CHALMERS
UNIVERSITY OF TECHNOLOGY

How contractors implement environmentally sustainable building

A study of compliance with environmental requirements across project organizations for municipal construction projects

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

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DEPARTMENT OF Architecture and Civil Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2024
www.chalmers.se

Master's thesis 2024

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Master's Thesis ACEX30 2024
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Cover: Green building implying environmentally sustainable construction.

Typeset in LaTeX
Printed by Chalmers Reproservice
Gothenburg, Sweden 2024

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Abstract

The continuous growth of the building and construction industry contributes to the sector accounting for one-third of all global greenhouse gas emissions. To reduce emissions and achieve more environmental sustainability in construction, environmentally sustainable directives must be followed globally and nationally. Today, clients are imposing increasingly stringent environmental requirements on their projects, posing a challenge for contractors to meet these demands and align the entire project organization towards the same goal. The study aims to investigate how environmental requirements are followed and complied with throughout the process of construction projects, as well as what drives and hinders their successful fulfillment. To investigate this, a case study was conducted in collaboration with Veidekke, focusing on two public projects located in Gothenburg, Sweden. Relevant actors from both projects were interviewed, including subcontractors, suppliers, site managers, and environmental managers. Furthermore, documents from both projects, such as contracts and environmental plans, were analyzed. The study finds that formulation and organizational issues hinder adherence to environmental requirements in the projects. It also highlights inconsistencies and lack of clarity in contract formulation and implementation, emphasizing the necessity of a monitoring system and clear production follow-up procedures, with a focus on leadership. To enhance compliance with environmental requirements in construction projects, contractors must clearly frame environmental standards for their subcontractors and suppliers. Early inclusion could ensure improved integration of the requirements throughout the project. Furthermore, it is advantageous to have a responsible person in the organization who is solely focused on environmental issues to ensure thorough attention already from the procurement phase into the production phase. An individual who is also responsible for monitoring routines and motivating environmental work throughout the project organization.

Keywords: construction sector, environmental requirements, contractors, suppliers, sustainable construction, contract, procurement.

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Sammanfattning

Den kontinuerliga tillväxten inom bygg- och fastighetssektorn bidrar till att sektorn står för en tredjedel av alla globala utsläpp av växthusgaser. För att minska utsläppen och uppnå mer miljömässig hållbarhet inom byggbranschen måste miljömässigt hållbara direktiv följas globalt och nationellt. Idag ställer beställare allt strängare miljökrav på sina projekt, vilket innebär en utmaning för entreprenörer att möta dessa krav och få hela projektorganisationen att sträva mot samma mål. Studien syftar till att undersöka hur miljökrav följs och efterlevs genom hela processen i byggprojekt, samt vad som driver och hindrar ett framgångsrikt uppfyllande av dem. För att undersöka detta genomfördes en fallstudie i samarbete med Veidekke, med fokus på två offentliga projekt i Göteborg, Sverige. Relevanta aktörer från båda projekten intervjuades, bland annat underentreprenörer, leverantörer, platschefer och miljöchefer. Dessutom analyserades dokument som miljöplaner och kontrakt från de båda projekten. Studien visar att formulerings- och organisationsfrågor hindrar efterlevnaden av miljökraven i projekten. Den belyser också inkonsekvenser och otydlighet i kontraktsformulering och implementering, vilket understryker behovet av ett uppföljningssystem och tydliga rutiner för produktion, med fokus på ledarskap. För att förbättra efterlevnaden av miljökraven i byggprojekten måste entreprenörerna tydligt fastställa miljökraven för sina underentreprenörer och leverantörer. Tidig inkludering kan säkerställa en effektiv integration av kraven genom hela processen. Dessutom är det fördelaktigt att ha en ansvarig person i organisationen som enbart fokuserar på miljöfrågor för att säkerställa noggrann uppmärksamhet redan från inköpsfasen in i produktionsfasen. Samtidigt som personen ansvarar för uppföljningsrutiner och motiverar miljöarbetet genom hela kedjan.

Nyckelord: byggsektorn, miljökrav, entreprenörer, leverantörer, hållbart byggande, kontrakt, upphandling.

Acknowledgements

This master's thesis has been the final assignment of five years of Civil Engineering studies at Chalmers University of Technology, carried out at the Department of Architecture and Civil Engineering.

First, we would like to thank our examiner Martine Buser in the Master Program Design and Construction Project Management for two enlightening and enjoyable years. Most importantly, we want to express our deepest gratitude to our supervisor Janneke van der Leer during this final project for excellent guidance and many valuable meetings.

We would also like to extend a big thank you to Veidekke Bygg Väst and supervisor Peter Gagner-Geeber for allowing us to develop our master's thesis idea and carry it out in collaboration with you. Lastly, we would also like to thank all participants throughout the study whom we have interviewed, visited, and contacted. You have provided us with valuable information, new interesting insights, and perspectives, that have led us to the end of this project. We hope your contributions will help the construction sector towards more environmentally sustainable building practices.

Linn Björk Filander and Emilia Mattsson, Gothenburg, June 2024

Glossary of terms

Client	Beställare
Contractor	Entreprenör
Environmental inspection	Miljörond
Environmental Management Plan (EMP)	Miljöplan
Environmental Management System (EMS)	Miljöledningssystem
Environmental manager	Miljöchef
Environmental Product Declaration (EPD)	Miljödeklaration
Environmental requirement	Miljökrav
Environmental supervisor	Miljöansvarig
Site manager	Platschef
Subcontractor	Underleverantör
Supplier	Leverantör
The City of Gothenburg	Göteborg Stad

Following Swedish words will be used as acronyms throughout the thesis:

Byggvarubedömningen (BVB)	Building material assessment concerning sustainability, environmental impact, and health.
Lokalförvaltningen (LF)	The Local Administration of Swedish cities manages, adapts, and constructs premises and accommodations.
Stadsfastighetsförvaltningen (SFF)	City of Gothenburg's Property Management Office

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1
Introduction

1.1 Background

The continuous growth of the building and construction industry and the high level of production cause more aggressive and negative impacts on the earth (Global Alliance for Buildings and Construction, 2022). At Present, buildings stand for one-third of all global greenhouse gas emissions (Nußholz et al., 2019). This in turn exacerbates global warming, making climate changes more evident - an inevitable reality that requires urgent mitigation efforts. For the construction sector where the embodied impacts of buildings stand for the majority of the emissions, will the focus of mitigation be directed towards the processes of building materials (Nußholz et al., 2019). Achieving sustainability in construction requires adherence to environmentally sustainable directives, both on a global and a national level.

1.1.1 Environmental sustainability

Sweden, as well as many other countries, are working on lowering their greenhouse gas emissions. The goal of reducing its emissions to zero by 2045 is based on the Paris Agreement 2015 (Sadri et al., 2022). This agreement is a legally binding international treaty that 196 parties signed. The primary objective is to limit the increase of the global average temperature to less than 2° Celsius and by pursuing efforts to restrict the temperature increase to 1.5° Celsius, compared with pre-industrial levels (UNFCCC, n.d.).

A second global vision on climate change is the United Nations Sustainable Development Goals (UN SDGs), an Agenda including 17 goals and 169 connected objectives. The intention is to address several global challenges to foster sustainable development by the year 2030 (Johnsson et al., 2020). Among many other countries and as a member of the United Nations, Sweden has adopted these goals as a governmental commitment and with the involvement of multiple stakeholders both within the country and across countries to reach a sustainable transition (STINT, n.d.). Agenda 2030 serves as a political framework for businesses to actively participate in sustainable development by outlining guidelines for what societies and markets will require, expect, and promote in the long term. This means that companies must adopt different strategies to achieve the SDGs. For the construction sector, this must be followed through the whole project process regarding supply chains and multiple operations. Relevant goals for the Swedish construction sector include (Gerhardsson et al., 2020):

- **SDG 11, Sustainable cities and communities.**
  "Make cities and human settlements inclusive, safe, resilient, and sustainable."
- **SDG 12, Responsible Consumption and Production.**
  "Ensure sustainable consumption and production patterns."
- **SDG 13, Climate Action.**
  "Take urgent action to combat climate change and its impacts."

From a global perspective, the Sweden Green Building Council (SGBC) is a constituent of the World Green Building Council (WorldGBC) that is working with supporting construction companies in the implementation of the Paris Agreement and the UN's sustainable goals. WorldGBC consists of companies, governments, NGOs, and approximately 70 Green Building Councils (GBC) and provides standards and guidelines to organizations worldwide (W. G. B. Council, n.d.). The organization SGBC is responsible for the Miljöbyggnad and GreenBuilding certifications in Sweden. Concurrently, they are operating to adapt Leadership in Energy and Environmental Design (LEED) and the Building Research Establishment Environmental Assessment Method (BREEAM) more into Swedish regulations and legislation (Bauer & Johansson, 2013). LEED and BREEAM are two other prevalent certifications that construction companies are increasingly adhering to. LEED is a global certification system launched in 1998 by the U.S. Green Building Council. The system aims to measure, identify, and implement environmentally sustainable construction. BREEAM is a certification system from Great Britain that was launched in 1990 and is the most widespread environmental certification in Europe. Since 2013, the Sweden Green Building Council has been managing the Swedish version of the system (S. G. B. Council, n.d.). Svanen is another domestic certification in Sweden that contributes to less climate impact through energy efficiency and the transition to renewable energy as well as the transition to sustainable materials is an important aspect (Svanen, n.d.).

On a localized international level, Sweden adheres to the European Commission policies. The construction sector plays a significant role in meeting EU energy and environmental objectives, leading to the development of policies outlining a legislative framework. Key policies, such as the Energy Efficiency Performance of Buildings Directive (EPBD) and the Energy Efficiency Directive (EED), aim to create a sustainable building stock by 2050, facilitating investment decisions and promoting cost and energy savings for businesses and consumers across the EU (Sadri et al., 2022). Recent developments show that buildings impact the construction sector through energy in the operational phase and the embodied emissions from material production, usage, and disposal, which emissions are significantly growing. Therefore the Swedish regulatory implemented another important parameter to assess a building's environmental sustainability, Environmental Product Declaration (EPD) (Rasmussen et al., 2021). This is one significant instrument for communicating environmental information. The EPDs are based on the European standard EN 15804, regulated by ISO 14000 series, and widely adopted in the construction industry since 2012 (Bovea et al., 2014). In the year 2022, a new Swedish law was implemented on climate declarations for buildings. This new regulation demands

the client to provide climate declarations to "Boverket" (Swedish National Board of Housing, Building and Planning) for registering. This makes the EPDs play a vital role in requesting declarations for the products and materials in procurement (iTid, n.d.).

1.1.2 Construction sector

To align with the climate goals and to stay attractive on the market, contractors must implement substantial measures. Embracing strategies such as transitioning towards building circularity is crucial and incorporating green procurement practices with clear environmental regulations early in the process can enhance the effectiveness of these efforts. However, construction projects are complex with many different activities, involving several actors and multiple requirements to adhere to (Jonasson et al., 2020).

Contractors play a large role in how the construction sector is performing regarding sustainability. According to Sadri et al. (2022) should contractors be flexible in how they integrate green practices in projects, to achieve a functional balance between environmental sustainability, and economic performance. The individual contractor's performance is heavily influenced by the structure and execution of contracts because it restraints or grants freedom to select the most environmentally friendly products and solutions available. Suppliers and subcontractors must follow what the agreed documents prescribe and provide relevant data and documents as well as develop their internal sustainability work.

When clients impose environmental requirements on construction projects, these requirements can vary from national, standard, or strict levels. However, engaging the entire project organization in working towards these environmental requirements is important. This pressures contractors, subcontractors, and suppliers to contribute to the environmentally sustainable practices in the projects (Sadri et al., 2022). Many of the environmental requirements are about actions to achieve net-zero emissions by requiring projects to have more sustainable materials, less climate impact on transportation, energy efficiency, and waste management (Naturvårdsverket, n.d.). Another example of environmental requirements assessing the sustainability performance of buildings, that most construction organizations have implemented is environmental certifications such as Miljöbyggnad, Green Building, Svanen, LEED, and BREEAM. Organizations' selection of certification depends on the characteristics of the chosen project and which aspects they are interested in measuring. By implementing such requirements in projects, the construction sector is working to reduce greenhouse gas emissions and achieve the climate goals Sweden is striving for (Bauer & Johansson, 2013).

The environmental requirements are not the only requirements to adhere to in projects. According to the Iron Triangle, the success of projects is measured based on whether project management delivers the requirements in time, budget, and quality. These are the standard assessment criteria of a project performance which for

decades has taken up all priority for a project organization. If projects fail to effectively manage all three constraints, the risk of not achieving a successful project is significant (Pollack et al., 2018). Adding more requirements such as environmental requirements to projects, or disconnecting project management increases the risk of failure. Key actors in projects such as clients and contractors can experience that other actors in the project organization are not fully engaged in sustainable issues (Bal et al., 2013). This may fail to fulfill the environmental requirements across the project organization. To fulfill environmental requirements, the project management must be closely integrated with the rest of the project organization and ensure their high priority throughout the whole process (Pollack et al., 2018).

1.2 Aim

The overarching aim of this study is to investigate how environmental requirements are implemented and complied with throughout the whole process of municipal construction projects. As well as what is driving and hindering their successful fulfillment. The intended outcome is to provide recommendations for contractors to make environmental requirements a continuous priority throughout the whole project to ensure their fulfillment across the project organization.

1.3 Research questions

To reach the aim, this study will focus on three primary research questions, with two sub-questions under research questions two and three.

1. **How are environmental requirements implemented in municipal construction projects?**
2. **How is compliance with environmental requirements ensured in procurement for municipal construction projects?**
   What are the driving and hindering factors affecting compliance in procurement?
3. **How is compliance with environmental requirements ensured in production for municipal construction projects?**
   What are the driving and hindering factors affecting compliance in production?

1.4 Research methodology

To answer the research questions, a case study was conducted including an interview study and document analysis. The case study is based on choosing representative projects working with environmental requirements in municipal projects (Flyvbjerg, 2006). These projects involve the construction of two new schools in the city of Gothenburg, Sweden, namely "Torslandaskolan" and "Gitarrgatan förskola", both subject to identical environmental requirements set by the City of Gothenburg. The projects are ordered by the City of Gothenburg, which is the client through the city

facility management (Stadsfastighetsförvaltningen), and Veidekke is the contractor. The interview study is based on actors within the project organization in both projects. The interviews together with the document analysis provided data on how the environmental requirements are complied with to ensure their fulfillment. Further, the interview findings provided relevant information about what driving and hindering factors to successfully fulfill environmental requirements in general construction projects.

1.5 Delimitations

The study is limited to a case study of two municipal projects in Gothenburg, which may affect the breadth of the results. The study adheres to a timeframe, which was the reason for the limited number of projects studied, while also restricting the number of interviewees. Furthermore, the interview study was limited by accessibility and contractor recommendations among the interviewees. Additionally, the study focuses on the available documents internally at Veidekke, which may affect the data representativeness for other stakeholders in the construction industry. The final limitation of the study is the lack of consideration of economic aspects. Lastly, the recommendations are based on the opinions of the interviewees and study investigations to promote environmental sustainability in municipal construction projects.

1.6 Contribution to Practice

The study contributes to the industry by suggesting what is necessary to change in contractor's work procedures to ensure subcontractors and suppliers follow the environmental requirements in the contract. Including insights into what is necessary to change how contractors procure by suggesting changes in the documents regarding environmental requirements. The results of the study further contribute by providing an understanding of what is necessary to change to get environmental requirements to maintain their high priority throughout the whole process. This mostly regards change management in an organization's business strategy in how to involve and communicate the importance of sustainability criteria further down in the organization, changing the behavior and mindset to adherence among the workers. Recommendations are provided to guide contractors on what the subcontractors and suppliers need from them regarding clearance in the contract, support in work procedures at the construction site, improved routines, and education. This study also provides suggestions on how an organization's routines in monitoring and reporting could be adapted to evaluate environmental requirements and further improve environmental sustainability in projects.

This master's thesis has been written by two authors and the workload has been divided equally between them.

2
Literature study

In the following section, relevant literature for the study's research questions is presented. This provides a theoretical background of subjects that are of interest when examining environmental requirements compliance in projects and what can affect the effectiveness and commitment.

2.1 Project structure

Organizational structure refers to the framework defining roles, communication, authority, and responsibilities that govern how work is coordinated and divided within an organization. It includes the hierarchy of positions and the relationships between them, as well as the policies, procedures, and rules that guide behavior and decision-making. The structure of an organization can be influenced by various factors, including the environment, technology, and the goals and values of the organization. More specifically within the construction industry, the project organization involves numerous parties as subcontractors and consultants, and its structure must take into account and impact the relationships and organization of the individuals involved. It is the management's responsibility to reach an effective construction process (Shirazi et al., 1996).

2.1.1 Project-based organizations

Project-based organizations are an organizational structure that is widely adopted in many modern industries and the construction sector is not an exception. This structure is developed for organizations to improve delivery efficiency for projects with time and cost constraints and delivery of specific quality (Wen & Qiang, 2016) (Bahroozyan, 2011). According to Miterev et al. (2017), project-based organizations utilize the management of the temporary organization's projects as their primary business strategy. The structure consists of project teams which in turn consists of employees from various departments that gather their knowledge, skills, and efforts in collaboration to achieve the project scope. The scope is the fundamental principle of project management to successfully complete the project (Bahroozyan, 2011). At the top of the management, there is a project director responsible for reaching the objective of the project and to whom the project team is obligated to report. Developing the project structure clarifies relationships among team members and with the external environment facilitating this process, but to succeed in the first place there is a necessity to design it in a way that makes the structure easy to

implement. Factors such as clear communication and information flow up and down in the organization and operational efficiency to manage the project needs are vital for a functional organization (Bahroozyan, 2011).

2.1.2 Project organization incorporating sustainability

For sustainable construction projects, there is another dimension in the set-up of the organization structure. Organizational leadership plays a central role within a company and acts as the driving force behind the overall strategy, vision, and direction aimed at achieving society's common sustainability goals. Making sustainable development part of the business strategy requires a leader who integrates sustainability strategies into their organizational activities. This includes developing policies, strategies, and guidelines to ensure that the sustainability agenda reaches the entire organizational chain. The construction sector has a major impact on the sustainability of society, with both advantages and challenges. In addition, it makes the leadership role and its responsibilities crucial. The role includes assigning tasks to the organizational team, motivating, and organizing towards the goal (Opoku et al., 2015).

> **A process whereby an individual influences a group of individuals to achieve a common goal.** - Opoku et al. (2015)

In addition, leaders must have the ability to communicate the importance of sustainability and implement a culture with sustainability in mind within the organization. Furthermore, leaders influence individuals to look beyond their own short-term self-interests and instead contribute to long-term success (Opoku et al., 2015).

Leadership is argued to be a key factor for success in organizations. Statically, it has been observed that organizational leadership roles in promoting sustainability initiatives vary based on the organization's size. Regardless of the organization's ability to pursue sustainable practices, it is the commitment and conviction in its leadership approach to sustainability that is the success factor (Opoku et al., 2015).

According to Koppfeldt and Revellé (2017), Swedish construction companies have obtained several employees with environmental sustainability knowledge, but only a few of them are assigned to specific environmental work. A role among the majority of the companies performing environmental work is the Quality, Environment, and Work-environment responsible role. The role has combined work to manage issues related to quality, environment, and safety and is usually done by executing separate or combined systems for each area. In projects, this work relies in most cases on one person, the Quality, Health and Safety, and Environmental (QHSE) role, which in Swedish is "Kvalitets, Miljö och Arbetsmiljö (KMA)".

2.2 Procurement

Procurement refers to "the process of obtaining goods, services, or works" from an external party by carefully comparing factors like quantity, time, and location to

achieve the most favorable price. Construction procurement represents a purchasing transaction and a holistic process capable of satisfying total client requirements. The process involves managing contracts and encompasses activities from identifying project requirements to project closeout. Procurement in construction is considered a crucial element for integrating organizational strategic directions. Recent trends in construction procurement include incorporating modern initiatives such as "sustainability, life-cycle costing, and standardization" (Ruparathna & Hewage, 2015).

There are two primary categories of procurement, public procurement, which involves transactions with governmental organizations or public institutions, and private procurement, which occurs when private organizations enter an agreement (Konkurrensverket (Swedish Competition Authority), 2024). This thesis will not further consider private procurement as it is not relevant to this study. Another relevant procurement category for the thesis to be introduced is green procurement.

2.2.1 Public procurement

Public procurement encompasses the activities of purchasing, renting, and leasing within the public sector. This process mandates public organizations to open their procurement to competition, thereby promoting fairness, transparency, and efficiency in the utilization of public resources. Public procurement is monitored by *Upphandlingsmyndigheten*, and covered by the laws within procurement. Depending on the procurement process and the size of the value, different laws will apply. When procuring objects of higher value, the process involves tender announcements to provide the public with insights into how taxpayers' money is utilized. This transparency facilitates easier control to ensure that the procurement is conducted on a purely business basis (Upphandlingsmyndigheten, 2024).

The Swedish legislation that regulates public procurement consists of four laws that were implemented in Sweden in 2016 based on a new EU Directive driven by an important change in sustainability focusing on social and environmental criteria. One of the new laws is The Public Procurement Act (LOU) which concerns technical specifications, for example, it is stated that environmental characteristics can be included in performance or functional requirements (Colligio, 2019).

In general, requirements in Swedish public procurement must adhere to the following principles (Colligio, 2019):

- Requirements must be linked to what is being procured, not to the entity delivering it.
- It must be possible to control and follow up on the requirements.
- Requirements must not be arbitrary, must have a clear connection to the goals, and must be proportionate. However, they do not necessarily have to yield measurable effects.
- Requirements must not favor or disadvantage specific suppliers.

According to Colligio (2019), is the second requirement of monitoring the require-

ments crucial from a sustainability perspective, as contract monitoring generally suffers from resource shortages. Colligio (2019) also presents some claims of critique. The third requirement about setting requirements linked to objectives, but not necessarily demanding measurable outcomes, can militate the ambition of reaching sustainable outcomes. The fourth requirement also opposes some suspicion toward the ability to reach sustainable outcomes, since the principle of not favoring or disadvantaging suppliers in the same way disbenefit those with a clear sustainability strategy.

One of the most important and central parts of a procurement process is the tender evaluation. The procuring organization is responsible for selecting the tender that best aligns with the specified requirements outlined in the procurement documents. The procuring organization shall accept the most economically valuable tender based on a set award criteria (Upphandlingsmyndigheten, 2024);

- Best combination of price and quality
- Cost
- Price

Regarding the evaluation criterion "best combination of price and quality" implies that a procuring organization can consider other award criteria adding value to the tender, for instance, environmental characteristics (Upphandlingsmyndigheten, 2024). The Green Procurement chapter will further explain environmental considerations in the procurement process.

2.2.2 Green procurement

Green procurement involves incorporating environmental preferences into every stage of the purchasing process. This encompasses identifying environmentally friendly products, services, materials, and technologies to establish specifications for contracts (Leire et al., 2009). The aim is to enhance both organizations' own, and their influence on suppliers, and environmental performance regarding product and production processes (Varnäs et al., 2009a).

Applying green preferences in the process of public procurement incorporates environmental considerations into purchasing policies, programs, and actions. In the European Union, public organizations are required to adhere to rules outlined in the EU procurement directives which give opportunities to incorporate environmental requirements in procurement decisions and tender evaluation (Varnäs et al., 2009a). Typical environmental requirements include, among other several environmental declarations, and Environmental Management System (EMS) (Varnäs et al., 2009b).

2.2.3 Environmental Management

By incorporating environmental goals in procurement, organizations transfer the objectives to their suppliers. Another way to improve environmental performance

for organizations and their suppliers, as well as all employees, is through an EMS. For clients to achieve a specific structure of environmental processes in a project, the demand for EMS increases in procurement which results in a wide adoption of it among construction companies in Sweden and the rest of the world. The ISO 14001 certification for environmental management systems is the most implemented one worldwide, of the ISO 14000 series of standardization for environmental management. For companies to develop an EMS, necessary elements need to include (Hui Zhang et al., 2000):

- an environmental policy
- a planning strategy
- an implementation and operation strategy
- an operational control strategy
- strategies for checking and corrective action; and
- management review procedures.

For Swedish public construction projects, an environmental management plan is also created, unique for the project, and based on the contractor's EMS. This document presents the environmental requirements in the projects together with the contracted organization EMS which makes the project-specific EMS (Lundberg, 2011). It should include the intended activities being conducted by both the contractor and its subcontractors during the project phases (Varnäs et al., 2009b), and information on how to fulfill the environmental requirements set up in procurement (Lundberg, 2011). This is a living document that is continuously being updated throughout the construction phase.

2.2.4 Environmental management in organizations

To facilitate the implementation of an EMS and utilize its full potential, a framework suggested by Chawla et al. (2018) can be introduced in an organization. The framework is constructed for the project-based structured organizations that dominate in the construction industry (Olofsson & Stenberg, 2018). The outline of the framework builds on human resources in three levels, emphasizing the crucial role of decision-makers, policy-makers, and the implementation for promoting sustainability in project management. The three levels are (see Figure 2.1); the management of the project company including directors, policy-makers, and other high-level management positions. The second level is the project manager including middle management such as general managers, these roles can be compared to decision-makers. The third level is the project staff where the implementation of policies and decisions happens in the role of supervisors and junior managers. To ensure the operations within the organization are being performed both effectively and efficiently, it is necessary to establish proper coordination, clear communication, and delegation of responsibilities between the three levels of human resources. To optimize organizational performance in sustainability, a feedback mechanism should be implemented in connection to each level. The feedback loop will comprehensively evaluate every decision, action, and process, assessing both the organization and stakeholders and by gaining insights serve as a guide for informed action, steering the organization

towards achieving sustainability in projects (Chawla et al., 2018).

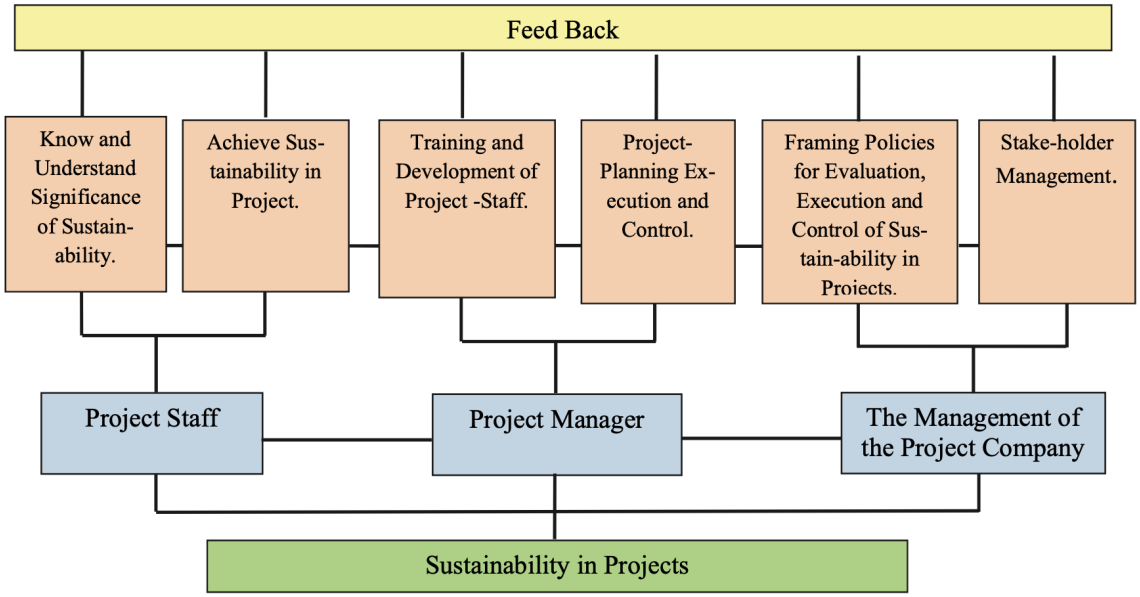

Figure 2.1: Framework for organizations in sustainable projects.

2.3 Contract and contract form

At the beginning of a project, the contractor clarifies and prepares a tender document, RFQ documentation, where requirements and criteria are established regarding the contract form and procurement form. (Boverket, 2023b).

In Sweden, there are two standard forms of procurement; divided contracting and general contracting. The form of procurement regulates which responsibilities the contractors have towards the client simultaneously as it regulates the contractors' responsibilities towards each other. When the client procures contractors in parallel the divided contract form is applied. The client can also procure a general contractor which in turn signs subcontractors in parallel by general contracts (Boverket, 2023b).

More specifically, the contract establishes responsibilities and roles between the various parties in a project and also establishes time, cost, and other relevant aspects. Mainly two different types of contracts are used in Sweden; Design-Build Contracts and Construction Contracts, for subcontractors. For these two types of agreements, standard contracts are most often used, ABT06 for Design-Build Contracts and AB04 for Construction Contracts (Boverket, 2023b). Purchase contracts regulated under ABM07 are a standard agreement for suppliers (Boverket, 2023a).

In recent times, Partnering has been developed and integrated. Partnering aims to simplify and streamline the collaboration between clients and contractors. Through this collaboration, the actors often work in the direction of the same cost target

and share additional costs/profits. The standard contracts usually regulate even Partnering (Boverket, 2023b).

2.3.1 Design and Build in Contract

A Design and Build contract (DB) is regulated by ABT06 and can be identified as a procurement method where the client specifies the requirements for the project and assigns a contract to a contractor who is responsible for both design and production. The contractor is responsible for the entire execution of the project, as well as the requirements contracted by the client such as time, environment, and approach. DB allows the contractor to further procure subcontractors for the services within the project the contractor does not have expertise in (Putro & Latief, 2020).

A DB contract with several environmental requirements has shown a better performance regarding green buildings when compared to the traditional Design-Bid-Build (DBB) where design and construction are carried out by different organizational units. DB generates a high level of project integration in the delivery process, which particularly affects the sustainability goals of the project results (Xia et al., 2015). In addition, Xia et al. (2015) explains that despite DB's efficient way of producing green buildings, the choice of contractor is crucial. The choice of contractor is defined in the Request for Proposal (RFP) process, which is a document where criteria and requirements are set for the design and construction phase. The RFP from the client, together with the contractor, sets the foundation for a project's success in terms of coordination, environment, quality, time, and cost.

2.3.2 Construction Contract

Construction contracts are regulated by AB04 and mean that the client is responsible for the planning phase including the design, drawings, and detachable temporary tools and functions. The execution of the project is the contractor's responsibility. Further, the contractor's performance is determined through the requested document where the client specifies all information about the project and the requirements placed on the project to achieve the client's project goals (Strand, 2013).

Konkurrensverket (2014) describes that it is the clients who determine the quality of the project to be carried out. Construction contracting is effective when the client has important requirements for design and construction. At the same time, it is suitable when there is a lot of time for the design phase where criteria and requirements can be carefully reviewed.

2.3.3 Purchase contracts

Another common contract form is the purchase of goods contract. This is a formal agreement between a buyer and a seller where the focus is on the purchase of goods for commercial construction. This contract has been developed by several committees in the industry. The contract has a framework of conditions and is regulated by

ABM07. The conditions are standardized to include price, payment, delivery, and product information (Föreningen BKK, 2016).

2.3.4 Partnering

Partnering is usually defined as a structured way of working to promote teamwork across the contractual boundaries between the client, contractor, and subcontractors. It can be explained as a management method between the parties to effectively collaborate and share mutual information to achieve a successful project (Ehrlin, 2017). Eriksson (2010) highlights the importance of choosing the right level of collaboration within construction projects. Clients should make an analytical assessment of a project's characteristics (complexity, duration, uncertainty) to achieve a balance between competition and cooperation. A low level resembles traditional business relationships while a high level implies trust, deeper relationships, and a sense of belonging in a team group rather than in an organization.

Furthermore, Ehrlin (2017) describes that partnering has been adopted in most industries and has a positive impact on the project outcome. In a partnership, the parties work with trust, confidence, and openness towards a common goal. Through well-executed collaboration, construction time can be shortened, costs can be reduced and quality can be increased. In addition, successful partnering has a positive impact on global sustainable development. Within the construction industry, environmentally sustainable construction is characterized by an efficient use of resources. If the construction organizations work continuously with the work towards energy efficiency throughout the entire project process and reuse leftover materials, this contributes to global development to a great extent. It is the client who has the greatest opportunity to influence sustainable work, through increased cooperation between contractors (Hultén, 2018).

2.4 Drivers for fulfilling sustainable requirements

The work aiming for a more sustainable construction sector is influenced by several drivers for change. The definition of a driver of change can vary among different persons. A common factor for the conceptual explanation is that drivers can be identified as influences that motivate people to engage and adopt certain green building practices. It may include decisions, actions, or benefits that persuade people to adopt green practices (Oke et al., 2019). In this chapter, some of them are mentioned and described since they are the most interesting for the study's research questions and purpose.

It is clear in the literature that high environmental demands from higher powers have a clear connection to economics and competitive advantages for organizations. Furthermore, the requirements mean that organizations must promote new attitudes and ways of working, which raises the level of knowledge and commitment of the actors in the industry. This is further described in the following sections.

2.4.1 Funding

It is well recognized that cost-effectiveness is one of the most important considerations for implementing green construction (Shi et al., 2013). In many cases, stakeholders are deterred by the high initial costs of green materials and sustainable construction projects. Therefore, financial incentives and funding have been identified as effective driving forces contributing to greater adoption of sustainable requirements in the construction industry (Oke et al., 2019).

To meet the sustainability goals of the Paris Agreement, large investments from the capital market will be required. The capital market is an important component of the economy that enables individuals, organizations, companies, and the state to use capital for operations and investments. Companies that want to invest, often seek financing through shares, obligations, bank loans, and from venture capitalists. Among projects that aim to promote sustainability and combat climate change, green obligations, and green loans are often noticed (Möllersten & Ejlertsson, 2021). In Sweden, the market for green financing is great in terms of volume, mainly in the construction and property sectors (Ayub & Atid, 2022).

Green obligations are a special type of financing instrument used by companies and organizations that seek to invest in sustainability projects. A green obligation represents a debt obligation where the company issues interest-bearing bonds, and the capital raised through the sale of these bonds is earmarked and set aside to be used exclusively for projects and initiatives that promote sustainability and environmental goals (Riksbank, 2020). The Green Bond Principles (GBP) have, together with other actors in the market, become the standards for green bonds. When companies issue green bonds according to the GBP, they create a framework. The framework explains how they choose, evaluate, report, and account for the investments they want to make. At the same time, they must report how they measure the environmental and climate effects, this is reported annually. As a guide, GBP suggests some project categories (Riksbank, 2020):

- Measures to prevent and limit pollution
- Renewable energy and energy efficiency
- Sustainable transport
- Conservation of biological diversity on land and in water
- Sustainable management of water and wastewater
- Green buildings
- Environmentally sustainable land use and management of living natural resources

Green loans are another common type of financial instrument used by companies and organizations. Green loans are offered by investors or credit institutions and are a type of financing that aims to promote the environment. The lenders make several demands regarding measures that contribute to sustainable assumptions. The requirements can be contrasted with more favorable loan terms, such as extended project times and interest discounts for the loans (Ayub & Atid, 2022). There are different types of green loans, green real estate loans, green building credit, and

green mortgages. This makes it possible for all parties to be able to take part in the green loans and they can be used by different parties during the different stages of the construction process (Hanson & Mohammad, 2023). Similar to green bonds, guidelines exist for the design of green loans. These guidelines are encapsulated within the framework known as the Green Loan Principles (GLP), established by the Loan Market Association. The GLP framework refers to the Green Bond Principles in its structure and focal points, yet it is tailored specifically to green loans as a form of financing instrument (Ayub & Atid, 2022).

2.4.2 Attraction on the market

Another driving factor organizations experience is the resulting attraction in the market that increases by incorporating sustainability in the organization. Sustainable development balances social-, and environmental aspects, and economic growth without risking the next generation. Leaders are believed to be an important part of sustainability work and they should integrate sustainability into their organizational strategies for long-term success and business survival. Previously, there has been a focus on the short-term pursuit of maximization of shareholder value described as one of the reasons why sustainability efforts are not successful in all projects. However, there has been a shift toward the work approach to emphasize more long-term strategies to draw attention to and examine the sustainability effects of their operations (Opoku et al., 2015). Larsson (2019) indicates that long-term goals can be more easily linked to sustainability work, which results in projects with strict time frames and short-term goals often prioritizing sustainability work lower. One reason why organizations do not reach sustainability goals is a lack of approach to show the financial gain and measurement that the work results in.

The effect of integrating environmental sustainability practices within construction organizations is numerous and positive. A large part is that resource efficiency is improved while creating a more pleasant environment for the staff. Many organizations today have implemented strategies that minimize energy and water use, waste, and pollution and preserve ecological diversity. In the production stage, the negative effects are most noticeable because building materials, transport, and construction production give rise to large emissions. By more organizations adopting the work, the total environmental impact on the project throughout its lifetime will be reduced. It is argued that the choices of sustainability practices in the construction industry are crucial for the promotion of environmental sustainability. Being aware from the planning phase to the demolition phase is important, which includes choosing the right design values, building materials, methods, and tools. These measures will mean significant cost savings for the organizations in the industry and a significant increase in their competitiveness in the market. Furthermore, the implementation will lead to increased customer and employee satisfaction, more efficient productivity, and increased safety and health. All these aspects will increase the total result and profit (Larsson, 2019).

2.4.3 High requirements from the top

Modern government issues in environmental protection have emerged in an important role since the 1960s. Since the UN conference in Stockholm in 1972, most countries responded by enacting legislation and administrative regulations aimed to control, prevent, and reduce the negative effects of the human factor on ecosystems, air, land, and water. In a broad context, regulation is defined as the diverse set of instruments through which governments impose demands on businesses and citizens (Bamgbade et al., 2019).

High requirements from the top are seen as a driving factor to adhere to environmental sustainability in the construction sector. It has been debated that high political and environmental regulations have competitively threatened actors in the sector. On the contrary, the sector benefits since strict environmental standards promote technological innovation and resource efficiency. Furthermore, it is a source of competitive advantage as organizations need to adopt new efficient processes, new market advantages, advantages in productivity, and lower costs for compliance (Testa et al., 2011). Apart from the competitive advantages, interests from stakeholders such as customer specifications and legislative environmental pressures drive the construction organizations towards environmental responsibility. Satisfactory achievement requires capabilities that are difficult to replace and imitate, mechanisms such as legislation and government policy (Bamgbade et al., 2019).

Furthermore, Bamgbade et al. (2019) discussed that regulations are a central factor for large companies to achieve their internal organizational goals. By working within a clear and stable regulatory framework, companies' environmental capabilities are significantly improved. A favorable regulatory environment including regulations and laws that promote sustainability practices is also required. This enables companies' resource management and contributes to positive ecological performance over time. It has been found that smaller companies tend to be less receptive to regulatory environments and environmental protection policies unless the requirements force them to conform to the framework. Large companies often possess greater resources and can therefore more efficiently adapt their technology and production and reduce environmental impact. Despite this, Larsson (2019) indicates that many companies still fail to achieve their sustainability goals. The reason for this is described as being that the goals are set too high and that the companies do not have enough help in the form of resources or tools. Alternatively, the companies do not make sufficient changes in the way of working so that the goals can be achieved. This is also interrelating to the barrier of lack of commitment from the top as E. Ojo et al. (2014) describe that support from top management is vital for organizations to achieve environmental sustainability in organizations.

2.5 Barriers to adhere sustainable requirements

When reading about hindering factors for environmental sustainability in construction projects, a list compiled by E. Ojo et al. (2014) provided several barriers to

green supply chain management in the construction industry. This list was the starting point in presenting relevant barriers for this master thesis. The study by E. Ojo et al. (2014) listed nine barriers:

- Lack of resources
- Lack of market for recyclable materials
- Lack of knowledge about environmental impacts
- Lack of information sharing between construction firms and suppliers
- Poor commitment by the top management
- Lack of legal enforcement by the government
- Lack of sustainable practices in the organization's vision and mission
- Lack of demand
- Lack of public awareness

Three of these barriers (lack of knowledge about environmental impacts, lack of information sharing between construction firms and suppliers, and poor commitment from the top management) created the first barriers, based on what this study investigated. Additionally, Häkkinen and Belloni (2011) pointed out that the lack of knowledge on how to specify environmental requirements hinders their achievement. Shi et al. (2013) mentioned that commitment from top management is essential to make the whole organization work towards the environmental objectives. Another barrier was identified by Varnäs et al. (2009a), a lack of priority as other aspects of a project are considered more important to address. Furthermore, lack of monitoring as Varnäs et al. (2009b) emphasizes is another barrier to addressing additional aspects of projects such as environmental consideration. This research formed the five relevant barriers this thesis presents in the following sections.

2.5.1 Lack of commitment from the top

Commitment from the top management is identified as an extreme hindering factor for implementing environmental practices in projects (E. Ojo et al., 2014). If the top management is not committed to environmental issues, it is reflected downward in the organization. The employees further down in the organization also do not possess the position of power that can contribute to major changes in management (Shi et al., 2013). Therefore it is vital to have strongly integrated top management in projects because of their ability to influence and support across organizations (E. Ojo et al., 2014). According to a study conducted by Gunduz and Almuajebh (2020) top management support is one of the highest-ranked critical success factors for sustainable construction. The top management can motivate employees and facilitate decision-making and in that way increase project efficiency by providing them with necessary resources. This is also interrelating with what Larsson (2019) discusses in the driving-chapter high requirements from the top, that companies fail to achieve sustainability because of a lack of support from resources and tools.

2.5.2 Lack of knowledge

One of the biggest obstacles to sustainable building can be found in the procurement process where there is difficulty in defining measurable requirements. It should also include specifications of quality control and monitoring of the requirements. If knowledge about specifying these requirements and strategies to work towards these targets is lacking, the challenge of achieving them will be even bigger (Häkkinen & Belloni, 2011). Another knowledge barrier includes the lack of common understanding about sustainability. TİZA (2022) also reported on the low knowledge of sustainability among actors in project organizations. In public-client organizations, it was also found that employees lack awareness and understanding of sustainability. The construction culture is characterized by low risk and a complex supply chain (Häkkinen & Belloni, 2011). Many different actors come from separate ways joining a project organization to complete a project. Therefore it is important to make the whole chain understand and be aware of sustainable practices to successfully meet the project objectives (TİZA, 2022). This is not an easy task since the construction culture is known as passive, where implementing new mindsets and practices comes with great ignorance and resistance (Khan et al., 2018).

2.5.3 Insufficient cooperation

The project organization requires good cooperation between all involved parties to reach the sustainability criteria successfully. Close interaction, effective communication, and participation across all tasks and phases are vital components of the project team. The challenge for the project organization is to manage the whole team in the right way so that innovation, knowledge, and learning influence the organization. One huge factor hindering this project organization's development is communication. It can be communication issues within the organization and between separate companies and actors, and regard language barriers, or poor management failure to communicate with the whole organization. For all levels in the organization to adopt sustainable building practices, the actors promoting environmental directives in the project should be part of the decision-making organ of the project organization (Häkkinen & Belloni, 2011). Construction projects are complex and hard to evaluate regarding sustainable performance. One big reason for this is that the purchase and procurement of materials are often by subcontractors and suppliers disconnected from the project organization. Their action will immensely impact the project organization's sustainable performance and ability to reach the company's sustainability goals (Gundersen & Høydal, 2022). Shattered and disconnected departments within a project organization prevent a fully comprehensive understanding of the supply chain which creates a major barrier to delivering the project with the end-customer focus (Häkkinen & Belloni, 2011).

2.5.4 Lack of priority

Traditionally, successful delivery of construction projects is based on, time, cost, and quality. Hence, conventional project processes fail to consider aspects beyond the technical and economic scope, such as environmental considerations (Varnäs et al., 2009a). According to Shi et al. (2013) both cost and time factors are included in the economic scope. Implementing sustainable solutions such as green techniques often brings extra costs. A project's schedule is generally one of the highest objectives for every involved actor in a project organization. Construction delays in projects affect the actors by different damages in further construction and increased costs. By adding the sustainability dimension of environmental requirements more integration between green practices and techniques with the construction is necessary. If this is not thoroughly regarded, the risk of the project being delayed will be a reality. Therefore, as suggested by Ofori (1992) both clients and contractors should regard projects with four objectives, cost, time, quality, and the environment. To be able to give the environment the proper priority throughout the project requires a shift in attitude and a deepening of knowledge during both the planning and execution phases. Moreover, monitoring the efforts to achieve the project's objectives is essential.

2.5.5 Lack of monitoring

Research has shown that construction projects lack or have inadequate monitoring of environmental requirements. This, in turn, depends on the lack of environmental data or the monitoring activities having high costs according to (Varnäs et al., 2009a). In a study conducted by Gunnesson and Åkelid (2019) it was revealed by a foreman working in production at a construction project that even if certain environmental management systems or other plans support how to manage work to achieve environmental requirements, it is not necessarily used by everyone. The reason it is not fully integrated into projects could depend on the fact that it is not completely understandable and easy to follow. Another study acknowledged the lack of routines and knowledge about how to monitor and follow up on environmental sustainability work (Dalrud, 2023).

For public projects in Sweden, it has been realized from a case study on the Sweden Railway Administration conducted by Lundberg (2011), that projects are lacking follow-up activities. This could be a result of projects relying their environmental work only on an EMS. The study showed that EMS lacks effective tools for monitoring during construction and operation as well as for verifying impact predictions' accuracy or assessing the efficacy of mitigation measures. It focuses on the routines and activities in how to achieve the environmental requirements making the actors pursuing the activity focus on how to act instead of focusing on what should be accomplished by the act. Furthermore, when a follow-up activity is performed, it generally does not document any specific data that could be used for evaluation and knowledge transfer across the organization. The monitoring activity rarely contributes relevant information on how the environmental work was successful or not and how environmental issues were managed. In the studied case, a performed

follow-up activity was also not distributed across the organization which hinders learning and continuous improvement of environmental actions. The temporary project organization is seen as a large hindering factor for monitoring activities, as it consists of multiple actors. Gained follow-up information in the temporary organization is lost when the actors leave the project as the construction finishes.

3
Method

This chapter presents the methodology used to reach the aim and answer the research questions for the thesis. It includes what research approach and research method was chosen as well as descriptions of the case study and the methods included to conduct it.

3.1 Research approach and research method

This master thesis is built upon a case study where the abductive research approach was the starting point. The research strategy is then followed by a deductive approach where the pre-theoretical hypothesis systematically adds arguments validating the abductive hypotheses in the study. This means that empirical facts were gathered through the case study to create a full understanding of the hypotheses in practice. This was done using methods such as interviews in combination with analyzing documents and materials. The data was later analyzed together with literature supporting or contradicting the findings (Åsvoll, 2014).

According to Bell et al. (2022), there are two research methods, quantitative and qualitative research. The difference between these is that the quantitative methods measure and test information or hypotheses with numerical data. Qualitative research focuses on the investigation and understanding of an individual's interests and opinions forming the data that are being analyzed. Since the purpose of this study is to analyze data from practice by different stakeholders in real construction projects, the qualitative research method is the appropriate choice.

3.2 Case study

A case study can be described as a detailed examination of examples providing information, and unlocking hypotheses and preconceived concepts by showing links in several different ways in the practice of cases. Another highlight of case studies is that they allow researchers to rigorously study real-life situations by directly testing perspectives on how they work in practical scenarios (Flyvbjerg, 2006).

There are different types of cases to study that provide different types of information and data. These various types of cases are random sample, stratified sample, extreme case, maximum variation case, critical case, and paradigmatic case (Flyvbjerg, 2006). For this master thesis, the purpose of the case study was to get generalized

insights into how municipal construction projects fulfill environmental requirements. The strategy for selecting the appropriate case for this case study had the purpose of locating a project that is typical and average and could represent generalized outcomes. Therefore random sample in the form of a representative case study was selected to best meet the purpose. For this case study, two representative municipal projects were chosen, which are described in detail in the following sub-chapters. The two projects were considered to complement each other as they are in different construction phases, representing a holistic view of a typical case, and also providing a sufficient amount of data to build the study on.

According to Flyvbjerg (2006) a representative case refers to a typical case within a given context and which is providing generalized findings to a larger population. More specifically for this master thesis, this means that by choosing representative cases the findings can be generalized for other projects having similar set-ups. The purpose is to investigate a certain type of project, which the two projects represent, and present findings for contractors and other actors involved in project organizations that they can take part in and apply to their projects.

3.2.1 School 1

The Torslanda School project is a new construction of a school for grades F-6, accommodating 600 students. It is located in the Torslanda district in Gothenburg, Sweden as displayed in Figure 3.1.

Figure 3.1: Map showing the location of the Torslanda School.

Gothenburg municipality is the client through Stadsfastighetsförvaltningen (SFF) and the project is commissioned by Lokalförvaltningen (LF). The school commenced in April 2022, with an expected completion in June 2024. Veidekke has been contracted for the assignment under a Design and Build contract. Veidekkes assignment includes new production of approximately 8900 square meters and the building is erected on three floors as Figure 3.2 shows.

Figure 3.2: Torslanda School in May 2024 (Private picture).

It is a pilot project following the City of Gothenburg's initiative "Rain Gothenburg", which aims to become a sustainable rainy city. The project is built according to the theme "The best school when it rains" and focuses a lot on sustainability and facing climate change (Veidekke, 2021). The project is not characterized by any specific environmental requirements, but LF has set the City of Gothenburg's standard environmental requirements. A project like this, public projects such as schools, is something Veidekke has worked with a lot and these environmental requirements are also well known. Torslanda School is interesting and relevant to the study's aim as it is a larger project with a project organization of 32 stakeholders, such as architects, suppliers, and subcontractors (ByggfaktaDOCU, 2023). The project is in its final stages, which gives a holistic perspective and a deeper insight into the whole project process.

3.2.2 School 2

The second project that was chosen is a preschool located on Gitarrgatan, in the Västra Frölunda district, Gothenburg, Sweden as displayed in Figure 3.3.

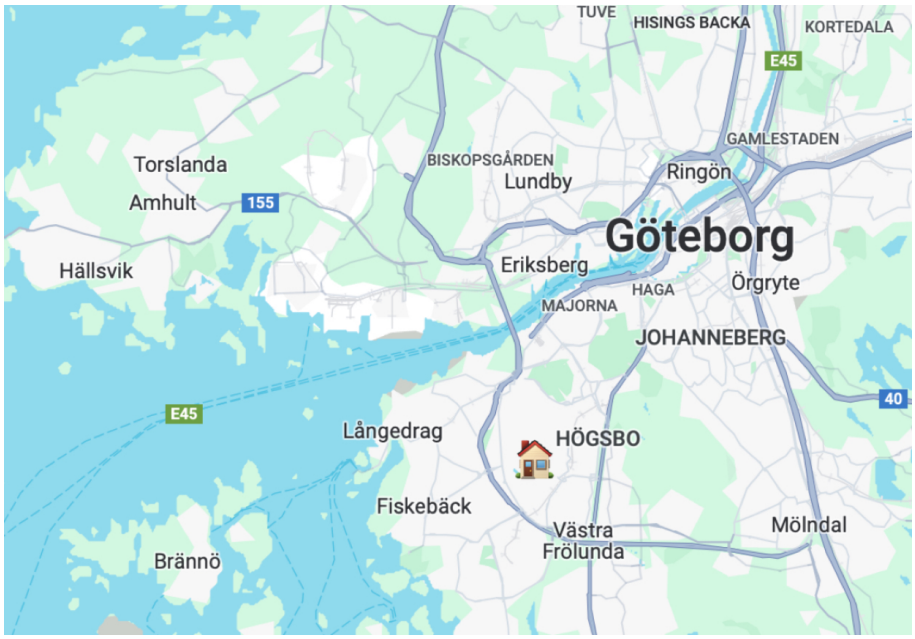

Figure 3.3: Map showing the location of Gitarrgatan preschool.

The previous preschool from the late 1900s century was demolished in the year 2022 and the work of building the new one was initiated right after. The new preschool is a two-story building with eight departments, a staff room, a kitchen and room for 144 children (Göteborgs Stad, 2024). During this case study was conducted, the construction was at the initial stage and the project is expected to be complete in 2025, see Figure 3.4.

Figure 3.4: Gitarrgatan preschool when finished in 2025 (Göteborgs Stad, 2024).

The client and project manager for the assignment is Gothenburg municipality through SFF on behalf of the preschool administration. Veidekke is engaged as

the main contractor in the Design and Build in contract form. Another number of about 40 actors were involved in the project organization, such as architects, consultants, subcontractors, and suppliers (ByggfaktaDOCU, 2024).

The project is also part of SFF for reduced climate impact. This means that the project is constructed with structural solutions with reduced climate impact, for example, wooden structural walls. Wood materials have further environmental requirements entailing a specific certification and label. Concrete is therefore also promoted to be less used in the project but for the tier of logs and foundation slab the concrete is required to be climate-improved on a certain level (Branschaktuellt, 2024). This project gives the study fresh insights as they presently work with the current environmental requirements, making the insights obtained from this project up-to-date and relevant.

3.3 Data and methods

In this section, the method used to collect and analyze the data that is central to this study is presented and described, based on the study's research questions. To gain an in-depth and diverse understanding of the subject under investigation, a combination of qualitative methods was used. In parallel a document analysis and interview study was conducted. Documents were also collected to obtain a broader knowledge base and more data for analysis. Through the document analysis, the research question "How are environmental requirements implemented in municipal construction projects?" was answered. Several interviews were conducted with different stakeholders and individuals, which collected different experiences and perspectives. The interviews further answered the research questions "How is compliance with environmental requirements ensured in procurement and production for municipal projects" as well as "What driving and hindering factors affect compliance in procurement and production". Below, the implementation of the methods is described in more detail.

3.3.1 Documents

The other part of the case study includes gathering relevant documents connected to both projects. These documents work as an extended arm complementing the interviews with further information. The documents provide valuable information, creating an understanding of how project organizations should work according to the demands of the project. These documents include contracts, Environmental Management Plans (EMP) for each project from the client, and the Environmental Management System (EMS) from the contractor. The documents were provided through the supervisor of this thesis working at Veidekke. The contracts were chosen based on the interviewees participating in the interview study. In that way could the documents serve as a tool to understand how the environmental requirements are framed and described for the procured firms in both projects. This was later analyzed together with the interview findings to get a broad knowledge of how the environmental requirements are presented, understood, and assimilated in construc-

tion projects by the different actors in the interview study.

The documents gathered for the case study are limited to the two projects and a total number of 9 documents were gathered. Unfortunately, not every contract for each interviewee was possible to obtain. The correct number of each document for each project is presented in Table 3.1.

Table 3.1: Compilation of documents.

Documents	Actor	Number	School
Environmental Management Plan	Client	1	1
Environmental Management Plan	Client	1	2
Environmental Management System	Contractor	1	Not applicable
Design-build Contract	Subcontractor	2	1
Construction Contract	Subcontractor	1	1
Construction Contract	Subcontractor	2	2
Purchase of goods Contract	Supplier	3	2

3.3.2 Interviews

The study includes an interview study as one of the main parts of the case study. An interview study is an effective strategy for data collection in qualitative research that uses case studies as a research method. Interviews with appropriate people in the subject, provide a broader understanding of behaviors, opinions, and experiences within the research subject under investigation. There are two main types of interviews, semi-structured interviews, and structured interviews (Naz et al., 2022). In this master thesis, a semi-structured study was conducted to achieve a balance between structure and flexibility. Semi-structured interviews are unique, personal, flexible, and based on open-ended questions. The structure of this type of interview is similar to a structured one in that the questions are pre-planned but the order is allowed to be shifted if the interview conversation tends to go in a certain direction. A list of questions was prepared to ensure that the interviewer asked all relevant questions. The questions in the list were formulated and divided appropriately to help the interviewer.

The interview process began with a dialogue with the supervisor for this master's thesis, the supervisor at Veidekke, and the sustainability manager at Veidekke to form an idea of which questions are appropriate to ask based on the aim of this study. With the help of the supervisors at Veidekke, seventeen suitable interviewees were identified and contacted. The selection of the interviewees was based on their participation in the two cases that the study analyzed. The requirement was that they must have been involved in one of the cases. Information about the interviews are compiled in Table 3.2. Each participant's title and role at the two schools are indicated in the tables, along with an accompanying acronym. Furthermore, the size of their organization is presented, as it could impact their ability and resources to manage environmental sustainability.

Table 3.2: Compilation of interviewees.

Role	Organization	Size	Acronym	School
Site Manager	Contractor	Big	Same as role	1
Site Manager	Contractor	Big	Same as role	2
Environmental Supervisor	Contractor	Big	Same as role	1
Environmental Supervisor	Contractor	Big	Same as role	2
Environmental Manager	Contractor	Big	Same as role	Not applicable
Regional head Sales	Subcontractor	Big	Subc1	1
Seller and business developer	Subcontractor	Medium	Subc2	1
Project manager	Subcontractor	Medium	Subc3	1
HR/financial manager/KMA	Subcontractor	Small	Subc4	1
Project manager	Subcontractor	Small	Subc5	2
Owner/carpenter	Subcontractor	Small	Subc6	2
Product manager	Supplier	Big	Sup1	2
Sustainability specialist	Supplier	Big	Sup2	2
Region Manager Sales	Supplier	Big	Sup3	2
Key Account Manager	Supplier	Big	Sup4	2
Environmental coordinator	Client	Big	Same as role	1
Environmental coordinator	Client	Big	Same as role	2

In addition to the interviewees above, an interview was conducted with Veidekke's business development manager who also serves as the project support manager and network leader for the environmental network on the construction side. This was done to gain insights into Veidekke's perspective and operational approach. In the study, the person will be called Environmental Manager.

The purpose of conducting several interviews with different people was to obtain a broader perspective on the subject. The interview questions were formulated based on the research questions to ensure relevance and focus during the interaction. The respondents had the questions, categorized and structured, sent to them in advance to understand the context from the start. The interview questions were generally formulated the same for all respondents but adjusted depending on their role.

During the interview process, the formulation of a few questions was changed and some questions were added. The change was because the interviewees did not answer in the way predicted and sometimes did not perceive the questions correctly. Questions were added during the interview because the authors gained new insights and wanted to add them to the study. Furthermore, is it relevant to mention that some interviewees responded in general to the questions, drawing from other experiences in different projects. Some questions were tailored specifically to one of the two projects, while others were more open-ended. If a person couldn't answer based on either of the projects, they responded generally. The interviews took place in February, March, and April through personal contact and Teams, and were held in Swedish. They lasted for approximately one hour but varied between 40-90 minutes. The two authors of the study were present for each interview. One author took the role of questioner and the other kept track of the audio recording, that all questions were asked and that notes were taken.

During the interviews, the privacy of the interviewees was protected to maintain trust by asking about the General Data Protection Regulation (GDPR) from the start. GDPR is a protection regulation that regulates how personal information and data are managed. Personal data is all information about a specific individual and this can be directly or indirectly linked to the information. The data process must be well-protected, organized, and carried out transparently. Further, the data processing must be approved by the person affected by it. The approach to the interviews began by asking if it was accepted that the interview was recorded to be able to transcribe and analyze results. Furthermore, it was stated that the data would be treated confidentially so that the identity would not be revealed and that the interviewee's consent is valid until further notice, and if the interviewee wants to withdraw, that is perfectly fine (Chalmers University of Technology, 2023).

After the interviews, the audio files were transcribed from audio-based to written information to analyze the most interesting key points and thus contribute to the discussion and conclusions in the report. The study used thematic analysis as "a method for identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006). The analysis followed the steps described by Braun and Clarke (2006). Once the information had been converted to text, the process began by looking for trends and interesting features in the text. The interviewees' answers were then coded according to the themes found, which were further coded with different colors. Once the coding was complete, the responses were divided under headings with different main themes found. Communication of environmental requirements and clear requirements in procurement/contracts were two examples of headlines. Furthermore, the themes were refined to visualize and define the contribution of the responses to the study. When all the data was retrieved and processed, the final analysis of selected excerpts began to be linked to the research question and the literature.

4
Result

In this chapter, the findings of the case study including findings from the document analysis and interview study are presented.

4.1 Implementing environmental requirements in municipal projects on paper

This chapter includes what the work procedures and routines should look like concerning environmental requirements according to the documents, such as environmental management systems and contracts for each project.

4.1.1 Procurement

The environmental aspects of public projects in Gothenburg start with an Environmental Management Plan (EMP), which is created by the project designer working for the department LF which is an establishment within the client organization "Stadsfastighetsförvaltningen" (SFF). This framework outlines the most important environmental aspects and how they are managed and serves as a tender document that contractors consider during the procurement process. It outlines the main environmental and energy requirements imposed on design and construction. It is therefore also directed towards the designers and contractors engaged in construction projects. It serves as LF's tool to ensure their environmental ambitions are realized in the construction projects. Both School 1 and School 2 projects are Design-Build contracts, giving Veidekke solely the responsibility to deliver the project fulfilling the environmental requirements set by the client, SFF. Since LF's EMP is the foundation of all environmental requirements set by the client, this document will be a contractual document that also should be followed in later stages of procurement in the following project phases at all levels.

4.1.2 Environmental Management

LF's EMP covers environmental requirements framed by legal requirements and additional requirements that the municipality separately is working with. The legal requirements are based on the objectives on a national level formed after the Paris Agreement 2015, the UN's Sustainable Development Goals, and the European Commission policies as previously explained in the literature. The environmental requirements that are legal requirements refer to the law in the EMP whereas LF's

environmental requirements in turn refer to additional documents posted by the municipality of Gothenburg, central for all their projects. These kinds of documents are the technical requirements and specifications (TKA) which are the municipality's specific complements to the laws, regulations, and praxis in the design of the buildings. The requirements and specifications covered by technical requirements and specifications include different technology areas such as environmental sustainability. This further gives direction on the framework agreement of blanket releases in the EMP, also reuse, waste management, and specification of climate calculations and reporting of climate emissions for new constructions.

For contractors, such as Veidekke, the overarching requirements to fulfill are found under *Design/Production* in the EMP. It should, in addition to applicable laws and regulations, also address (Göteborgs-Stad, 2024):

- Air pollution and dusting
- Noise
- Selection and handling of materials and chemical products
- Materials and goods
- Management of masses, waste, and hazardous waste
- Vehicles, machinery, and hydraulic fluids
- Climate impact from fuels
- Water management
- Natural values and invasive alien species

The EMP together with the corporate technical requirements and specifications for the municipality form all the environmental requirements set by the client in both projects. This is also what Veidekke as the contractor, is obligated to fulfill. Veidekke also has its own Environmental Management System (EMS) with internal environmental goals they work with in every project. This EMS is not unique for every project but entails goals and objectives for the company based on their corporate environmental goals. These are based on the UN's Sustainable Development goals mostly concerning SDG 13, Climate Action, and the Paris Agreement 2015 (Veidekke, 2024). Veidekke's EMS entails environmental requirements attending the following categories:

- Climate impact from fuels, vehicles, and machinery.
- Management of masses, waste, and hazardous waste
- Selection and handling of materials and chemical products
- Wood materials and goods

4.1.3 Project-specific Environmental Management System

The introduction description of LF's EMP clearly expresses the contractor's further obligations to adhere to the environmental requirements. First of all, at the start of construction, contractors, and in this case Veidekke are supposed to be complementing LF's EMP with routines showing how the environmental requirements are

going to be fulfilled. To this, responsible functions and names to fulfill the requirements, and affected actors in the project organization to ensure the fulfillment shall be added. These new complementing instructions should be added to LF's EMP, making this the only document including how to fulfill the environmental requirements. The creation of this system is a routine requested by SFF in their projects. In turn, Veidekke requests the subcontractor's and supplier's EMS 4 weeks before the start of construction, to be able to complement LF's EMP.

Second of all, Veidekke also has its internal EMS. It can be merged with LF's environmental requirements in the completion of the project-specific EMS or attached in procurement as a contractual document ensuring that none of the environmental requirements in any of the documents have been missed and every subcontractor or supplier in the projects is provided the requirements the same way. Veidekkes internal EMS is attached subordinate to LF's EMP making that one the superior, that the projects must follow during construction. If Veidekke's internal EMS is not merged into this plan, it has to be adhered to as well but LF's requirements are ranked higher if there would be any misalignment between the two.

4.1.4 Procurement of subcontractors and suppliers

The project-specific EMS presents all environmental requirements to adhere to in the projects. This means that when Veidekke purchases goods, services, and works from subcontractors and suppliers the environmental requirements written in the project-specific EMS have to be regarded and fulfilled by every actor in the project organization. When Veidekke also attaches their internal EMS these two documents together present all environmental requirements to adhere to and which all procured companies are obligated to follow at all levels of the project organization.

In turn, when suppliers or subcontractors make further purchases of the environmental requirements one or two EMSs have to be attached to ensure that the environmental requirements are provided to the whole supply chain.

Additionally, some environmental requirements are also expressed in separate chapters in the contract documents besides being attached in the general regulations. This also depends on which type of contract and how they are designed. For this study and in the two projects, three different types of contracts have been located:

- Design-build contract
- Construction contract
- Purchase of goods contract

In the design-build contracts, a separate description in the general regulations highlights a certain requirement considering what database to register the products and materials that are being used in the project. When the construction concerns it, a specific environmental requirement regarding a certain certification on a material type can also be highlighted in the same place of the contract.

For both the design-build and construction contracts, Veidekke requests a quality- and environmental management system from their subcontractors. This is for Veidekke to be able to complement LF's EMP. About fulfilling environmental requirements, there is also a detail in the contract with liquidated damage when not fulfilling environmental requirements. This only regards the environmental requirements concerning vehicles, machinery, and hydraulic fluids since the client, SFF has this demand from the technical requirements and specifications document on the contractor, Veidekke. This, in turn, means that Veidekke needs to put the same liquidated damage on their subcontractors.

Regarding the construction contracts, when the material is included in the contract and if the construction requires it to meet the environmental requirements, a detail in the agreement highlights if the products are required to have any environmental certifications or other more sustainable labels. For example, wooden goods must have a specific label, and concrete products must fulfill a certain level in the scale for climate-improved concrete.

The purchase of goods contract has a detail in the agreement as an addition to the general regulations which includes highlighting that the products in the contract shall be approved and registered in the database "Byggvarubedömningen" (BVB) and Environmental Products Declarations (EPDs) for products that have it shall be provided. BVB is a system whose criteria assess products and materials used in construction based on their environmental impact and chemical ingredients. In this system, all stakeholders must register the products they intend to use.

4.2 Implementing environmental requirements in municipal projects in practice

This chapter describes how the environmental requirements in the projects are implemented, presented, and understood in project organizations. The interview findings have been divided into separate sub-chapters locating different inadequacies in how project organizations work with and adhere to the environmental requirements based on the two projects of the case study and general experiences.

4.2.1 Environmental requirements in procurement and contracts

Most of the interviewees think that the environmental requirements are well-defined from the beginning in the procurement phase and not difficult to comply with in the following phases of their construction or service. According to Sup1 and Sup2, the invitation to tender documents clearly presents the environmental requirements. Further, they expressly state that the requirements concerning their delivery were very clear in the contracts during procurement. They refer to the detailed description in the agreement describing the requirement for a more sustainable product with a certain label. Subc1, Subc2 and Sup4 agreed that it can differ about the environ-

mental requirements evidence in the early stages of procurement but emphasized that they are shown clearly in the contract as attachments.

> ***"In procurement and contract Veidekke is referring to LF's EMP so it is very clear what environmental requirement applies."***
> **- Subc2**

Sup1 and Subc4 highlight the importance of environmental requirements being clear from the start. When utilizing materials that may present challenges for the staff or differ in their application during production, it is crucial that the pricing remains consistent with the conditions provided. With more clarity, justice is also created among the actors who submit tenders. Sometimes people may miss reading certain parts of the bid, causing a lower price to be set, while those who have read everything have set a higher price.

However, some subcontractors and suppliers think that the environmental requirements are not clear in the procurement or contracts. Sup3 did not know the environmental requirements beforehand this interview took place. This supplier takes the second position in the supply chain since they sell their products through a distributor in the project. The distributor did not provide their supplier with the environmental requirements but during the interview, it appeared the distributor rather communicated the necessary characteristics for the products to pass the requirements.

The environmental requirements evidence in the procurement or contracts can also depend on the subcontractor's and supplier's own responsibility to assimilate it. According to Subc5, the environmental requirements are both clear and not clear. This depends on a couple of different factors as explained by Subc5:

> ***"The environmental requirements were clear already in the invitation to tender document but I have not prioritized reading all of them. Many of them are standard requirements these days making my environmental sustainability work not so varied. In this project, most of the material was provided for us which lowered the necessity of reading all of the requirements."***
> **-Subc5**

Another factor explaining the lack of evidence of the environmental requirements among subcontractors and suppliers also depends on not knowing where to find them. Sup4 believes that the environmental requirements in the project are included in some parts of the framework agreement they have with Veidekke, which proves the ignorance of where they are found. According to Subc6, there was too much text and numbers to read the EMS to catch all environmental requirements. According to Subc3, the environmental requirements were not explicitly clear in the contract document when compared to other procurements with other contractors that might put specific environmental requirements in detail in the agreement and

not in the attached contractual documents. In that way, Subc3 emphasized that the contract does not contain what environmental requirements apply to the project. According to the Environmental Coordinator for School 1, there is also an inconsistency in what environmental requirements clients set in projects which also builds on the ignorance to embrace them. Having to adjust to many requirements in different projects, creates difficulties for contractors and suppliers to manage all of them successfully, as acknowledged by Sup2. The difficulty of managing and adhering to the requirements can be due to conservative behaviors as emphasized by Subc1. In the construction sector, actors work in old tracks, adding more dimensions, such as environmental sustainability and managing environmental requirements, brings extra administrative work. This affects the daily work by taking up extra time and resources and is not something every actor is willing to adapt to, as acknowledged by Subc3 and the Environmental Manager.

Despite various experiences regarding evidence of the environmental requirements in procurement, several interviewees emphasized the importance of having them. Environmental requirements were also seen as a driving factor for sustainable construction. The commitment to working towards environmental goals and reducing the climate footprint was emphasized by Sup1, Sup3, Subc1, Subc3, Subc5, and Veidekke. They believe it's a responsibility for all, viewing internal environmental goals as crucial drivers for progress. Additionally, meeting these goals not only benefits the environment but also presents a business opportunity and enhances market competitiveness.

For actors to be attractive on the market is another key motivator for environmentally friendly practices in projects. The suppliers Sup4 and Sup1 stress the importance of being ahead in sustainable construction to stay competitive. They highlight how meeting high demands such as legislation and demands from top management drives attraction and market value. The Site Manager and Environmental Supervisor for School 2 advocate for even stricter environmental regulations, to widen and urge the adoption of sustainability practices for actors on the market. Furthermore, the Environmental Manager indicated that heightened client requirements increase employee engagement, fostering environmental awareness and motivation.

4.2.2 Environmental Management System

As the contractor in the two projects of this case study, Veidekke is supposed to create project-specific EMS before the start of the construction. According to the Environmental Manager, this activity is conducted slightly differently for different projects within Veidekke's internal organization depending on several factors. One factor is SFF's requirements for the project. If these environmental requirements are subordinate Veidekke's internal ones, there is no need to merge them. In that case, LF's EMP will be the one the project will follow. It depends on how far the clients have progressed, and how good their environmental management is. The Environmental Manager further explained:

"Either we ensure that our requirements are covered in their

Environmental Management Plan or we take their requirements and ensure they are included in our Environmental Management System. The key point of creating a Project-Specific Environmental Management System is to clearly describe what the environmental requirements entail, how to fulfill them, and the responsible roles for fulfilling them. Also, and perhaps most importantly having a follow-up routine checking that the environmental requirement is fulfilled by final documentation, protocol, or certification signed by the responsible roles."
- Environmental Manager

The second factor is from start to have sufficient support from the environmental department within the organization to be able to create the best solution for the project-specific EMS. The support should also follow during the construction phase to be able to ensure it is well established within the project organization for the respective projects and monitor that everyone follows it.

The third factor according to the Environmental Manager is having an environmental supervisor in the projects that motivates and pushes this kind of work with the EMS within the project organization. It is also important that the environmental supervisor in the projects is not performing this work alone but delegates the work further in the project organization to make it even more established.

As already explained in the chapter above, LF's EMP and Veidekke's EMS are contractual documents attached to every procurement of the projects. According to Environmental Supervisor 1, the EMPs with the project's environmental requirements are provided for the first time in tendering and later on, attached to the contract. During the design phase, LF's EMP was complemented with activities from the contractors involved which created a project-specific EMS for the design. According to the Environmental Coordinator for School 2, a project-specific EMS for production was not created before the start of construction. The environmental requirements for production were instead addressed during regular environmental inspections and routines for these are complemented gradually as construction proceeds. Site Manager 1 further explained that they go through the EMP for the project with relevant roles from each firm before they start their construction. This is the second time they are expected to read and understand the environmental requirements where also a signing is stating this.

Whether subcontractors and suppliers assimilate the environmental requirements varies in several aspects. The suppliers that deliver goods to the projects through distributors are not provided with the documents with the environmental requirements. Even though subcontractors and suppliers are provided with them, it does not mean that they will read it.

> ***"The EMP contained too much information for me to be able to read."***
> **- Subc6**

One of the subcontractors, Subc3 explained they were given the EMP at registration at the site of the project, but that it did not contain much information relevant for them to regard. It was also too long ago it was provided even to remember what it contained. Subc3 also emphasized it would be beneficial to have some clearance about the environmental requirements in it. That the environmental requirements had not been assimilated properly by other subcontractors was noticed since Subc5 expressed uncertainties about what requirements were applied regarding vehicles and hydraulic fluids in the project. Subc4 also expressed uncertainties about whether they even were provided the environmental requirements as they did not know about any other document besides the contract and order document.

4.2.3 Assurance of compliance with environmental requirements

Whether subcontractors and suppliers ensure that their work, goods, or services fulfill the environmental requirements in the projects varies. This study has located three ways for subcontractors and/or suppliers to ensure their construction is performed according to the requirements;

- Provide their environmental management system.
- Provide data that their work and goods fulfill the requirements.
- Registering the products in a database to ensure they are approved.

The first step is for subcontractors to provide Veidekke with their own Quality- and Environmental Management System which is required in the contract agreement. According to the Environmental Manager, the Quality- and Environmental Management Systems provided by the subcontractors are framed very differently. This is also depending on a couple of factors. The industry has set norms and regulations about the qualitative aspects. There is a different structured order on the quality aspects and a different type of regulatory framework than on the environmental aspects. The Environmental Manager continues to explain that there is a need to set harder demands for subcontractors to develop the material of their EMS. The variation of the material depends on the level of environmental sustainability work the subcontractors conduct in their daily business. Generally, EMS compared to the corresponding one for quality, is not as developed with detailed information as routines, monitoring check-ups, and responsibilities. According to Subc5 are they providing an EMS which Veidekke is checking to ensure it contains all the information relevant for the construction, if something is lacking then an adjustment is needed. According to the Environmental Manager, the purpose of going through a subcontractor's EMS is to pick up certain routines concerning specific environmental work in their construction and add them to the project-specific EMS.

The second step is to provide data on the goods services and work for climate calculations which are usually based on EPDs. Providing EPDs is one of the requirements framed in Veidekke's EMS. Every subcontractor and supplier delivering material should therefore include EPDs for their work. According to some of the suppliers and subcontractors in the projects, they are only providing EPDs when Veidekke specifically requests it during or after their work is completed in the project. Subc3 and Subc5 expressed uncertainties about whether it was necessary or not in their projects to include EPDs in their work and deliveries. This depended on vague requirements explicating what products to provide it for or the that the request about EPDs has not been properly heard.

> ***"We have not been required to provide EPDs in this project, maybe it will be a complementing activity for us later in the project because we only provide it when we are directly asked to do it."***
> **- Subc3**

The perception of the requirement to provide EPDs or not also varies between the suppliers where Subc1 has been given clear directives from their distributor to provide EPDs whereas Sup4 does not put this request on their suppliers since they perceive that this requirement does not apply to them. The two suppliers, Sup1 and Sup2 always provide EPDs independently if they are requested or not in projects. This creates an inconsistency in who provides EPDs or not in the project organization.

The third step is registering the products in the database BVB. The subcontractors and suppliers in the two projects are contracted, in LF's EMP, to log their products in BVB. This database has the purpose of ensuring that all the products that are built in the schools are confirmed and approved in terms of environmental requirements. Most often, the products already exist in BVB and then it is only required to log them in the project-specific folder that exists for the various projects. If the prescribed products are not included in BVB, the operator is required to find an equivalent product and log it. Furthermore, SFF must approve the equivalent product before it can be used.

The Environmental Manager, mentions that they have been working with the database for 15-20 years and that it is not a new way of working that has been introduced. It is the responsibility of the subcontractors and suppliers to ensure that they are logged in and licensed to register and rate their products. However, it is still difficult for some entrepreneurs, not everyone can manage and understand the database. The Environmental Manager also indicates that it can vary from project to project, that site management is kind, and logs products for the subcontractors and suppliers. In the interview, the supplier Sup4 mentions that they know that the products they purchase from their manufacturers are included in BVB, therefore they do not need to check it. In addition, it is mentioned that they do not have a login to the database and that it is the construction site's responsibility to log their products. They rely more on the fact that it is the regulatory level that ensures that what is bought in

is approved. Furthermore, Sup4 mentions that if products are not included in BVB, this should be checked early by management to avoid construction delays.

> ***"If it's not in BVB, one should ensure at an earlier stage than delivery and out on the construction site that the products enter BVB."***
> **- Sup4**

Subc6, as well as Sup4, relies on it being logged by the site management.

> ***"We don't log anything, it's probably already logged."***
> **- Subc6**

Subc1 also states that they are included in BVB and that their products are already approved. When the certificates need to be updated, they do it. However, they mention it is Veidekke's responsibility to log in to the project's project-specific folder. For the used product that is not logged in BVB, Sup3 and Subc3 go in and log themselves and check that it is approved according to the environmental requirements. If it is not approved, they try to find an equivalent. Sup2 mentions that it is their internal organization that assesses that the products are approved. Subc3 also points out that BVB generally works well.

> ***"Generally, BVB works well as a tool, and it's easy to get your products in there; handling it digitally is convenient."***
> **- Subc3**

Something that even Subc4 agrees with, the tool is a good routine where you can put everything in easily. The Environmental Supervisor for School 2, mentioned that she occasionally comes across products on the site that are not registered in BVB. Nowadays, they are often approved, but the subcontractor has forgotten to log in.

4.2.4 Monitoring of environmental requirements compliance

The client and the contractor have the responsibility to monitor that the construction work is fulfilling the environmental requirements of the projects. This study has identified some different activities that can interpreted as monitoring activities and feedback has a vital role in successfully fulfilling environmental requirements.

The client has the main responsibility from the design phase to provide current documents for the construction by approving for example drawings and environmental management system. This is essential work and a prerequisite to be able to fulfill environmental requirements. The project management approach to solving these matters has been very differently managed throughout the project because several managers replaced each other with different ways of working. This made some parts of the project suffer, especially the review of drawings. SFF also lacks the routine to follow up on the project-specific EMS they request contractors to create at the start of construction. Their different ways of working and lack of monitoring routines have been affecting the fulfillment of environmental requirements in later stages of

the project, as in construction. The Site Manager for School 1 further explained that this has led to difficulties for them in monitoring environmental requirements since the project management did not provide the correct documents and the EMP that the project follows has multiple inadequacies.

During the construction, it is SFF's responsibility to hold environmental inspections every six weeks where the agenda is to ensure that the environmental requirements are still regarded in the construction. In these meetings, a lot of focus is on the goods in the projects, whether they are approved and registered in BVB, if EPDs are provided as they should, and waste management. During the interview with the site managers, it was evident that the Environmental Coordinators representing SFF in the projects have different ways of working with monitoring and control of the environmental requirements. For example, some make a more thorough check that every product is logged in BVB whereas others only take spot checks.

Veidekkes responsibility is to monitor that their subcontractors and suppliers are fulfilling the environmental requirements. Besides the work of going through the subcontractor's quality- and environmental management systems, gathering environmental data such as EPDs, and checking that every product is registered in the project's logbook in BVB as already mentioned in the chapter above, they also perform some other activities. The Site Manager for School 1 describes that they usually have meetings with subcontractors and workers at the site where they present the protocol from the environmental inspection meetings with the client. This is to create some feedback loop for the ones performing the construction work. It was also discussed in the interview that in the meetings where environmental sustainability questions should be raised, there is still not much time spent on those types of questions. The focus is instead directed toward the construction, production, and progress. The environmental aspects are given less attention and priority in the construction process, since the time pressure is considered more urgent, to complete the project. The Site Manager for School 1 also acknowledged that the adherence to the environmental requirements is still very important and highly regarded in the process but the monitoring and feedback about them is what is lacking.

> ***"The environment, unfortunately, ranks a bit lower on the priority list, not contractually but perhaps in terms of prioritization. More effort could have been put into feedback. The focus is mostly on production and progress."***
> **- Site Manager for School 1**

It was also evident from the interview with Subc1, that it is desirable from the subcontractor's point of view to engage a larger feedback loop inviting them to improve their performance by letting them know how the work went. They could see beneficial results by taking part in that information, not just for the project they are in for the moment but for future projects and their own business as well. Subc1 also acknowledged that in large project organizations, there are several subcontractors and suppliers, which means that the knowledge and information often do not reach everyone.

> ***"Workers are often replaced on a project, which makes it more difficult to keep all information in the organization."***
> **- Subc1**

The Environmental Manager highlighted the importance of including environmental aspects in start-up meetings for projects to educate and inform the various actors. It is equally important to continue providing information during the project, partly internally in site organizations but also for the respective actors. Sup1 shares the same perception about communicating necessary information to their supply chain. They have experienced an obstacle for their suppliers to understand the importance and the required actions requested by them to perform by the environmental requirements. Subc5 also forgot to communicate specific expectations of an environmental work activity on the site which led to repeated mistakes. Through clear communication from the start and continuous monitoring during the project, the actors in the project organization understand the importance of the environmental work which also facilitates the next processes regarding this.

Furthermore, the Environmental Manager explained the importance of having a role within an organization that follows up regularly on the environmental work as the construction progresses. It is crucial to not let the environmental work suffer because of tight time schedules or financial issues taking up all priority. It can be easy to lose a large part of the environmental work for example documentation when it is not monitored continuously. This is also emphasized by Subc3 indicating the importance of the "KMA" role.

> ***"Before we got our KMA, the work took a lot of resources from other things. Nowadays we can pass on more work to her and there is more time for tasks we actually have."***
> **- Subc3**

The responsibilities of this role have facilitated the work required to manage the environmental sustainability objectives, both internally and in projects. The Environmental Coordinator for School 2 explained that the "KMA" responsibilities vary in different organizations. In smaller organizations, such roles are only assigned to one person which is burdened with heavy environmental work. This creates difficulties in how to manage the complexity and great extent of the environmental work. As the Environmental Manager also expressed this brings challenges to decision-making processes.

The Environmental Manager indicates that projects with certification and requirements for verification come with a review where a responsible person checks what the contractor has done. In such projects, more emphasis is placed on ensuring that all documentation is in place and that monitoring has been completed. This third-party inspector makes the contractor steer toward this work. In cases where one does not entirely reach the goal, it might be necessary to handle it with the financial aspect. Suppliers and subcontractors are skilled at producing and building, but the documentation is not always delivered on time. To ensure the work is done,

let them invoice when everything is completed and handed in. On the other hand, contracts overlap and subcontractors finish after different periods which prompts the need to emphasize the importance of having a closing meeting to verify that all documentation is completed. This requires a dialogue with the client regarding whether providing final documentation continuously throughout the project is acceptable. Sometimes, the clients want all documentation in the end.

4.2.5 Future

A major driving force for subcontractors, suppliers, and organizational management is high clear demands set by the top. Moreover, the requirements must be both justified and achievable, considering the available resources and support from the top. This was discussed further among some of the actors when the question of what is important in the future regarding environmental requirements and sustainable construction was asked.

According to Subc1, it is important to have serious actors in the industry who set demands on the construction sector to drive development forward. Sup1 also agrees with this but mentions on the other hand that there must be resources and tools that make it possible to follow them. Furthermore, Subc1 says that it is important that the environmental requirements are clear to the recipient and that their importance is made clear. The actors must understand the background of the requirements and why this development is being pushed forward. In this way, you can get the question higher on the agenda and create seriousness in the questions. It is no longer acceptable to show initial concern for the environment in the early stages and then diminish its importance or cease prioritizing it.

> ***"I believe the future will show that everyone needs to be more environmentally aware, there is a long way until all entrepreneurs are on board, but this will increase with continued high demands."***
> **- Subc3**

Sup1 also points out that the climate footprint should be valued together with the tender sum. Something Subc2 also emphasizes. The client of the industry or the market should be aware that you can use materials or products that are even better and already take this into account in the tender request. It is advantageous to take into account the contractor's knowledge of the environmental issue already in the first stages. Other aspects highlighted by Sup4 are that the design should be completely ready at the start of construction to save resources, the environment, finances, and time. To save on the environment, Subc4 mentions that material selection is an aspect that must be continued to work on, continue to develop products in, for example, concrete and reused materials. The concrete industry must work together to reach the goals of reduced CO2 emissions, indicates Sup2.

4.3 Summary of results

The findings from the case study as presented in the chapter above represent several driving- and hindering factors to successfully fulfill environmental requirements, based on the two studied projects and insights from respondents about projects in general. Since this study focuses on the procurement and production processes of the projects, the identified factors will be presented according to those categories. A clearer view of the different factors will be found in the figures of this chapter and later discussed more thoroughly in Chapter 5.

4.3.1 Driving factors to success in construction projects

Based on the findings from the case study involving documents- and interview analysis, several driving factors to successfully fulfill environmental requirements have been identified. These factors are presented in two categories, the first category contains driving factors in procurement, see Figure 5.1. The second category contains factors to succeed in production, see Figure 5.2.

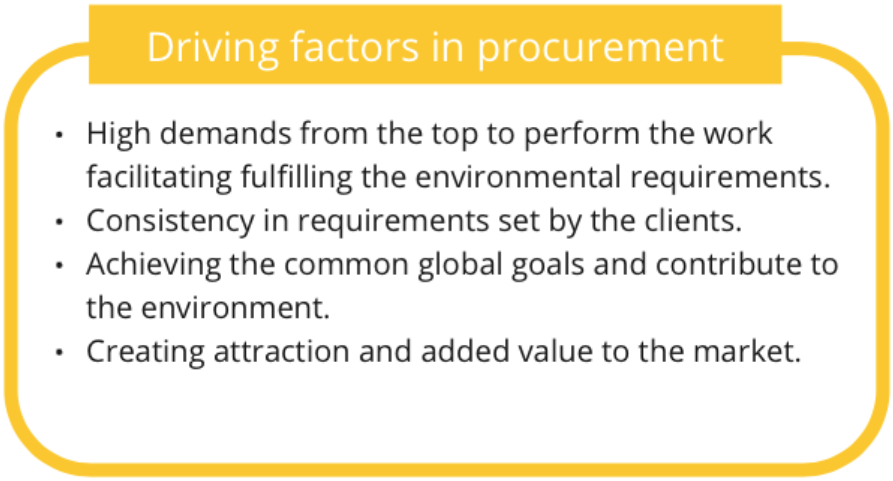

Figure 4.1: Summary of driving factors in procurement to successfully fulfill environmental requirements in municipal construction projects.

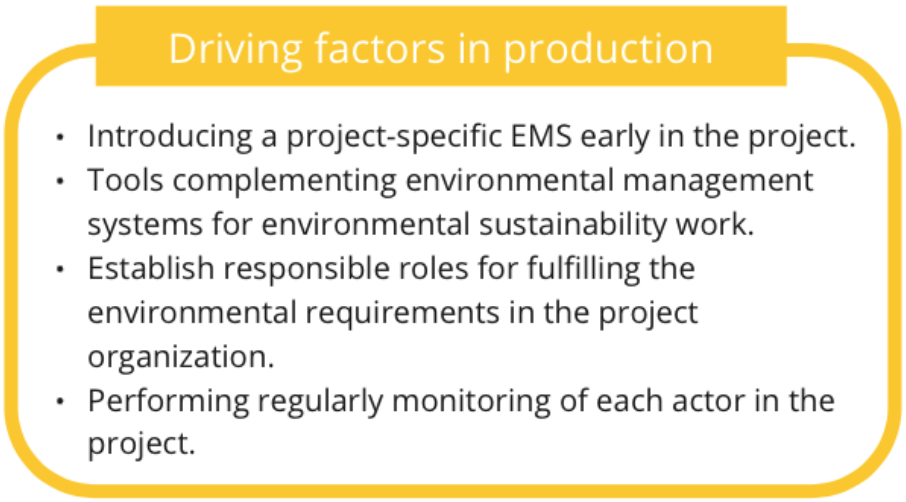

Figure 4.2: Summary of driving factors in production to successfully fulfill environmental requirements in municipal construction projects.

4.3.2 Hindering factors to success in construction projects

The document- and interview analysis identifies several hindering factors to success in construction projects. Despite the driving factors, there are issues regarding environmental efforts that require to be addressed and resolved. The primary challenges highlighted are divided into two figures. Hindering factors in procurement are presented in Figure 5.3 and hindering factors in production are presented in Figure 5.4.

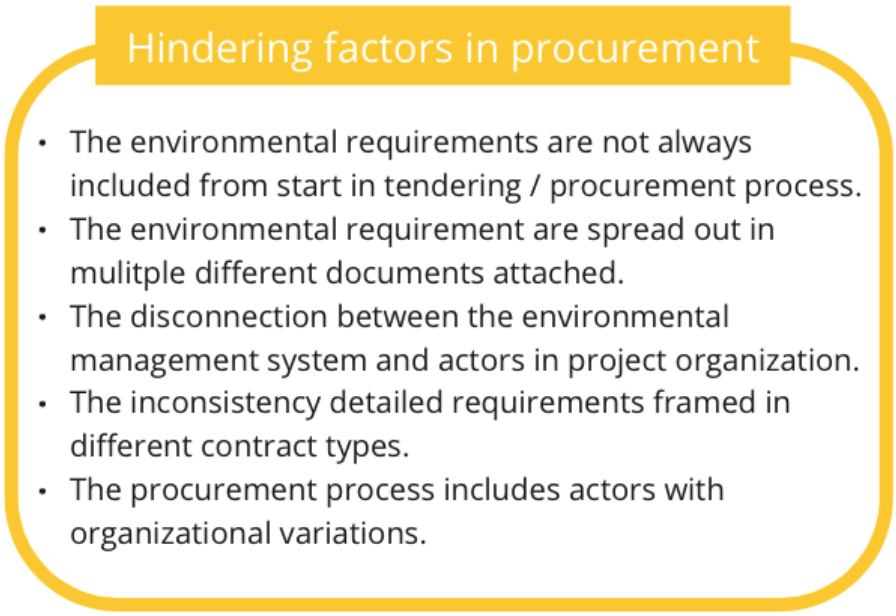

Figure 4.3: Summary of hindering factors in procurement to successfully fulfill environmental requirements in municipal construction projects.

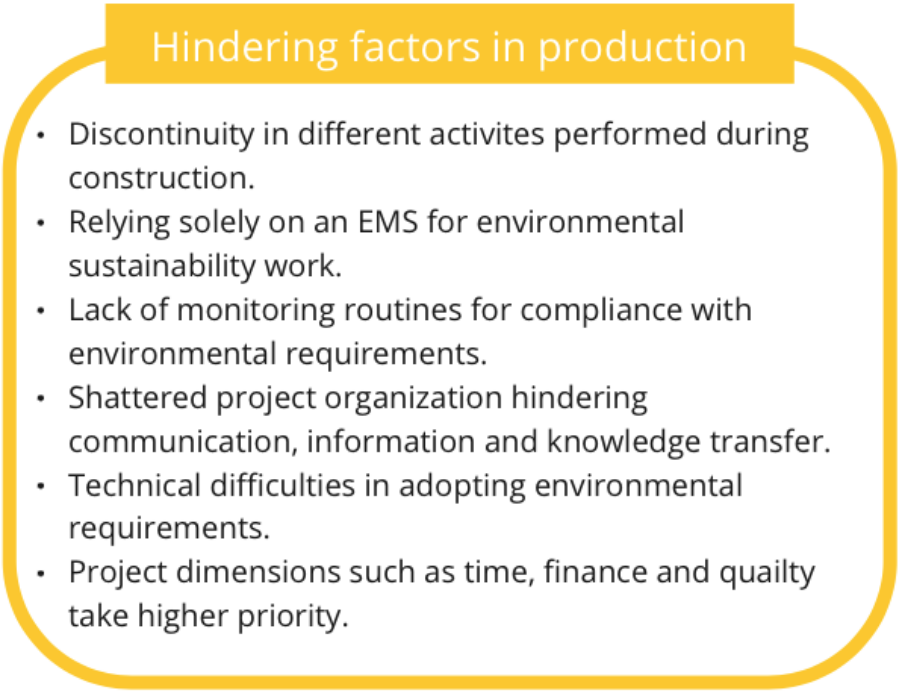

Figure 4.4: Summary of hindering factors in production to successfully fulfill environmental requirements in municipal construction projects.

5
Discussion

Based on the findings from the case study, subcontractors and suppliers in the project organizations show a positive attitude toward the environmental requirements. The literature highlights financial incentives (Oke et al., 2019) and high requirements from the top (Bamgbade et al., 2019) as major drivers for sustainable construction as well as adhering to the environmental aspects create attractiveness on the market (Opoku et al., 2015). This study found similar drivers as high demands from the top to promote environmental requirements. Additionally, adhering to them creates attraction and added value to the market as well as motivation to achieve the common global environmental sustainability goals. Even though there are several drivers for organizations to fulfill the environmental requirements there are still challenges with compliance with them. The literature presented a lack of commitment from the top (E. Ojo et al., 2014), lack of knowledge and insufficient cooperation (Häkkinen & Belloni, 2011), lack of priority and monitoring (Varnäs et al. 2009) as barriers for environmental sustainability in construction projects. This study also found that environmental sustainability lacks priority and monitoring in the projects and shattered project organizations. Other barriers found include unclear, inconsistent, and spread out environmental requirements as well as disconnection between environmental sustainability work in the projects to the EMS. Findings from the case study indicate that the adherence is rooted in management issues. Which in turn are divided into two main issues. The first one is formulation issues of environmental requirements in documents. The second is about organizational issues, to get the project organization committed to fulfilling the environmental requirements.

5.1 Formulation issues

The study conducted by Varnäs et al. (2009a) located several barriers to environmental preferences in procurement. These issues relate to four themes;

- application of different types of preferences which usually concern requirements,
- project-specific environmental preferences,
- environmental evaluation criteria,
- and monitoring of environmental requirements during construction.

The findings from the study conducted by Varnäs et al. (2009a) highlighted that the application of environmental requirements varies in projects, based on client organization, type of project, legal directives, and procedures formulated by the EMS. The

findings from this master thesis also found similar indications. Interviewees support what Varnäs et al. (2009a) discusses about clients' different applications of environmental requirements and their different framing in contracts. According to Varnäs et al. (2009a), there is a difference between the implementation of environmental requirements in contracts depending on the contract type, as it's a difference between procurement of construction and procurement of products. In this thesis, this was identified as a hindering factor among actors in the project organizations since it requires you to adjust, learn, and work towards several requirements concurrently as you often are assigned to multiple projects at the same time.

The findings from this thesis's case study contribute additional aspects hindering a successful fulfillment of environmental requirements. The interview study showed that actors in the same project had different perceptions about how clear the environmental requirements are in contracts. This can depend on that the environmental requirements are spread out in many documents and not easy to locate in all the text, as indicated by a couple of subcontractors. In turn, this could depend on inadequacies in creating the project-specific EMS. If this was done properly according to the findings of the document analysis and what the literature suggests (Varnäs et al., 2009b), the project would only rely on a single document on what environmental requirements to follow and how to fulfill them. Lundberg (2011) found that EMS is not optimal for construction projects, as they are based on general environmental requirements and according to Varnäs et al. (2009a) the EMS is designed to meet the objectives of the permanent organization in a fragmented sector. These difficulties were also noticed in the case study projects as actors in the project organizations had a hard time understanding and complying with the project-specific EMS because of unclear environmental requirements and formulated procedures. L. D. Ojo et al. (2021) describe that the ambiguity in understanding EMS creates confusion in how to manage the environmental sustainability of construction. In turn, this can lead to inefficient production, which Varnäs et al. (2009b) mention as a negative aspect of implementing EMS in construction projects. Lundberg (2011) suggests that a follow-up tool should complement the EMS to ensure an effective execution plan of how to fulfill the environmental requirements in practice. This tool should describe follow-up activities based on the EMP for a project organization. Important tools were control programs and the project-specific EMS which specifies monitoring activities for each construction work performance. This makes it even more important to create a solid project-specific EMS, less general by presenting the environmental requirements clearly and designed more specifically for the organization assigned to the project.

5.2 Organizational issues

Furthermore, the lack of understanding may be because the financial and time aspects have a higher priority within projects, confirmed by Site Manager and supported by Varnäs et al. (2009a). Even if there are specific meetings to address environmental work, they have a different focus or only address a few issues repeatedly. For example, a high specific focus on waste management as an environmental requirement was experienced at School 2. Findings from the interview study showed that environmental requirements are still highly regarded at the start of construction, but also that many parts lack follow-up and monitoring. This may be due to a disconnected project organization where various smaller organizations isolate themselves from interacting with aspects other than just their construction in terms of quality, cost, and time. Further interview findings revealed that both suppliers and subcontractors relied on other actors in the project organization or their network to manage the environmental aspects. As the literature states, when subcontractors and suppliers are not fully committed to the project organization and willing to commit to all project goals, the project will be difficult to successfully deliver (Gundersen & Høydal, 2022). The literature also shows the importance of close interaction and communication across the project organization to successfully meet project objectives, especially the sustainability aspects (Häkkinen & Belloni, 2011).

A noticeable difference in prioritizing quality and cost higher than the environment could potentially lead to human factors being a hindrance to the successful fulfillment of environmental requirements. Human factors such as ignorance of reading and adhering to the environmental requirements as noticed in the interview study. Khan et al. (2018) describe actors in the construction industry as not wanting to change how they work. In a study conducted by Sadri et al. (2022), it was found that integrating environmental practices in a project brings extra administrative work which is a hindrance to addressing the environmental dimension. This study also supports this finding since it was recognized by different organizations as it hinders the performance of daily tasks. Other reasons for the mixed understanding of environmental requirements among organizations in the projects may be the size of the organization and the leadership promoting them. Organizations having management that actively support environmental efforts tend to be more successful in meeting environmental requirements. In addition, larger companies often have more available resources and can adapt their technology and production processes more effectively to integrate environmental aspects. On the other hand, it has been found that smaller companies tend to be less receptive to environmental protection policies and regulations unless the requirements force an adaptation (Bamgbade et al., 2019). TİZA (2022) discusses that it may be a matter of low knowledge among actors in project organizations and that many employees lack understanding and awareness of sustainability. To ensure a comprehensive understanding and commitment throughout the organization regarding expected tasks and activities, it is imperative for project management not only to establish clear contract requirements but also to integrate them through effective communication, training, and support mechanisms.

When comparing the results from the case study on how the project organizations work and interact with each other to how the literature suggests a project organization should act, it became clear that both projects in the case study lacked a monitoring and feedback loop connecting all levels and processes. This might depend on that construction projects usually rely on EMS which lacks the right conditions for monitoring activities and does not support the structure of project-based organizations Lundberg (2011). Varnäs et al. (2009a) points out that the issue of monitoring must become a priority for management. The results from this study also indicate that monitoring needs to be integrated into management. From the experiences described by a Site Manager, the follow-up and feedback must work from the start of the project. It should originate from top management and be reflected further down in the organization. It was found lacking in the case study projects that there are no clear procedures for conducting a follow-up activity in production. Yet, it was evident that some follow-up activities were performed, but not to the fullest extent. When following up on environmental work and requirements in construction, it is important to use documentation methods to create a feedback loop and retain the information gathered in the project organization. Otherwise, there is a risk that the information will be lost or forgotten once the project is delivered and the organization is dispersed Lundberg (2011). Implementing a structure as proposed by Chawla et al. (2018) with a feedback mechanism covering the entire project organization enhances the ability to achieve sustainability in projects. In this way, motivation is created for other actors, such as middle managers and project staff, to increase engagement in the monitoring and follow-up processes. To maintain the environmental work and monitoring, it is also important to have a dedicated role in projects responsible for this, as highlighted by the interview findings.

Furthermore, Opoku et al. (2015) describe organizational leadership that works with and motivates environmental development in business strategies as pivotal for sustainable construction projects. In current organizations established in the construction sector, the resource leadership working with environmental issues is usually placed on the role of KMA. Interviewees explained the importance of the KMA's role in their organization as it facilitates the environmental work by focusing on Quality, Environmental, and Work Environmental issues. Both literature Koppfeldt and Revellé (2017) and the interview findings indicated that even a dedicated role such as KMA is not fully concentrated on environmental issues since they manage more aspects. The current role such as KMA whose purpose is to manage environmental work in an organization has not had full attention and commitment to these matters. Opoku et al. (2015) reasoning aligns by emphasizing leadership as a key role for achieving sustainability success in organizations and the commitment of that role to not lose priority and focus on environmental sustainability. Yet again, this shows how important leadership and management priorities are to reach a well-functional organizational structure able to manage all aspects of a project and maintain environmental work as highly regarded throughout every process.

6

Conclusion

This master thesis investigated how environmental requirements are implemented and complied with throughout the whole process of municipal construction projects. As well as what is driving and hindering their successful fulfillment. This investigation was conducted through a case study of two municipal projects, the new production of schools located in the city of Gothenburg, Sweden. The research questions of this study were answered through an interview study with mainly subcontractors and suppliers. As well as a document analysis with relevant documents for the environmental requirements such as environmental management plans.

The first research question this study answered was ***how the environmental requirements were implemented in municipal construction projects***. It was found that the environmental requirements were implemented in the projects through the client's (Stadsfastighetsförvaltningen) EMS which also referred to several other documents including additional requirements, technical requirements, and specification areas such as waste management and climate calculations. In the two school projects, the contractor (Veidekke) also implemented their internal environmental objectives, like climate impact from fuels, vehicles, and machinery.

To answer the second and the third research questions ***how is compliance with environmental requirements ensured in procurement and production for municipal construction projects?*** The study investigated ***what driving and hindering factors affect compliance in procurement and production.*** For the procurement, there were nine driving and hindering factors identified. The most prominent hindering factors include the spread of environmental requirements in multiple documents and the inconsistency of detailed requirements in different contracts. A total number of ten driving and hindering factors were identified for production. The most important hindering factors were the lack of routines for monitoring the environmental requirements and the absence of feedback loops within the organization.

The main findings of this study were surprising in how a wide range of different actors assimilate the environmental requirements in the projects. Despite the positive attitude toward the implementation of environmental requirements, there are still many factors affecting the successful fulfillment of them. The main issues are rooted in management issues failing to prioritize environmental sustainability in projects. To facilitate the processes of successful fulfillment of environmental requirements, strong leadership should be demonstrated to foster an environmental sustainability

culture in project organizations. Management prioritizing environmental sustainability could potentially influence many other actors in the organization. Engaging actors in environmental work encourages collaboration across the organization ensuring alignment with and facilitating the successful delivery of the sustainability objectives in the project. In turn, this contributes to a more sustainable construction sector and the achievement of environmentally sustainable directives, on both a national and global level.

This thesis contributes with recommendations for contractors to maintain a high priority of environmental requirements throughout the whole project cycle in municipal construction projects. The recommendations are based on the main findings and are presented in the next sections.

6.1 Recommendations for practice

This section, we present four recommendations to enhance and optimize practices within the production and procurement phases of construction projects. These recommendations are aimed at ensuring efficiency and adherence to environmental requirements. Further, they are designed to be applicable in various stages of the project cycle; some are useful in the procurement, production, or both phases.

Present clear environmental requirements
To reach an effective and successful result in completing the work and fulfilling the environmental requirements, they should be framed clearly and understandable in the procurement phase. Based on the findings from the interview study, the environmental requirements should not be diffused in many documents as that decreases the ability to apprehend and understand all of them fully. The recommendation is to compile the requirements in one document, suggestively in the project-specific EMS, promoting that document as the only source to rely on in projects.

Furthermore, another recommendation is to set even more specific requirements in contracts. The document analysis, as well as the interview study, gave clear indications that the subcontractor's EMS varied in the extent to how detailed they were. Therefore, The recommendation will be that the contract request about subcontractors providing their EMS should contain specific demands of what it should include. The request should include routines about their environmental work to fulfill project environmental requirements and a responsible role for the fulfillment. This later also facilitates the compiling of the project-specific EMS based on complementing LF's EMS.

Involve subcontractors and suppliers in the early stages
Based on the findings from the interview study it was noticed that it was desired by actors to be involved earlier in the procurement phase. By early involvement, subcontractors and suppliers would be given earlier prerequisites to manage the environmental requirements for their construction or delivery facilitating a successful

fulfillment. Suggestively, the early involvement would include a discussion about the purchase, and how to best achieve the environmental goals. The seller of the product or service can provide expertise and knowledge of the most successful delivery fulfilling the environmental requirements. In this way, early involvement promotes environmental requirements and facilitates the work of fulfilling them.

Having a dedicated individual responsible for the environmental work
Assigning a dedicated individual within an organization to monitor environmental requirements ensures efficient management without compromising other project aspects. It is vital to have someone solely focused on environmental issues to ensure thorough attention from the procurement and production phases. Furthermore, delegating information, knowledge, and tasks to the rest of the project organization and subcontractors is important. It is essential to keep the knowledge and information gained from the temporary project organization to the permanent organizations. Therefore it is vital to foster a project culture of knowledge sharing between departments and a way to store environmental data to achieve organizational environmental improvement and learning. Investing in environmental initiatives and integrating them into the business structure is crucial for keeping pace with evolving requirements. Prioritizing environmental concerns alongside quality, time, and economics fosters seriousness and engagement in the sector. This investment also yields a competitive edge and market appeal, achievable even for smaller organizations with the right developmental mindset.

Monitoring routines
To ensure that the environmental requirements are fulfilled across the project organization in construction projects, a clearer monitoring routine should be established. Even if monitoring activities are performed, it has been shown they are lacking documentation. To ensure a correct follow-up routine, with documentation to also maintain the knowledge gathered through these activities within the project organization, a structured documentation standard should be defined. This will not only frame a consistent work procedure but also store information in an easy and accessible way. Furthermore, to ensure a smooth process facilitating the work of fulfilling environmental requirements, the routine could be supported by a checklist. This checklist will work as a tool to control and make easy documentation about what is already completed, progressing, or needs to be done. Furthermore, the interview study revealed that feedback regarding sustainability requirements is not prioritized as highly as production and progress, as time pressure is perceived as more urgent. It also emerged from the subcontractors and suppliers that it is desirable to engage in a larger feedback loop that encourages them to improve their way of working. This entails a recommendation to contractors in the production stage to put more energy into feedback within the project actors. An established feedback loop will result in reduced mistakes and delays in the project while increasing engagement and motivation among the actors for other dimensions as well, like environmental sustainability. To achieve this, it is recommended that contractors implement regular follow-up meetings where the project process or specific activities are discussed.

6.2 Future Research and Development

This study has identified that implementing sustainable buildings in construction projects through environmental requirements has good potential. There are still difficulties in managing them and ensuring a successful delivery of the project's objectives. As the requirements get tougher and more specific, the development of organizations and project objectives must follow the same pace. To reach a sustainable construction sector, the whole industry must work together.

Future research could include further investigations of a wider range of actors in the sector. Interesting studies could include the private sector. Perhaps a comparison of how contractors implement sustainable building in private and public projects. Also, investigating more contractors would provide a broader understanding of what challenges they face in achieving environmental sustainability in projects. By comparing several contractor's points of view, a more straightforward strategy could be found to manage these challenges.

Other studies could be to focus on fewer environmental requirements which create the largest impact on how projects perform sustainability. Also, studying projects with sharper environmental requirements, such as environmental certifications could show further strategies and procedures for success. These approaches would provide deeper insights into what specific strategies and support are necessary to secure a successful fulfillment in each phase of the project lifecycle.

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A

Interview Guide

In this section, the interview questions included in the interview study will be presented. The questions have been tailored based on the interviewee's role and responsibilities in the projects, as well as the nature of the dialogue during the interviews. Below are the interview guidelines for site managers, environmental coordinators, suppliers, subcontractors, and environmental managers.

A.1 Appendix 1

The 20 interview questions pertaining to the site managers are presented below.

1. Please tell us about your role, your tasks, and how you are involved in the project.

2. How do you think the environmental management plan and its environmental requirements from the City of Gothenburg work? Do you think they/it provides the right conditions for you to achieve the objectives, would you like them to improve? If so, how?

3. When enrolling in the project, UEs must sign that they approve the work environment plan, should they sign that they have read and understood the environmental management plans as well?
   -Are the environmental management plans included as attachments at enrollment or is it their own responsibility to read and understand them before enrollment?
   -At what stage is the UE informed of the environmental management plan and the environmental requirements of the project? Tender stage? Contract stage?

4. Do you receive a complete quality and environmental plan from the subcontractors?
   -Last 4 weeks after order/after request?

5. What is their environmental management plan?
   -Is it integrated into the quality plan?
   -Does it contain as much detail as required by the quality plan (responsibilities, project review, procedures and checklists for self-inspection and final inspection, basis for inspection plan, follow-up proposals)?

-Do the documents contain reports of work that is environmentally critical?
-Do the documents contain planned measures to limit environmental risks that are reported in work preparation and self-inspection?

6. How is the client's environmental plan supplemented with documentation from your UEs?
-Via the work environment plan? Are the environmental requirements included in the work environment plan?
-Which environmental management plan becomes the contract document on which the project is based?
-What happens to the "new" environmental management plan after completion?

7. Who at Veidekke receives these and compiles them (for completion of the environmental plan)?

8. What is reviewed at the environmental review held with all contractors?
-Environmental requirements of the project to be achieved (environmental management plan)
-Waste management
-Registration and logging of products in BVB (who logs in BVB, Veidekke or UE)
-When to submit EPDs?

9. In a perfectly functioning project, what are the procedures with BVB, who logs and when, ensures that it is logged and checks that it is approved?

10. Do you find that communication (language barriers) and lack of knowledge about sustainability is an obstacle to meeting environmental requirements in projects?

11. Do you experience a fragmented supply chain that makes purchases of materials where environmental requirements are not always attached and this creates additional work later in the process to ensure that products meet the requirements?

12. What are the drivers for you to achieve the sustainability requirements of the project?

13. Have there been challenges or difficulties for you to comply with the environmental requirements of the project?

14. How do you experience the attitude and climate towards the environmental requirements of the project?

15. How do you experience the focus on the construction site in terms of environ-

mental work and sustainability requirements, are they prioritized?
-Where, in which phase, or which parts is the environmental work most/best prioritized?
-When and with whom (different roles on site) are they least prioritized?

16. How is the entire project organization's work towards environmental requirements perceived? (Cooperation, communication, and knowledge transfer within the project organization)

17. Do you experience that actors (UE, suppliers) use products that have not yet been approved by theLokalförvaltningens environmental coordinator (for BVB)?

18. Are there any already existing working procedures or activities that you think would need to be changed to better meet the environmental requirements? (something that is not working so well today) How?

19. What measures or improvements would you suggest to increase awareness and compliance with environmental requirements on the construction site?
-With you at Veidekke (requirements, contracts, organization)
-With the subcontractors/suppliers

20. How do you see the future of sustainability and environmental awareness in construction projects? What changes or advances do you think will be most significant?

A.2 Appendix 2

The 16 interview questions pertaining to the environmental coordinators are presented below.

1. Tell us about your role, your tasks, and how you are involved in the project.

2. How do you ensure compliance with the environmental requirements of the project and what is your procedure for monitoring the environmental requirements? (environmental rounds, meetings, etc)

3. What obstacles have you encountered in the monitoring and follow-up of these requirements in the project? (attitude, lack of clarity, communication, ignorance..)

4. What driving forces do you see in production to want to achieve the environmental requirements? (leadership, awareness, motivation)

5. What additional tools or support would you like to see from Veidekke and its subcontractors to facilitate compliance with environmental requirements in

the construction project?

6. Would you have liked Veidekke to have clearer/more procedures for monitoring compliance with environmental requirements in production?

7. How would you like Veidekke to supplement the environmental management plan? Complete LF's environmental plan or create a new project-specific one?

8. How do you feel about the attitude and climate towards environmental sustainability requirements on the construction site?

9. How do you experience the focus on the construction site in terms of environmental work and sustainability requirements, are they prioritized?
   -Where, in which phase, or which parts is the environmental work most/best prioritized?
   -When and with whom (different roles on site) are they least prioritized?

10. How is the entire project organization's work towards environmental requirements perceived? (Cooperation, communication, and knowledge transfer within the project organization)

11. How does communication and reporting take place between you as an environmental coordinator and Veidekke and Veidekke's subcontractors?

12. What is the most common issue in a project that the contractors do not meet the environmental requirements?

13. Are there any resources or tools that you think would be helpful to facilitate the implementation of environmental requirements in general?

14. Are there any existing work practices or activities that you think would need to change to meet environmental requirements better? (something that is not working so well today) How?

15. What actions or improvements would you suggest to increase awareness and compliance with environmental requirements on the construction site? (workshops, meetings, briefings, etc)
   -With the main contractor Veidekke (requirements, contracts, organization)
   -With subcontractors

16. How do you see the future of sustainability and environmental awareness in construction projects? What changes or advances do you think will be most significant?

A.3 Appendix 3

The 21 interview questions pertaining to the suppliers are presented below.

1. Tell us about your role, your tasks, and how you are involved in the project.

2. Are the environmental requirements clear in the procurement and contract of your supply?

3. Do you have a framework agreement with Veidekke? Or do you always go via a wholesaler? Is there a call-off agreement?

4. How have the environmental requirements in the project affected your work/delivery?

5. Do you have the right conditions/resources/tools to deliver according to the project requirements?

6. Do you and your team have the right knowledge and skills to comply with the environmental requirements of the project?

7. What kind of support and resources have you received from Veidekke to comply with the environmental requirements? Do you feel that there is enough support to succeed?

8. How do you assure Veidekke/Gothenburg City that the environmental requirements are met?

9. Does Veidekke/Gothenburg City follow up, check, and provide feedback on whether your services meet the environmental requirements? Do you feel that there should have been more follow-up from the client during the course of the project, and if so, when (procurement, in production)?

10. Have you felt that your tasks to achieve the requirements of the project have been in conflict or limited in any way by what is stated in the contract?
    -What clarifications in the contracts would have been needed?

11. How do you perceive the work of the whole project organization to achieve the environmental requirements? (Cooperation, communication, and knowledge transfer within the project organization)

12. How does your and Veidekke's communication and cooperation work regarding products and services used in the project and not yet registered in the BVB?
    -Who ensures that the product is approved by the Lokalförvaltningens environmental coordinator?
    -Does Veidekke follow up that the product is approved before it is used?

-Is it correctly entered in the BVB?

13. How have the increased environmental requirements affected your daily work?

14. What are the drivers for you to reach environmental requirements? What is it that motivates you? Is there anything that could be implemented to motivate you more?

15. Have there been challenges or difficulties for you to comply with environmental requirements? What could prevent you from achieving environmental requirements, are there any particular factors that could make environmental work more difficult?

16. Have there been any challenges or obstacles that you have encountered in integrating sustainability and environmental awareness into your working practices? How have these been addressed?

17. Are there any existing work practices or activities that you think would need to change to better meet environmental requirements? (something that is not working so well today) How?

18. Are there any other resources or tools that you think would be helpful to facilitate the implementation of the environmental requirements?

19. What actions or improvements would you suggest to increase awareness and compliance with environmental requirements?
-At the main contractor Veidekke -With you as a supplier

20. How do you see the future of sustainability and environmental awareness in construction projects? What changes or advances do you think will be most significant?

21. Do you have anything else to add?

A.4 Appendix 4

The 24 interview questions pertaining to the subcontractors are presented below.

1. Tell us about your role, your tasks, and how you are involved in the project.

2. Are the environmental requirements for the project clear in the procurement and contracting of your service?

3. Has Veidekke clearly communicated the specific environmental requirements and expectations to you as a subcontractor? How has this affected your daily

work? (Compare with other experiences)

4. Do you provide a quality and environmental plan to Veidekke as a basis for their project-specific environmental management plan? Is it clear what it should contain?

5. Do you have the right conditions/resources/tools to meet the environmental requirements of the project?

6. Do you and your team have the right knowledge and skills to comply with the environmental requirements? Are there areas where additional training or resources would be beneficial?

7. Have you read and understood the environmental management plan, including its procedures and measures to ensure that environmental requirements are met?

8. How is the environmental management plan followed in production?
   -What are your procedures/activities to achieve the environmental requirements?
   -Checks by Veidekke/customer who owns the environmental management plan
   -Feedback and feedback

9. What kind of support and resources have you received from Veidekke to achieve the environmental requirements?
   -Do you feel that there is enough support to succeed?
   -Would you have needed any other resource or tool to facilitate the activities to be carried out in such a way that the environmental requirements are met?

10. How do you ensure towards Veidekke/Gothenburg City that the environmental requirements are met?

11. Does Veidekke/Gothenburg City follow up, check or provide feedback on whether your services meet the environmental requirements? Do you feel that there should have been more follow-up from the client during the course of the project, and if so, when (procurement, in production)?

12. Have you felt that your tasks to achieve the requirements of the project have been in conflict or limited in any way by what is stated in the contract? What clarifications in the contracts would have been needed?

13. How is the work of the whole project organization towards the environmental requirements perceived? (Cooperation, communication, and knowledge transfer within the project organization)

14. How do you experience the focus on the construction site in terms of environ-

mental work and environmental requirements, are they prioritized?
-Where, in which phase or which parts is the environmental work most/best prioritized?
-When and with whom (different roles on site) are they least prioritized?

15. Are environmental requirements given as much attention as other requirements in the project such as meeting the schedule or delivering the right quality?

16. How have the increasing environmental requirements affected your daily work?

17. What are the drivers for you to meet environmental requirements? What is it that motivates you? Is there anything that could be implemented to motivate you more?

18. Have there been challenges or difficulties for you to comply with environmental requirements? What could prevent you from achieving environmental requirements, are there any particular factors that could make environmental work more difficult?

19. Have there been any challenges or obstacles that you have encountered in integrating sustainability and environmental awareness into your working practices? How have these been addressed?

20. Are there any existing work practices or activities that you think would need to change to better meet environmental requirements? (something that is not working so well today) How?

21. Are there any other resources or tools that you think would be helpful to facilitate the implementation of environmental requirements in general?

22. What measures or improvements would you suggest to increase awareness and compliance with environmental requirements on the construction site?
-With the main contractor Veidekke (requirements, contracts, organization, procedures)
-With you as a subcontractor

23. How do you see the future of sustainability and environmental awareness in construction projects?
-What changes or advances do you think will be most significant?

24. Do you have anything else to add?

A.5 Appendix 5

The 15 interview questions pertaining to the environmental manager are presented below.

1. Tell us about your role and your tasks at Veidekke.

2. What is your organizational structure regarding environmental work, how do you work with sustainability and what are your goals?

3. How do you experience the attitude towards environmental work and environmental requirements throughout the organizational chain?

4. What do you see as the drivers and barriers to compliance with environmental requirements in projects in general?

5. What exactly is logged in the BVB?

6. Where and how and to what extent are EPDs logged in the project? Is it all products or which ones more precisely? How is that logging followed up? What happens to the EPDs after they are entered into the database?

7. The client selects tenders based on a combination of price and quality, where they can also include other points that add value such as environmental characteristics. How do you prove in the tender that you can deliver according to the environmental requirements, is any climate calculation done?

8. Do you calculate the carbon footprint when tendering? Is it compared after project completion with the actual carbon footprint?

9. There is a climate calculation in the design that the Lokalförvaltningen, project manager and environmental coordinators are responsible for, are you involved in this in any way, thinking of the projects you also do design. Are there any difficulties with this?

10. You yourselves are responsible for the climate calculation in production, which includes transportation and specific building elements such as climate screens, load-bearing structures and interior walls.
    -Are there any difficulties with this? Are you getting enough EPDs?
    -Could this have been included more specifically in the contracts of the UE/-suppliers concerned?

11. The request for EPDs is only found in purchase contracts, is the point about the issue of logging in the BVB and EPDs in any other contract?

12. Does Veidekke complement the City of Gothenburg's environmental management plan, if so when? And how is it used? And is it forwarded to the City of Gothenburg for approval? Is it complemented by UE's quality and environmental plans?

13. AFC.224 Contractor's quality and environmental plan: It only states what the quality plan should contain, why does it not state what the environmental management plan should contain?

14. In some contracts, there is a penalty for non-compliance with environmental requirements according to the contract document "common environmental requirements for construction" and the client's environmental plan, which applies to fuels, vehicles, work machines, and chemical products that refer to a document that can be found via a link in the environmental plan.
    -We have noticed that only turnkey contractors get this penalty in turn, why is it not also suppliers and other UEs who bring materials to the construction?
    -Otherwise, the environmental requirements are not specified in the contract, it is the document that applies. Would it not have been possible to specify some other requirements here as well that Veidekke finds it very difficult to comply with, such as logging products in BVB (which Veidekke includes in its internal environmental appendix?

15. Are there any existing work routines or activities that you think would need to be changed to better meet environmental requirements in projects in general?

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