or hear about the most common fault reports in some way. The main issue today is according to the interviewees that the information, knowledge and experiences that the Warranty department has are not used anywhere in the organisation. This can also be confirmed when looking through internal documents, the company does not ensure that experiences from warranty employees are used to become better even though the company has goals to lower the fault reports.

4.2.3 Barriers for collaboration

During the first interview set, several problems that hinders the sharing of information, knowledge and experiences were mentioned. Three of these obstacles for the sharing of information, knowledge and experiences were mentioned by several interviewees. These were: lack of time during the workday, the long lead times in a project, and the design instructions. In the second interview set it was therefore asked to the interviewees about these problems to get the opinions about them from all of the interviewed employees.

Both warranty employee A and D said that time is something that hinders the communication because they already have a lot to do in both of the departments. In the second interview several other also thought that this is a problem. Design employee C and warranty employee A and E thought that time could be a problem and that the Warranty department therefore has to prioritise what to do. According to warranty employee E, they often prioritise their main work tasks in the projects instead, as taking care of fault reports and customers. Both design employee C and warranty employee D said that it is an organisational issue. Design employee C thought this since the organisation does not provide enough opportunities to share their knowledge and experiences. Warranty employee D instead believed this because they have too many work tasks to carry out and that their work descriptions are not clear enough about how to share their information, knowledge and experiences, which makes it hard to prioritise it. Both of the top managers also believed that lack of time is something that hinders sharing of information, knowledge and experience between the departments. The rest of the interviewees did not think that lack of time was a problem. Design employee A and B and warranty employee B and C all thought that if they plan to share information, knowledge and experiences, they have the time to do it. Design employee D stated that the problem is more about how it is done because if it was easier to do it, it would take less time. Design employee E believed that time was not a problem generally, however, during intensive periods in their projects, it can be.

Further, several of the interviewees mentioned that the long lead times that the construction industry has, is a barrier for the Warranty and Design department to communicate more. It could be several years between the design and the warranty phase depending on the project which means that problems that the Warranty department manage right now, could already have been changed in the design instructions, laws or wherever the problem has its roots. A normal project at the Case Company takes about 2 years to build, which means that it is about 2 years between the finishing of the design phase to the start of the warranty phase. Design employee A sometimes feels that the design and warranty phase is too far away from each other in the process to have anything to learn from each other. Still, design employee A thought that it would be interesting to learn more about the problems that the Warranty department handles. Lead times as a problem is something that other employees at the Case Company also have mentioned in informal conversations during participant observation. During the second interview set, about half of the interviewees thought that lead times are a problem. Design employee D said that because of the time it takes for the Warranty department to take over and then receiving fault reports, the same faults are already designed in several projects. Design employee B and E and warranty employee

C also thought that the lead times are a problem. However, design employee E still believed that it is very important to collect the faults from the Warranty department in order for the organisation to improve, regardless of the lead time. Top manager A also believed that lead times are a problem and that the departments do not have any natural connection points since they are working in completely different phases in the projects. Contradictory to this, the rest of the interviewees did not think that the lead times are a problem. Warranty employee A even believed that the long lead times could be positive for the sharing of knowledge since the design managers then have a lot of time during the project to collect the Warranty department's knowledge.

Warranty employee A and D thought that the design instructions are an issue for the sharing of information, knowledge and experiences. They believed this since the design managers have to follow them strictly if they do not apply for a change, which is a process that takes time. Thereby it does not matter if the warranty employees have inputs that differ from them. Most of the interviewees, from both of the departments, agreed that this was a problem when asked specific about it. Design employee A thought that there is too much documents in the organisation overall, and the design instructions is a part of this. The design employees do not have the chance to think freely because of them and this also makes it hard to design differently if someone from warranty has inputs about something. Design employee E believed that the design instructions and the warranty employees sometimes say different things and then it is difficult to know how to handle it. Warranty employee A, B and E all thought that they sometimes have better solutions than the design instructions which the design managers then cannot follow because of the governing design instructions. Top manager A also believed that the design instructions could be a problem since they have a lot of them which can lead to the design managers feeling too safe that everything is included there and therefore do not gather experiences from other departments. Design employee D however thought that the design instructions are not a problem, and instead thought that it is the best information they have to follow when they design. Design employee B also said during the second interview that the design instructions helps a lot.

In the first interview set, some other barriers than the three major ones were also mentioned. Almost all of the design employees stated that there is nothing that hinders the contact between the departments. However, one problem is, according to design employee D, that they follow the business systems that exists and according to it, there is nothing that says that the departments should communicate and thereby it does not happen. Thus, it is not included in their work description that they should communicate with each other. Design employee D also thought that some knowledge is difficult to share with the systems that already exist. The warranty employees, on the other hand, mentioned several different obstacles for the collaboration and communication between the departments during the first interview. Warranty employee B, C, D and E first said that there is not anything that hinders the contact. However, warranty employee C later during the interview said that one problem is that they sit in different parts of the office and that the Design department is understaffed. Warranty employee D mentioned that another problem is that the people who work in the design phase of a project sometimes have stopped working at the Case Company when the Warranty department takes over it. In the second interview, several other interviewees also described this problem and believed that the change of personnel is a problem for the sharing of information, knowledge and experiences. Another problem is that they work in two completely different ways and have poor insight in each other's work, according to warranty employee B and E.

Top manager A also mentioned another problem than the three major ones which was the view in the company of when a project is finished as an obstacle for the sharing of information, knowledge

and experiences. Today the general view is that a project is finished when the construction phase is done according to top manager A, and therefore the Warranty department's experiences have not been prioritised by the company. However, top manager A thinks it is good to see the projects as finished when the construction phase is over but that they should get better at gathering the experiences from the Warranty department either way. Top manager B mentioned another obstacle that hinders the experience feedback, which is that even though everyone wants to feed back more experiences; it is difficult to find a good way to do it. It is also a short time frame where the design managers are open to absorb other's experiences, because according to top manager B, you are not receptive for feedback that relates to something else than the task that you work with at the moment.

4.3 Future systems

It could be stated from the first interview set and after reviewing the internal documents that there is a need for some sort of new system or routine if the warranty employees should be able to share their information, knowledge and experiences to the design employees. The systems and routines that are available today are good, but they need to be complemented to make the information sharing, knowledge sharing and experience feedback more efficient and easier for the Warranty department. Therefore, this subchapter is about how future possible systems and routines could look.

There are somewhat mixed opinions from the design employees about how often there should be some kind of communication between the departments. The design employee A did not believe that there is a need for the departments to talk more frequently, while design employee B and E wanted to be in more contact with the Warranty department. However, both design employee B, C and D stated that they only want to be in contact when there is a problem and need for it. Design employee D did not want any unnecessary meetings but thought that there is a need for a more efficient communication between the departments, since only communicating through the systems that exist can take several years. Design employee B and E wanted to have more contact in the beginning of the design process, and maybe let the warranty employees review the programme documents, to be able to utilise the knowledge of the warranty employees from the beginning.

Most of the design employees thought that some type of meeting would be good to have to transfer the information, knowledge and experiences from the Warranty department to the Design department. In this way, they could discuss the faults that are common, according to design employee B. Both design employee B and C said that the knowledge and experiences from meetings are not taken further, which is a problem. That things are not taken further from meetings is something that has been heard from other employees at the Case Company during participation in informal conversations at the office. Design employee B thought that it is important that the things discussed in a meeting is summarised in some way and taken further. Another opinion regarding the collaboration in the future is that the information, knowledge and experiences should be transferred back to the Design department through the business system or design instructions, according to design employee E. For example, the warranty employees could add comments to the design instructions which could explain why it should be done like that.

The warranty employees wanted to be in contact with the Design department when there is a problem and the contact is needed, exactly as most of the design employees believed. Warranty employee E also wanted to see more communication between the departments but only if the Design department is interested in hearing what the warranty employees have to say. The warranty

employees wanted to feed back their knowledge and experiences more than they do today. Warranty employee A thought that the Design department should be able to take part of the experiences from the warranty employees in a more efficient way. This would shorten the time it takes for necessary changes to be done in the design phase, compared to the time it takes today via the systems that exist. Most of the warranty employees thought that a meeting would be a good way to share experiences. A meeting is better than only sharing documents since written words can easily be misunderstood, according to warranty employee E. There are some different opinions about which type of meeting it should be. Warranty employee A, B and E believed that a meeting associated to a project would be good, where warranty employee E suggested a meeting in the beginning of projects where they can discuss solutions and products. Another way would be to have regular meetings outside of the projects where a discussion can be held with representatives from both the Warranty department and the Design department, according to warranty employee D. Warranty employee A, B and D thought that it is important that an experience feedback-meeting is structured and has a clear agenda. The meeting should be in the business system and be obligatory to carry through, according to warranty employee B and D. It is also necessary that the things discussed in the meeting is taken further according to warranty employee D and E. Warranty employee D suggested that one person should be responsible of the meeting and take the discussions further into the organisation, it could for example be a person employed for only that purpose. Sharing the knowledge could also be done through documents as long as everyone read them according to warranty employee B.

4.3.1 Suggestions for future solutions

During the second interview set, six suggestions on future solutions were presented to the interviewees. The suggestions have been produced by the authors of this report, based on both the theoretical data and thoughts that the interviewees expressed during the first interview set. For each of the suggestions, some questions were asked on what the interviewee thought about the suggestion and why he or she thought in that way. It was also asked if the interviewee had some inputs and improvements for the suggestion and if he or she saw any problems with the suggestion. Further, the suggestions will be presented one at a time followed by thoughts from the interviews. All the suggestions are supposed to work either if they are implemented independently or combined with each other. The suggestions are not interdependent but could be combined. How each suggestion was developed is explained and discussed further in the analysis.

Suggestion 1

The first suggestion on a solution is a meeting between the Warranty and Design departments where the most common fault reports during the last months are presented. The meeting has an agenda with a large part of discussion where the employees from the Warranty department can explain what the customers think and what the fault reports mean. The design employees are free to ask questions. The meeting plans to be held four to five times a year and should result in meeting minutes so that everybody can go back and check what was said. This enable new employees to look through the old minutes so that they also have a chance of getting valuable knowledge from old projects. If anything comes up on the meeting that could result in an improvement proposal or supplier comment, it should be decided on the meeting who are responsible to write this.

There were mixed opinions about this suggestion from the Design department, but they were mostly positive. Design employee B, D and E thought that the suggestion was very good. Design employee B said that they need to hear more about what the Warranty department has to share and design employee D thought that this would lead to that they receive feedback sooner than they do today. The other design employees, A and C, were more hesitant but still positive to the

suggestion. Design employee A had some objections to the suggestion. One objection was that the Warranty department works with older projects which means that faults should already have been changed in the design instructions, thereby improvement proposals would not work at this stage. However, design employee A believed that this type of meeting could increase the team spirit in the company. Design employee C thought that there were both good and bad sides of the suggestion, it would be good to receive more feedback from the Warranty department, but it is more important that faults are presented for the ones who can change the design instructions. All the design employees stated that they would attend the meeting if they were invited.

The Warranty department was also positive to the suggestion in general. Warranty employee B, C and E all believed that it would be a good way for the departments to communicate more and have a regular dialogue. Warranty employee E thought that this would lower the costs for the company by decreasing the number of faults over time. Warranty employee D was a bit more hesitant about the suggestion since there are already a lot of meetings, but still believed that this meeting could be worth it to share the faults with the Design department. In contrast to the other warranty employees, warranty employee A was negative to the meeting. Warranty employee A believed that the design managers would not absorb the information if they are not working in the same stage in their own projects at the time. Despite this, all the warranty employees said that they would participate in the meeting if they were invited.

The two top managers had opinions which differed from each other about this suggestion. Top manager A thought it was a very good solution to get the Warranty department to share their experiences to the Design department and believed that the employees would attend a meeting like this. Top manager A also highlighted that it would be easy to implement and also easy to end if it does not fulfil its purpose. Top manager B was a bit more sceptical to the suggestion, and thought, as warranty employee A, that it could be unnecessary for the design employees if they were not working in the same stage as the faults that are discussed.

The interviewees also had different ideas of how often the meeting should be held. Most of the interviewees thought that four to five times a year, as the proposals suggested, would work. Warranty employee A thought that this could be a good start but also pointed out that they could adjust it if it feels too much or too little after a while. Several of the interviewees mentioned that it was important that the meetings were not too close to each other in time since then the risk could be that there have not appeared any new faults since last time. Therefore, design employee A and E and top manager B believed that it would be better with the meeting being held two to three times a year instead.

There were some different opinions about the agenda of the meeting. Warranty employee D and E believed that the Warranty department should share their summarised experiences from their work with faults and warranty inspections. Design employee A and D thought that it would be good to discuss what have been common faults and how they have been fixed. It is important to analyse the faults in depth according to design employee A and C. Design employee C also mentioned that it is important to discuss how to improve and not only discuss what the problems are which warranty employee B agreed upon. Design employee D had a different opinion and thought that they should not have a too detailed discussion. The experiences from what the customers think about their accommodations should also be discussed according to design employee B and E and warranty employee C. Warranty employee A wanted to discuss specific questions and talk about the projects that the Design department works with at the moment. They should also follow up previous meetings according to design employee B.

Most of the interviewees believed that it should only be the Warranty and Design departments that should participate in the meeting. From the Design department, both design employee A, B and E thought that all the design managers should participate. The opinions about who from the Warranty department that should participate varied more. Design employee B and E thought that it is important that the warranty supervisors participate since they are the ones who meet the customers and have worked with the faults. Some of the warranty employees had the same opinion. Warranty employee A thought that the head of the Warranty department does not have to be part of the meeting. There would be enough with a few people from each department, according to warranty employee D, if too many are involved there is a risk that the meetings become inefficient. This is something that top manager A agreed with, it is important that only the relevant people are included in the meeting. There were also ideas from the interviewees regarding having other departments involved in the meeting. Design employee C and warranty employee B believed that a bigger meeting with the Construction department would also be good and design employee D mentioned that also the purchase department could be interesting to talk to.

One possible problem with this suggestion that several interviewees mentioned was time. Design employee A said that it is important to take time for a meeting like this and time is something that a lot of the employees do not have. Top manager A talked about that it is important to have a clear structure and agenda for the meeting to be efficient since the employees already have a lot of meetings. One thing that many interviewees mentioned as something that is important to think about, is to take the information, knowledge and experiences that are discussed further. Design employee B thought that it is important that the meeting minutes is utilised after the meeting. Design employee E and warranty employee A said that it is important that the meeting ends up in improvement proposals in order for the design instructions to be updated.

Concerning who should be responsible for the meeting, the opinions from the different departments differed a lot. Most of the design employees believed that the head of the Warranty department should be responsible for the meeting since it is the Warranty department who are presenting the material. This was also the view of top manager B. Design employee E on the other hand thought that it should be the head of the Design department that should invite to the meeting since they are the ones who need the knowledge and information. This was also what most of the warranty employees believed. Warranty employee B and C agreed with design employee E, that since the Design department is the ones who will benefit from it, they should be responsible and invite to the meeting.

Suggestion 2

Secondly, we suggest a solution where one warranty employee is involved in the review process of programme documents, project planning documents and construction documents to new projects. Today, a representative from the Construction department is already involved in this process. The warranty representative should be, in the suggestion, involved in the same way. The agenda of the review process should remain the same as today. Participating in the review process would enable the Warranty department to share their knowledge and experiences in an early stage of the projects.

Both the design and the warranty employees were positive to this suggestion, but however they also saw some obstacles to the suggestion. Design employee B and E thought that the warranty employees would contribute much to the process which would result in better projects with fewer warranty issues. Design employee A however stated that it is not that easy to review documents

if you are not familiar with the design instructions. This is also something that design employee B believed. Therefore, it is important that the warranty employees get an introduction to how the design instructions and the review process work, according to design employee B and E. Design employee A, B, C and D were however unsure if the warranty employees would have the time to do this. The Warranty department already has, as stated many times before, a lot to do, and if they should review in a good way, they must spend time getting familiar with the project. As design employee D said, if urgent warranty problems occur, the tasks that a review process imply are probably not prioritised. Thus, if this would be implemented, the organisation needs to make sure that the warranty employees have the time to do it. According to design employee B, it should be the supervisors or craftsmen that should do the review, because they are the ones that are out and see the real world and have the detailed view of the common faults. Also design employee E put the supervisors as the most suitable role for reviewing the documents. Design employee D thought that the one who should review must have an understanding of both the practical and the theoretical part, and therefore had a hard time to see which role that should be involved in the review process. All the design interviewees believed that the warranty employees would have the competence to review documents. Maybe it will be a bit hard in the beginning, but they will learn, according to design employee E. This is a good idea, but maybe hard to establish in the organisation for many reasons, according to design employee D. Design employee E did however not agree and instead believed that it would be easy to implement this in the organisation. Design employee E meant that it is enough to write in the business system that they should be invited and make sure that they get some time for it.

The warranty employees would like to be a part of the review process, but as the design employees, warranty employee A, B, D and E believed that it maybe would take too much time for them to do it with the same number of tasks that they have today. It is important to give them time to do the review if the suggestion is implemented. Warranty employee B and E thought that they maybe need to be one more supervisor in the Warranty department to be able to have time to review documents. This is not something that warranty employee C agreed with though and instead believed that the Warranty department would have the time do it if they take the time. Still, warranty employee C agreed with that if it is not planned, time can be an issue. It needs to be planned in advance, and there needs to be enough time during the review session to be able to also handle unexpected warranty issues that sometimes occurs. Many of the warranty employees did today experience that their knowledge is only asked for when something bad already has happened, no one asks them in order to prevent issues. Warranty employee A, B and D were unsure if they have the competence to review the documents, but they are willing to learn, and they believed that they have inputs to the process that could benefit the projects. If they get an introduction to the process, warranty employee D believed that they would have the competence. Similar to the design employees D and E, all the warranty employees thought that it should be a warranty supervisor that should be involved in the preview process, or perhaps a craftsman. Warranty employee E did not think that they should review all the documents, only the documents that are relevant for the Warranty department.

Even though the employees were mostly positive to this suggestion, both the interviewed top managers were unsure about it. Top manager B explained that this thought has earlier been discussed within the Case Company but has not been implemented. It is easy to argue for this to be implemented, according to top manager B, the warranty is the last phase of the projects and are the one that meets the customers after they have moved in. Of course, this is something important that the Case Company should use to make better projects in the future, but as top manager B described it, it is hard for the warranty employees to translate their knowledge and

experiences that they get from the warranty work to be useful comments in a review process. The faults that the warranty employees encounter is often hard to find solutions to, they are complex problems. The faults would not be fixed if just the Warranty department were involved in the review process, according to top manager B. For example, the easier faults that appear for the warranty employees, as problem with a product, could instead be written as improvement proposals or supplier comments, and in that way the Warranty department does not need to participate in the review process. The more complicated faults, as customers who complains about the temperature in the accommodations, are hard to fix regardless if the warranty supervisor is involved in the review process or not. Further, top manager A described that there already are a lot of people involved in the review process and believed that it is not good if too many people are involved. Top manager A furthermore described that the Construction department, that the Warranty department are a sub-department under, are already involved in the review process and that it would be better if the thoughts from warranty were gathered by the construction representative that reviews the documents. However, the top managers did not completely reject the suggestion, they were just unsure and hesitant to it. If the suggestion should be implemented, top manager A believed that it could be better if they are involved later on in the process, when the construction documents are shaped. Top manager A also believed that just picked parts of the document should be reviewed by the Warranty department. According to top manager B, a supervisor or a craftsman at the Warranty department would be most suitable for the task, because they are the ones that are closest to the customer and the activities that are done.

Suggestion 3

The third suggestion is that a meeting is held after the 2-year warranty inspection. It should be similar to the meeting that today is held after the construction processes are finished, as the business system describes. The agenda of the meeting should include which warranty issues that have been the most common in the project and it should be discussed how those issues could have been avoided. Who the meeting will gather is not decided in the suggestion, instead the interviewees were asked who they think should be invited.

The interviewees had different opinions about this suggestion. From both departments, both positive and negative reactions were expressed. Warranty employee A, B and E believed that this is a good suggestion while warranty employee C and D did not like the suggestion. All three of warranty employee A, B and E saw the benefits of sharing the most common faults and the customers thoughts in the project to the project group, and thought that it is important to share what happens in the project after the customers have moved in. However, warranty employee A also saw the risk that the other project members may see the warranty supervisor as the bad guy who is coming with criticism, which also warranty employee D believed is a problem with this suggestion and therefore did not like it. Still, warranty employee A thought that this meeting could lead to happier customers in the long run. Contrariwise, warranty employee C believed that this would be an unnecessary meeting since they already have a dialogue with the project manager about faults in the project. Warranty employee D thought that this would also take too much time to do, which they do not have. Further, warranty employee E described that people in the organisation can have been replaced or quit which are a bit of a problem with this solution. If the meeting should give something, it is important that it is structured so that the participants can prepare themselves before the meeting, according to warranty employee B.

All the interviewees from the Design department were at first positive to this suggestion, but the design employees saw many potential obstacles to this meeting. Design employee C thought that this is a good idea in theory but did not believe it would work practically. Many employees have

probably started to work with other things which will make the meeting not as rewarding as it could be, explained the design employees C, D and E. Design employee B thought it is a bit problematic that it only is the project group that takes part of the information, knowledge and experiences. To improve the suggestion, design employee B believed that the suggestion also should contain some part that ensured that the information, knowledge and experiences also are spread to the rest of the employees in the organisation. Design employee B, D and E did all imply that this suggestion could be combined with the meeting in suggestion number one. What the customers think about the project should be an important part of the meeting, according to design employee A, D and E. Additionally, design employee D thought that issues with the maintenance that the warranty employees have discovered should be presented, for example if a lamp who needs replacement of a light bulb is placed inaccessible. Design employee E emphasised that the main focus should be on what have happened in the project after the construction phase is finished.

Both the top managers thought that it is a good suggestion and believed that it would be a great idea to complement the current process with a meeting like this. Top manager A liked the suggestion because the Case Company then can get to know what the customers who have lived there during those two years think about the project and the accommodations, such as the material choices, the floorplans or the placement of the garbage room. Top manager B agreed with this and explained that many experiences have been gathered after the 2-year warranty inspection. Top manager B did however also emphasize that a problem can be the time aspect, because many people can have changed job or moved from the project in another way, but this is always something you have to handle in project-based organisations. Further, top manager B reflected about if the feedback that the meeting gives, should only be shared within the project group during the meeting, or if it also should be shared in some other forum where more people in the company can take part of the information, knowledge and experiences. Top manager B thought that it would be good to share what the meeting brings up in another forum but is not sure how that should look.

Suggestion 4

The fourth solution is that the warranty supervisor, that is responsible for a project, participates in the experience feedback meeting that is already held when the construction phase ends in each project, as described in the chapter about the business system.

Design employee A, B and D, warranty employee B and top manager B were all surprised and thought that it is strange that this not is implemented yet. Additionally, design employee E and warranty employee A, D and E believed that this is a good suggestion. All of them thought that this is a great opportunity for the warranty supervisor to get information about what have happened in the project from start to construction finish. This could give the warranty employee an understanding of potential future issues and what could come as fault reports in the project which could help them to know how to handle it. Design employee A and E, and warranty employee A saw this meeting mostly as a good information opportunity, as it would be too late for the warranty supervisor to contribute with anything that could change the project. However, the warranty supervisor also could contribute with input at this meeting with solutions to how something could be done next time if something has gone wrong, according to design employee B. Warranty employee B and D also believed that they could contribute to the meeting. Warranty employee D explained that they often already have started to be involved in the project before this meeting is held, which means that they already have seen faults and issues that they could bring up at the meeting if they were invited. None of the interviewees that were positive to the suggestion could find any problems that the suggestion could bring, but design employee B meant

that it is important to think about how the meeting minutes should be documented so that it is possible to look back and see what has been discussed afterwards.

Design employee C, warranty employee C and top manager A did however not agree with the others and was negative to the suggestion. All three of them thought that it would be better if the Warranty department is more involved in the earlier stages of the project so that they really could contribute with their information, knowledge and experiences. Warranty employee C and top manager A were also unsure if the warranty supervisors would have time for the meeting. It needs to be planned in a good way if the warranty supervisor should be able to participate, according to warranty employee C. Further, top manager A explained that this meeting contains much points on the agenda that do not concern the Warranty department, which would make the warranty supervisor unnecessary at the meeting, warranty employee C also agreed to this. Still, design employee C acknowledged that it maybe would be a good introduction to the project for the warranty supervisor.

Suggestion 5

The fifth suggestion is that a person is employed with the purpose of gathering, documenting, analysing, compiling and supplying information, knowledge and experiences that exist within the Case Company. This person could hold meetings where information, knowledge and experiences are exchanged and then make sure that the information, knowledge and experiences are taken further into the organisation.

Many of the interviewees had similar thoughts of this suggestion, most of them did not think that this would be the best option for the Case Company. Design employee B and D, warranty employee B and E, and top manager A believed that this would be a hard job for one person to do, the tasks would be too diverse in a position like this. The tasks of this role should instead be delegated to the managers of each department, according to design employee A and D and warranty employee C. Top manager A and B had similar thoughts, which means that everybody in the organisation needs to work on how to share their knowledge and experiences. Further, design employee C saw a risk that a person like this could create a bad atmosphere when it gathers information, knowledge and experiences and then criticise the employees. Another important aspect of this suggestion is the economical one. Design employee D together with warranty employee B and D believed that it would be profitable since then they could do things better and avoid repeating mistakes in future projects. However, it can be hard to show the economic benefits according to design employee D. Contrariwise, design employee C, warranty employee C and top manager B did not at all think that this person would be economically beneficial to hire. Top manager B explained that it costs very much to hire people that not directly are linked to the main business, which are the projects.

Warranty employee D were the most positive interviewee about this suggestion and believed that this could help the whole organisation with compiling knowledge and experiences that the employees has. Warranty employee D thought that this person is needed because the current employees do not have time to prioritise these tasks. The time aspect did design employee D agree on, and in just that aspect, design employee D also thought that this is a good suggestion. If the role should be a full-time job or if it should be less hours did however warranty employee D leave unsaid.

Two interviewees that stands out when asking about this suggestion are design employee E and warranty employee A. Both of them had the reaction of that this person already exist in the

company, at the central department the Development department. What differed between design employee E and warranty employee A were however that design employee E thought that it would be good if the Development department had one representative in the Gothenburg region and the other regions in the country, while warranty employee A did not think that this is a good idea. Warranty employee A could not see why a representative should be sitting in the Gothenburg office. Design employee E though, believed that this would benefit the development of the Case Company, and that more comments from the regional offices would be intercepted. When asked about it, top manager A also thought that it would be a good idea if someone from the Development department was placed out in the regional offices. That would make the contact with the Development department easier.

Suggestion 6

The last suggested solution is that the fault reports should be shared through one or many documents as written words to the Design department. It could be either as separate fault reports or some kind of summary. No presentation of the faults, verbal communication or interaction between the employees are done, only written documents are shared.

In general, the interviewees were negative to this suggestion and almost everyone expressed concerns about it. However, if this information was to be shared, all the interviewed employees thought that it would be best to share a summary of the fault reports and not the separate fault reports. Most of the interviewees expressed a concern that the Design department would not read this information if it was shared. Design employee A, C and E thought that this would not be something that they would prioritise and read during their workdays. Almost all of the warranty employees also had this view.

Several interviewees also mentioned that they believe that more background is needed behind the fault reports in order for it to benefit the design management. Design employee A and E and warranty employee C said that the Design department would need to know why the faults are common and the background to the fault reports. Design employee A and B thought that only looking at the fault reports would lead to misunderstandings since everyone can interpret it differently. It would be better to have a discussion about the fault reports for the sharing to be more effective according to warranty employee A, B and E and design employee C. Both design employee D and top manager A believed that a problem with this suggestion could be that they already receive a lot of information and already have a lot of documents in their platforms and more documents would be too many. Top manager A therefore believed that a meeting would be better than only sharing the information like this. Design employee B and C thought that it would be better to share the information from the fault reports by a presentation, for example at the region meetings, according to design employee C. Design employee C also had another idea which was that the most common fault reports could be showed on a TV in the lunchroom. In this way, everyone could see it which hopefully could lead to the design managers having the faults in mind when designing a project.

Top manager B was, in contrast to the other interviewees, positive to the suggestion. If the fault reports were shared on their current platform, it could be a way for the design managers to find the information when they need it. Top manager B had a suggestion where the fault reports would be divided into the different stages of the design phase which would enable the design managers to search for the information when they are in different stages. This would benefit the design managers more than hearing the information in a meeting when they are in another stage.

Ranking

After all suggestions were presented to the interviewees, they were asked to rank the suggestion. When compiling the ranking, suggestion number 1 and 3 are the most popular suggestions among the interviewees. Suggestion number 2 and 4 are placed in the third and fourth place, dependent on if you include the top managers ranking or not. If the top managers are included, suggestion number 4 are placed at the third place, while suggestion number 2 are placed at the third place if only the employees ranking are included. Suggestion number 5 and 6 are placed at the bottom when compiling the ranking, where suggestion 5 are at the very last position.

5 Analysis

In this section, the theory is compared with the empirical results. The section contains a discussion where the situation in the Case Company is analysed, including both the current situation and what future systems that could be applicable at the Case Company. The empirical findings confirm much of what the literature review provided. The analysis discusses why it looks like it does today, and what could be improved for a future without the same problems.

5.1 Existing collaboration and systems

With the empirical data as a base, it could be stated that the Case Company works with their structural capital in several ways. As Lundkvist et al. (2011) explain, a construction company that works in an industrialised way has benefits when it comes to managing information and knowledge. After reviewing and analysing the Case Company, we can see that they have an industrialised way of working, with their business system and the design instructions. Beyond the design instructions, the improvement proposals and supplier comments are also ways of working that can be seen as industrialised. Thereby, the Case Company has benefits with managing information and knowledge.

The relationship and collaboration between the departments of Warranty and Design in the Case Company is according to the empirical data poor. The relationship is basically built on just occasional, small, questions and cross talking in the office landscape. The employees from the Warranty and the Design department do not know much about what the other department works with. There seems to be a poor understanding from the employees about what the other department does and how it works. This is something that can be seen as problematic. This poor understanding of each other can complicate the communication between the departments and lead to frustration. If the departments do not have a common ground, it can be difficult for them to find ways to collaborate with each other in order to improve the projects. Today, as stated before, the only way the departments communicate is through sporadic verbal communication in the office. This is something that the literature describes as a way which knowledge can be shared. According to the SECI-model by Nonaka & Konno (1998), tacit knowledge can be shared in this way, with individuals interacting with each other. The framework by Boh (2007) also describes this way as a possible mechanism for sharing knowledge. This type of sharing can work in a good way, but a downside to it is that it is up to each individual (Boh, 2007). Boh (2007) stated that this mechanism works better in smaller organisations which the Case company is not, and therefore, it is not sure that this is a good way to share the information, knowledge and experiences in the Case Company. This mechanism is also an uncertain way since it is not structured. Therefore, it cannot be ensured that all important information, knowledge and experience from the Warranty department to the Design department are shared today, which also matches with the picture that was provided by the interviewees. The interviewees in general believed that there was not enough knowledge sharing and experience feedback from the Warranty department to the Design department.

The different departments had different opinions about how well the sharing of information, knowledge and experiences from the Warranty department to the Design department works today. The Warranty department had a more negative view than the Design department. The reason to why the departments had different opinions regarding this could be their different opinions about how much they should communicate. That the Design department had a more positive picture of the communication today, could depend on that they have little insight in the Warranty department's work and does therefore not see how they could benefit from the information,

knowledge and experience that the Warranty department has. The Warranty department do on the other hand feel that no one asks for their opinion, which could be because of that they know that they could contribute. Both design employee A and warranty employee D stated that the transfer of information today is done mostly from the Design department to the Warranty department and not the other way around.

Further, as mentioned in the empirics, it already exists some general systems for sharing of information, knowledge and experiences within the Case Company. These are, the Case Company's business system, improvement proposals, supplier comments and also a platform where they can share documents in projects. The business system is quite extensive, but it does not provide much information about how knowledge and experience should be shared from the Warranty and Design department. According to Okere (2017), it is important for the sharing of knowledge to be supported by the top management in an organisation. Because of the lack of content about this in the business system, this could mean that the top management does not fully support the sharing of information, knowledge and experiences between the Warranty and Design departments.

The improvement proposals are something that the warranty employees had similar ideas about, they thought that it took too much time to write an improvement proposal and both warranty employee C and E criticised how the improvement proposals are handled. The system with improvement proposals seems to be a good way to share knowledge and experiences, according to the definitions of these concepts in the theory, but it has some flaws that could be improved for it to work even better. This is the easiness to use it, more feedback to the individuals who have sent in the proposals and more of a chance to affect the decision, instead of just being rejected. The thoughts about the supplier comments, that can be seen as more of a system for information sharing according to the theory, were instead a bit divided. As with the improvement proposals there are opinions that mean that it takes too much time to do it. Other than this, some of the interviewees believed that it worked out well while others thought it was not easy to use. As the improvement proposals, the supplier comments could also be improved and made easier to use in order for more employees to use it. The warranty employees possess many things that could be written as improvement proposals or supplier comments but do sometimes have problems with formulating the proposals and comments in order for someone else to see what the proposal or comment could improve.

The improvement proposals and supplier comments are systems that are not mandatory to use at the Case Company which make the individuals responsible for this type of sharing of information, knowledge and experiences. It is hard to make systems like this mandatory to do, since they require that the employees either have something they want to improve and know how they want to change it, or that they have a comment to make at a specific supplier, which is not sure that the employees have. Several of the employees stated that they want to use these systems and that they have it as a goal every year. It is good that they have it as a goal, but that does not however ensure that it is done. Still, it is better to keep these systems as voluntary systems. According to Gannon & Banham (2011) structure is needed to improve sharing of knowledge. Therefore other, new systems, which are mandatory are also needed in the Case Company, and these could, in turn, potentially lead to improvement proposals or supplier comments.

As presented in the literature, one way of sharing information and knowledge is having a platform (Styhre & Gluch, 2010). This is something that the Case Company has in their organisation. The Case Company has both the business system, design instructions but also a platform where the

different projects can share their information and knowledge. Since Styhre & Gluch (2010) believe that platforms is a good way to transfer information and knowledge and some of the interviewees wished for a way to share meeting minutes in a better way, it is good that the Case Company has the current systems. The platforms could possibly be developed to fit the aim of sharing the Warranty department's information, knowledge and experiences better. In this way, information, knowledge and experiences that have been discussed in a meeting can be shared to the bigger organisation. Jansson et al. (2015) stated that it is important for the platform to be updated regularly and the Case Company has the improvement proposals as a tool for doing this. However, there is no meeting where both the Warranty department and Design departments are represented which discusses information, knowledge or experiences. Hence, there is no kind of improvement meeting which Jansson et al. (2015) mentioned is a good way to improve platforms. A platform is not enough to share the information, knowledge and experiences in the Case Company, but instead is something that could work as a complement to meetings.

5.2 Sharing and benefits

From the empirical data, we have identified three parts that should be shared from the Warranty department to the Design department that would benefit the Design department. These are: the faults that have been reported, what the customers think and feel about their new accommodations, and lastly, the Warranty department's experiences of how the buildings work once they are finished. All three of these parts are important to share from the Warranty department to the Design department in the Case Company to improve the company's business. To be able to come up with solutions to how these parts can be shared, there is a need to categorise them into information sharing, knowledge sharing and experience feedback. The first part, the fault reports, can be categorised as information sharing because they are easy to spread and are not attached to the receiver (Lundkvist et al., 2010). If the fault reports were to be shared, they do not need to be shared to any particular person and they are not attached to anyone, and therefore the sharing of it can be called information sharing (Sharratt & Usoro, 2003). The common faults in previous projects are something that most of the interviewed employees, from both departments, mentioned could benefit the Design department. Especially design employee B, C and D believed, according to the empirical data, that they would benefit from the information about the fault reports. Design employee B, C and D meant that if the fault is caused by the design employees, information about the fault could help them solve the fault instead of repeating it. That the fault reports are information is strengthened by Sharratt & Usoro (2003), who describe that information is per definition something that describes something, which the fault reports do. It is also strengthened by the interviewees who term the fault reports as clean information when they talk about the fault reports. The information that comes from the fault reports are thus one part of what can be shared from the Warranty department to the Design department.

The warranty employees gain much knowledge about the customers when meeting them by both hearing what they say and seeing how they act. This is something both employees from the Warranty department and the Design department have mentioned as something that could benefit the Design department, for example, design employee A mentioned this. The customer's opinion about the projects is the second part of what can be shared from the Warranty department to the Design department. In contrast to the fault reports, this is something that needs to be attached to the receiver if the message should mean something. The customer's thoughts and feelings are hard to understand via only written documents, as with all kind of emotions. This means that the part cannot be placed under information. This part can neither be classified as experience since it only takes one time to catch what a person feels; the experience concept requires repeated

occasion to really understand. Therefore, we categorise this part as knowledge, and knowledge sharing is what needs to be done to share this.

Since the different departments work differently, with the Design department mainly working in an abstract world in the beginning of the project and the Warranty department working in the end when the building is finished, the departments speak different kind of languages. Design employee D highlighted several times that the design employees work in a theoretical world and do not often have any insight in the practical, “real”, world where the warranty employees are working. This makes the design employees speak a more theoretical language while the warranty employees speak a more practical language which can make it difficult for the departments to understand each other. The different languages make it important to ensure that the departments understand each other when an exchange are to be done. Hence, which type of knowledge that the thoughts of the customers are, must be discussed. It is sometimes hard to distinguish tacit and explicit knowledge since all types of knowledge always contains some part of tacit knowledge (Nonaka et al., 2013). However, just because of the theoretical and the practical languages that they speak, we will try to clarify what kind of knowledge that the thoughts of the customers are. A part of this could be categorised as explicit knowledge since what the customers have said about different problems or solutions can be written down and only shared as documents (Nonaka & Takeuchi, 1995). However, one part of this knowledge can also be seen as tacit knowledge. This tacit part is the knowledge of how the customers act. The warranty employees receive a full picture of how the customers are doing in their accommodations, which is harder to express and share with others, especially through words written down (Nonaka & Takeuchi, 1995). When designing a new system our routine for sharing what the Warranty department knows in the Case Company, we consider it to be important to take both tacit and explicit knowledge into account.

The third part, the experiences from the finished buildings, can be categorised as experiences since the warranty employees’ knowledge from several warranty inspections and visits at new buildings, is something that has been built up during more than one occasion (Ruiz et al., 2014). This part includes how the building works after it is finished, what expectations there are in a building dependent on how it looks, and what maintenance a building need. The experiences from a finished building can also be about which choices of materials and equipment that are the most suitable for a specific building, as warranty employee A described. Those experiences cannot be gained from just one warranty inspection or visit, they need to be built up during many inspections and visits, and therefore it could be seen as a specialisation of knowledge, or in other words, experiences. These experiences are something that should be fed back to the Design department to give the design employees a better understanding of the finished projects. Both one employee from the Design department and one from the Warranty department mentioned the gap between the design employees’ theoretical world and the practical is a problem, as described in the part about knowledge from the customers. If the design employees got the chance to take part of the experiences from the “real” world that the Warranty department have, the design employees could get a better understanding of what works and not in their designs.

A collaboration between the Warranty and Design department could help to improve the design instructions, since both the theoretical and the practical view is needed when developing a building. As it is today, the Warranty department has little or no understanding and insight about the design instructions and has therefore a hard time to write any improvement proposals about them, and the Design department has little or no understanding or insight about the finished buildings which makes it difficult for them to see the issues. Together, the departments could complement each other and produce good and faithful improvement proposals for both design

instructions and other things in the Case Company. If the information, knowledge and experiences are shared from the Warranty department to the Design department, it could reduce the number of fault reports over time and thereby reduce the costs for fixing these faults, which several earlier studies also has shown (Josephson et al., 2008; Anumba, 2009; Harris & Scott, 1998). We consider this because if the design employees got to know what problems there have been in earlier projects and why they have been problems, they would probably be more careful and thoughtful when designing those parts in the future. The buildings could also be improved in general by the Warranty department's knowledge and experiences from the customers if the Design department took part of them. A few of the design employees have mentioned that they do not know much about the customers' opinions today. Design employee E stated that it would benefit them if they got to know the customer's ideas about the floor plans and how the accommodations are designed in general. This is something we agree on, if the Warranty department shared their experiences and knowledge about what the customers think, the Case Company could receive happier customers in the future.

5.3 Barriers for collaboration

In the Swedish construction industry, it is not unusual that evaluations and experience feedback-meetings are held, according to Josephson et al. (2008). However, the knowledge and experiences from the meetings are rarely shared to others in the organisation than the meeting participants and this is something that the empirics also implies. In the Case Company, they have a few meetings where the employees should share their knowledge and experiences, as the department meetings. Several employees in the interviews stated that the things they have discussed in meetings, concerning knowledge sharing or experience feedback, are not taken further and only stays with the people involved. This means that the Case Company has the same problem as other organisations in the Swedish construction industry. This is problematic for the Case Company since the sharing of knowledge and experiences gets stuck within smaller groups in the organisation. In order for the projects to be improved, a sharing between the departments is needed.

In the research by Josephson et al. (2008), they identified that learning is often not prioritised in construction organisations and this is also be the case in this research. As the empirical data shows, the business system does not contain much information on sharing of information and knowledge or experience feedback. This implies that in the Case Company, there is not much focus on learning through sharing of information, knowledge and experiences. The employees general view of the sharing of information, knowledge and experiences is that it is nothing that is done in a large scale in the company, which also implies that it is not high prioritised.

The Case Company in this study is a project-based organisation which in itself could be a barrier for sharing of knowledge (Bakker et al., 2011; Bresnen et al., 2004). Many of the barriers that were identified in the literature, that is common in project-based and construction organisations, have also been mentioned by the interviewees in this research. In the first interview set, the interviewees mainly mentioned three barriers, which were lack of time, the lead times and the design instructions. The lack of time is one of the barriers for effective knowledge sharing that is also mentioned in the literature (Josephson et al., 2008; Harris & Scott, 1998). Several of the interviewed employees in this research mentioned that the lack of time is a problem also in the Case Company. Many of the interviewees that did not mention it in the first interviews agreed to it in the second set. The reasons for why lack of time is a problem according to the employees were that they had too much other things to do and that they have to prioritise their main work

tasks. This could show that it is an organisational problem; the organisation is not making sure that the employees have time to share their information and knowledge or feed back their experiences. In the second interview, two employees argued that this was the case. Design employee C believed that the organisation does not have enough systems for the sharing of knowledge and experiences and warranty employee D thought that their work description was not clear enough on how to do it. Therefore, these are problems that need to be considered when trying to improve the sharing of information, knowledge and experiences. Warranty employee C said that the departments are understaffed which could be a possible reason to the time problem which is also an organisational problem that cannot be fixed by the employees. However, it could also be that the individuals in the organisation do not take time for it and that they prioritise other things even though they should have the time. This would point to that it is not only a problem at an organisational level, but also on an individual level.

The lead time between the departments was also something that was mentioned in the interviews, however, information on this was not found in the literature. Still, individuals in an organisation can hinder the experience feedback by their attitude towards it and the problem with lead time could result in a poor attitude for the employees (Josephson et al., 2008). Several employees have mentioned that they in some way feel that the departments are too far away from each other in time and that changes take long time to implement. This could lead to the employees feeling that it is not worth trying to share their knowledge since nothing is going to change for a long time. It is understandable that the design employees feel that the faults that are reported today is something that they worked with a long time ago, but we consider them to still not be irrelevant. Several of the interviewees have mentioned that the same faults are repeated over and over again which implies that improvements are needed and at least not all faults are irrelevant because of the long lead time. If the information, knowledge and experiences that the warranty employees have would be shared, the repeated faults could be decreased in the long run which is better than not being improved at all. Thus, we do not really see the lead times as a big barrier which some of the employees do.

As with lead times, design instructions as a barrier is nothing that we have found in the literature. Many of the interviewees thought that this was a barrier because of that the design managers must follow them and therefore it is difficult to change something right away if the warranty employees have discovered something as a fault. This is something that we see as a barrier for the Case Company because it takes time to change the design instructions and the same faults could already have been designed multiple times when a fault is discovered. However, there is a possibility for the design managers to design in another way if they have good arguments and applies for it. Even though this requires more effort, it still means that the information, knowledge and experiences from the Warranty department can be used right away. Still, we understand that the design instructions could be a barrier because it can be confusing for the design managers to know what they should follow. The Case Company should continue to use the design instructions, and these should be the base source of information for the design managers, but the design employees should not be afraid to apply for a dispensation if they together with the warranty employees have discussed a better solution. They should in that case send in an improvement proposal so that it in the long run gets changed, and then apply for a dispensation for their current project.

Another barrier, that is partly connected to the design instructions, is that there can be an information overload in the organisation. Design employee A believed that there can be too much information in the organisation and that it hinders the chance of thinking freely, since there already is much information about everything. This is something that can be seen both as a

problem and as a benefit. The problem is that, as design employee A stated, it can be too much and that it hinders the design managers to design according to what they think is the best. However, the benefit with this information is that everything is done in a more standardised way, which give organisations advantages when it comes to knowledge sharing and experience feedback (Lundkvist et al., 2011). Therefore, if the design instructions are improved, it will improve every building that the Case Company builds and thereby the information is spread more widely in the organisation. Too much information can however lead to that the employees do not absorb the information, because there is too much to take in and keep track of.

Lack of structured systems in an organisation is a barrier that was mentioned in the literature and in the interviews (Gannon & Banham, 2011; Dave & Koskela, 2009). As stated before, design employee C thought that the Case Company does not have enough systems for knowledge sharing and experience feedback. Both Dave & Koskela (2009) and Okere (2017) argued that a system for knowledge management is important in an organisation. Dave & Koskela (2009) also stated that the system needs to be easy to use and prioritised in the organisation. The Case Company today has a few different systems which is positive, but several of the interviewees mentioned that there are problems with them. Warranty employee A, B and C believed that the systems are not easy to use. This implies that one barrier for the sharing of information, knowledge and experiences in the organisation is the lack of systems for the purpose which also are user-friendly. This is something that can be seen as an organisational problem, it does not exist enough structured systems that the warranty employees in the Case Company can use to share their information, knowledge and experiences to the design employees. However, the Case Company's industrialised way of working is a good start to improve this. The business system that they have is structured but needs to be complemented to also include a structured part of how the information, knowledge and experiences should be shared and fed back from the Warranty department to the other departments in the company.

According to Josephson et al. (2008) and Gannon & Banham (2011), another obstacle for knowledge sharing is the change of which persons that are working in a project, meaning that employees are exchanged during the project life cycle. Several interviewees mentioned the change of personnel as a problem which hinders information, knowledge and experiences to be shared. Warranty employee D mentioned that the design employees sometimes have already stopped working at the company when the Warranty department takes over the projects. This is a barrier since it is difficult to transfer back information, knowledge and experiences to the Design department if the employees have been exchanged. It could be so that new employees, that have not been working in the projects that the warranty employees have worked with, do not absorb the information, knowledge and experience as good as if it was the ones that have worked with the project.

The warranty employees overall had a more negative view of the relationship between the departments and warranty employee E stated that it felt like the design department is not that interested in their work. This is also something that can be seen as a barrier, that the warranty employees feel underestimated and not involved in the projects in the same way. We can also see this since the Warranty department is not involved in neither the review process nor the experience feedback meeting that is held after the construction phases. Their opinions are not used enough today and therefore they feel underestimated. As stated before, there are many benefits with using the information, knowledge and experiences of the warranty employees, and in order to do this they need to be more involved in the organisation. Further, warranty employee E explained the Warranty department as an "appendix", no one cares about them and no one asks for them. This

could be seen as a gap between the Warranty department and the rest of the organisation. Furthermore, we have identified that there is a gap both between the warranty employees and the design employees, and also between the warranty employees and the rest of the organisation, as stated above. Warranty employee C mentioned that it feels like the group who takes care of their improvement proposals does not understand what they mean and that the group only looks at documents and not how it works for real in the projects. This means that there is a difference in how they see the problems and how they want to solve it, they have different kind of competences which can be a barrier for the sharing of information, knowledge and experiences. Also, warranty employee E mentioned this, as the group that works with improvement proposals is placed in another region without the same problems as in the Gothenburg area. This creates a gap between the warranty employees and the ones who take care of the improvement proposals and could lead to that the warranty employees do not feel that it is worth to share their information, knowledge and experiences.

5.4 Applicable future systems

As described in the empirics, six suggestions for solutions were presented to the interviewees during the second interview set. These six suggestions have been produced after analysing the organisation and the data from the first interview set together with the theoretical framework. Since both Dave & Koskela (2009) and Okere (2017) write that systems for managing knowledge is important in an organisation, all the suggestions are ways of managing the information, knowledge or experiences from the Warranty department to the Design department in a more structured way. Further follows the suggestions with a discussion of how they were developed and produced, and then the empirical data about each suggestion is analysed and discussed. The ranking of the suggestions is discussed as a spare part at the end of the subchapter and then a compilation of the different suggestions are presented.

Koch & Thuesen (2013) and Lundkvist et al. (2011) mean that people need to meet if knowledge should be shared. This is also confirmed by Dave & Koskela (2009) who explain that social interactions are a good way to share tacit knowledge in the construction sector. In the framework by Boh (2007), it was suggested that in large organisations with unique projects, which the Case Company is, institutionalised-personalisation mechanisms for knowledge sharing works best. This means that the knowledge should be transferred between individuals in the organisation, but it should be institutionalised. Most of the interviewees said in the first interview set that meetings in different ways would be a good way to transfer knowledge and experiences between them. According to the empirics, it can also be stated that there is a bit of dissatisfaction among the warranty employees that they are not invited to already existing meetings that are held in the Case Company's projects. Furthermore, the one-time meeting that was held during the research time where a warranty employee presented some information about the fault reports in the department meeting for the design employees, seemed to be appreciated by the design employees. Therefore, meetings are the base in four of our suggestions.

Suggestion 1

In the beginning of this research, a meeting was held where a warranty employee presented some information to the Design department, as described earlier in this report. This meeting was an inspiration when suggestion number one was produced. The first suggestion, where a meeting between the warranty and the Design department should be held, has thus both its base in several sources in the literature and in empirical observations. Nonaka's (1994) SECI model has also been an inspiration for the first suggestion. The knowledge that should be shared from the

Warranty department is, as we have discussed earlier, a combination between tacit and explicit knowledge. The tacit part of the knowledge is discussed and shared within the Warranty department through their informal daily chitchatting, as in the first field of the SECI model with the complementing Ba. The meeting in the first suggestion is then thought to fulfil the second field in the SECI model – externalisation – so that the tacit knowledge that the warranty employees have, can be shared and converted to explicit knowledge with the help of the Design department. The participants in the meeting should for example together discuss and formulate eventual improvement proposals that later can help to spread the knowledge to the organisation in the third field. Lastly, new employees and employees that did not participate in the meeting have a chance of getting this knowledge by the organisation that now has learned the knowledge. Furthermore, many interviewees from the Design department have also requested some sort of presentation of the most common faults that the Warranty department handles. As design employee B stated, it is also important that the things discussed during the meeting are written down and taken further. In suggestion number one, this is achieved via meeting minutes and delegated responsibility for the action of writing improvement proposals and supplier comments. In this kind of meeting, all the parts we have identified that could be shared from the Warranty department to the Design department can be shared. The relevant information from the fault reports would be presented to design employees by the warranty employees and then discussed. The discussion would give the warranty employees the chance to share their knowledge and experiences they have from working with the faults and seeing the customers.

The reactions from the interviewees to this suggestion were mainly positive from both of the departments. Several of the interviewees highlighted that this would be a good way to start communicating more which has also been our intention with the suggestion. If the departments meet more often, it could lead to a more open relationship between them. Warranty employee E stated that a meeting like this could decrease faults in the projects and thereby lower the costs for the Case Company, which is of great importance. Top manager A stated that this suggestion is good and would be easy to implement but also that it is easy to end if it is not working in a good way. This is good since then they can easily try it and see if it is something that would work in the organisation.

The interviewees had different opinions about how many times per year the meeting should be held in this case, most of them thought that our suggestion with four to five times a year was good. However, some believed that it would be better with less meetings, only two to three times per year. Because of this, three to four times a year could be a good start. Warranty employee A said that it could be changed after a while if needed which we think is a good idea. If the departments notice that they do not have enough to talk about or if they have too much to discuss at the meetings, they could adjust the number of meetings. The meeting's agenda should be as proposed according to most of the interviewees, the common faults should be presented by the Warranty department and then discussed. Some of the interviewees highlighted that it was important to discuss the faults in depth and how to improve in the future. Design employee B mentioned that they also should follow up previous meetings which is a good idea. In this way it can be made sure that the information, knowledge and experiences that have been discussed actually have been taken further to the bigger organisation.

Most of the interviewees thought that only the two departments, Warranty and Design, should be involved, which is our opinion too. Warranty employee D and top manager A said that too many people involved in the meeting can lead to it being inefficient. To start with, it would be good to only include the departments we have examined for this reason, otherwise there is a risk that it

takes too much time which is important that it does not. In the future, if the meeting works well, the organisation could see if more departments should be included or if there should be similar meetings between other departments. However, since we have not examined other departments at the Case Company than the Warranty and Design departments, we cannot say whether there is a need for it or if it would be doable.

The most different answers regarding this suggestion were about who should be responsible for the meeting. Everyone at the Warranty department believed that the Design department should be responsible, while almost all of the Design employees thought that the Warranty department should be responsible for it. This makes it difficult to decide who should have the responsibility. On one hand, the Design department are the ones who needs the information, knowledge and experiences from the Warranty department and therefore should make sure that it happens. On the other hand, the Warranty department are the ones who are going to present the faults and therefore, it could be better that they decide when and where the meeting should take place. We lean towards that the Design department should be responsible since they are the ones who needs the information, knowledge and experiences in order to improve their designs. More investigation could be needed to know for sure what would work out best.

Some drawbacks and risks have also been addressed by the interviewees. Design employee A stated that the information, that the Warranty department would present, in this kind of meeting would be old for them and be faults they have done a long time ago and therefore not relevant. We do not agree with this since even though it takes long time before the faults arise, they still need to be addressed in order for the Design department to improve. Another opinion about the suggestion was that it would be better to present the information for the group that can change the design instructions according to design employee C. This is a valid point, but it would be good if the departments instead discuss the faults first and then together take it further by improvement proposals which can lead to changes in the design instructions. In this way, the departments could together come up with improvements. Warranty employee D addressed that the departments already have a lot of meetings to attend which is a problem. This also goes together with that many of the interviewees stated that lack of time was a problem. The time aspect, which we already have identified as a general problem within in the Case Company, therefore needs to be considered. Top manager A said that the meetings need to be efficient and have a structured agenda, and this is two things that is important for the employees to feel that the meeting is worth attending even though they are already struggling with lack of time.

One concern from two of the interviewees, warranty employee A and top manager B, about this suggestion was that the design employees may not absorb the information if they are not in the same stage at the time as the faults which are discussed comes from. This is something that could be a risk that could appear, however, by making sure that what has been discussed in the meeting is taken further it could still lead to improvements in the design instruction which the design manager has to follow. That things are taken further from the meeting is also something that several of the interviewees have mentioned is important. Therefore, before the meeting, it should be decided who is responsible for that the meeting minutes are shared and for improvement proposals to be made. Despite the drawbacks and possible risks with this suggestion we still think that this is a good suggestion which would improve the sharing of information, knowledge and experiences from the Warranty department to the Design department.

Suggestion 2

The second suggestion, that the warranty employees should review documents, is also produced with the thoughts of that meetings are important. Additionally, the fact that it is cheaper to change things in an earlier phase than in a late phase in a construction project also argues for this suggestion. During our review of the internal documents in the Case Company, we encountered the governing documents about how the review process of a project should be done. We discovered quickly that the Warranty department was not involved in this process, whilst almost every other department were represented. From this, the suggestion that also the Warranty department should be involved in the review process was formed. The design employees B and E also mentioned something similar to this suggestion in the first interview which strengthened our thoughts during the development of the suggestion. This suggestion fulfils especially two of the identified parts about what the Warranty department can share to the Design department – the knowledge part of what the customers think, and the experience part of a finished building – which makes the suggestion good, but it could be even better if combined with another solution that could share the information part.

Most of the reactions from the interviewees to this suggestion were positive since most of them believed that the faults would be reduced if the warranty employee's knowledge and experiences would be utilised. Both design employee B and E said that they would like to get feedback in the review process from the Warranty department, and the warranty employees would like to be a part of the process. The warranty employees today feel that they are only asked when something bad already has happened, but with this suggestion, they would always be asked for their opinions in advance. As design employee B and E suggested, it should be the supervisors that should be the warranty representatives in the review process. This assessment is done after both taking the interviewees opinion into account and after our participant observation at the office.

The biggest concern is however if the warranty employees would have time to do the reviews which already are identified as a hinder for the sharing process regardless of which solution. As always when the time is scant, good planning is a basis if something new should be implemented. Beyond the time aspect, it is important that the organisation let the warranty employees get some kind of introduction to both the design instructions and to the review process if the suggestion is to be implemented. The introduction to the design instruction would not only be beneficial in this suggestion, it would also be a good thing regardless of which suggestion or solution that is selected in the Case Company. Further, some of the interviewees were hesitant to if the warranty employees have the competence to review the different documents. The other interviewees did not agree to this and thought that the warranty employees would learn if they were to be involved in the review process. The warranty employees maybe do not have the competence to review the documents as of today, but they will learn along the way.

After the interviews with the employees, we were mostly positive to this suggestion and considered that it was a good idea to implement it. However, after the interviews with the top managers we became more unsure as they raised other aspects of the suggestion. Apparently, the suggestion has been discussed earlier in the Case Company according to top manager B, which we did not know during the development of the suggestion. Top manager B described that the issue with the suggestion is mainly that it is difficult for the warranty employees to translate their knowledge and experiences to be applicable comments in the review process. Maybe the warranty employees need an introduction to the review process if the suggestion should make any difference if implemented. If they need a longer education to it, then it can be questioned if it is

worth it. Top manager A also pointed to that there already is many people involved in the review process today.

Still, this could be a good way to get the thoughts from the warranty employees in the review process, however, it does not have to mean that it must be a warranty supervisor involved in the review process. Instead, the construction representative that already is involved in the review process could broaden its perspective to also include the Warranty department. How this should be done is not anything that we have studied, why it needs to be further investigated before it is implemented.

Suggestion 3

The third suggestion also has meetings and interactions between people as its base. During the review of internal documents and in the first interview set, we learned about the feedback meeting that today is held after the construction phase in the Case Company. This inspired us to come up with a meeting where the Warranty department's information, knowledge and experiences could be shared after the 2-year warranty inspection. According to us, it is first after the 2-year inspection that the experiences from the project really can be shared and discussed. The meeting that today is held after the construction phase is finished misses a big part of the experience feedback that needs to be done in the company, after which this suggestion was developed. If this suggestion were to be implemented, all three parts of the identified items would be able to be shared in this meeting. Mainly the first two parts, the information about the fault reports and the knowledge about the customers thoughts would be shared in this meeting, but also the third item, the experiences from finished buildings could be shared. The information from the fault reports would be easy for the warranty supervisor to present at the meeting to the invited meeting participants. The information could also be shared before the meeting so that the meeting participants could read it before the meeting and come prepared. Further, the knowledge about what the customers think would also be quite easy to share in a meeting like this. The meeting would probably not be that big which enables an opportunity for discussion and interactions between the meeting participants to really understand each other. The third part of what the Warranty department has to share to the Design department, the experiences from a finished building, could also be shared in a meeting like this, but the experience would according to the suggestion just be about the current project.

As the empirical data shows, this suggestion has been perceived differently by the different interviewees. Three of the warranty employees thought this was a good suggestion, and two did not like it. The design employees were all positive to the suggestion but saw potential obstacles with it. Both the top managers thought the suggestion was good and wanted it to be implemented in the Case Company. The opinions were thus scattered between the interviewees. This may be because it means different workloads and changes to the different interviewees. The two warranty employees that believed that the suggestion would be unnecessary claims that there is no time for this, which is a general barrier, and that people in the project group can have been replaced. This is also something that one design employee and one of the top managers stated, but still, they believed that the suggestion is good. The warranty employees that are negative to the suggestion did thus see the same obstacles as the design employees and the top managers. However, they did not see the benefits that the suggestion could come with as the design employees and top managers saw. If the benefits of the suggestion were presented to the warranty employees that do not like the suggestion, they may change their mind about the suggestion.

All of the employees did assume that the meeting should invite the project group that has worked with the project and not anyone else. This is why one of the obstacles that was identified during the interviews is the problem that the information, knowledge and experiences that are shared during the meeting, would not reach the whole organisation, as also Josephson et al. (2008) found in earlier studies. As we agree with the interviewees, that it probably would be the best if the meeting just invited the project group, we see three possible solutions to how the information, knowledge and experiences also could be shared to others in the organisation. If the meeting is encouraged to write improvement proposals for the things that are discussed in the meeting, the whole organisation will take part of the information and experiences that the meeting builds up and discusses. However, the knowledge part, of what the customers think, is hard to bring forward in the improvement proposal forum since the customers thoughts are more about project specifics things that are not regulated in the design instructions. This solution is thus not complete. The second solution is to share the meeting minutes so that they are open for everybody to look through. To read them is not something that needs to be obligatory for everyone to do since that would be too time consuming, but it would be good for someone who are searching for information, knowledge or experiences about a specific thing that he or she know has been done before in the company. This, however, would not ensure that the whole organisation would learn which would be the best. Lastly, one solution could be that each participant in the meeting reports what the meeting has brought up in their department meeting that every department has regularly. In this way, everybody in the same region gets the information, knowledge and experiences, but the whole company does not get it which however is not always needed. The downside with this solution is though that all the meeting participants present it differently on each department meeting which entails opportunities for different interpretations. Another problem with this type of meeting, according to warranty employee A, is that there is a risk that the warranty supervisor is seen as the bad guy. This could be a problem since the Warranty department handles faults, and therefore a lot of the information, knowledge and experiences they can share, will be negative. However, to solve this, the meeting could have a point on the agenda that they also should talk about what has worked well in the project.

Even though obstacles have been spotted in this suggestion, this would be good to implement in the Case Company since it has many benefits, as mostly of the interviewees also believed. However, because of that the suggestion involves also other departments, the suggestion needs to be discussed and investigated further with each department so that not only the Warranty and the Design department think that this suggestion should be implemented.

Suggestion 4

The fourth suggestion is also a suggestion based on the literature about meetings. The suggestion proposes that a warranty supervisor participates in the experience feedback meeting, that already exists in the Case Company, after the construction phase. Except for the benefits of having a meeting, it would be easy to implement this since it is an already existing meeting that is already governed by the organisation and thereby it is not a big change. Furthermore, in the first interview, some of the warranty employees expressed that they wanted to be a part of this experience feedback meeting which resulted in this suggestion.

In general, the interviewees were positive to this suggestion. However, this suggestion does not fulfil the main purpose of this study, the sharing from the Warranty department to the Design department, as the other suggestions do. Several of the interviewees mentioned that this would be a good way for the warranty employees to receive information about the project but not a way for them to share their information, knowledge or experiences. At this point, the warranty employees

have not been involved in the project for a long time and have therefore not received many fault reports or done any warranty inspection. Design employee B and warranty employee B and D, on the other hand, believed that the warranty employees could contribute with what they have learned so far. Because of the opinions from the interviewees, it is unsure if the warranty supervisor would be able to share what they know in this meeting. Instead, neither the information part, the knowledge part or the experience part can be shared in a good way in this meeting. Since few or no fault reports have yet been reported, no warranty inspection has been made, the customers have barely moved in and the warranty supervisor has not been visiting the building many times, it is unlikely that this would be a good opportunity for the sharing of information, knowledge and experience.

Some of the interviewees, design employee C, warranty employee C and top manager A were completely negative to the suggestion since they believed that meeting would not be relevant for the Warranty department. It would be better if the Warranty department was involved earlier in the project. This is a good point and the Warranty department should be involved earlier in the process, which our suggestion two proposes. However, as many of the interviewees say, it would be a great introduction to the project for the warranty supervisor and also an opportunity for the warranty supervisors to be more involved in the project and the project group. Furthermore, this suggestion would be very easy to implement at the Case Company and we are therefore of the opinion that it should be implemented. However, since this research has been focusing on only the Warranty and Design departments, and there are other departments involved in this meeting, we cannot be sure that this would work. Because of this fact, the suggestion would need more investigation before implemented in the Case Company.

Suggestion 5

The fifth suggestion is that a person should be employed with the purpose of making sure that information, knowledge and experiences are shared in the organisation. This suggestion comes from that it is important to share knowledge throughout the whole organisation (Gerth et al., 2013) and that there is a lack of time to do it according to the employees. Several interviewed employees stated that things discussed in meetings are not taken further, and instead stays in the meetings. Also, one employee mentioned that having a person working with the sharing of information, knowledge and experiences would be a good solution. Therefore, a person that only works with the sharing process could make the sharing of information, knowledge and experiences better. This person would make sure that the information, knowledge and experiences from the warranty employees would be shared between projects and departments and not only within them. Suggestion five have the opportunity to share all the three identified parts: information from the fault reports, knowledge from the customers and experiences from finished projects, as this would be the persons main tasks to do. However, the picture from the interviews were clear, this would not be an option for the Case Company, and we agree. On one hand, the time barrier would be solved with this suggestion, but on the other hand, other barriers could arise with a suggestion like this. For example, as design employee C mentioned, there is a risk that this person is perceived as disturbing by the other employees since the person maybe needs to chase the ones that should submit their knowledge and experiences and comes with criticism to them that they need to change their ways of working. There is also a risk that the information, knowledge and experiences are wrongly interpreted when there is an intermediary. Additionally, none of the top managers believed that it would be profitable to hire a person like this, and we assume the top managers are the most appropriate to assess the financial part.

However, not all interviewees were negative about this suggestion. Warranty employee D saw many benefits with hiring a person like this and believed that this person could help the organisation. Especially the time is a big benefit, no one else has time for it today, according to warranty employee D. However, the current employees still would have to set aside time for the sharing purpose since the hired person needs the current employees to gather information, knowledge and experiences from. Some information, knowledge and experiences could also be lost along the way the more steps it needs to take to its final destination.

Further, two of the interviewees' first reaction to this suggestion were that this person already exists in the company, but as a central position at the Development department. We had not thought about this before but the more the interviewees talked about it, the more it became clear that they may be right. The Development department is the department that collects and reads all the improvement proposals, are responsible to investigate the improvement proposals and takes the decision if to implement the improvement proposals in the Case Company, thus, to gather and share the knowledge and experiences that the employees has to the whole organisation. The employees who are working at the Development department seem to be similar to the person that this suggestion proposes. In that case, it would be a good thing for the Case Company to investigate in, if the Development department should have one representative who works out in the different regions. This would strengthen the collaboration and connection between the Development department and the regions which in turn could benefit the sharing of information, knowledge and experiences. However, as mentioned, this would need more investigation before it is implemented.

Suggestion 6

The last suggestion as a solution is that the fault reports should be shared through a document. Since the fault reports were identified as information, they can be shared through written words (Braf, 2000). Fault reports are also something that most of the interviewees have mentioned as something that they think would be good to share from the Warranty department to the Design department. Hence, to share the fault reports through a document in order for everyone to get access to it could be a possible solution. In this suggestion, only the information from the fault reports would be shared and no knowledge or experiences, since it would only be done through a document.

This suggestion was not appreciated by the interviewees in general. Both employees from the Warranty and Design department had a lot of concerns about the suggestion. Once again, the time aspect is mentioned as a problem also in this suggestion. Several of the interviewees said that they do not believe that the design managers would read this information because of the lack of time and that they would not prioritise it. Another concern was that there could be misunderstandings if only information is shared and no background to it. There is a risk that important knowledge and experiences are lost if the sharing of fault reports only is done through a document. Both design employee B and C said that they would prefer to receive the information about fault reports in a presentation so that questions can be asked. This is something that suggestions one and three propose. Even though most of the interviewees did not like this suggestion, everyone said that if this suggestion would be implemented it would be best for the employees to receive a summary of the fault reports and not the separate ones. The separate fault reports would probably not say much to the design managers while a summary would give important information on the most common faults. The design managers could use that information to be extra careful when designing those parts of the building which have resulted in fault reports.

The only interviewee who was positive to this suggestion was top manager B, who believed that if the summarised fault reports were shared via a document in their current platform, then the design managers could find the information when they need it. This is something we also see as a positive side of sharing the information like this. Therefore, this could work as a complement to one of the suggested meetings. We do not consider this suggestion to be the best one and therefore it should not be the main solution. However, regardless which other suggestion that is the most preferred, it would be good if the information is also available in some way in the company's platform. This would give the employees the opportunity to search for information when they need it, or at least know who to turn to when they have questions regarding a specific area.

Ranking and Implementation

The interviewees have, as stated in the empirics and discussed earlier in the analysis, had different opinions about the different suggestions. However, suggestion number one and three had the best ranking when all the interviews were compiled, which were not a surprise after the answers they gave when asked about each suggestion. Suggestion number one and three were both mostly appreciated by the employees and by the top managers. Those suggestions are the most popular because the interviewees find it easy to see the benefits in meetings, and it would probably not be too hard to implement them in the Case Company as it is today. Both the theoretical and the empirical data shows that both suggestion one and three would be good to implement in the Case Company. Further, suggestion two and four were placed at third and fourth place. We do, as in the discussion of suggestion two not believe that it should be implemented in the original version. Instead, with the empirics as a base, the suggestion two could be reformulated so that the Warranty departments view is involved in the review process, but in a collected form by the construction representative. However, suggestion four should be implemented in the Case Company. As the discussion result in, even though the suggestion four is not going to improve the sharing from the Warranty department, it is a great opportunity for the Warranty department to become more included in the projects and get important information about their future warranty work in a project. Neither suggestion five nor six should be implemented.

To summarise the opinions about the suggestions, two tables, 3 and 4, have been compiled to present the benefits, the barriers and some improvement point of each suggestion.

	Suggestion 1	Suggestion 2	Suggestion 3
<i>Benefits</i>	• Design employees get feedback sooner • Increased team spirit • More communication between the departments • Easy to implement	• Early contribution from the warranty employees • Warranty gets more involved in the project group	• More involvement of warranty employee in the project group • Gives a more complete view of the project to the organisation

<i>Barriers</i>	• Takes time • Lead times • Design employee does not absorb the knowledge if it is not working with the same stage at the time	• Takes time • Warranty has no experience of reviewing documents • Hard for warranty to translate their practical knowledge • Already many people involved in the review process	• Takes time • Warranty supervisor is seen as the bad guy • Change of employees • It is only the project group that is involved
<i>Improvement points</i>	• Fewer meetings a year than in the original suggestion	• Warranty needs an introduction to it • Only some of the documents should be reviewed by warranty	• The meeting minutes should be shared with the whole organisation

Table 3: Compilation of suggestion 1-3.

	Suggestion 4	Suggestion 5	Suggestion 6
<i>Benefits</i>	• Opportunity for the warranty employee to gain information • Warranty gets more involved in the project group	• Does not take time from the current employees	• Available for everyone in the organisation all the time
<i>Barriers</i>	• Takes time for warranty employee • Too late for the warranty employee to contribute with any changes to the project • Meeting contains issues that do not concern the warranty employee	• Too many and difficult tasks for one person • Expensive to hire outside the main business • Could create a bad atmosphere in the office	• Takes time to read • The design employees would not read the information • No interaction between employees • Could lead to misunderstandings
<i>Improvement points</i>	-	• This person could be someone that already works at the development department	• Connect and structure the fault reports to the design instructions

Table 4: Compilation of suggestion 4-6.

6 Conclusion

In this chapter, the study's conclusion is presented. The conclusion is based on what the analysis has discussed and structured after the four research questions that the study has.

Existing collaboration and systems

RQ1: What are the existing exchanges between the Warranty and Design department?

The information, knowledge and experiences that the Warranty department at the Case Company has are not shared enough today. The communication between the Warranty department and the Design department is today poor and needs to be improved in order for the Warranty department's information, knowledge and experiences to be utilised. The only way the departments communicate today is by sporadic informal conversations when questions arise. We conclude that the Case Company has an industrialised way of working which means that they have benefits when it comes to knowledge management. Today, especially two systems are used to transfer information, knowledge and experiences in the Case Company, those are the improvement proposal system and the supplier comment system. Those systems do however not ensure that there are any exchange of information, knowledge or experiences in the Case Company since it is up to each individual to write in any of those systems. However, we believe that it is best to keep these systems voluntary.

Sharing and benefits

RQ2: What information, knowledge and experiences are there to share from the Warranty department to the Design department?

Our analysis shows three main parts that the Warranty department has, that could be shared to the Design department. First, it is the information that the fault reports provide. Second, it is the knowledge that the warranty employees get by being in contact with the customers. This knowledge is mainly tacit. Last, it is the experiences from how finished buildings work. These parts could help the design managers to design better buildings since they would know what the most common faults are and thereby avoid them in the future. The design managers will also be benefitted by the customers' opinions about the buildings which will lead to more satisfied customers in the future. Therefore, our conclusion is that these three parts should be shared from the Warranty department to the Design department and can thereby result in improved buildings and lower costs from fixing faults.

Barriers for collaboration

RQ3: What barriers exist, that hinder the sharing of information, knowledge and experiences from the Warranty department to the Design department?

Through our interviews and literature review we identified several barriers to the sharing of information, knowledge and experiences. These were: lack of time, that the sharing was low prioritised, the lead time between the departments, the design instructions, information overload, the lack of structured systems, the change of personnel, that the Warranty department is underestimated and the gap between the Warranty department and the rest of the organisation. All these barriers are hindering the sharing of information, knowledge and experiences from the Warranty department to the Design department. However, the lack of time, the low prioritising of sharing and the lack of structured systems, we do consider as the main barriers. Lack of time is a main barrier since it was mentioned in the interviews by several interviewees repeated times and has also been written about in previous literature. The low prioritisation of the sharing is a main

barrier since there are not any clear guidelines to how the Warranty and Design departments should share their information, knowledge and experiences with each other and has also been identified in earlier studies. The lack of structured systems is a main barrier since without them, it cannot be guaranteed that the employees share their information, knowledge and experiences. These three barriers are all written about in earlier studies which means that this research confirms the earlier literature on the subject and thereby strengthens that these are barriers in construction companies and project-based organisations.

Future systems

RQ4: How can the collaboration between the Warranty department and Design department develop and which systems could be used to share the Warranty department's information, knowledge and experiences?

First of all, regarding the two systems improvement proposals and supplier comments which already are used at the Case Company, we have identified a few improvements points which could make the systems better. These improvement points are the easiness to use the systems, feedback on the improvement proposals and more of a chance to affect the decision regarding improvement proposals. We believe that if both of the systems were easier to use and access, more of the employees would use them regularly. Regarding the improvement proposals, we believe that if the employees receive more feedback and have the chance to follow the process and argue for their proposal, more employees will think it is worth sending in one. Still, we state that the two current systems are good and should be kept in the Case Company. However, we also conclude that the systems that the Case Company has today, needs to be complemented with other systems for the sharing of information, knowledge and experiences from the Warranty department to the Design department, to be improved.

Both the literature and the empirical information strongly shows that structured interactions between the employees are needed if the information, knowledge and experiences that the Warranty department has should be shared to the Design department. The empirics shows that if a structured system does not exist, knowledge will not be shared even if the individuals want it to happen. Regardless of exactly which solution that are implemented in a project-based organisation for sharing information, knowledge and experiences from a late to an early phase, it is important that the solutions include opportunities for meetings, discussion and interactions between people. Based on this, our conclusion is that the Case Company needs to implement more opportunities for the warranty and the design employees to meet in structured ways. The employees in the Warranty and the Design departments need to interact if the information, knowledge and experiences from the Warranty department should be shared. We therefore propose to implement three new routines, of which are specified in the following subchapter, recommendations to the Case Company. Generally, our main conclusion is that if information, knowledge and experiences should be shared, meetings between the involved parts is to recommend.

6.1 Recommendations to the Case Company

Based on what reactions the interviewees have had to the suggestions, and which ranking the suggestions have gotten, our recommendation is to implement three changes. For the first, we recommend a meeting where the warranty supervisors present the current most common warranty issues to the design managers. Thus, as the first suggestion, but however with some adjustments. The meeting should contain a large part of discussion possibilities for the employees to interact with each other. We recommend as a start to have the meeting three to four times a year, but the managers need to be aware to adjust the time setting if the employees feel that it is needed to be

held more often or if it is too often to have it three to four times a year. Furthermore, we recommend the Case Company to also implement a meeting that are held after the 2-year warranty inspection for each project. The meeting should be between the project group and should focus on which fault reports that the project has had, what the customers have thought about the accommodations and the building, and how the maintenance of the building has worked after the finishing of the construction phase. The meeting should be similar to the experience feedback-meeting that the Case Company already has after the construction phase. In this way, it will probably be easy for the employees to accept and understand this meeting. However, this recommendation involves other departments as well, which means that the recommendation should be investigated and discussed further by the regional management. Lastly, we recommend the Case Company to invite the warranty supervisor to the experience feedback-meeting that are already held after the construction phase in the Case Company. This does not fulfil the purpose of this research directly, but it would still improve the communication between the departments and give the warranty employees important information about the project. This could in the long run benefit the sharing of information, knowledge and experiences from the Warranty department to the Design department because of the improved relationship between them.

Regardless if any of the suggestions or recommendations are selected to be implemented in the Case Company, there are some general activities that should be introduced at the Case Company. Firstly, we recommend setting up a short introduction of how the design instructions work and are worked with. This introduction could be an education for the Warranty department, other employees at the Case Company and new employees to learn about the company. The introduction should be obligatory to go through for at least the warranty employees. The introduction is supposed to create a better understanding of the design instructions which we believe would make it easier for the warranty employees to send in better improvement proposals. The design instructions are of such great importance to how the Case Company works that everyone in the company should know about them. Secondly, we recommend that the departments should get an introduction to the other departments to get a better understanding for what the other employees at the Case Company do and how the Case Company's work is planned to be done. The understanding of each other's work is a basic need for better knowledge sharing and experience feedback. If the employees have an understanding for each other's work, their communication will be simplified.

A risk is that because of new implemented routines to the Case Company, some old ones need to be removed because of time. The barriers identified in this research strongly show that time is something that limits and hinders the sharing of information, knowledge and experiences, and therefore, time needs to be released if new routines should be implemented. However, this study does not investigate in what current routines that possibly could be removed.

6.2 Future research

Our research is only based on the Warranty and the Design department, and in the region Gothenburg. Therefore, we have some thoughts about future researches that could be interesting to do for the Case Company. First, it would be interesting to investigate in if the recommendations that this study concludes also could fit to be implemented between other departments. It would also be interesting to do the research in another company to see if the recommendations would fit there too. Secondly, it would be interesting to redo this study in another region in the Case Company to see if the same problems exist there or if the employees at other regions perceive the Case Company's situation differently. Thirdly, as we described in the recommendations for the

Case Company, it may be so that the new routines that we recommend being implemented results in that other routines have to be removed because of the time aspect. Therefore, it would be interesting to go through the Case Company's routines to investigate if every part is necessary or if something could be removed or improved to release time. Lastly, we believe that it would be interesting to dig deeper into a company with high personnel-turnover to see how they ensure that the information, knowledge and experiences are remained in the company when someone quits. Our belief is that a company with high personnel-turnover, must be good and efficient to get their employees to share their knowledge and experiences, otherwise, it is lost when the employee quits.

7 Bibliography

- Alves, T. C., Paliari, J. C., & Milion, R. N. (2017). Impacts of residential construction defects on customer satisfaction. *International Journal of Building*, 35(3), 218-232.
- Anumba, C. J. (2009). Towards next generation knowledge management systems for construction sector organisations. *Construction Innovation*, 245-249.
- Backman, J. (2016). *Rapporter och uppsatser*. Lund: Studentlitteratur.
- Bakker, R. M., Cambré, B., Korlaar, L., & Raab, J. (2011). Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer. *International Journal of Project Management*, 29, 494-503.
- Boh, W. F. (2007). Mechanisms for sharing knowledge in project-based organizations. *Information and Organization*, 17, 27-58.
- Braf, E. (2000). *Organisationers kunskapsverksamheter - en kritisk studie av "knowledge management"*. Institutionen för datavetenskap, Forskningsgruppen VITS. Linköpings universitet.
- Bresnen, M., Goussevskaia, A., & Swan, J. (2004). Embedding New Management Knowledge in Project-Based Organizations. *Organization Studies*, 25(9), 1535-1555.
- Bryman, A., & Bell, E. (2015). *Business research methods* (Fourth ed.). Oxford: Oxford University Press.
- Chen, C., & Hicks, D. (2004). Tracing knowledge diffusion. *Scientometrics*, 59(2), 199-211.
- Cummings, J. (2003). *Knowledge Sharing: A Review of the Literature*. The World Bank Operations Evaluation Department.
- Dahmström, K. (2011). *Från datainsamling till rapport: att göra en statistisk undersökning*. Lund: Studentlitteratur.
- Dave, B., & Koskela, L. (2009). Collaborative knowledge management - A construction case study. *Automation in Construction*, 18, 894-902.
- Dubois, A., & Gadde, L.-E. (2002). Systematic combining: an abductive approach to case research. *Journal of business research*, 55(7), 553-560.
- Fagerberg, J., Mowery, D., & Nelson, R. (2005). *The Oxford handbook of innovation*. Oxford University Press.
- Gagné, M. (2009). A Model of Knowledge-Sharing Motivation. *Human Resource Management*, 48(4), 571-589.
- Gannon, M., & Banham, G. (2011). Managing knowledge in construction engineering projects. *OR insight*, 24(1), 17-30.
- Gerth, R., Boqvist, A., Bjelkemyr, M., & Lindberg, B. (2013). Design for construction: utilizing production experiences in development. *Construction Management and Economics*, 31(2), 135-150.

- Grandinetti, R. (2014). The explicit dimension: what we could not learn from Polanyi. *The Learning Organization*, 21(5), 333-346. Retrieved from <https://doi-org.proxy.lib.chalmers.se/10.1108/TLO-06-2013-0027>
- Gurteen, D. (1999). Creating a Knowledge Sharing Culture. *Knowledge Management Madazine*, 2(5).
- Harris, R., & Scott, S. (1998). A methodology for generating feedback in the construction industry. *The Learning Organization*, 5, pp. 121-127.
- Hobday, M. (2000). The project-based organisation: an ideal form for managing complex products and systems? . *Research Policy*, 871-893.
- Holste, J., & Fields, D. (2010). Trust and tacit knowledge sharing and use. *Journal of Knowledge Management*, 14(1), 128-140.
- Inkpen, A., & Tsang, E. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review*, 30(1), 146-165.
- Jansson, G., Johnsson, H., & Engström, D. (2014). Platform use in systems building. *Construction Management and Economics*, 32, 70-82.
- Jansson, G., Lundkvist, R., & Olofsson, T. (2015). The role of experience feedback channels in continuous development of house-building platforms. *Construction innovation*, 15(2), 236-255.
- Jergeas, G., & Van der Put, J. (2001). Benefits of constructability on construction projects. *Journal of construction engineering and management*, 281-290.
- Josephson, P.-E., Styhre, A., & Wasif, I. (2008). *Organisera och leda för lärande i bygg- och anläggningsprojekt*. Gothenburg: Sveriges Byggindustrier.
- Koch, C., & Thuesen, C. (2013). Knowledge sharing in construction partnering projects - redundancy, boundary objects and brokers. *Int. J. Project Organisation and Management*, 5(1/2), 156-175.
- Liebowitz, J. (2001). Knowledge management and its link to artificial intelligence. *Expert Systems with Applications*, 20, 1-6.
- Love, P. E., Edwards, D. J., & Smith, J. (2016). Rework Causation: Emergent Theoretical Insights and Implications for Research. *Journal of construction engineering and management*, 142(6), 04016010.
- Lundkvist, R., Magnusson, O., & Meiling, J. (2011). Erfarenhetsåterföring: Dags för klargörande, omtag och nya nivåer. *Samhällsbyggaren*(2), pp. 16-21.
- Lundkvist, R., Meiling, J., & Vennström, A. (2010). Digitalisation of inspection data: a means for enhancing learning and continuous improvements? *Association of Researchers in CONstruction Management*, 2, 829-838.
- Mack, N., Woodson, C., MacQueen, K., Guest, G., & Namey, E. (2005). *Qualitative Research Methods: A data collector's field guide*. Family Health International.

- Maxwell, J. A. (2013). *Qualitative Research Design* (3 ed.). SAGE Publications.
- Nationalencyklopedin. (n.d.). *Erfarenhet*. Retrieved 03 10, 2020, from Nationalencyklopedin: <https://www-ne-se.proxy.lib.chalmers.se/uppslagsverk/encyklopedi/l%C3%A5ng/erfarenhet>
- Newell, S., Bresnen, M., Edelman, L., Scarbrough, H., & Swan, J. (2006). Sharing knowledge across projects: Limits to ICT-led project review practices. *Management Learning*, 37(2), 167-185.
- Newell, S., Robertson, M., Scarbrough, H., & Swan, J. (2009). *Managing knowledge work and innovation*. Palgrave Macmillan.
- Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1), 14-37.
- Nonaka, I., & Konno, N. (1998). The Concept of "Ba": Building a foundation for knowledge creation. *California Management Review*, 40(3), 40-54.
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press.
- Nonaka, I., Kodama, M., Hirose, A., & Kohlbacher, F. (2013). Dynamic fractal organizations for promoting knowledge-based transformation - A new paradigm for organizational theory. *European Management Journal*, 32(1), 137-146.
- Okere, G. O. (2017). Barriers and Enablers of Effective Knowledge Management: A Case in the Construction Sector. *The Electronic Journal of Knowledge Management*, 15(2), 85-97.
- Othman, A. A. (2015). An international index for customer satisfaction in the construction industry. *International Journal of Construction Management*, 15(1), 33-58.
- Polanyi, M. (1966). *The tacit Knowing*. London: Routledge & Kegan Paul.
- Robertson, D., & Ulrich, K. (1998). Planning for product platforms. *Sloan Management Review*, 39(4), 19-31.
- Ruiz, P. P., Foguem, B. K., & Grabot, B. (2014). Generating knowledge in maintenance from Experience Feedback. *Knowledge-Based Systems*, 68, 4-20.
- Senaratne, S., & Sexton, M. (2008). Managing construction project change: a knowledge management perspective. *Construction Management and Economics*, 26, 1303-1311.
- Sharratt, M., & Usoro, A. (2003). Understanding Knowledge-Sharing in Online Communities of Practice. *Electronic Journal on Knowledge Management*, 1(2), 187-196.
- Styhre, A., & Gluch, P. (2010). Managing knowledge in platforms: boundary objects and stocks and flow of knowledge. *Construction Management and Economics*, 28, 589-599.
- Swan, J., Scarbrough, H., & Newell, S. (2010). Why don't (or do) organizations learn from projects? *Management Learning*, 41(3), 325-344.

- Tracy, S. J. (2019). *Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact*. John Wiley & Sons.
- Walle, A. (2014). *Qualitative Research in Business : A Practical Overview*. Cambridge Scholars Publisher. Retrieved from <https://ebookcentral.proquest.com>
- Wallin, M., & von Krogh, G. (2010). Organizing for Open Innovation: Focus on the Integration of Knowledge. *Organizational Dynamics*, 39(2), 145-154.
- Wong, W., & Radcliffe, D. (2000). The tacit nature of Design Knowledge. *Technology Analysis & Strategic Management*, 12(4), 493-512. Retrieved from <https://doi.org/10.1080/713698497>

8 Appendix

Below follows the appendix that belongs to the study.

Appendix A – Interview questions set 1 design employee

Initial questions

- Briefly, tell us about your background?
- Briefly, what do you work with?
- Would you like to explain what your department's main tasks are and how the department is organised?

Issues and information

- If you have a question or a challenge, what do you do?
 - *Follow up:* Do you ask for any help, or do you try to search for answers at your own? If you ask someone, who do you go to first?
- Do you experience any difficulties when searching for help with a question?
- Do you feel that internal information always is available at the Case Company if you search for answer in a question?
 - *Follow up:* If not, where do you search for information?
 - *Follow up:* If there is, where at the Case Company can you find the information? Is there any system where information can be found?
- Do you believe that there is internal information at the Case Company that you do not use even though you could be helped by it?

Knowledge sharing and experience feedback

- Do you think that it is difficult or easy to find experiences in the company?
- In which way do you get knowledge and experiences from your colleagues? Both from your own department and from other departments.
- Do you feel that you receive positive feedback if you design something that works very well in a project?
 - *Follow up:* From who does this feedback come from?
- Do you feel that you get any negative feedback if something does not work well in a project that you have designed?
 - *Follow up:* From who does this feedback come from?
- What does the concept experience feedback mean for you?
- How do you and your department work with experience feedback?
- Has there been any way that you have worked with experience feedback earlier that you no longer do?
 - *Follow up:* Why do you not work like that anymore?
 - *Follow up:* What did you think about that way of working?
- Do you know if experience feedback is something that the business system is controlling for your department?
- Have you been involved in some meeting or similar where experience feedback or knowledge sharing has been the main topic?
 - *Follow up:* Who attended the meeting and what was brought up?

- Do you believe that experience feedback is something that the Case Company should work more with or are you happy with the way that it is worked with today?

Relationship between the Design department and the Warranty department

- How do you experience the relationship between the Design department and the Warranty department?
- How often do you have any contact with someone that works in the Warranty department?
 - *Follow up:* What does the contact include?
 - *Follow up:* Why do you not have contact more often?
- How often would you like to have contact with the Warranty department?
- Are there any barriers for contact between the design and the Warranty department?
- Do you feel that the Design department has enough knowledge to design good projects?
- Which knowledge do you think that the Warranty department has that would be good for you to learn from?
- If there were systems and routines for it, would you like to learn from the Warranty department?
 - *Follow up:* In which way would you like to learn from the Warranty department?

Other

- Do you have anything other to add?

Appendix B – Interview questions set 1 warranty employee

Initial questions

- Briefly, tell us about your background?
- Briefly, what do you work with?
- Would you like to explain what your department's main tasks are and how the department is organised?

Issues and reporting

- How often do you feel that the same problem or issue occurs at different projects?
- If you encounter a problem or issue that has with earlier stages to do, do you report this then?
 - *Follow up:* If you report it, how and where do you do this?
 - *Follow up:* How difficult or easy is it to report a problem or issue?
- Which system do you know about that the Case Company has where you can report a problem or issue?
- If you see a good example of something in a project, what do you do?
 - *Follow up:* Do you report it or tell someone about it? Who do you tell?
- Do you feel you get feedback or response on what you report?

Knowledge sharing and experience feedback

- What does the concept experience feedback mean for you?
- How do you and your department work with experience feedback?
- Has there been any way that you have worked with experience feedback on earlier that you no longer do?
 - *Follow up:* Why do you not work like that anymore?
 - *Follow up:* What did you think about that way of working?
- Do you know if experience feedback is something that the business system is controlling for your department?
- Have you been involved in some meeting or similar where experience feedback or knowledge sharing has been the main topic?
 - *Follow up:* Who attended the meeting and what was brought up?
- Do you believe that experience feedback is something important that the Case Company should work more with or are you happy with the way that it is worked with today?
- How do you today share your knowledge and experiences that you have?
- In which ways could you think of sharing your knowledge and experiences?
 - *Follow up:* Are there any ways that you not would be willing to share your knowledge and experiences?

Relationship between the Design department and the Warranty department

- How do you experience the relationship between the Warranty department and the Design department?
- How often do you have any contact with someone that works in the Design department?
 - *Follow up:* What does the contact include?
 - *Follow up:* Why do you not have contact more often?
- How often would you like to have contact with the Design department?

- Are there any barriers for contact between the warranty and the Design department?
- Which experiences do you think that you have that can help the earlier stages in a project?
 - *Follow up:* In which way do you think that those experiences could help?
- If you have shared your knowledge that you have earned from working with warranty, do you think that this could help the Design department to design better projects?
- In which way do you think would be good to share the knowledge from the Warranty department to the Design department?

Other

- Do you have anything other to add?

Appendix C – Interview questions set 2 design employee

Additional questions to the first interview

- How can the system improvement proposals be improved?
- How can the system supplier comments be improved?
- Does it say anywhere in your work description, the business system or elsewhere that you must write improvement proposals if you think that something is not working?
- Does it say anywhere in your work description, the business system or elsewhere that you must make supplier comments if you think that something is not working?
- Do you know how the Warranty department's work is organised?
- Do you believe that lack of time during your workday is an obstacle for the sharing of knowledge, information and experiences?
 - *Follow up:* If so, why are time not taken to share this?
 - *Follow up:* Do you think that it depends on the organisation or the individuals?
- Do you believe that lead times are an obstacle for the sharing of knowledge, information and experiences?
 - *Follow up:* If so, do you think that it depends on the organisation or the individuals?
- Do you believe that the design instructions are an obstacle for the sharing of knowledge, information and experiences?

Questions on suggestion 1

- What do you think of this suggestion?
- Would you have attended such a meeting?
- How often do you think such a meeting should take place?
- What should the agenda for the meeting contain?
- Which roles do you think should participate in such a meeting?
- What could be a problem with such a meeting?
- What is important to think about if such a meeting would be implemented?
- Who should responsible for the meeting?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 2

- What do you think of this suggestion?
- Do you believe that it would work practically?
 - *Follow up:* Would the Warranty department have time for it?
 - *Follow up:* Would the Warranty department have the right competence for reviewing documents?
- Which roles from warranty do you think should be a part of the review?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 3

- What do you think of this suggestion?
- What do you think that the agenda of the meeting should contain?
- Which roles do you think should participate in such a meeting?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 4

- What do you think of this suggestion?
- Do you think that the warranty supervisor could contribute to the meeting?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 5

- What do you think of this suggestion?
- Which work tasks do you believe that this person should have?
- Do you believe that the person needs a background in the construction industry and in the Case Company to be able to perform in this role?
- What could be a problem with this suggestion?
- Do you believe that it would be profitable?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 6

- What do you think of this suggestion?
- How do you think these documents should be shared?
- Do you think the fault reports should be shared separately or in a summarised form?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Other

- Could you rank the suggestion from best to worst?
- Do you have anything to add?

Appendix D – Interview questions set 2 warranty employee

Additional questions to the first interview

- How can the system improvement proposals be improved?
- How can the system supplier comments be improved?
- Does it say anywhere in your work description, the business system or elsewhere that you must write improvement proposals if you think that something is not working?
- Does it say anywhere in your work description, the business system or elsewhere that you must make supplier comments if you think that something is not working?
- Do you know how the Warranty department's work is organised?
- Do you believe that lack of time during your workday is an obstacle for the sharing of knowledge, information and experiences?
 - *Follow up:* If so, why are time not taken to share this?
 - *Follow up:* Do you think that it depends on the organisation or the individuals?
- Do you believe that lead times are an obstacle for the sharing of knowledge, information and experiences?
 - *Follow up:* If so, do you think that it depends on the organisation or the individuals?
- Do you believe that the design instructions are an obstacle for the sharing of knowledge, information and experiences?
- What knowledge, information or experience do you think you have that could benefit the Design department?
 - *Follow up:* Why is this not shared today?

Questions on suggestion 1

- What do you think of this suggestion?
- Would you have attended such a meeting?
- How often do you think such a meeting should take place?
- What should the agenda for the meeting contain?
- Which roles do you think should participate in such a meeting?
- What could be a problem with such a meeting?
- What is important to think about if such a meeting would be implemented?
- Who should be responsible for the meeting?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 2

- What do you think of this suggestion?
- Do you believe that it would work practically?
 - *Follow up:* Would the Warranty department have time for it?
 - *Follow up:* Would the Warranty department have the right competence for reviewing documents?
- Which roles from warranty do you think should be a part of the review?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 3

- What do you think of this suggestion?
- What do you think that the agenda of the meeting should contain?
- Which roles do you think should participate in such a meeting?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 4

- What do you think of this suggestion?
- Do you think that the warranty supervisor could contribute to the meeting?
- What could make this meeting feel unnecessary for the warranty supervisor?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 5

- What do you think of this suggestion?
- Which work tasks do you believe that this person should have?
- Do you believe that the person needs a background in the construction industry and in the Case Company to be able to perform in this role?
- What could be a problem with this suggestion?
- Do you believe that it would be profitable?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 6

- What do you think of this suggestion?
- How do you think these documents should be shared?
- Do you think the fault reports should be shared separately or in a summarised form?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Other

- Could you rank the suggestion from best to worst?
- Do you have anything to add?

Appendix E – Interview questions top manager

Initial questions

- Could you describe how the Case Company works with information sharing, knowledge sharing and experience feedback today?
 - *Follow up:* Are there any way today that information, knowledge and experiences should be shared from the Warranty department to the Design department?
- Why has our subject of the thesis not been prioritised earlier in the Case Company?
- Why do you think that there is not any exchange between the warranty and the Design department today?
 - *Follow up:* Does it depend on time and how could this in that case be solved?
 - *Follow up:* Does it depend on lead times and how could this in that case be solved?
 - *Follow up:* Does it depend on the design instructions and how could this in that case be solved?
- Do you know if the warranty and the design employees have insight and understanding of each other's work?
- Does it say anywhere in anyone's work description, the business system or elsewhere that you must write improvement proposals or supplier comments if you think that something is not working?
- What information, knowledge and experience do you think that the warranty employees could contribute with to benefit the design employees work?
 - *Follow up:* What could this exchange improve?

Questions on suggestion 1

- What do you think of this suggestion?
- Do you think that the invited ones had attended such a meeting?
- How often do you think such a meeting should take place?
- What should the agenda for the meeting contain?
- Which roles do you think should participate in such a meeting?
- What could be a problem with such a meeting?
- What is important to think about if such a meeting would be implemented?
- Who should responsible for the meeting?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 2

- What do you think of this suggestion?
- Do you believe that it would work practically?
 - *Follow up:* Would the Warranty department have time for it?
 - *Follow up:* Would the Warranty department have the right competence for reviewing documents?
- Which roles from warranty do you think should be a part of the review?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?

- Do you think that this would be doable at the Case Company?

Questions on suggestion 3

- What do you think of this suggestion?
- What do you think that the agenda of the meeting should contain?
- Which roles do you think should participate in such a meeting?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 4

- What do you think of this suggestion?
- Do you think that the warranty supervisor could contribute to the meeting?
- What could make this meeting feel unnecessary for the warranty supervisor?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 5

- What do you think of this suggestion?
- Which work tasks do you believe that this person should have?
- Do you believe that the person needs a background in the construction industry and in the Case Company to be able to perform in this role?
- What could be a problem with this suggestion?
- Do you believe that it would be profitable?
- If this not are a good suggestion, who should have responsibility over those tasks?
 - *Follow up:* Is this role similar to a role at the Development department?
 - *Follow up:* Could it be an idea to place one who are employed at the Development department to sit in the regional offices?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Questions on suggestion 6

- What do you think of this suggestion?
- How do you think these documents should be shared?
- Do you think the fault reports should be shared separately or in a summarised form?
- What could be a problem with this suggestion?
- What is important to think about if this suggestion would be implemented?
- What could be improved with this suggestion?
- Do you think that this would be doable at the Case Company?

Other

- Could you rank the suggestion from best to worst?
- Do you have anything to add?

DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING
CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden
www.chalmers.se



CHALMERS
UNIVERSITY OF TECHNOLOGY