



CHALMERS
UNIVERSITY OF TECHNOLOGY



Environmental Management in Swedish Construction Projects – Actors, Tools, Incentives and Development

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

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

Environmental sustainability has been given increased focus during the later years and technical solutions and management practices have therefore been applied. Environmental Management Systems are today present in almost every larger company in the Swedish construction industry as the companies strive to stay competitive on the market. To enhance the environmental work and to market projects, environmental certifications are commonly applied on various projects.

The purpose of this thesis is to investigate the status of the environmental work and processes related, in the Swedish construction industry. It is an abductive and qualitative study including both a literature review and interviews within the Swedish construction sector. The results from the empirics are compared with theory as well as other studies performed within the same research area.

It was concluded that there is an ongoing development in environmental sustainability. Further, the consensus between the respondents was overall great in many of the aspects about challenges and possibilities. A need for broad collaboration across roles and actors in these complex matters were evident.

Key words: Environmental sustainability, green building, collaboration, environmental management, EMS.

Miljöledning i svenska byggprojekt – aktörer, verktyg, drivkrafter och utveckling

Examensarbete inom masterprogrammet Design and Construction Project Management

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SAMMANFATTNING

Hållbarhet inom miljö har getts en ökad fokus de senaste åren och tekniska lösningar och arbetsmodeller för att leda har därmed utvecklats. Miljöledningssystem används idag av nästan alla större företag inom den svenska byggindustrin eftersom företagen strävar efter att förbli konkurrenskraftiga. För att förbättra miljöarbetet och för att marknadsföra projekten har miljöcertifieringar blivit allt vanligare i projekten.

Syftet med denna uppsats är att undersöka det aktuella läget gällande miljöarbete och dess processer inom den svenska byggindustrin. Studien är kvalitativ och bygger på en abduktiv metod och innehåller både en litteraturstudie samt intervjuer inom byggbranschen. Resultaten från intervjustudien jämförs med befintlig teori samt tidigare studier inom ämnet.

Sammanfattningsvis drögs slutsatsen att det finns en pågående utveckling i hållbart miljöarbete. Det finns dessutom en stor samsyn mellan respondenterna i flera aspekter gällande såväl utmaningar som möjligheter. Ett behov av brett samarbete mellan både roller och aktörer i dessa ofta komplexa frågor tydliggjordes flera gånger.

Nyckelord: Miljöarbete, hållbarhet, grönt byggande, samarbete, miljöledning, miljöledningssystem,

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Preface

This Master thesis is the last and final step for our Master degree in civil engineering at Chalmers University of Technology. After five interesting and intense years this era has come to an end, and marks the start of another. To round up our education by this study has been both interesting and gained us deepened knowledge within our fields of interest. This study has resulted in numerous interesting discussion and reflections with persons we spoke to during this semester regarding both the chosen subject, but also beyond the framework of the thesis.

Mathias Gustavsson, thank you for your support and reflections upon our work during this semester. It is always interesting to discuss related topics with you. We would also like to give a special thanks to Anna Bengtsson and Anna Granberg for your thorough feedback and reflections during the forming and process of this thesis. Last but not least we especially want to thank our respondents, whom we chosen to remain anonymous. Thank you all for your involvement and interesting inputs to our study.

Gothenburg June 2017
Anders Koppfeldt & Jakob Revellé

Glossary

BREEAM	International environmental certification system
EC1	Environmental Consultant no. 1
EC2	Environmental Consultant no.2
ECS	Environmental Certification System
EMS	Environmental Management System
ISO	International Organization for standardization
KMA	Quality, Environment and Safety in Swedish
LEED	International environmental certification system
MB 2.0	Miljöbyggnad 2.0. The ECS that the empirics in this thesis relates to
MB 3.0	Miljöbyggnad 3.0. Upcoming version of the present MB 2.0.
NOI	Net Operate Income
PR	Public Relations
PuC	Public Client
PVC	Polyvinyl Chloride. One of the world most common plastics
QES	Quality, Environment and Safety
QMS	Quality Management System
SC	Subcontractor
SGBC	Sweden Green Building Council
SM1	Site manager no. 1
SM2	Site manager no. 2

1 Introduction

This report is a master thesis for Architecture and Civil Engineering within the master's program Design and Construction Project Management at Chalmers University of Technology. Following chapter describes the background as well as state the purpose and aim of the report. Further the boundaries and delimitations of the report will be presented.

1.1 Background

During the past three decades, environmental awareness within Swedish construction industry has seen a significant increased (Gluch, 2005). The industry has gone from identified itself as a technical solver in construction issues to a view upon itself as an important player in the development of society as a whole. This development tends to continually increase the focus on sustainability regarding social, environmental and economic among actors within the construction industry.

One use to refer to Swedish building sector as the “40% sector”, due to its part of the total use of both energy and material produced plus its responsibility for 40 percentage of the generated in waste in society. As the construction industry is a large part of the building sector in Sweden, it is important to deal with those environmental effects to stay in line with the growing awareness regarding sustainability in the society. As technical systems in buildings are developed into more energy efficient systems the construction phase tends to play an increasing role due to environmental aspects. Therefore, both clients and construction companies tend to increase the importance of environmental issues in their corporate strategies in order to retain its market shares (Gluch, 2005, Gluch et al., 2011).

The awareness regarding the above mentioned environmental issues has increased, it is now an important part of many construction companies' corporate strategies in order to align with the market. Within midsize and large construction companies in Sweden it is now almost standard to apply Environmental Management System (EMS) in order to be able to monitor and control the green development within the company. Despite such organizational development towards environmental focus, there are according to Gluch et al. (2011) still resistance to the implementation of those strategies on site. Their survey shows that there is a development within the industry, but it is very slow and tends to fall behind other comparable industries.

1.2 Purpose & Aim

The demands for environmental construction is increasing among stakeholders but it is low on initiative from some of those who have the expertise and experience of construction processes related to environmental issues, i.e. the contractors. There are as Gluch et al. (2011) states multiple barriers and inertia against the environmental work within the industry, which need to be addressed to further improve the environmental work of today.

The aim of this master thesis is to investigate the status of environmental processes in Swedish construction industry today and which parts within it that can be developed

more. Furthermore, the influence and impact of EMS's and contractual forms will be investigated and discussed. This results in the following research questions;

What is the current situation regarding environmental processes within the Swedish construction industry and how far has the Environmental Management System (EMS) brought us? As well as which are the incentives for involved actors to enhance their work and how could initiative being spread throughout the project organization?

1.3 Delimitations

The report focuses on the Swedish construction industry although some literature is based on international sources and studies, cross-referencing with Swedish references make it applicable in this study. Environmental certifications systems will be handled as a phenomenon and not regarding differences between different certificates. I.e. LEED or BREAM would be equalized in terms of processes and tools where Miljöbyggnad will be acting as an example throughout the study. The same reasoning is applied within the field of EMS, as it will be described as a process or system rather than differences in each system.

The type of projects to keep in mind while we address the questions of EMS, environmental certification and other issues described in the thesis are generally larger projects. This is done since the application of mentioned systems is mainly applied within larger projects due to the scale of economic framework and organization as well as the need for bureaucratic structures of the processes. Thus, the thesis is limited to midsize and larger firms for the interviews as well as the projects discussed within these interviews.

The thesis mainly focuses on later parts of the design phase, such as detailed design, as well as the construction phase. Focus is therefore also on the contractual relationships during design and construction phase. Thereby this thesis will not look at processes after final hand-over to client to any larger extent. Both clients from the private and public sector will be included in the thesis empirics as well as literature. Some differences between them will be handled although it will not be the main focus. There will be no structured comparison between such organizations or projects. Possible differences or similarities will be briefly discussed during the analysis and discussion in relation to findings done through literature study and interviews.

Delimitations of chosen method and other issues related to choices of method will be handled in the section about method and what impact that may have on the thesis.

2 Method

In this section, the methodology and strategic choices made for the study will be explained and discussed. The alternative options will briefly be presented and reasons for chosen method will be given. The choice made are presented as well as a motivation. In short, the report is a qualitative study with empirics from interviews combined through abductive reasoning with a theoretical framework. A briefer reflection including a methodical reflection will be presented in the final chapter of the report.

2.1 Disposition of method

The chosen methods and tools used in the report are based on the research question made in the beginning of the work. The report consists of a theoretical frame, i.e. a literature study where concepts of environmental management is presented. The literature study is based on peer reviewed articles, text books, trade papers and other publications relevant for the thesis. The results will be compared with how the work is performed in the industry, which will be the second part of the thesis. An interview study will provide knowledge and will serve as an example of how the work is performed today. The interviewees will be of different roles connected to the environmental questions mainly concerning the production to provide a general view upon the work made on a general project.

The analysis of the interviews is the third part which will enable a discussion and comparison to the literature study. Thus, giving an opportunity to answer the research question and make some conclusions of the thesis.

Table 1 The reports disposition and purpose for establishment of method.

Literature study	Interviews	Analysis & Discussion
<p>Aims to:</p> <ul style="list-style-type: none">• Give an understanding of environmental management• Provide knowledge of fields for improvement• Present earlier research within the field of study• Generate a basis for an analysis of real life work	<p>Aims to:</p> <ul style="list-style-type: none">• Give a general picture of how the industry works with environmental questions today• Exemplify the industry's view and driving forces for environmental work• Provide fields and sectors for improvement• Generate a basis for an analysis of real life work	<p>Results in analysis and conclusion of:</p> <ul style="list-style-type: none">• How the work with environmental issues is performed• What improvements that can be made• How to transfer driving forces throughout the project organization• Proposition for further research

2.2 Relation between literature and empirics

The relation between the literature and empirical part are mainly given by three principles, an inductive, deductive or abductive method. The deductive reasoning will first focus on theory, creating a theoretical framework that will lead to a hypothesis. The hypothesis will then be tested through a collection of data and be either confirmed or disproved. The inductive way of reasoning is quite the opposite, instead a collection of data will initiate the study and then the theoretical framework will be constructed and a literature study will lead to a possibility for conclusion based on the collection of data (Bryman and Nilsson, 2011). The third method is the abductive way of reasoning. At first glance it can be described as combination of the other two (Patel and Davidson, 2003), but it should not be considered as a mix of them but is in fact a third and stand-alone method (Alvesson and Sköldbberg, 2008). The abductive method enables an ongoing work with both empirics and literature. The ongoing work means that new findings in either the empirics or the literature can inspire to new findings in the other sector too, enabling a process of back and forth between empirics and literature. If needed such processes can be performed multiple times over a research (Patel and Davidson, 2003).

According to Bryman and Nilsson (2011) the deductive method provide the research with prior knowledge before the empirics thus giving the opportunity for a solid data collection. The inductive method on the other hand would increase the risk for missing out on the data collection. Instead the inductive method's strengths lie within findings that could not be foreseen and thus it can be explained by theory afterwards and it offers a lowered risk for prejudice hypothesis. While the abductive method is a combination of both, it shares their strengths and weaknesses. Thus, the conclusion would be that the advantage of the abductive method is that the researcher is not forced to handle the connection between theory and empirics in a certain way, on the other hand there is a risk of choosing empirics and theory based by earlier experiences rather than having an open mindset (Patel and Davidson, 2003).

Choice of method: The abductive way of reasoning has been chosen to enable ongoing connections between empirics and theory. This assure relevant data will be collected during interviews while also giving opportunity to further investigate theoretical answers on questions raised within the empirics. The pre-knowledge is required to understand, discuss and formulate questions for the collection of data.

2.3 Qualitative or Quantitative research design

The empirics usually are collected through two different categories, qualitative or quantitative research. Traditionally the approaches were tightly connected to the choice of relation between theory and empiric, later this view has been questioned and today it is generally agreed that qualitative or quantitative could be chosen regardless of that relation (Bryman and Nilsson, 2011).

Quantitative research origin from the deductive reasoning and the data is collected throughout statistical studies and structured interviews. This results in easily comparable data and the surveys or examinations can easily be reproduced (Bryman and Nilsson, 2011). Qualitative research instead originated from the inductive

reasoning that is the empirics are gathered before the theory is studied. The qualitative research focuses on deeper analysis and therefore also often has a fewer amount of points of measurements. The disadvantage is that the research will be harder to compare and reproduce in comparison with a quantitative research.

Choice of method: A qualitative approach has been chosen to enable possibilities for deeper analysis as it gives greater opportunities for longer sessions and broader reflections from the respondents. It also enables for respondents to come up with own thoughts and perspectives that can be used in the analysis.

2.4 Interviews

Qualitative studies often consist of interviews since it enables the type of data collection that is needed to provide a deeper understanding. There are three main ways to design interviews, structured, semi-structured or unstructured interviews (Bryman and Nilsson, 2011).

A structured interview is based on several questions, each with a clear purpose and often requires a short answer or a multiple-choice style. Thus, the possibility to reflect upon answers is limited and this method is more of a quantitative way than of a qualitative. It gives a data that is easily compared between respondents. The unstructured interview is instead the opposite. A few, very open questions are used; sometimes only a theme for discussion is presented and the respondent are given plenty time to freely reflect upon the matter. According to Bryman and Nilsson (2011) it provides a scattered data that is hard to compare but the respondent can provide deeper data for analysis and can freely express matters that otherwise could have been neglected. The semi-structured interview is a combination of the two techniques, thus it shares the strengths and weaknesses of the above. A collection of questions or themes are at hand for the interviewer, they can be freely arranged in any order during the interview and time and focus can be shifted, however the questions should be the same for all interviews. The respondents can elaborate the questions that are of importance for them, but answer more shortly on other (Bryman and Nilsson, 2011).

Choice of method: A semi-structured interview guide will be used since the respondents own thoughts and opinions are considered as important for the study. By choosing semi-structured instead of unstructured interviews it will also give a somewhat comparable data which is needed for the analysis. The interviews will be face-to-face interviews and recorded to provide a possibility to go back and check the data if needed. A main guide was developed to function for all interviews, although focus was shifted depending on respondent.

2.5 Selection of respondents

The selection of who to interview is of equal importance as of method for the interview. It can be made through different stages of selection, commonly by already known persons, random sample or a goal-oriented sample (Bryman and Nilsson, 2011). Each selection principle has its dis- or advantages. A selection of already known respondents may result in greater accessibility to roles hard to reach as well as an increased possibility for deeper reflections due to increase comfort zone for the respondent. The downside could be that opinions already align with the interviewer.

The random sample has the opposite possibilities and risk, it offers a wider perspective. A goal-oriented sample is when respondents are chosen out of competencies and/or other pre-evaluated criteria.

Choice of selection: A combination of known persons and goal-oriented samples were made. The authors existing network were used to get in contact with some of the respondents. Although, to be able to reach some roles within the industry and to reduce the risk of already aligned opinions some respondents were selected from a goal-oriented method.

2.6 Data analysis

The chosen qualitative techniques as well as the interview technique provides a possibility to categorize the opinions expressed by the respondents. To do this a method for analysis of interviews need to be applied. There are according to Kvale (1997) five models usually applied, concentration of opinion, categorization of opinion, narrative structuring, interpretation of opinion or ad hoc. In this thesis however, only the concentration, the categorization or an ad hoc method can be applied. The interpretations of opinion are mainly used for a deductive reasoning research method and have high risks of authors influencing and misinterpret the answers. A narrative structure analysis focuses more on what is not said on the interview and is also depending on both experience and extensive analysis knowledge of the researcher (Kvale, 1997).

Kvale (1997) describe the concentration of opinion as a method where the actual wordings by the respondents are reformulated into briefer phrases. The categorization on the other hand is used to categorize the answers into different categories and then divide them into occurrence/nonoccurrence or in terms of the phenomena's strength of occurrence. The categories can either be defined before the interview is performed or afterwards. Through categorization the answers may also be presented throughout tables or figures.

The third option, ad hoc, can be chosen more freely. It is an eclectic method which can be adopted and customized to every study. However, the ad hoc lacks a possibility to reproduce in an easy way and offers almost a non-limited analysis method.

Choice of method: To compile the materials from the interviews and enable a discussion together with the literature a mixture of concentration and categorization of opinion has been made. First, a categorization was made both before the interview and afterwards to be able to handle the data more efficiently and to note if more theoretical research needed to be executed. Then a concentration of the expressed opinions was made to have briefer sentences concluding several of the respondents' opinions. The method could then also be described as an ad hoc method, but since the method used is heavily depending on the above mention it cannot be considered as an ad hoc.

2.7 Method delimitations

While trying to ask questions about a general project there could be a risk that a whole system of environmental management and environmental work is highlighted by singular specific situations that got caught in the respondents' minds. Thus, the selection of interviewees must be done carefully and trying to get a broad selection but with great experience within the field. The risk is then reduced but another risk may be applied, the risk of not fully being up to date with the newest processes or systems applied within each company and rather working with older systems. However, that is one of the questions within the report as well. Therefore, that risk will be investigated within the report.

The choice of abduction reduces the risk for a narrow theoretical part and a prejudged hypothesis affecting the analysis or questions asked. It also reduces the risk for a too wide theory or empirical study as it is an ongoing correlation between literature study and empirics.

Through the choice of qualitative instead of quantitative research the volume of easily comparable data is reduced. However, as the study focus on perceived knowledge and behavior in terms of environmental work the importance of a deeper data analysis outweigh the ease of comparison.

The usage of categorization of the collected data implies a risk of rejecting opinions of low reoccurrence. But by also using a concentration of the same data that risk is reduced. The awareness of this fact is also present during the interviews to make sure the meaning of the respondent is understood correctly and assessed within the right category. Therefore, some follow up questions that may not be in the interview guideline sometimes where asked.

3 Literature Review

The theoretical framework will be presented in this chapter aiming to give the reader a better understanding of the complexity with management and especially environmental management within the construction industry. It will also provide knowledge and fields for improvement and present earlier research within the subject.

The chapter starts with a brief explanation of the structure of project organizations as well as transfer of knowledge and barriers for environmental work connected to those two. It provides information about Environmental Management Systems as well as ISO certification of those and certifications of environmental work. Environmental aspects of procurement and the differences or similarities between private and public clients will round up the literature study.

3.1 Organizational Structures

In order to retain a competitive position on the market, all organizations need to have an efficient organizational structure (Lindkvist et al., 2006). There is extensive amount of research and theories regarding organizational theories both in general and specified for specific industries and organizations. Despite this aggregated research one cannot claim a certain organization structure to be the best fit for a certain organization as a fact. This could change over time and research shows that the ability to reflect and react on changes in the surrounding becomes more and more crucial to keep up with the ever-changing market.

To obtain a successful implementation of organizational changes in an efficient way, the organizational structure for spreading information, knowledge and competence is vital (Lægaard, 2006). This exemplify the complexity of organizational structures. Thus, it could be troublesome to find a general solution to be applied on different organizations as they are individually configured.

3.1.1 The project based construction industry

Construction industry is one of many industries denoted by an organizational form referred to as project-based organizations. It is a term used for a broad variety of organizational forms that are based on temporary systems or setups to perform projects. It is commonly used in industries with complex products and systems but also within consulting companies (Hobday, 2000).

The project-based organization can have different configurations and has been in use for many decades (Galbraith, 1971). The actual configuration can be different depending on several factors such as product complexity, size of organization or the degree of project based organization in contrast to other organizational designs. However, the project-based organization focuses on the projects the organization produces and therefore the structure will be fit to the project. Teams, divisions, leaders and departments will be divided to fit the company's projects. Representatives from each function will at some level be taken part of each major project, e.g. representatives from engineering, management and financial departments in a construction company (Hobday, 2000).

In the construction sector the project-based organization is present both within each company but also within constellations of multiple firms working with the same project (Hobday, 2000). Sydow et al. (2004) mentions these, often short lived, organizations as an advantage due to its lowered risks compared to a permanent organization. Multiple factors contribute to the lowered risks, such as low-cost experiments, no or little irreversible resource commitments of fixed costs and possibility to delimit ventures to smaller units without risking too much.

Through investigating the factors mentioned in previous paragraph a framework can be created. This has been done in a frequently quoted article by Lundin and Söderholm (1995) where time, task, team and transition provide the framework of the temporary or project-based organization. Time is self-explanatory as the key concept of a project is that it has a limited time, a defined start and end. Thus, time establish one part of the frame as the organization is supposed to disperse after completion of the project. Secondly is the task, which also is a key concept of a project. The task consists of the mission or focus of attention of the project; it could be a more standardized task, as in constructing a common and standardized building or it could be a more specific singular task as in creating the most energy efficient building in the world. The task can be divided into a limited number of defined tasks too, and will set the main focus for the whole organization, thus it establishes a second part of the framework.

Time and task provides material and economical resources, the resource of manpower is within the team, which is the third concept. The team will be what often is recognized by the bystanders as the organization. However, they are just one part of the organization in this framework. The team is not calculated only in hours but also in competences inherited by each person. Further, it also includes culture, conceptions and attitudes of the individuals too. Making the selection of the team is a powerful way to manage the organization. Thus, the team is the third part of the framework. The transition is the last of the four factors. It explains the change made by the temporary organization, one of the purposes or one of the tasks is always to create or change something in a qualitative matter, i.e. the improvement that is made is the transition (Lundin and Söderholm, 1995).

The four concepts, time, team, task and transition, can be applied to describe all organizations, however they distinguish the settings of the project-based organization in an efficient way (Lundin and Söderholm, 1995). It also provides a useful tool to identify if the organization is a project-based organization or not. The four concepts describe the organizations key points. Thus, it can also be used to enlighten its strengths and weaknesses. Although part of a specific analysis system they are in close relation with the well-known Iron triangle of projects, where cost, quality and time interact within a triangle. Even more closely related to the elaborated version of the Iron triangle, the square route defined by Atkinson (1999). Where focus is put on the outcome of the project, which could adhere to the transition as mentioned above. To summarize, the project-based organization and its structures are closely related to which scope and settings the project itself has.

3.1.2 Knowledge management in construction projects

Knowledge transfer, information sharing and knowledge management in general is complex by its nature. However, the structure and nature of a project-based organization further complicate the matter. Even though projects, as mentioned before, are an often used tool to enable innovation (Hobday, 2000) the transfer of knowledge and learning between projects is problematic. The short-term goals within a project may be in contradiction to the organizational learning process where longer time span is judged to be crucial (Ekstedt et al., 1999).

The project-based organization structure poses a threat to learning and embedding of new knowledge due to its decentralized nature (Bresnen et al., 2004). The organization will also enable benefits in transferring knowledge through temporary networks containing several other companies or organizations (Hobday, 2000, Bresnen et al., 2004). Therefore, it is important to trace and identify means of knowledge sharing throughout the whole project-based organization, including external sharing of knowledge and not only on pay attention to the internal learning. The decentralization is further complex within the construction industry as a result of the differentiation and broadness of activities (Orlikowski, 2002).

When implementing new management knowledge, such as environmental management, the structure of the project based organization is not the only criteria for success. There is a complex relationship between the structure and the existing project management practices within the organization (Lindkvist et al., 2006, Lindkvist, 2004). Depending on the structure of the project organization and the setup of the team, implementations could have various results. Thus, in some cases a process of implementation could be successful but with other settings the same process could be unsuccessful.

Bresnen et al. (2004) stresses that project managers play a key role in knowledge transferring in project-based organization in terms of management procedures. If their existing toolkit can be improved with tools that will benefit the project goals it will be easier to legitimize the change. Thus, providing means that will be focusing on solving tasks or facilitate completion vital for the project can be an effective way to enable new practices.

3.1.3 Barriers caused by organizational structures

A few common barriers for environmental work can be found within the construction industry. Gluch et al. (2011) divide them into internal and external, the latter is beyond the company's direct control and the first is possible to control. Among the internal a second division is made into, resources, organization and management, information and collaboration. Among resources, the lack of educated employees and the expenses for environmental work is mentioned. In the latter two categories, the lack of organizational structure and lack of experience or knowledge sharing between projects are worth highlighting as the two largest barriers.

The external barriers consist of both the lack of demand on green products or services but also a lack of competitive advantages, lack of cooperativeness from mainly contractor and subcontractors but also from client and a lack of promoting legal systems. The last could indicate that the governing aspects of the legal system are not

facilitating an improvement of environmental work. All the perceived barriers have been increasing the last years. While the reason cannot be determined, Gluch et al. (2011) suggest that one reason could be that the increase in environmental work may have identified more barriers.

Several companies today have a slowly increasing number of employees with environmental expertise. Although, many of them are only partly assigned to the environmental tasks (Gluch et al., 2011). An often-used role is a so called “KMA”, that is Quality, Environment and Work-environment responsibilities combined into one role. Further, more companies seem to establish departments for environmental work (Gluch et al., 2011). However, a majority of the employees are most likely to be found within companies working with architecture or technical consulting. Thus, indicating that the environmental expertise is mainly conceived as a consulting service. Important to note is also that the companies’ environmental manager or responsible is by 2011 within the company’s directorate in about 50% of the studied companies.

The employees liable for environmental questions within the companies seem to agree that it is important that each individual take their own responsibility for improving the environmental aspects. But an increasing number also agree on their own role and responsibility to further strengthen the work with environment within the company as well as their knowledge for doing so. Unfortunately, a large number do express that they lack the authority to stop ongoing activities that risks harming the environment. On the other hand, they feel they can influence strategical decisions, indicating that environmental management is today a strategic question for many companies (Gluch et al., 2011).

3.2 Environmental Management

Within construction industry today, it is not uncommon to use a combined management system for issues related to Quality, Environmental and Safety (QES). Traditionally it is a top-down process, indicating that decisions are made at the top management and then distributed down within the organization (Koehn and Datta, 2003). The QES of today is often integrated versions of the ISO; 9000, 14000 and 18000. However, although often threatened as one it is becoming more common that there is a separate Quality Management System (QMS) an Environmental Management System (EMS) and a Safety Management System (SMS). Many companies use the different systems somewhat separately throughout the organization but in the projects the responsibility rely on few individuals, or sometimes one who is responsible for the whole QES, in Sweden those are the “KMA” (Koehn and Datta, 2003, Gluch et al., 2011).

Implementing an EMS or the QES in an organization may first be perceived as a bureaucratically burden, although one of the main aspects of the QES is to ensure higher productivity, lower costs, improved quality and safer work environments. A common argument for not implementing a management system is an increase of cost and time constraints. However, as the EMS if implemented correctly and used wisely will among other things cut costs, improve market image and competitiveness. Thus, an implementation of EMS should offer a payback on invested time and money (Koehn and Datta, 2003). Further, Koehn and Datta (2003) suggest that a larger

organization more easily would benefit from the EMS as the larger firm easier benefit from the positive sides while the costs can be split up within the organization.

3.2.1 Concepts of EMS

Environmental Management systems (EMS) are implemented in organizations in order to address the environmental impacts due to activities within the organization (Christini et al., 2004). The EMS is defined as a part of the overall management system of the organizational structure (Ofori et al., 2002). By implementing an EMS, organizations gain benefits beyond the addressed environmental impacts caused by their business. Through such management system organizations are able to align with environmental legislation in an effective way, reduce risks related to environmental impacts and reduce costs.

An EMS can be structured in different ways and adjust to a certain organization's need and should be based upon the environmental policy of the organization. In order to do so, certain characteristics should be addressed in the EMS (Christini et al., 2004):

- Goals and methods for meeting environmental requirements
- Structured processes and structured to maintain certain quality of documentation related to the environmental goals.
- Allocation of responsibility for different parts of the environmental issues and description of assigned resources for those tasks.
- Environmental Contingency plan and processes for preventative actions.
- A plan how to train employees to act in accordance with the EMS
- A development plan for continuously improvement of the EMS in order to stay in line with environmental goals and performance.

The benefits of implementing an EMS are plenty. If the bullet-point list above is efficiently adopted the main benefits should consist of both market advantage such as an enhanced corporate image, improved relations with industry & government, greater market share and a higher degree of competitiveness. Other positive effects consists of improvements in the organizations cost control, usage of materials & energy, quality and greater satisfaction from the customer and their demands (Koehn and Datta, 2003). As a result, the EMS should provide both environmental and economic benefits for the companies implementing it (Axelsson et al., 2003). Axelsson et al. (2003) further implies that the EMS will also provide an ongoing development in both sectors and that it will affect organizations in different ways. Thus, the EMS needs to be adapted specifically for each organization to fit its needs and prerequisites.

3.2.1.1 ISO-certification of Environmental Management Systems

The ISO 14000 is a series of standardization for environmental management. One of the most implemented standards among the 14000 series is the ISO 14001 certification for environmental management system that is implemented by companies worldwide (ISO, 2015). For example, more than 158 countries are using the ISO 14001 standard (Koehn and Datta, 2003). By implementing a certification onto their

environmental management system like the ISO 14001, organizations are able to manage their environmental processes and issues in a structured way using international standardization. Such implementation also increase the ability to identify all aspects of environmental impacts by the organizations activities (Edwards, 2003). Furthermore, organizations lower the risk for bias estimations of environmental impacts caused by business activities.

ISO 14001 has evolved from the related Quality Management System (QMS) certification ISO 9001 (Ofori et al., 2002). Many organizations that choose to apply ISO 14001 have often already certified their QMS in accordance with ISO 9001. Implementation of ISO 14001 can also enhance organizational issues beyond the environmentally related ones (ISO, 2015). Companies that have applied ISO14001 witness improved confidence among stakeholders and achieved competitive and financial advantages compared to competing businesses without a certified EMS.

3.2.2 EMS in Construction Industry

Between 2006 and 2011 the proportions of companies working with EMS stayed unchanged. Slightly above 70% was working with EMS and 15% stated that they are implementing an EMS (Gluch et al., 2011). Between 2002 and 2011 the numbers of EMS usage within the construction industry greatly increased. During the period, in between 2006 and 2011, such development had stagnated in amount of EMS usage among companies. Instead the amount of companies working with certified versions of EMS increased significantly during that period. According to Gluch et al. (2011), this indicates that the EMS is an important factor for the companies and especially the certification throughout the ISO14001.

Because of the high usage of EMS several companies have taken management measures for improving sustainability. The amount of companies working with such measures in according to the EMS tends to increase their work with; Routines for judging and affirm legal demands, creating and implementing of environmental policies, using measurable goals for environment aspects, both creating and striving for strategical goals for environment (Gluch et al., 2011). This indicates that the aspect of environment is of strategical importance for companies, which also can be proved by the increasing numbers of companies implementing environmental information within the annual reports. However, to be noted is that many of the mentioned aspects are connected to the content of ISO14001.

Even though there is a consensus about the importance of EMS, there are differences between actors view upon importance of variable aspects of the environmental work (Gluch et al. (2011). The study made by Gluch et al. (2011) indicates that the contractors are falling behind in several processes related to green aspects. Although, it seems to be the case that where organizations have already existing knowledge they are more prone to work with environmental questions related to such knowledge. One example is when calculating LCA for decisions the contractors and real estate companies are keener on becoming an active part than architects and consultants which often has lower knowledge and experience of executing such LCA's.

On the other hand, roles are the opposite when it comes to design phase where contractors are falling behind and real estate companies and architects and consultants

are more active. However, the production and the recycling are factors where most environmental work has been done which are highly connected to the contractors.

Further, the integration of environmental work is highly connected to the EMS, with quality control, goals or safety, or to pure commercial aspects such as PR or strategical decisions. Little connection can be found to effectivity, or social values such as motivation, internal company relations (Gluch et al., 2011). In other studies the quality, goals and commercial aspects are highlighted as the benefits, but also the effectivity should increase (Koehn and Datta, 2003). Further, the motivational aspect is emphasized as an important factor to fully achieve an integrated EMS in the work (Koehn and Datta, 2003, Ofori et al., 2002). The results found by Gluch et al. (2011) may indicate that such integration is not yet fulfilled.

3.2.2.1 ISO 14001 in construction industry

The usage of ISO14001-certifications has increased among companies within the Swedish construction industry during the last decades. This is according to Gluch et al. (2007) a result of it being more common with requirements on environmental management systems in procurement processes. Clients increasingly set demands of environmental management systems through their procurement documents to obtain a certain level and structure of environmental processes within their construction projects. The certification of EMS's within construction companies has increased to a larger extent than the increase of EMS's itself, which according to Gluch et al. (2011) is a product of the increased demands that arising among clients in the industry. In order to obtain competitiveness, certifications as ISO14001 are shown to become more or less a standard for large and mid-size construction companies in Sweden.

Following listed elements is according to Hui Zhang et al. (2000) necessary for the company to develop when applying an EMS to a construction company:

- A planning strategy
- An environmental policy
- An implementation and operation strategy
- An operation and control strategy
- Control and corrective action
- Management review procedures.

Despite the costs related to the certification of EMS, such as an ISO14001, the benefits of such certifications compensate for the cost of implementation and certification (Valdez and Chini, 2002). Through the structured work with EMS the organization is able to develop increased awareness among employees and improve the environmental performance in the organization. Although some research claims overall positive effects of ISO implementations Ofori et al. (2002) mention challenges that comes with such implementation and further processes. One risk for successful implementation is a lack of commitment among employees due to the extra documentation needed, shortage of staff and the need to restructure some processes.

There are some disagreements among authors regarding whether the effects of ISO-certifications are positive or negative for construction companies (Ofori et al., 2002).

Research of the benefits and downsides of ISO is especially done for the ISO 9000 quality management certification that can be seen as a predecessor to the ISO 14001. The opponents to ISO-certifications onto constructions companies QMS and EMS argue that the fragmented nature of the project based construction industry lack the conditions for an efficient and qualitative implementation of ISO-systems.

3.3 Green aspects in procurement processes

In order for public authorities to develop their environmental policies, governments in many countries strive towards increasing integration of environmental preferences onto public financed purchases (Varnäs et al., 2009a). The Swedish government is no exception, which is shown through continuously development of environmental legislation in order for the future to exceed green performance of today. (Sternér, 2002). The building sector is called “the 40 sector” because of the 40 percentage of the total CO₂ impact in Sweden. Therefore, such legislations are partly focusing on the building sector as the impact of regulations and legislations generates considerable effects on environmental performance.

3.3.1 Public procurement

To strive further, public clients are governed to apply environmental aspects in their procurement processes. By applying such green aspects in public procurement documents, it also tends to enhance the environmental performance among private clients as the public procurement functions as a market-like incentive (Varnäs et al., 2009a). Among the Swedish public clients’ 60 percent apply green aspects onto their procurement processes. Although research shows that the impact of such green aspects can appear weak and have small or none effect on the outcome of a procurement decision, as the environmental aspect often aren’t among valued criteria’s. To create pre-requisites for successful implementation of green aspects the clients’ ability to formulate, evaluate and verify such aspects are crucial for an efficient development (Sternér, 2002).

Siemens (2003) states that green procurement strategies can strengthen governmental leadership regarding the environmental governance. This could also create a greater consistency and reliability to the national environmental agenda. Furthermore, emphasizing environmental policies in the public procurement is an often-used method for politicians to influence the industry (Sporrong, 2011). Public procurements also tend to vary according to different political viewpoints in different counties et cetera.

The Swedish government has giving the Swedish Environmental Management Council the authority to facilitate the environmental requirements in procurement for organizations in the construction industry (Upphandlingsmyndigheten, 2015)

According to The National Agency for Public Procurement (Upphandlingsmyndigheten, 2015) there are four ways to require environmental preferences in the public procurement. These are; qualification requirements, technical specification, evaluation criteria and special contract terms, as describe in table 2 below.

Table 2 Four ways of implementing the demands.(remade with information from Upphandlingsmyndigheten (2015)).

Term	Explanation	Example
Technical specification	Mandatory requirements on the goods/services/contracting work	Clients demands PVC free carpets
Evaluation criteria	Award criteria	Criteria for competence about energy efficiency, which may lead to the economic advantage
Special contract terms	Requirements on the supplier that the conditions on the contract are met	Waste management

3.3.2 Private Procurement

Although public clients are believed to be in lead of green procurement development, private clients also tend to enhance green aspects in procurement to a larger extend than previous (Sternier, 2002). Private clients are often driven by other factors than the clients within the public sector. The influences of political decisions and agendas are far less important among the private clients. Instead the market value of green aspects is far more important (Eichholtz et al., 2010). According to Varnäs et al. (2009a) the ability to link green purchasing to business benefits is an important part in order to enhance and develop green procurement among private clients.

Certifications of buildings has become such tool that concretize the value of environmental incentives (Eichholtz et al., 2010). Environmental certified office buildings also tend to have a lower vacancy rate than traditional office buildings. This reduces the financial risk for such facilities and a lower profit rate can be accepted in order to cover the increased cost due to environmental building technics and certifications. Fuerst and McAllister (2011) conclude that there are several positive effects for a private client. The main positive effects are connected to the certifications where rental and assets should be higher. Prices for a certified building could be as much as 25% higher compared to without the certification. To be noted is that there are a majority of non-certified buildings in the market, which may boost the prices for certified buildings. The net operating income, NOI, may also be increased as energy values are lowered and income from rents increased.

The progress is still ongoing and many companies are still in the beginning of adapting green building. This lead to an uncertainty if green building and certifications really are worth what research suggest (Myers et al., 2007). What can be summarized in the research that has been conducted is that there are some clear benefits of sustainability thinking, such as energy reduction which is proven to be directly cost-effective. However, the real value of assets and rental levels are hard to foreseen and according to Myers et al. (2007) it will take a longer time-period to fully grasp the benefits and downsides of environmental friendly and certified buildings. Fuerst and McAllister (2011) suggest that the NOI and rents will change over the time

until equilibrium is to be found. This considers the costs for certificate, the amount of certified buildings and the willingness to pay rents for a certified building. As such the benefits on short hand is great and at a longer perspective it might be of less value but a non-certified building might become very expensive in contrast to a certified (Fuerst and McAllister, 2011, Myers et al., 2007).

In the Swedish market, there are studies that indicate that certified buildings provide increased revenue for the clients (Bonde et al., 2009, Persson, 2009, Van der Schaaf and Sandgärde, 2008). As the contractual relationships between end-user and real estate owner traditionally mean that the end-user does not pay for energy used such a criterion is valuable only for the owner (Bonde et al., 2009). Instead the value of publicity is the important factor for the tenant (Eichholtz et al., 2010, Myers et al., 2007, Bonde et al., 2009). This could be changed if the contracts are arranged so that the tenant pay for energy, although that would decrease the value for the owner (Bonde et al., 2009).

The choice of green building could also be an choice of making it pleasing to the investor, according to Myers et al. (2007) this is becoming more and more important. Many investors have policies where demands are that projects invested in shall have an environmental friendly or a sustainable approach. As such, a private client with need for investors may have easier to persuade them to invest in a project whit green focus.

3.3.3 Environmental Building Certification Systems

As described in previous chapter, there is a uprising awareness among client organizations to regulate environmental practices within the industry in order to enhance the construction of green buildings (Aulin and Elland, 2013). Sweden is well known for its strong environmental awareness and the ability to enhance the development of sustainable cities (Varnäs et al., 2009b). This awareness among actors on the market has created a demand of structured ways to declare choice of technical solutions and actions from an environmental perspective (Eichholtz et al., 2010). The concept of green building consists of many different factors that include environmental, social and economic sustainability. In order for clients to enable monitoring and control-functions, many clients adapt some sort of environmental certification systems (ECSs) in order to ensure the execution of environmental goals (Aulin and Elland, 2013).

Miljöbyggnad is the ECS that is most frequently used in Sweden and the amount of certified buildings are increasing rapidly (Aulin and Elland, 2013). Miljöbyggnad is developed by Sweden Green Building Council (SGBC) and is adapt to Swedish circumstances. Miljöbyggnad evaluate materials, pollutions and indoor environment in the certification process. Miljöbyggnad only take the building itself into account in comparison with international ECS's like BREEAM and LEED which includes production phase and other extended factors such as public transportation within the area etc. (Elland, 2011). There are three levels of certifications. Depending on how well a building manage to obtain the demands set up by Miljöbyggnad the building can be certified into Miljöbyggnad Guld, Silver or Brons.

Miljöbyggnad has during the past years been developed into a new version, which is to be introduced during May 2017 (SGBC, 2017). Wahlström, project manager Miljöbyggnad 3.0 implies the importance for such development in order to keep push the industry towards a more sustainable process (Wahlström and Warfvinge, 2017). The certification criteria of the previous version are to be seen as standard procedures nowadays why they had to be updated in order to meet the environmental demands and goals of today. One example of updates that will arise in Miljöbyggnad 3.0 is the extended prohibition of hazards materials to be built in.

Parallel with the development of Miljöbyggnad 3.0 there is an ongoing debate regarding criteria's in both Miljöbyggnad 2.0 (MB 2.0) and the upcoming 3.0. (MB 3.0) The process of EMS is very complex and includes several indicators and restrictions that could be interpreted in vary ways. It is argued that some of the indicators tend to be target for Green Washing instead of fulfilling the purpose of such indicator (Dotzauer, 2017). Dotzauer (2017) especially discuss indicators regarding energy use and supply. In MB 2.0 the energy aspect of a property only consider energy bought from extern sources and not the actual energy consumption. This is one example of indicators that tend to be misleading and exploited instead of aiming towards the intended purpose of such indicator.

Another example of debate that has occurred during the development process of MB 3.0 is related to indicator regarding waste management within the property.

The vice president of Swedish waste supply association Avfall Sverige Weine Wqvist (Wqvist, 2017) states that MB 3.0 should include stricter requirements for waste separations within the facility. In contradiction to Wqvist, SGBC believes that such requirement generates to high costs in comparison with the benefit and has therefor chosen to stick to requirements through BBR (Wahlström and Warfvinge, 2017).

4 Empirics

In the following chapter the data gathered throughout the interviews will be presented. It aims to give a general picture of how the industry works and acts regarding environmental issues. It will also exemplify the driving forces for the actors involved and provide a suggestion of fields for improvement. The results will then be used in a discussion and comparison with literature study.

The data collected will be analyzed according to the chosen methods and will be presented as such. As the collection of data was done in a qualitative way the amount from each interview is extensive. Therefore, the analysis made through concentration and categorization was necessary to present it efficiently. The categorization fits the subtitles below and the texts are written out of the authors' interpretation of the interviewees' answers and discussions throughout the interview session. The sentences used are therefore not direct quotes unless stated otherwise. The roles of the interviews are stated below.

4.1 Presentation of interviewees

The respondents are from different companies, have different backgrounds and are of different genders. While a spread in ages are present they are all experienced and have been in the industry for several years to provide a broader picture of the questions. They were asked to give a general description of the industry and to involve their experience from different projects throughout their profession. The subchapters briefly describe the interviewed persons and their experience and roles within their companies and the industry. They will remain anonymous throughout the report as well as no companies will be stated.

4.1.1 Public Client (PuC)

This interviewee works as Senior Project Manager at one of Sweden's largest public property clients. They are an integrated part of a Swedish county council who manage their existing and new developed facilities. As a public client with such commitment they manage their facilities during the total life time of the property. With such time span, there is a focus on the total life cycle of a property and may therefore act a bit differently in comparison with a private client. This public client representative has an executive responsibility in major refurbishment projects and new production projects related to the county health care. The interviewee has great previous experience as a client in both public and private sector.

4.1.2 Site Manager 1 (SM1)

He has experience from different construction firms as well as management consulting with focus on technical consultancy on client's behalf in construction projects. He started out as blue-collar worker and has therefore a thorough understanding for the processes of construction. During his employment as consultant management he worked especially in hospital project as technical consultant on the client's behalf. Through such projects, he gains experience connected to environmental issues.

4.1.3 Site Manager 2 (SM2)

As Senior Site Manager, this interviewee has long experience of construction projects. His experience covers both large new construction projects and smaller refurbishment projects. He has during the last 10 years worked solely with partnering projects and before that with both traditional fixed price projects in both Design Bid Build and Design and Build contracts. During the last 3 years, he has managed large complex projects on behalf of public clients.

4.1.4 Environmental Consultant 1 (EC1)

She is an experienced environmental consultant working with management regarding sustainability and environmental issues. The projects she is working with now are mainly consisting of larger projects, such as hospitals, offices and other buildings open for public. There has also been a period of dwellings projects. As an environmental consultant, she is working on behalf of the clients, supporting them in environmental management as an environmental coordinator, from early pre-stages to production and sometimes during the property operation to verify that set goals and targets are met.

4.1.5 Environmental Consultant 2 (EC2)

An experienced consultant from a larger international company who has been working on several different types of projects as an environmental coordinator or consultant. Her tasks are equal to EC1 and are usually working on behalf of the clients. In some projects focus has been more on certain elements of environmental questions such as humidity.

4.2 Application of EMS in construction projects

The site managers that both work in midsize and large construction projects (100< MSEK) identifies the use of the companies' EMS in their projects. SM1 identifies the importance of the company's EMS in the development of projects specific environmental plan. This is done in the beginning of the projects in order to set the boundaries for environmental issues during the project. SM2 also describes the importance of EMS as a tool for structured environmental work during construction phase. EC1 stresses that it is the clients' EMS that is the one involved in the project need to relate to, although it is common that everyone also uses their own companies' EMS. This could be troublesome as individuals working with multiple EMS or policies at the same time. EC2 on the other hand states that they work mainly with their own EMS and then transfers documentation to other consultants or actors, thus not really need to consider other companies' EMS as long as documentation fulfill demands from involved EMS.

EC2 mentions that her company's EMS is closely integrated to their company's QMS. And that the support she gets during everyday job is mainly from the QMS. In fact, the systems are in practice the same system, providing structures for both quality and environmental topics. She believes that on her department, as already of high environmental focus, the EMS will not contribute that much but instead the QMS is

more important. On the other hand, she believes that other departments use the EMS as an aid equally with the QMS.

None of the site managers can answer for specific parts of their companies' environmental policy. Despite that they believe the environmental policy to be well included in the EMS and especially framework-tools for development of project specific environmental execution plans. SM1 describes a development of environmental issues during the past 10 years where he experiences greater focus on environmental issues among the top management today. SM2 also relate to the constantly increasing importance of environmental issues within the company and believe that such development is natural in relation to the development of society. This is also confirmed by EC1 and EC2, whom states that the awareness largely has increased during the past years.

SM1 describes the use of their internal EMS-system in each project as a structural system for handling the administrative part of environmental issues and documentation but experience the set of demands to solely reflect specific demands from the client and not their own company. SM2 also reflect upon the difficulty to see parallels between internal environmental policies and its application in the EMS. Despite the unclear connection both site managers state the importance of EMS in projects in order to monitoring and control the processes connected to environmental issues.

The PuC is convinced that EMS are of great value for structured processes of manage environmental issues, especially among contractors. In order to ensure such structure among contractors in their construction projects they always set ISO-14001 and ISO-9001 certification as criteria's in the procurement of larger construction contracts. He also reflects upon the problem of such procurement criteria's when purchasing smaller firms for minor contracts as those firms rarely have the financial means to manage such certifications as it involves a considerable cost. Such certification cost can be hard for smaller contractors to derive a financial value from. Furthermore, PuC state that such certifications are especially necessary in large construction projects and have less value onto small contracts anyway. EC2 is well aware about the fact that the company's EMS is ISO-certified but unsure what the actual benefits are besides qualifying in some tendering processes.

EC1 often uses their own company's environmental policies in an early stage involving mainly the client and sometimes also the end-user. This is done through discussions, which in turn influences the goals and targets to become more environmental friendly. But also, to explain what it really means practically for the end-user or client. In such way EC1 can help the client to further improve their ambition. Although, the projects EC1 usually are included in is already having a high ambition, thus hiring the services of an EC.

4.3 Environmental management in project organizations

Both site managers state that specific environmental targets and goals in projects are solely set by the client. EC1, EC2 and PuC also confirm this but indicate that it's often the clients' project manager who makes the last decision. The role of the EC is to help and explain the consequences of targets and goals in that stage. EC1 also feel

that the possibility for her to influence projects environmental goals is quite high, while EC2 are more uncertain of her possibilities in this question. According to SM1, EC1 and EC2 clients in general has increased their awareness regarding environment which can be seen as specific increase on environmental targets and demands. As the client set most part of the environmental demands according to the site managers has the policy of their own company a supportive function in the project organization. Furthermore, SM1 implies that the environmental management is depending on the client and their environmental coordinator. He argues that this is a product due to the financial power of the client which is confirmed by EC1 and EC2. EC2 states that in the end its, unfortunately, almost always the money who talks. Despite the clients' important role both site managers argue the importance and value of high environmental focus for the own companies interests apart from the benefit for the client and the project. EC2 states that some actors seem more interested to improve the environmental issues. And that it could be that those companies have other goals than others, such as company policies.

EC1 implies that the environmental management procedures differ not only because of client, clients experience or individuals but also in different type of projects. As an example, in a hospital building the indoor climate, work environment and emissions from materials are of high focus for the end-users. The uniqueness in each project is highlighted as well by both EC1 and EC2. Although working with perhaps the same certifications or ambitions the plans and measures taken may differ widely.

The ever-changing dynamics in a project organization is a source for problems too. An example is mentioned by EC1 where a change of represent ants from the architectural firm in one project occurred. This was a setback since many discussions and decision needed to be explained once again, in this particular-case it was discussions about daylight and window placements. This indicates that documentation is necessary to maintain a continuousness throughout the project. EC2 also mentions this topic but from another point of view. Since actors will be involved in different stage of design and construction, the importance that environmental focus is included in the projects timeline is mentioned. According to her, the risk is that it loose focus throughout the projects continuous process and decisions made early may be lost.

4.4 Environmental Certification Systems

All interviewees are well familiar with the appearance of environmental certification systems (ECS) and its application. They all believe that such certifications are here to stay, and that it will increase due to constantly developed demands on environmental performance. They all have completed several projects where ECS has been applied. Both the site managers are convinced that ECS have a positive effect on the development of environmental issues connected to both design and construction phase. This is a view that the interviewed client also agrees upon. Despite the consensus of positive effects due to ECS almost every interviewee remarks some sort of challenges due to the implementation and fulfilling of the certification process. Site managers experience some challenges regarding which material to be used during construction. Both site managers reflect on some specific material categories that appear to lack of approved alternative to fulfill the criterions of such ECS. One example brought up by several interviewees where the anti-corrosion painting for ground constructions. Such products are needed for the approval of construction

methods which then turn into an opposing demand to the environmental criteria's due to the ECS. Due to experience from previous projects where ECS's has been implemented, the site managers perceive the design consultants to lack knowledge and experience in how to fulfill the environmental demands during construction. EC1 instead mentions that many clients often search to improve their energy demands in contrast to some of the ECS where energy might be lower than the clients wish. Although, that is not a problem since it always possible to have higher demands than those within the ECS. In relation to the challenges of certain ECS criteria's in relation to other demands during construction Both SM1 and PuC emphasize the importance of an experienced environmental coordinator to achieve a successful implementation of environmental criteria's in relation to quality, cost and time.

Important to note is that it is not sure that the ECS will achieve the best environmental output, instead it stands for a quality assurance as of reaching certain targets according to EC1 and EC2. This means that it might be more environmental friendly to use other approaches or other targets, but the benefit with the ECS are the control program that ensures all goals are fulfilled. Because of the verification needed after completion the environmental work will be from the very first stages until the last. Further it gives a certain support for the involved in the project since there is existing documentation as well as predefined goals. Although the bureaucratic burden could sometimes be quite heavy in similar way as with many EMS. EC1 also stresses that there is a risk to focus too much on scoring on the ECS scoresheet instead of focusing on best possible output for environment. She finally comments that the quality and economical aspects of the end-product using an ECS is of great value. There is a slight risk that a choice of a certain level of ECS will make a project stay at that level even though it could produce better values according to EC2. For example, a certain value is reached to obtain the second highest grade in a certification, thus no more improvements are made although it could be possible and not very expensive to go further.

PuC also relate to the great amount of bureaucracy that comes with the certification process. Despite that they have choose to implement such certifications in all their larger new construction projects. He states that ECS's create a structured system that many actors within the projects are well familiar with. Such pre-set of quantitative environmental demands makes it easier to apply onto projects where the organization differs between every project. Apart from demanding a certain level of criterions for the ECS, for example "Miljöbyggnad Guld" this Public Client organization also has environmental criteria's that goes beyond the demands included in the chosen ECS. Such demands are according to PuC and important function in order to lead the development within the industry.

Furthermore, he also reflects upon the certification process that follows after completed the construction. He argues that the implementation of ECS criteria's such as Miljöbyggnad is great even for public clients but believes that the actual certification process may not be necessary. The certifications itself may not have such great value for a public client who's tend to stay owner and user of the building over the lifespan of the construction. Therefore, the marketing value of the completed certification certificate may not be relevant, especially not as it is financed with taxpayers' money he argues.

4.5 Project members' influence and impact on environmental issues

The role of individuals in the project organizations are of great significance according to EC1. The fact that each person has different experience and agenda is often clear. Their ambitions and pre-knowledge are often both assets and disadvantage. It also often represents their companies' ambitions, as such energy is a good example where EC1 states that many clients are well-aware of the benefits of economics behind an energy efficient building but may lack in knowledge about other environmental questions. In many projects, certain energy consultant or energy coordination is present as well, which further indicates the importance of energy efficient for the clients.

According to several of the interviewees, interest for environment have largely increased during the past years. EC1 Believes that its more common today compared with a few years ago that persons with environmental focus are in positions where they can influence the decision-making process to a larger extend than before. Furthermore, she states that more decisions are made, and allowed to be made, by environmental educated employees. Both site managers also argue that environmental issues and roles connected to environmental aspects such as environmental and energy coordinators have greater influence today than a few years ago. PuC also relate to such phenomena as he believes that both public and private clients focus more on environmental issues today which gives such issues a greater legitimacy within the project organization.

EC2 repeatedly stresses the individuals' role in the organization and in the focus of environmental questions. If the individual possesses both the interest, knowledge and mandate to facilitate environmental issues the end-product will become much greener. According to her it is almost impossible to separate companies and or actors in regards of focus for environment but it is all depending on each person. Although, she looks brightly on the future as she believes younger generations take more and more responsibility for environment, an opinion shared by many of the respondents.

As mentioned earlier it is the project manager who often makes the final decision about goals and targets. However, EC1 indicate that the burden might be too much sometimes for one individual and that it is of importance that there are people with both knowledge and experience in environmental issues that can aid the project manager in the processes. Both site managers and clients also argue the importance of such function within the project organization. EC1 suggests that such aid could be from internal support divisions or contracted support from a consultant.

4.6 Public and Private Clients relation to green aspects in construction projects

The driving force behind choosing to build an environmental friendly building is according to EC1 often a building that is easy to use. The operational phase needs to be efficient in terms of economics but also in terms of other resources, such as time, staff and as maintenance free as possible. It also needs to fit the end-user in an effective way, where the indoor climate and other such areas are of importance. EC2 also highlight that private clients argues that vacancy is lowered and that rents can be

higher. Further she states, that during several projects where international investors were present they demanded ECSs to be applied to the project in order to invest. Interestingly she also mentions that there have been a few cases recently where Swedish investors also demands certificates.

A public and a private client may differ in who the end-user will be, creating different demands on the environmental work. A hospital will, as mentioned, focus on non-emissions materials and good indoor climate. An office building needs a low energy output to achieve lower operational costs, but also a well-known certification that can be used as marketing. According to EC1 some projects will be more of an innovative project that may serve as an icon building showing what a company can and will do within the sustainability theme.

EC2 mentions that the reasons behind what ECS or what goals and targets a project may have could depend on private or public client. Although some similarities could be found, as for example operating income always will be interesting for the owner. She also implies that the financial possibilities could differ as public clients can have more money to invest in decisions of political characteristics, which often are the case with environment and sustainability.

Public clients often have other economical demands than a private client, according to EC1. The public client often uses their building for longer time periods while a private client may already have a plan to sell their building in the near future. Although, requiring a high standard and an assurance for the environmental work done. According to PuC, the high environmental performance is also related to quality. By implementing a high environmental standard and avoidance of hazard materials during construction one reduces the risk for interruption for maintenance. Such interruption can be devastating in hospital facilities. He argues that the avoidance of such risks is therefore also financially tenable.

4.7 Impact of contractual forms and collaboration methods

EC1 state that one of the larger challenges she faces is to make sure everyone in the project understand the goals, the visions and the targets. But that is of high importance in an efficient workflow to have everyone working together in these questions since the concretized actions are on so many levels for the different actors. EC2 are having similar thoughts, she states that everyone needs to share the same vision and need to be aware of why things are done. One way EC1 mentions that they do in some projects is to at early stages gather end-user, clients, project design members and if already decided the contractors too. At such a meeting, the goals can be set together; each can contribute with their own opinions and give a greater understanding together. If the contractor is not present already there she states that the same workshop can be done several times during a project. Gather the team members, talk about the goals and have a possibility to by themselves express their thoughts.

PuC also mention the importance of communication and collaboration with the different actors within the construction project as every actor has their view and knowledge that relate to environmental issues in different ways. He also reflects on the differences between contractual forms and conclude that in project where one use

partnering or similar collaboration models the contractors often take a greater responsibility for environmental issues in comparison with a traditional project with fixed priced applied. By implementing partnering with net cost financial model, the contractor is able to spend more resources onto environmental activities in comparison with a fixed price alternative where the contractor has calculated on less effort in order to gain a competitive price offer in the tender process. PuC also state that the environmental progress can be good in a traditional project also without collaboration models applied. Although that demands more resources from the client's organization as the contractor often aren't willing to fund such initiative if it wasn't a part of the tender requirements.

EC2 state that design and build-contracts are somewhat troublesome as there is no clear financial winning for actors involved to create good environmental solutions. Instead there is a risk that the cheapest and easiest way is chosen. She thinks that solutions as partnering and net cost financial models it is possible to obtain better solutions during the project, and where all individual competences and knowledges comes to better use. She also states that there is a possibility for her role to be better used in a project with high collaboration between the actors. This as she today is not very involved in tendering or purchases where her competences sometimes seem to be needed. This is a thought shared by EC1.

5 Discussion

This chapter consist of a discussion and reflection upon the subtopics covered both in the literature review as well as the answers and reflections that the interviewees shared during our sessions presented in the empirics. By connecting references from literature and research with input from respondents within the Swedish construction industry analysis can be made. The discussion and analysis will indicate how the progress with environmental work has been developed within the Swedish construction industry and provide example of areas for improvement. The meaning of incentives and how to improve the transfer of incentives or driving forces will be discussed.

5.1 Interrelations between respondents' reflections

The respondents represent different roles within the project organization. Thus, they should have different approaches to the subjects discussed during the interview sessions. They also have different experiences from different projects they have been involved in. Even though these differences they subsequently showed a similarity in their opinions regarding many of the questions asked. Although there were some smaller variations in expressions the consensus was present.

It also proves that the challenges that exist are shared between several of the actors within the construction industry. Thus, solving the remaining problems and overcoming barriers will benefit several areas and several actors concerned. It is evident that the need to collaborate to achieve such result is important as it concerns so many of the individuals and companies involved in a project.

5.2 Application of EMS in construction projects

There is no doubt that EMS is widely used in the industry. According to the interviews carried out in this thesis and confirmed by the extensive survey Miljöbarometern (Gluch et al., 2011) almost all larger companies has their own EMS. The appearance of several different EMS in each project is mentioned by the interviewees. Although it seems like the clients' EMS will be the system setting guidelines for all contracted companies, each company usually refers to their own systems in the end. This is indicating that the importance of ISO-certification may have a greater role in understanding and bridging different EMSs. In theory, the ISO-certification shows that certain criterions within the EMS is fulfilled, guaranteeing certain key points within each EMS and making it possible to compare different companies' EMS structures. Thus, it serves as a guarantee that the companies contracted possess the knowledge and capability to fulfill certain goals.

The derivation of EMS as to QMS (Koehn and Datta, 2003) is clear in some cases, many of the interviewees state that the EMS has similarities to the QMS and in some cases QES are present. It could be both strength as well as a weakness. The cons are the familiarity to work with a QMS and knowledge about a management system, but it could also strengthen the feeling of another bureaucratic burden, as many of the respondents indicate.

Thus, the usage of ISO is of importance for the contractors and consultants in order to obtain competitiveness on the market. As confirmed by the PuC interviewed the

certification of different ISO in the list of demands can be devastating for companies lacking the ISO certificate. The PuC also mentions that the importance of ISO and EMS is greater in larger projects rather than smaller projects which can be explained by the list of characteristics addressed in EMS set by Christini et al. (2004). Several of the bullet points are complex questions in large projects demanding thoroughly documentation, time and focus. The tendency for contracting environmental consultants in those projects may therefore not be a surprise.

Due to the implementation of EMS and ISO certification companies should develop and adopt an environmental policy (Hui Zhang et al., 2000). Perhaps the clients' policy is the one that today influence each project the most, this as the goals and targets are directly influenced by that policy. It may be hard to translate a policy to concretize objectives for the project why consultant services may be needed. As several of the interviewees states they have limited knowledge of their respectively companies' environmental policies. However, they are certain that it is included and reflected in the EMS they are using. And that the tendency is to further improve questions and issues related to environment. It can be concluded that the EMS indeed is a top-down process where some decisions are made at different levels and not all parts directly affects the adaptation of EMS in each project although the interest is increasing.

In previous research, one of the main concern with implementing an EMS is the bureaucratically burden it may impose to the project as suggested by Koehn and Datta (2003) and as a result, the time constraints and lack of commitment to effectively use the EMS. During the interviews, the bureaucrat aspect of EMS was addressed several times by the respondents. The fact that several EMS are used, i.e. the clients, the consultants, the contractors own, may even further increase the bureaucratic burden. Although it seems like the benefits still outweighed the burden and that the EMS rather improved the bureaucratically aspects as it is supposed to do in theory.

One of the characteristics of EMS is to achieve a structure to handle documentation and contingency plans to aid the work. This is especially highlighted by the SMs as they mention the facilitation of projects specific environmental plans as one of the most important parts of the EMS they use. Such a cause, where tools benefit the goals will be easier to adopt for the SMs or other staff involved, as suggested by Bresnen et al. (2004). Proving the need for knowledge about why and how the EMS should be applied to a project. The tendency for every actor to use their own EMS could also be a sign of the importance of possessing the know-how of the processes and tools within the EMS to successfully utilize it.

5.3 Environmental management in project organizations

EMS is, according to literature, traditionally viewed upon as a top-down-process where decisions made at a higher management level in the projects then are distributed downwards in the project organization. This is something we also show, where policies, EMS and other strategies are decided at one level but executed at another level, pushing down the goals and targets of each company further in the organization.

The interviewees' state that the targets and goals are set by the client and especially the client's project manager further strengthen the perception of a top-down-process. Which reflects how the traditional project organization within construction is

organized. As the financial power is derived from the client, and project manager, the decision making is concentrated to the same. This is, according to some of the respondents a troublesome aspect as the project manager have limited time. Instead a spread of decision making could be a better way to further increase the environmental focus. As suggested by Lundin and Söderholm (1995) the project team consists of not only individuals but also individuals' competences this could transfer decisions to the one with right competence and knowledge. Decisions made at a correct level and with the highest degree of competence in the area could provide a better end-product. This is supported both by theory as of Hobday (2000) and of Bresnen et al. (2004) but also by the interviewees.

It is also made clear by the interviews that those who possess knowledge or fields of interest for certain areas will be keener to improve those. As the SMs implies, their companies' interest and environmental plans reflects their everyday work. Those plans originate from their companies' environmental policies, thus creating an increased focus and interest in that specific area. This fact is supported by the study at Miljöbarometern (Gluch et al., 2007, Gluch et al., 2011) where it is obvious that knowledge, interest and competences influence the focus for individuals and companies.

The dynamics of project organizations is highlighted in the interviews too. Different projects are affected by different problems and therefore require particular solutions. Both the scope of the project that, in support with theory (Atkinson, 1999, Lundin and Söderholm, 1995), will change the organization and the . This implies that not only the EMS need to be flexible and dynamic to fit the needs but also that there is a need for environmental experts in projects to handle, translate and explain the objectives to every part of the organization.

5.4 Environmental Certification Systems

Implementation and quantification of green aspects in construction projects is complex and contains a great number of different factors to take into account. In order to quantify and visualize these green aspect and requirements in a structured way the development and implementation of Environmental Certification Systems has established as a natural part of many construction projects today (Aulin and Elland, 2013). There seems to be consensus regarding the ECS's relevance for implementation onto constructions in order to develop green aspect within the industry. Although there seems to be a consensus regarding the application of ECS there some issues to be solved. In order to be able to monitor and control the application of certification requirements the process derive a large amount of bureaucratic work in order to declare all the ingoing aspects of the ECS. This procedure cost a lot of time and money to fulfill and is therefore a bit questioned whether the system is efficient enough. Apart from the high cost of the certification process it also demands a lot of work during both construction and design phase in order to ensure that every part of the process is done accordingly with the ECS criteria's.

Interviewees involved in construction phase also reflected upon the quick development of ECS requirements in comparison with the pace of environmental improvements within the industry. The bottom line is quite the same as several authors view upon the development of Miljöbyggnad (Dotzauer, 2017, Wijkvist,

2017). The frequently increasing requirements of ECS's are meant to encourage green innovation and development of the industry. Although the desire for development is good it could backfire if the industry is unable to meet the requirements through reasonable actions. In such case there is a risk that the requirements aren't met properly. As the assessment of ECS criteria's can be hard to verify. Such gap between requirements and the industry could give rise to an impression of the ECS standards as green washing. That would be devastating for both the ECS's but also for the industry as there is a great focus on improvements of environmental performance among most actors. Therefore there is a delicate balance needed in the development of ECS criteria's to push the industry forward and the ability for suppliers and contractors to be able to fulfill such criteria's.

5.5 Project members' influence and impact on environmental issues

A successful usage and implementation of management practices, such as EMS, is among other things dependent on the individuals of the organization that the management is applied to according to Lindkvist (2004). In the interviews, this case is confirmed by several of the respondents who states that individuals in the project organizations are of great influence on the achieved results in terms of environmental success. The interviewees mention ambitions and pre-knowledge as examples that may affect the work but between the lines it is obvious that their different agendas, personal reflections and interests as well as possibility to affect decisions may play a bigger role than their existing knowledge.

Individuals within the organization with knowledge about and experience of working with environmental issues have according to the interviews been appointed power to make decisions during the later years. This is also confirmed by Gluch et al. (2011). While the responsibility of environmental issues sometimes relies on a few or even one individual (Koehn and Datta, 2003) the importance of their possibility to have the mandate to make decision is crucial.

As organizations are built on individuals the importance for EMS to be adapted specifically for each organization is easy to understand. This is supported by literature (Axelsson et al., 2003, Edwards, 2003, Lindkvist, 2004, Sydow et al., 2004, Bresnen et al., 2004) but also by the interviewees who state that depending on existing knowledge and experience within the organizations, they will require different degree of support functions, such as environmental coordinators. Those will not only aid the project manager, and thus by theory (Bresnen et al., 2004) aid the implementation of management structures as EMS but also improve the overall environmental work in the organization. The need for those consultants to be involved in an early stage to prevent wrong decisions and promote good attitudes and alignments towards environmental friendly solutions is almost indisputable as both the interviews and studies proves it (Gluch et al., 2011). Involved in a later stage the damage may already have been done and changes may unfortunately be too expensive.

Those individuals, working as environmental coordinators, may need to seek support from external organizations to further strengthen their position within the project organization as well as in the industry. As an example of such there are different environmental forums, groups and institutions within the construction industry. This

would also counter the external barriers as mentioned by Gluch et al. (2011). Further, it could improve the else so problematic knowledge transferring within the industry as it could provide a forum for transferring experiences and knowledge between organizations, companies, project organizations and actors in the construction industry (Hobday, 2000, Bresnen et al., 2004).

5.6 Public and Private Clients relation to green aspects in construction projects

Theory states that there are differences between a private and a public client, where private clients tend to focus on marketing, competitiveness, increased revenues and other market related concerns (Bonde et al., 2009, Eichholtz et al., 2010, Myers et al., 2007). Public clients are instead driven by other factors, such as political decisions, opinions from society and other strategical agendas and lobbying (Eichholtz et al., 2010, Varnäs et al., 2009a, Sporrang, 2011). All these factors are mentioned several times by different respondents during the interviews. Also mentioned by the interviewees, the type of building may be more conclusive for the incentives for the client. Thus, the differences between the public and private may in some cases be reduced. Some buildings are almost solitary connected to one of the sectors, such as offices for rental are connected to private clients.

The respondents mention that vacancy rates are indeed lower for buildings with environmental certifications, and that rates can be higher. This is one of the main aspects as to why private clients may choose to certificate according to Fuerst and McAllister (2011). Another important aspect for the private client is the investors, as theory also states there are today investors who will demand sustainability in projects before investing. According to Myers et al. (2007) several international investors will only go into construction projects where known environmental certification is applied. This is also confirmed by one of the interviewees who has been working with international investors. In addition, the respondent mentions that there is at least one Swedish investor who recently has been demanding certifications too in order to invest.

Public clients tend to focus more on the direct benefits of environmental work rather than the positive effects of the certificate itself. As such, the energy, quality of materials and avoidance of hazard materials is important as well as financial beneficial according to the respondents. This is governed by legislation and political policies (Sporrang, 2011, Siemens, 2003). The public client also often has other financial possibilities than a private client according to our interviews, because of strategic investments. This is one of the reasons to why the public can act as a pioneer in many environmental questions as suggested by Sporrang (2011).

5.7 Impact of contractual forms and collaboration methods

All the interviewees stress the importance of good communication and collaboration in order to retain a good environmental work within the projects. By sharing information and communicate the environmental focus in projects there seems to create a greater understanding for the importance of processes related to such focus. Mainly all interviewees also agree upon the important role of the client in regard to environmental issues and focus. They state that the client's level of environmental demands will set the tone for such focus throughout the project. Furthermore, such focus tends to be dependent on the environmental criteria's set by client in the tender documents during procurement process. There were also consensus regarding the clients almost solely responsibility for setting the level of environmental focuses within the projects and the small influence of project members on such environmental goals.

Gluch et al. (2011) relates barriers for efficient environmental work to the organizational form of construction projects and the lack of continualness. Related to the organizational issues they conclude that the incentives for progressing environmental work is often perceived as weak among many project members. Such reflections were also brought up by several interviewees. The interviewee related to construction companies reflected upon the connection between incentives for exceeding environmental goals and contractual forms where they perceived the fixed priced contracts to be problematic in terms of environmental development. This depends according to the site managers on the traditional focus on costs in that kind of projects which make small or none space to strive further in environmental issues within such projects.

The public client representative also related to differences between contractual forms and financial models, where he also believes that collaboration models like partnering create better opportunities for including contractors and subcontractors in environmental issues. The contractors also believe that the incentives for striving further in the project based environmental work also are enhanced by contractual forms where client includes partnering collaboration and dynamic financial models. They imply that the own company have stronger incentives for such initiatives as it could give great credibility throughout upcoming procurements and tenders where indicators related to environmental processes can give high scores with good reference projects from the past.

Both literature, previous studies and the data gathered in this study shows similar relations between contractual forms, incentives for environmental work and the utilization of competences within the project organization. By implementing some sort of developed collaboration method such as Partnering in combination with financial models applicable for this sort of methods one creates greater opportunities for environmental focus within the project organization. By implementing financial models where each actor has their financial profit secured one can focus on issues that gain the project instead of guard keeping the profit for the own company. Environmental work is one such activity in projects that through that sort of contract relationship have the opportunity to gain a tinged part in the project.

As PuC argue during interview the contractors are given better prerequisites in partnering projects compared with traditional fix price contracted projects due to the higher flexibility economically within the projects. With net cost models, the client is able to strive towards a higher level of environmental development together with the contractors during construction to a reasonable cost. By engaging the contractors in the environmental development beyond fix criteria's in the contract documents one can derive green development supported by contractor's practical experience in combination with environmental experts and visions.

6 Conclusion and further research

This chapter summarize the findings from the discussion. The conclusion aims to answer the initial purpose of the report and will provide suggestions to improve the environmental work as well as describe the current status of the industry. It will also provide suggestions for future research and ends with a general reflection of the report. The main findings are summarized in the titles of the subchapters.

6.1 Together towards green development within construction industry

The consensus regarding both the importance of building environmentally and the challenges as well as the progress that has been made in the Swedish construction industry is distinct. The reasons may vary as to why and smaller variations in what improvements are the most crucial to made in the forthcoming can be found.

The broad effect of every question and the number of involved actors in each question implies that the collaboration in those questions must continue to increase. It is necessary to continue the work towards environmental friendly solutions as the techniques and interest increases. By doing it together in the industry it is possible to faster obtain a development as well as further spreading the benefits.

6.2 EMS both as an assessment and a management system

The EMS serves multiple purposes within a construction project. First, it is the guidelines for how to create documentation, quality controls and as guideline for decision making throughout both the design and construction processes. It also provides a base for a legally binding structure where environmental questions and responsibilities are divided between actors.

According to our study, the usage of ISO certification of EMS provides a comparable version between different companies with different structured EMS. The ISO standard provides a solid base for certain key elements that need to be fulfilled within the EMS. As such, it guarantees the EMS to, at least by the paper, to be in order. Perhaps is this one of the main advantages with EMS and ISO, as they provide knowledge about a company's abilities to work with environmental issues. The EMS can provide one part for assessment in the tendering process, and the ISO could be one way to zero out differences.

The EMS is normally, as many management systems, criticized for being bureaucratic and sometimes massive to comprehend and to work with. On the other hand, as our interviews show perhaps the individuals do not need to comprehend the whole EMS as long as they are aware of what parts are of their concern and their competences. If so, they could as part of a larger organization then take responsibility for their part as other, more experienced, take care of theirs. Further, the EMS does really provide practical tools that aid the work for many of the interviewed. Therefore, we think the EMS is a necessary system to use but also to explain the main benefits as it is easier to work when the advantage is clear.

6.3 Environmental management in project organizations – A client orientated structure

The client often has the overall control regarding as well environmental related as other project related issues. This is a natural effect of the financial supremacy often own by client. Such control has both positive and negative effects regarding the environmental performance in construction projects. As the client has the financial authority to set demands it can be efficient and gain direct effects on environmental issues as it creates short decision processes and high legitimacy. Although both literature and empirics shows that the client's central role in many issues and decision-making processes can also create problems for specific issues as they get down prioritized in the large amount of other parallel processes that need the clients' attention simultaneously.

By delegate the authority of environmental decision-making and strategies to a project member with competences within the area of knowledge, for example an environmental consultant the focus on green aspects within the projects can be enhanced. As previous stated the collaboration and involvement of actors within the projects with diverse competences in the decision-making and conformation of green aspects the environmental performance of the project could be enhanced.

Environmental Certification Systems is according to empirics a good tool for structuring the environmental criteria's in a project in a way that is familiar for many project members. It also eases the environmental management implementation.

6.4 Environmental Certification Systems – One way forward

The number of EMS-certified buildings is constantly increasing in Sweden. It is especially public buildings together with office buildings on the private market that stands for the largest part of certified buildings. It is a common view upon this development and the growing interest for such certifications. EMS creates structural systems for implementing green aspect onto construction projects. Client can see the benefits of using EMSs as it quantifies many environmental aspects in a structured way. By using such certification, the client can easily reach certain standards within the environmental work left to be done.

As Miljöbyggnad is the most used EMS in Swedish construction industry it serves as an example of the processes of environmental certifications. There are a lot of discussions regarding the content and restrictions within the certification, especially the latest version 3.0 to be implemented during 2017. Both literature and empirics shows some issues with the alignment of environmental demands and other restrictions and regulations within the industry. Apart from opinions regarding the strict requirements there is also some concern regarding the large amount of bureaucratic connected to such certification.

Such strict requirements have both positive and negative sides. The idea of strict requirements is to encourage environmental development within construction industry. The downside of these harsh demands is the risk for so called "green washing that tend to appear when one has hard to fulfill such criteria that contractors

and clients takes shortcuts in order to gain the diploma which often is a valuable placard that comes with the certification.

6.5 Improving environmental work through individuals

Both literature and our study show that it is in many cases the individuals of the teams that sets the standard in a project organization. It is their knowledge, competence, interest and motivation that will decide the outcome of the project. This rather than the companies their representing or the role or chair they occupy. It seems that it is the project manager that makes the uttermost important decisions regarding the environmental work and therefore set the standard within the organization. It is also important that everyone take their responsibility to contribute to the final product.

To improve the environmental work, the focus on improving the team and thus the individuals it consists of is indisputable. Therefore, their knowledge need to be improved, not only in terms of technical aspects but more important the reasons to why goals and targets are set. The reasons for what good the choices are for the end-product and why certain decisions are made as they are. Providing the individuals with such knowledge will most likely encourage their interest and understanding for environmental questions. It will also facilitate other projects members wish to get their environmental solutions accepted in the team as the overall acceptance is improved and goals are shared.

6.6 Public and private incentives differ, but results in similar environmental effects

There are indeed some differences in incentives between the private and the public client as proven both in theory and by empirics. While the private client must reconsider market shares, possibility to not only rent the facilities but perhaps also sell it in a perspicuous future. The public client instead needs to focus on facilitating maintenance, longer ownership and operating costs. Investors' demands affect the private client as a governing principle from external stakeholders while the public client is instead directly affected by politics and policies. These policies are usually adapted directly on procurement setting demands and goals at an early stage which is highlighted as very important throughout the interviews conducted.

While the reasons may vary as mentioned above the outcome seems to be not that far from each other. Regardless of the demands it is common that the EMS, the ECS and other tools, targets, goals and principles are set at the same standards. Therefore, the buildings themselves are not constructed in different ways and are usually equally environmental friendly or harmful. The usage of similar certification models may be one way for the industry to improve itself, since the initial increased claims often come from the public sector the private will coherently follow.

6.7 Create incentives for green development beyond project requirements

To reach beyond the environmental requirements, set by the client, contractual forms play an important role. By implementing collaboration methods and agreement like partnering one creates incentives for project members to strive further in order to gain experience and knowledge within the field of environmental development and execution. Apart from the environmental value of such activities all project members can benefit from such activities in upcoming procurement evaluations of partnering contracts and similar. Such procurements consider experience and soft value to a larger extent than a traditional fixed price contract procurement why the contractors and consultant can achieve higher scores if they have performed well due to environmental activities and processes in previous projects.

The results also point to the value of such collaboration methods to achieve a higher level of communication and exchange of knowledge in-between the parties in the project. In partnering projects one also often involve more actors such as contractors and end users in an early stage which improve the ability to get different viewpoints and experience together and implemented in the project. By such early contractor involvement, one can also achieve a greater understanding among the project members for the importance of green aspects which could have important impact during production.

6.8 Further Studies

The construction phase tends to play an increasing role due to the environmental impact of the building sector. As concluded in previous chapter, the need for collaboration among actors in construction projects regarding environmental aspects is important. To achieve such collaboration there is a need for project structures and contractual forms that support such activities and development. Therefore, further studies regarding procurement models and contractual incentives that involve green development are purposed. Following research questions and research areas are suggested:

- How could procurement documents be formed to shed light on the importance of green development and create incitements for such development?
- How to create tender evaluation methods to support and gain environmental experience and achievements?
- Development of collaboration methods in construction project in order to enhance knowledge transfer between project members
- Development of tools and methods to support green innovations and development within project organizations that goes beyond environmental goals set by the client.

6.9 Thesis reflection

The choice of using abduction as a method gave us possibility to enhance our knowledge before the interviews. This gave a possibility to ask relevant questions and better discussions during the sessions with our respondents. But it also meant that we could follow up interesting ideas mentioned by the respondents. This enabled a couple of new fields in the theoretical framework as well as guided our reading and suggestions for future research. In the end, it enabled a deeper understanding for the subject as well as better analysis of the empirics and theory combined. We believe that our choice gave us a better thesis in the end as well as deeper understanding of the topics discussed.

The interview guide, was at great aid during the interview sessions. Several of the sub questions were used although in some cases almost none were needed as the conversation almost automatically covered the subjects intended. We tried to have as open sessions as possible as the opinions of the respondents were of interest for the study. The selection of the interviews has been successful in most cases. Unfortunately, one of the actors we tried to find a date with where not succeeded why we lack an interview with a private client. However, the data obtained from other respondents as well as the literature study contains a lot of information about the private clients' perspective. Thus, the conclusions are still valid.

Overall the work with this thesis gave a greater understand on where the industry is today and where it is heading. A lot of readings, material and reflections did not make it into the report although gave possibilities for great discussions with students, active in the industry and teachers at Chalmers. The consensus between the respondents were surprisingly large, but seems to reflect the general feeling within the Swedish construction industry that can be found within many discussions. Although, they are not recorded or included in the thesis, it strengthens the reliability of the conclusion of this report. Slowly, we are making progress within the field of sustainability.

7 References

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8 Appendix

8.1 Interview Questions

The following questions were used during our interviews. As previously stated those interviews were held in Swedish as the respondent are more convenient to talk their native language.

Introduction

- Explanation of recording and anonymity
- Brief description of the master thesis and its purpose
- Describe briefly who you are and your profession
- What is your role in the project organization regarding environmental issues and activities?

Environmental Management in projects

- Are you familiar with your organization's comprehensive environmental targets and goals?
 - Are those targets and goals present in the daily work in projects?
- How are specific environmental goals and targets set in projects?
 - Why?
- How are environmental goals transferred into demands and requirements in projects?
- Are environmental certifications common in the projects you are involved in?
- What is the value of such certifications for the end user according to you?
- How is the application of ECS working practically in construction projects?
 - What is good?
 - What can be developed further?
- Are environmental goals within projects comparable and equal with requirements in the ECS's or do they differ?
- Do the environmental requirements within projects work well?
 - What can be developed further?
 - Which project roles do you experience as driving forces in those issues?
 - How do those environmental requirements synchronize with your own company's EMS?
- Are you setting requirements regarding the contractors' EMS? (Client Specific question)
- What is the value of certified environmental systems for you as a client? (Client specific question)
- How do you as a client follow up on the contractors' environmental work within projects? (Client specific question)
- Is there any other environmental tools used in your projects apart from those we discussed?
- Do you miss any environmental tool in your construction project?

- What do you believe is the driving forces and incentives for environmental engagement within construction projects?
 - From who is the driving force derived and how does it affect the environmental work and commitment within projects?
 - Is it shifting in-between projects?
- Do you act differently compared to a public/private client? (Client specific question)
- Do you experience the driving forces to reflect upon environmental goals within projects?
- How could incentives for environmental focus and commitment be spread throughout the project members?
- How do you perceive the commitment for environmental issues among project members?
 - Does it differ in-between the different actors/roles?
 - Does it differ in-between projects?
 - What could such differences depend upon?

Environmental aspects in procurement

- How do you take environmental aspects into account in the procurement of contractors and consultants? (Client specific question)
- How do you take environmental aspects into account in the procurement of subcontractors and materials?
 - Does it differ?
- How does contract forms and collaboration methods impact environmental work within projects?
 - How do different contractual forms differ regarding environmental processes?
 - Does it affect incentives and driving forces among actors?
- Is some contractual form more beneficial than other regarding green aspects?
- Do you believe that procurement processes are important for a successful execution of environmental aspects in projects?
 - If yes, explain further

Challenges and opportunities for future development and application of environmental issues

- Which challenges within your organization in order to develop environmental issues and goals?
 - What changes are needed?
- What is needed to be done in order to lighten the negative impact on environment due to the construction phase?
 - Should there be stricter laws and regulations?
 - Or should the construction industry be self-regulated regarding green issues?
- In what/which areas do you believe there is highest potential for improvements?