Towards Ecological Sustainability in Renovation Projects

Challenges and Factors for Success from a Project Management Perspective

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

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CHALMERS UNIVERSITY OF TECHNOLOGY
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ABSTRACT

Material extraction, building, and demolition are all contributors to the major climate impact of the construction industry. Therefore, the environmental awareness and requirements in the sector are continually increasing and so is the focus on ecological sustainability. To reduce emissions and achieve an improved ecological sustainability in building projects, renovation, and project management are two important aspects to consider. Hence, the thesis investigated challenges and factors to succeed with ecological sustainability in renovation projects, from a project manager's perspective in a client organisation. The research is conducted through a literature review and empirical study. The empirical data collection is performed at a real estate company via interviews, a focus group and participant observations. The main findings are the identified challenges, such as the scope of sustainability work, resistance to change, and that project managers often have limited time and cost. Further challenges are lack of knowledge, missing guidelines in renovation projects, and lastly, lots of and diffuse responsibilities. In order to meet these challenges several critical factors were recognised. The study shows that defining, repeating, and exemplifying ecological sustainability is crucial for a successful implementation in projects. Also, the importance of exchanging information and experience, explaining measures, and examine opportunities with sustainability is highlighted. Finally, the aim with the critical factors is to function as recommendations to facilitate project managers sustainability work in renovation projects.

Key words: Project Management, Ecological Sustainability, Renovation Projects, Challenges, Critical factors

Mot ekologisk hållbarhet i renoveringsprojekt

Utmaningar och faktorer för framgång ur ett projektledningsperspektiv

Examensarbete inom mastersprogrammet Design and Construction Project Management

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SAMMANFATTNING

Materialutvinning, byggande och rivning är bidragande faktorer till byggbranschens stora klimatpåverkan. Miljömedvetenheten och miljökraven ökar ständigt inom sektorn, och fokuset på ekologisk hållbarhet växer. För att minska utsläpp och uppnå en förbättrad ekologisk hållbarhet i byggprojekt är renovering och projektledning viktiga aspekter att ta hänsyn till. I rapporten undersöks därför utmaningar och faktorer för att lyckas med ekologisk hållbarhet i renoveringsprojekt, ur en projektledares perspektiv. För att genomföra forskningen används metoderna litteraturstudie och empirisk studie. Den empiriska datainsamlingen utförs på ett fastighetsbolag genom intervjuer, en fokusgrupp och deltagande observationer. Studiens huvudsakliga resultat är identifierade utmaningar, såsom hållbarhetsarbetets omfattning, motstånd mot förändring och att projektledare ofta har begränsad tid och kostnad. Ytterligare utmaningar är bristande kunskap, få riktlinjer i renoveringsprojekt samt många och diffusa ansvarsområden. För att mäta dessa utmaningar har flera förbättringsfaktorer identifierats. Studien visar att det är avgörande att definiera, upprepa och exemplifiera ekologisk hållbarhet för ett framgångsrikt genomförande i projekt. Det är vidare viktigt att utbyta information och erfarenheter, förklara åtgärder och undersöka möjligheter med hållbarhet. I slutändan är syftet med de kritiska faktorerna är att fungera som rekommendationer för att underlätta projektledarnas hållbarhetsarbete i renoveringsprojekt.

Nyckelord: Projektledning, ekologisk hållbarhet, renoveringsprojekt, utmaningar, kritiska faktorer

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Preface

This study is a master thesis within the master programme Design and Construction Project Management, at Chalmers University of Technology, Sweden. The work is carried out from January 2023 until June 2023 at the department of Architecture and Civil Engineering.

We would like to give credit to and thank our supervisor at Chalmers Mathias Gustafsson for being helpful and giving us feedback during the process.

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Göteborg, June 2023

Malva Eliasson & Caroline Jakobsson

Annotations

BVB	*Byggvarubedömningen* A database containing information about products and materials related to the building sector. Used in projects to register the materials/products applied. (Byggvarubedömningen, n.d.)
Ecological sustainability	Actions to reduce the impact on nature and achieve long-term sustainability of the earth's ecosystem. Provides the framework for economic and social sustainability (Nationalencyklopedin, n.d.-a).
Green public procurement	Public authorities intend to buy goods, services, and work with a decreased environmental impact through their life cycle (European Comission, n.d.).
LCA	*Life cycle assessment* A tool to assess the environmental impact of a product or service over its life cycle (Larsson et al., 2016).
Renovation projects	A type of building alteration, the concept remodelling is included under renovation (Boverket, n.d.-e).
Reuse	Utilizing a used product or material again for a similar purpose (Nationalencyklopedin, n.d.-b).
Sustainable project management	Application of methods and tools to achieve a defined goal while consider the full life cycle of the project's outcome to ensure a positive environmental, social, and economic impact (Green project management, n.d.).

Wordlist

Client	Byggherre
Early stage	Tidigt skede
Emissions	Utsläpp
Framework agreement	Ramavtal
Public procurement	Offentlig upphandling
Reuse	Återbruk
Stakeholders	Aktörer
Sustainable project management	Hållbar projektledning
The procurement authority	Upphandlingsmyndigheten
Waste management	Avfallshantering

1 Introduction

The thesis investigates how project managers are working with ecologic sustainability in building renovation projects. The focus is on how project managers work with increasingly complex challenges and requirements to address carbon footprint, choice of material, reuse, etc. Furthermore, this chapter contains background information, problem statement, aim of the research, limitations, ethics and sustainability, and the structure of the report.

1.1 Background

Disturbing biodiversity, abusing land, producing greenhouse gas emissions, generating landfill, and discharging dirty water, are just a few of the harmful environmental effects that construction activities contribute to (Zhang et al., 2019). Emerging from the excessive use of resources and energy the construction industry contributes to a major climate impact and during 2020, it accounted for 21% of Sweden’s greenhouse gas emissions (Boverket, n.d.-f). Similarly, Naturvårdsverket (n.d.-a) emphasizes the negative climate impact and greenhouse gas emissions due to the construction and management of buildings. A high construction rate in combination with achieving Sweden’s set climate goals entails that various actions need to be implemented. Hence, the building sector has developed a joint plan to reach net zero emissions by 2045. As the industry contains actors from all life cycle stages, it requires commitment and responsibility from every part involved to achieve an environmental improvement (Naturvårdsverket, n.d.-a). For this reason, sustainability requirements are increasing in building projects, not only ecological aspects but economic and social factors as well (Álvarez Antón & Díaz, 2014).

Ecological sustainability is defined as actions to reduce the impact on nature and nurture the Earth's natural resources in the long-term (Nationalencyklopedin, n.d.-a). To increase the knowledge on ecological sustainability in the construction sector lifecycle analysis can be used to calculate the environmental impact of a building, considering all lifecycle phases, from raw materials to end-of-life stage. The climate calculations can be used to see how much a new building versus re-building the existing one impacts the climate (Ferreira et al., 2015). Building renovation projects are an opportunity to decrease the industry’s climate impact, and as a result increase the buildings sustainability. The ecological sustainability can increase by reducing energy consumption, -social through improvement of indoor climate and economic sustainability by increasing the building process’s productivity (Jensen et al., 2018). Additionally, the concept ‘renovation’ is in Swedish regulations included under alteration of a building. Renovations include all sizes of projects, even remodelling is a type of renovation (Helsing, 2016). Remodelling of a building is an alteration that significantly renews either the whole building or a substantial part of it. To count as significant renewal the actions for alterations should be subject to a building permit, a large economic investment, and have a certain extent, if these three criteria are not fulfilled it is not a remodelling (Boverket, n.d.-e). Henceforth, the term renovation is used to refer to any modification of existing buildings.

In order to achieve a successful building project, a well-executed project management is required (Robichaud & Anantatmula, 2010). Most construction organisations invest in resources and techniques to integrate a suitable project management (Stanitsas et al., 2021). Furthermore, Webster and Knutson (2006) explain project management as work mainly consisting of the three components planning, controlling and monitoring. A crucial part in construction project management is the project manager that plays a key role in a building project. According to Walker (2015), a project manager's task is to manage and structure projects based on the client's needs. Hence, the work role should resolve conflicts and ensure that the project process runs as smooth as possible. Elmezain et al. (2021) similar describe the role of a project manager as a vital part in the success of a project.

1.2 Problem Statement

The construction industry is constantly growing, with larger and more complicated projects (Emes et al., 2016). At the same time, the environmental awareness is increasing in the sector which means that the industry needs to concentrate on existing buildings to a larger extent. The need for new construction must be reduced and instead increase the focus on renovation. Several previous studies have discussed the construction industry's climate impact and the need of reducing the carbon dioxide emissions (Boverket, n.d.-f; Larsson et al., 2016; Naturvårdsverket, n.d.-a).

It is often up to the project manager to handle sustainability in a project (Stanitsas et al., 2021). More complex building projects gives the project manager more job. Previous research has not studied how the project manager can handle the increasing sustainability demands in renovation projects. The focus of previous studies has primarily been on sustainable project management but not connected to renovation projects in the building sector (Glaumann et al., 2016; Kamari et al., 2017; Robichaud & Anantatmula, 2010). Previous research has thus investigated these topics separately but not together. Additionally, this report studies the topic from a real estate company's point of view, which provides a client perspective on the subject.

Sustainable project management in renovation projects needs to be further researched to facilitate project managers work and to increase the ecological sustainability in renovation projects. The report will contribute with recommendations regarding how to handle ecological sustainability challenges for project managers working with renovation projects.

1.3 Aim

The aim of the paper is to investigate how project managers work with ecological sustainability in renovation projects, from a client perspective. Firstly, by identifying obstacles and what type of challenges exist in the matter. Further investigate how climate calculations and reuse are implemented in renovation projects. Also, to find ideas for improvements in the area. The goal of the report is to provide recommendations for project managers on how to work with the encountered challenges. The target audience for the study is the building sector, also researchers and students within civil engineering and sustainability. To reach the aim following research questions with complementary sub questions have been constructed.

Research questions:

- What challenges regarding ecological sustainability does a project manager encounter in renovation projects?
- What are the factors needed for a project manager to succeed with ecological sustainability in renovation projects?

Sub questions:

- How is the implementation in practice?
- What role does the organisation play?
- To what extent are there differences between small and large projects?
- What implementations can be made to facilitate the challenges?

1.4 Limitations

The focus of the study is the construction sector where the empirical data collection is based on a real estate company in Sweden. Hence, a client perspective will be implemented with an organisational viewpoint. The focus will be on project managers working at the company. The research will be project based focusing on the company's renovation projects of primarily universities and office premises. However, new construction will be covered to some extent. Furthermore, the study will focus on ecological sustainability. Still, as social- and economic sustainability is important and clearly connected to ecological sustainability, and these aspects are reviewed to some degree.

1.5 Ethics and Sustainability

To ensure a high level of moral, ethics is considered throughout the research. Hence, to involve the ethical aspect, several parameters are included. Firstly, reliability is verifying the quality of the study as honesty permeates the report through an open, well-distributed research process with clear and complete information. Besides, the studied company, research participants, environment and society are treated fair and respectful.

In addition, responsibility from start to end of the research has been taken including proper handling of the collected data in accordance with ethical guidelines. The data is used with the aim to improve, not to affect anyone negatively. Ethics has also been applied in the work process, the authors has treated each other with respect and the work has been divided equally between them.

The research considers the global sustainability goals, and the focus is primarily on goal number 12: ensure sustainable consumption and production patterns. Reducing the climate impact through changing the process of consumption and production of goods and resources. Part goals is to promote sustainable management and efficient utilisation of natural resources, also to encourage companies to apply sustainable methods. Another goal that is addressed is goal 11: make cities and human settlements inclusive, safe, resilient, and sustainable. Where a sub goal is to decrease cities environmental impact (United Nations, n.d.).

1.6 Report Structure

The report is divided into six main chapters, starting with an introduction to the investigated topic and ending with conclusions to the formatted research questions. A short description of each chapter is shown in figure 1.

Chapter 1. Introduction	The first chapter includes a introduction to the study involving background, problem statement, aim of the research, limitations, ethics and sustainability, and the structure of the report.
Chapter 2. Theory	Chapter two is the literature study of the research. Here the topics building process, ecologic sustainability, organisation, project management and renovation projects are addressed.
Chapter 3. Methodology	In the methodology chapter, the methods used in the thesis are explained. Including research strategy and design, literature study, empirical data collection, reliability and validity, and analytical method.
Chapter 4. Empirical result	Chapter four consists of the empirical result, findings from interviews, focus group and participant observations. Areas highlighted are, inter alia, project management, carbon footprint and reuse.
Chapter 5. Discussion	In chapter five the discussion is carried out, were the literature is compared with the empirical findings. Topics discussed are, for example, challenges, implementation in practice, and facilitating measures.
Chapter 6. Conclusion	The last chapter consists of conclusions and recommendations, answering the stated research questions.

Figure 1. The report's structure.

2 Theory

In this chapter the literature study is presented. The topics covered are the building process, ecological sustainability, renovation projects, organisation, and project management. Further introduction to the sections is found in the beginning of each section.

2.1 Building Process

The construction industry involves several stakeholders, inter alia, clients, contractors and consultants (Bal et al., 2013). Type and numbers of stakeholders varies depending on construction project. Furthermore, there are many types of projects, from new construction, renovation to demolition of e.g., housing, hospitals, or schools (Emes et al., 2016). A common factor is that all type of projects involves a similar process.

The construction building process includes four main stages (Nordstrand, 2008). The first part of the process is called pre-study and begins when the client wants to start a project. Thus, information regarding what is going to be built, where it will be built and what the needs for the building are, is developed. Furthermore, objectives and visions for the up-coming building project are created. Additionally, necessary frameworks for the project are briefly described during the pre-study. The second part of the building process is the programme stage where the objectives and requirements for the project are explained in building programme documents. In addition, type of contract form is decided at this stage. The next stage of the building process is the design phase which consists of work with the building's design, layout, and various investigations. Besides, the building permit is applied, and essential technical documents are produced. The last part of the building process is the production phase and later the follow-up to reach a final approval of the building so it can be put into use (Nordstrand, 2008). This process mainly concerns new construction. However, the process is similar in renovation projects, further elaborated in section 2.5.

2.2 Ecological Sustainability

In the building process there are many factors affecting the environment, as a result sustainability has become an increasingly important part of the construction industry. The number of sustainable construction projects is increasing every year. A sustainable construction project is a project where sustainability issues are included throughout the whole life cycle of a building (Boverket, n.d.-c). Applied in this study is a perspective on how to achieve sustainable development and how the sustainability dimensions are connected. The perspective used is described by Boverket (n.d.-b) as the idea that one of the sustainability dimensions sets the prerequisites, in order to reach sustainability in the other dimensions. Usually, it is the ecological dimension that provides the prerequisites for the goal, normally the goal is to reach social sustainability. The economic dimension is then used as a mean to reach the goal. Simply, use ecological sustainability as a basis for achieving social sustainability by means of economic sustainability.

Ecological sustainability measures within sustainable construction are, for example, to use lifecycle perspective on buildings environmental impact, consider ecosystem services in the construction phase and adapt buildings to the climate (Boverket, n.d.-c). There are legal requirements regarding the climate impact of buildings, stemming from the Swedish environmental law. Furthermore, as of 2022 there is a law on climate declaration for new buildings, meaning that the client needs to show how much a building impacts the climate (Boverket, n.d.-d). Additionally, to reduce the climate impact of the construction industry, many actors in the sector have agreed on a common climate roadmap with the vision to reach a climate neutral and competitive value chain by the year 2045. To reach the vision, the plan is divided into sub-objectives, one of which is to reduce greenhouse gas emissions by 50% by 2030, compared to 2015 (Fossilfritt Sverige, 2018). A further important part of the environmental aspect is waste management since it can minimise the impact on both the environment and health in society. With good waste management, much waste is already prevented and resources in the resulting waste are taken care of (Boverket, n.d.-c). According to Gluch et al. (2011), there are obstacles slowing down the environmental work in the building sector. The major hindrances are stated to be that it is too costly and a lack of educated personnel in the area. Also, there are shortcomings concerning the knowledge transfer between projects, inadequate cooperation between actors in the building process, and lack of knowledge regarding accessible tools.

2.2.1 Climate Footprint

Janse and Wiers (2007) describe climate footprint as a tool to address climate change in terms of greenhouse gas emissions. Sameer and Bringezu (2021) explain climate footprint as the global warming impact while Wiedmann and Minx (2008) define it as the amount of greenhouse gas emissions measured in carbon dioxide (CO2) equivalents. The construction industry accounts for 21% of the greenhouse gas emissions in Sweden, hence, measures need to be taken to reduce the emissions (Boverket, n.d.-f).

To reduce the climate impact of the construction industry, a new law on climate declarations concerning new buildings has been implemented (Boverket, n.d.-d), mentioned in the previous section. To facilitate the introduction of the new law, Boverket published a climate database and a climate declaration register regarding climate declaration of buildings. The client is the actor responsible for performing the climate declaration and submitting it to Boverket, however, several actors are impacted by the law. The client can delegate the work regarding the climate declaration to consultants, contractors, and architects, but are still responsible for ensuring that the climate declaration is completed, submitted, and complies with the rules. The law only concerns new construction; however, the construction industry generally focuses more and more on rebuilding. Though, it is harder to perform climate calculations on renovations since they have different conditions and different types of constructions (Boverket, n.d.-d).

A tool to assess the environmental impact of a product or service over its life cycle is Life Cycle Assessment (LCA). Included in the life cycle are all stages from extraction of resources, production, transport, use and waste management. When all life cycle stages are covered, the total environmental impact is added up and forms the whole product system (Larsson et al., 2016). According to the European Standard EN 15978:2011, the life cycle of a building includes the areas A, B, C and D (see figure 2) (The European Committee for Standardization [CEN], 2011). A1-A3, the product stage, covers the production of construction products and other resources used during the process. The next stage, A4-A5, is called the construction process stage and includes the transport of construction products to the site and the production of the building. The following stage, B1-B7, named the use stage, involves the use, maintenance, repair, renovation, and operation of the building. Further, C1-C4, the end-of-life stage, includes the processes required to demolish and remove the building elements when the lifetime is reached. The last stage, D, named beyond and loads past the system boundaries, focuses on the reuse-, recycling- and recovery potential of the building elements (Boverket, n.d.-g).

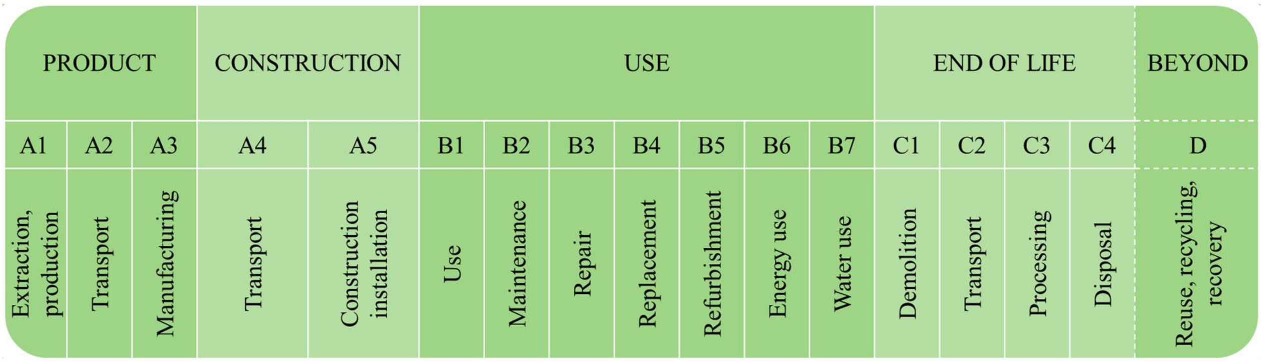

Figure 2. Life cycle of a building according to European Standard EN 15978.

According to Boverket (n.d.-a), the biggest climate impact occurs during the building phase (A), especially in the manufacture of building materials. Larsson et al. (2016) similar state the product stage (A1-A3) as the phase with the highest climate impact from a life-cycle perspective. The knowledge regarding the climate impact of the operational phase (B) of buildings is constantly increasing and therefore, the environmental impact of the operations decreases gradually with the transition to renewable energy sources. However, regarding the climate impact of the construction process, from material extraction to the finished building, more knowledge is required. This is of high importance, especially since it is the part with the highest environmental impact.

Since material contributes to a large part of the climate impact in the construction industry, it is important to carefully evaluate the material selections. To reduce the environmental impact, it is important to ensure that the entire lifetime of the materials is used, hence, if a material needs to be removed before its full potential is consumed, it should be reused or recycled to the maximum extent possible (Miller & Ip, 2013).

Furthermore, Miller and Ip (2013) discuss several materials and identify timber as a sustainable material since it is a renewable resource if it is handled properly. Looking at a longer period, timber is sustainable if the forests are correctly handled. Further, when the timber has reached its full lifespan, it can be recycled and burnt as a fuel or naturally decomposed in a landfill. Unlike timber, the production of concrete contributes to large emissions of carbon dioxide. These emissions are primarily due to the release of carbon that earlier has been bound in the limestone. Concrete is often used in big amounts, for instance in a building's shell. Therefore, it is important to evaluate the material options and find new more environmentally friendly production techniques (Naturskyddsföreningen, n.d.).

When choosing materials and products in a project there are tools that can help make sustainable choices. The non-profit organisation Byggvarubedömningen, BVB, founded by actors in the sector to create a database with assessed products. The database consists of information on evaluated products and material related to the building sector. Thus, companies can get access to information on assessed products to make sustainable choices and register chosen products in projects. Also, gain an understanding of what impact products have on people and the environment. The assessments are made based on criteria developed by the organisation. There are two criteria groups with experts in the subjects, one concerning chemical composition and lifecycle aspects and the other one for sustainable supply chains. The criteria are based on chemical legislations, EU Directives and international conventions (Byggvarubedömningen, n.d.).

2.2.2 Reuse

Naturvårdsverket (n.d.-b) explains that demolition of a building should be done through planned, competent, and prudent procedures, where reusable components and hazardous materials are identified in advance. This is done to handle resources in buildings in an efficient and safe way. The ultimate responsibility of waste management lies with the client. It is also the client's responsibility to ensure that an inventory of materials is made before any building- or demolition activities are carried out. The inventory should identify which construction products can be reused and what waste the activities create, also how these are handled. Besides, there are demands on sorting of waste that generally take place on the site, which minimises contamination and facilitates reuse and recycling. The recycling of materials should occur in all stages of the building process. Through the sorting of waste, it is possible to increase the reuse and recycling of materials, collect hazardous waste in a controlled way, and reduce the amount of deposited waste (Naturvårdsverket, n.d.-b).

According to Aarikka-Stenroos et al. (2021), the construction industry has great potential for reducing the environmental impact by applying more innovative and effective reuse systems. Reuse can be applied in the building sector through, inter alia, reuse business models or individual product reuse schemes. The authors emphasize the importance of an increased understanding within the sector regarding that considered waste for one part of the industry can be valuable for another. Hence, a communication structure between the actors in a construction project regarding reuse is required to be able to start working with the topic at an early stage. Due to this, Aarikka-Stenroos et al. (2021) claim that commitment from the client, contractors, consultants, customer, and other parties involved is needed to achieve a successful reuse work.

To achieve an increased spread of reuse in the construction industry, it needs to be implemented in the companies' business models and strategies and become a natural part of a project. Reuse in construction projects contributes to a reduction of CO2 emissions. However, it also contains challenges such as a low demand, increasing costs, and new reuse technologies. With that said, reuse requires a change along the entire value chain, an increased collaboration within the sector and an effective reuse system with involvement of all actors (Aarikka-Stenroos et al., 2021). In addition, Harala et al. (2023) describe reuse as a concept with high potential in the construction sector that contributes to a better economy and reduced environmental impact. Reuse can lead to increased costs if the material needs to be renewed to a large extent but can reduce costs if it can be kept without major changes. However, to reach a wider spread of reuse, the industry needs to overcome several barriers. The industry must remove the negative image of the subject, increase the demand, and thus innovate together within the sector and create a common network regarding reuse.

2.2.3 Certifications

Environmental certifications are becoming an increasingly common part in connection with the higher sustainability focus of the building sector (Fauzi & Abdul Malek, 2013). Two typical international certification systems are BREEAM and LEED whereas a commonly used Swedish environmental certification system for buildings is Miljöbyggnad. It requires that the environmental work and performance of the building is audited by a third party. The organisation Swedish Green Building Council develops the system and implement the certifications. There are 16 indicators on which the building is assessed to reach one of the three levels of Miljöbyggnad: gold, silver, or bronze. The indicators are e.g., energy consumption, indoor climate, and chemical use. To reach the first level of Miljöbyggnad bronze, it is sufficient to follow legal requirements or recommendations. If a buildings performance is much better than the requirements in the aspects of sun protection, sound environment, and ventilation, the building can reach level silver. Silver is the level that most companies select for their building, to make a statement that they are engaged in environmental work. To reach level gold, the building often has an outspoken environmental profile, and the demands set are very high (Sweden green building council, n.d.).

2.3 Organisation

To achieve development of any kind, not least in terms of ecological sustainability, the organisation is a vital part. An organisation is a social structure of individuals working towards the same goal. In the building sector organisations often have a clear goal, as the projects mainly are of specific type (Walker, 2015). Type of projects in the construction sector includes all categories within civil engineering, from building new to maintaining and repairing existing constructions (Emes et al., 2016). Consequently, it is typical for the construction industry to have project-oriented companies, as the activities consist of a collection of projects at different stages of realisation (Iliashenko et al., 2016). Moreover, Zhang et al. (2019) state that in society, construction projects contribute to many jobs and has a high turnover, even so it is a fundamentally irresponsible industry with a huge impact on the environment. As the industry has a large influence on society, it implies for construction companies to increase their corporate social responsibility. The drivers for more social responsibility at construction companies are policy pressure, market pressure and development of technologies. The motivations for more social responsibility for the companies include branding, financial benefits, reputation, relationship building, and organisational culture. However, there are barriers affecting the implementation of corporate social responsibility in the construction industry, and these include government policy, the construction company, and stakeholder perspectives. In other words, lack of legislation, not enough knowledge within the company, and insufficient communication and collaboration between stakeholders (Zhang et al., 2019).

According to Hao et al. (2008), the construction industry is very fragmented as it includes many actors and different types of temporary projects. The number of actors and variation of projects implies a complex stakeholder structure (Bal et al., 2013). Thus, implementing change in the building sector involves a series of challenges. A common factor that often leads to failure when integrating change is resistance from organisation members. Lines et al. (2015) identified several important parameters when implementing change in an organisation. Firstly, leadership is considered as a crucial factor when integrating change. Furthermore, when an organisation decides to implement change in the business, they need to assign change agents who are responsible for leading the change management. Another important parameter in implementing change is to have patience since change takes time and needs to be a gradual process. Lastly, to achieve a successful change in a construction organisation, it requires involvement of the right personnel. In addition, the study shows that there is less resistance from organisational members to change in smaller and shorter projects compared to bigger and longer projects. Less resistance due to a higher opportunity to participate throughout the change process as it is a shorter project. Furthermore, the change may be easier to control because of the project's small size (Lines et al., 2015).

There exist several barriers when it comes to implementing change in an organisation (Zhang et al., 2019). A common barrier is lack of governmental support and absence of policies regarding the change. Further, lack of expertise, internal resources and strategic guidance often complicates the implementation. In addition, poor communication and coordination among the stakeholders means that a cohesive process of working towards the change is harder to achieve (Cameron & Green, 2019). Lack of awareness and knowledge among customers is a common barrier for change since the customer's interest is crucial for the implementation. One more barrier is lack of evaluation tools and frameworks for the change, without a clear structure and aids, it becomes more challenging to change. Lastly, a change often implies increased costs and time which can lead to resistance and a negative attitude that makes the implementation of a change more difficult (Zhang et al., 2019).

Currently, there is a lot of focus on implementing sustainability into projects and organisations, however, it becomes a challenge since the project involves several actors and organisations who need to be synchronised (Overgård et al., 2022). According to Overgård et al. (2022), an assessment methodology needs to be developed in order to facilitate the sustainability work in project-based organisations. The methodology shall include how to assess, monitor, measure, and report sustainability information of a project. Another important aspect to consider when integrating a higher degree of sustainability in construction projects is procurement (Lingegård et al., 2021).

Two common procurement types are public and private procurement. Upphandlingsmyndigheten (n.d.-b) describe public procurement as the process that public organisations use to make purchases. In public organisations, the purchases are financed by public funds which implies stricter rules compared to private actors. Private procurement can be applied by private organisations since they do not have to follow the procurement laws as public organisations have to. Hence, the private procurement process is often faster compared to public procurement.

Furthermore, Upphandlingsmyndigheten (n.d.-b) explain that public procurement can be used in order to contribute to a sustainable social development. According to Lingegård et al. (2021), public procurement can be a driver to reduce the carbon emissions and increase the use of green products and services. The phenomena of using public procurement as a tool to increase the sustainability in the sector is called green public procurement and sustainable public procurement. This could be done through state sustainability measures in the agreements. Since the construction industry often involves temporary projects with a variation of actors, it becomes a challenge to achieve a linked, cooperative system of actors working towards reducing the carbon emissions in a project. Therefore, Lingegård et al. (2021) highlight the importance of creating inter-organizational relationships to achieve an increased level of information exchange. A further challenge when working towards increasing the sustainability by using public procurement is the lack of green products and services. In addition, information regarding the environmental impact of products is often lacking which results in limited choices (Lingegård et al., 2021).

In the procurement process, agreements need to be produced. Upphandlingsmyndigheten (n.d.-a) describes an agreement as a legally binding contract between two parties on their rights and obligations towards each other. There are different types of agreements, a commonly used agreement in the construction sector is framework agreement. Upphandlingsmyndigheten (n.d.-c) describes a framework agreement as an agreement that sets the terms of contracts for a decided time-period. Framework agreements can be signed for procurements of both goods, services, and construction contracts. A framework agreement is appropriate and efficient when the procured authority can predict future needs and want to plan for those. In addition, a framework agreement can be formed between one or several procured authorities and one or several suppliers. Besides, a framework agreement has a limited time of four years, however, exceptions can be made for specific reasons (Finansdepartementet OU, SFS 2016:1145).

2.4 Project Management

In project-based organisations, project management is an obvious and essential part. Project Management Institute (2021) defines project management as "The application of knowledge, skills, tools, and techniques to project activities to meet project requirements". To achieve a successful project management, several parameters should be included. Firstly, coordination within the project is needed to achieve a smooth workflow and to prevent issues. It is important to have a clear oversight of the work process and to establish objectives for all parties involved in the project. A further crucial parameter in achieving a well-functioning project management is communication. Hence, clear lines of communication between all parties are required. Furthermore, emphasizing the importance of having a functional feedback process and a support system within the project management. Lastly, it is vital to have the right knowledge, resources, and expertise available to maintain a successful project management (Project Management Institute, 2021).

The project manager is a key in the process of achieving a successful project management. Walker (2015) describes a project manager as a central and vital part of project management. The project manager's task is to help the client to achieve its goals by resolving conflicts and facilitate the construction process. Project Management Institute (2021) describes the project manager as an organised and solution-oriented person with the work task to design successful projects. According to Anantatmula (2010), the problem-solving characteristic is the most important of a project manager since all projects are unique with a high level of complexity and uncertainty. Besides, the project manager works in various teams containing different people which means they must have good leadership skills.

In connection with the increasing climate demands and environmental awareness, the project management needs to adapt to the changes. Stanitsas et al. (2021) claim similar as Project Management Institute (2021) that planning, collaboration, communication and multi-tasking are main components in project management. However, sustainability can be implemented in all parts of project management (Stanitsas et al., 2021). For instance, to achieve an efficient and well-planned construction project, sustainable project methodologies can be applied in the project management group.

Furthermore, Robichaud and Anantatmula (2010) highlight the importance of the project management's knowledge in sustainability to increase the implementation of the topic in the sector. In addition, it is crucial that the project team is united in terms of sustainability to include it throughout the whole construction process.

Stanitsas et al. (2021) describe that to have a sustainable project management the project manager is of high importance, especially regarding stakeholders' involvement and ethics. Stakeholders' involvement implies that sustainable project management should include a stakeholder analysis which leads to a strategy for the management of the involved stakeholders. The ethics part is about how sustainable project management can contribute to the sustainability of the organisation and society. In both these parts the project manager should be highly involved to obtain a sustainable project management. According to Nordstrand (2008), the project manager is responsible for the implementation of sustainability in a project. The project manager may, if necessary, appoint an environmental coordinator for the project. However, the project manager needs to push the sustainability issue through a project and if the involved participants do not have a big interest in the area, it gets tough. Therefore, it is important to have a structured plan and clear objectives regarding the topic from the very start of the project process. With that said, the engagement of a project manager affects the result of a project (Stanitsas et al., 2021).

2.5 Renovation Projects

Project management is highly relevant to the realisation of a renovation project. According to Femenias et al. (2015), there are several factors that force the need for building renovation. One aspect is the age of the building, where the technical systems have passed their longevity, or that the requirements of the tenants have changed, and the building needs to be adapted to new social prerequisites. Another aspect is the increasing climate demands, leading to property owners making comprehensive measures in the buildings climate shell and ventilation system to decrease energy consumption (Femenias et al., 2015). Furthermore, renovation of buildings increases social values, but also it is more environmentally sustainable compared to demolishing and building new (Ferreira et al., 2015). Thus, there are barriers stopping the implementation of renovation projects for more sustainable buildings. Glaumann et al. (2016) point out the fear of high investment costs and profitability issues, but also the absence of many factors like knowledge on sustainability matters, a simple evaluation tool and coordination between energy-saving and other measures. Furthermore, Femenias et al. (2015) states that companies in the building sector do not have any guidelines or goals for renovations and claim that there is an absence of specific policy regarding renovation. Renovation instead falls under the general guidelines of the company. However, companies always have an environmental policy, often consisting of a target to reduce energy consumption in new buildings but it normally does not apply to renovation projects. Also, these kinds of energy targets are generally at a company level, not at a project level as it can vary depending on type of project.

According to the European Standard EN 15978:2011, building renovation represents a "modification and improvement to an existing building in order to bring it up to an acceptable condition". The standard defines renovation as a sub-part of the use stage, part B5 seen in figure 2. The part includes a buildings major technical or functional change that are not related to the other use stages, like maintenance or foreseeable repairs and replacements. The boundary description of the renovation stage should include the modules A1-A5 and C1-C4, (see figure 2), concerning new components and handling of the replaced products (The European Committee for Standardization [CEN], 2011). A kind of building renovation is adaptive reuse, meaning altering the use of a building to a new use, e.g., altering a factory into an office building (Bates et al., 2019). Further referred to as tenant adaptions in this study.

The use stage of buildings has had a large focus in life cycle assessment because of the simple ways to lower the climate impact in that stage, e.g., renewable energy sources (Larsson et al., 2016). Thus, Glaumann et al. (2016) states that the focus has increased on the product stage, as the embodied impacts from the building material production have a significant impact on the climate. This shift in focus is pushing the need for life cycle assessments in renovation projects. For instance, Larsson et al. (2016) states that during a renovation of a building, a lot of material is transformed, which contributes to a significant environmental impact. Nevertheless, Bates et al. (2019) highlights the importance and life cycle benefits of renovation projects to reduce the overall building material production. While, further explaining that there is a lack of guidelines on how to conduct a LCA on renovation projects which prevents the usefulness of a LCA to see the environmental advantages of renovations and makes it harder to understand how many benefits of renovation there are in practice. By performing an LCA in connection with a renovation, Larsson et al. (2016) claims that various choices can be evaluated to achieve the lowest possible environmental impact.

Compared to the process of new construction, Femenías et al. (2012) states that the renovation processes are more uncertain and complex concerning decision-making, planning, and execution. The existing buildings' qualities and weaknesses need to be considered. Similarly, Glaumann et al. (2016) explains that renovation projects already have fixed preconditions and boundaries that need to be considered. Femenías et al. (2012) continues by describing that, normally, the process of rebuilding contains the same stages as to building new. Whereas, in renovation more time and resources should be set aside to the preliminary investigation stage, to achieve a good result. Also, Glaumann et al. (2016) emphasizes the importance of making decision early in the process, as these decisions have a great impact on the environmental performance of the building. Thus, renovation processes often start with inadequate documentation of the existing building conditions. Lack of knowledge about the existing building risks the loss of incalculable values, for instance when elements of good material is being replaced by new industrial, low-quality products with a shorter lifespan. There is also a risk that architectural, cultural, and social values are being overlooked for energy and economic performance measures. Though, in the building sector these immaterial values are often perceived as obscure and hard to handle (Femenías et al., 2012).

Finally, because the project manager is an essential part of a building project it entails a large responsibility. To get a broader understanding of the responsibilities, the work of project managers is researched more in depth in this study. It is seen that the work with ecological sustainability is often assigned to the project manager which implies for even more responsibility. Also, as the environmental awareness increases in the building sector, a higher focus is placed on renovation projects. Focusing on renovation means more sustainability challenges for the project manager as it is an existing building to consider, and other undertakings compared to new construction. To capture the totality of a building project, this research includes the topics building process and organisation. Understanding the building process makes it easier to see where measures can be implemented and where to prioritise sustainability. The organisation is an essential part both at a company level and a project level, therefore it is important to understand the organisational role in a construction project and what procurement can contribute with.

3 Methodology

This chapter describes the methods used to produce the report. Starting with the research process, including what type of research strategy and design that was applied. This is followed by the methodology of the literature review and the empirical study. Thereafter, an evaluation of the reliability and validity of the report. Lastly, a description of the type of analytical method used.

3.1 Research Strategy and Design

The research strategy for the study was qualitative research, which according to Bell et al. (2022) emphasizes words instead of numbers, as quantitative research does. The qualitive strategy has an inductive view of the connection between theory and research, meaning that the theory is generated from research. Also, it underlines the view of the research participants. The qualitive strategy is used as it is a flexible research strategy that can have an iterative process, where the steps of data collection and analysis is parallel. Hence, an iterative process was applied in the report. Accordingly, research methods for the study were qualitative interviewing together with collection and analysis of studies and texts (Bell et al., 2022).

Moreover, the study follows the main steps in qualitative research, described by Bell et al. (2022) as firstly defining general research questions, then selecting relevant subjects, next step is the collection of relevant data, then analysis of that data, alternating with conceptual and theoretical work, and lastly, writing up findings. A simplified scheme of the work process is found in figure 3. Further are the research questions for the report stated in section 1.3 and the interviewees are the selected subjects of the study.

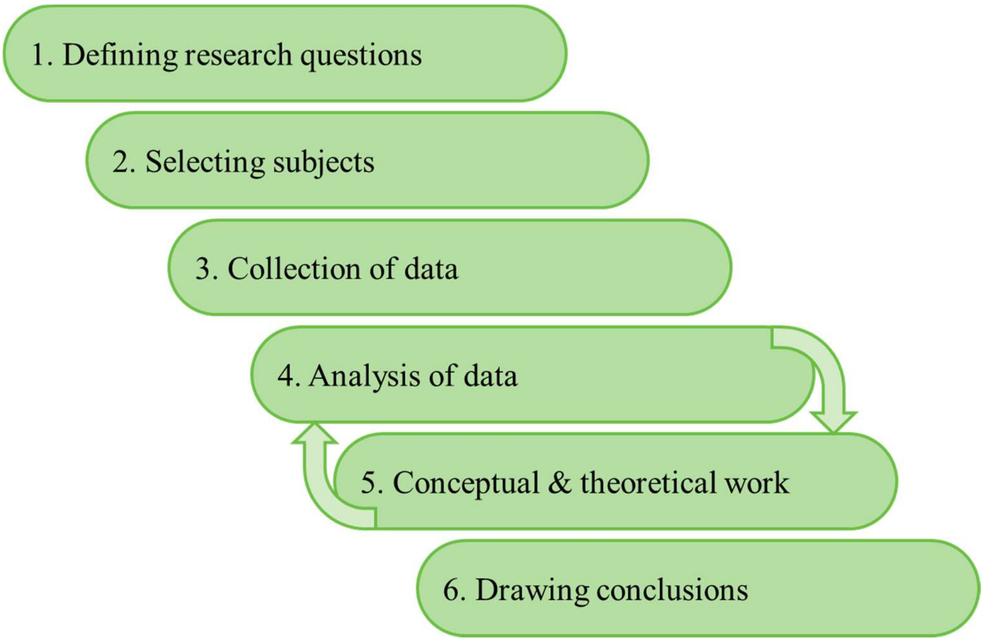

Figure 3. Schematic over the work process.

According to Bryman and Nilsson (2018) the research design provides a framework for the collection and analysis of data, where which type of design reflects what aspects is prioritised in the work. The research design for the study was a comparative design, consisting of more or less identical comparisons of two or more contrasting subjects. Hence, a comparative logic was implemented to gain a better understanding of the identified challenges through a comparison of diverse subjects. Moreover, comparative design was used because of its ability to distinguish aspects from multiple subjects to reach theoretical reflections on different results (Bryman & Nilsson, 2018). The subjects compared in the study was the interviewed persons in the qualitative interview study, which was one of the chosen research methods.

3.2 Literature Study

The literature study created a basis for the topic and explained relevant theories and concepts that later was used and analysed in the report. Furthermore, it clarified which parts of the subjects that were not deeply investigated and therefore was examined to a larger extent in the empirical study.

The process of gathering relevant literature started with a data collection from the databases Google Scholar and Chalmers library. To find appropriate sources, the keywords *construction, project management, building sector, renovation projects, ecological sustainability*, *change*, *challenges*, and *organisation* were combined. Types of sources used were scientific articles, books, and websites. As sustainability is a topical subject, the collected resources about it were up to date to ensure the sources to be relevant. In addition, articles from different countries were used, however, it was ensured that these articles contained information that could be compared with Swedish practices. The literature was then read by both authors of the report and if the source was considered relevant, the most essential parts were highlighted and summarized. Furthermore, the sources were read from a critical perspective to perceive credibility and usefulness (Bell et al., 2022).

3.3 Empirical Data Collection

The empirical data collection was conducted through three methods. The methods used were an interview study, consisting of nine interviews, a focus group, and participant observations. The empirical data collection was studied through the case of a real estate company. The company's publications related to sustainability were used to assess visions, goals and working methods within the area. Additionally, the company's website contributed with knowledge regarding their sustainability focus and climate impact. The data gathered from the real estate company was later in the report compared with information provided by the project managers.

3.3.1 Interview Study

The empirical study was conducted through a qualitative interview study. Bell et al. (2022) describe qualitative interviewing as a method where the researcher analyses the interviewees' knowledge and experiences to get their understanding within a specific topic. The interviews were held in a semi-structured format where the researcher formulated a list of questions before the interviews were performed. The interview list, or interview guide, consisted of open-ended questions which enabled the respondents to carry the discussion in a direction they considered important for the studied topic. Hence, the interviews were quite flexible and different follow-up questions were asked depending on the interviewee's answers (Bell et al., 2022). The interview guide was structured around different types of questions. Both introducing, follow-up, specific, direct, indirect, and interpreting questions were asked to get as much relevant information as possible. In addition, the interview guide contained critical questions to obtain perspectives and nuanced information.

The empirical data collection consisted of nine interviews with project managers at the studied real estate company. The first contact was conducted through email, 14 project managers were contacted and nine were interviewed. The interviewees were based in different geographical regions within the company, north, middle, and south of Sweden. The selection of interviewees was made with help of a project manager at the company to achieve a breadth in terms of the project managers knowledge, experience, interest in the subject, and size and type of renovation project. A purposive sample was thus used to select interviewees to reach as wide and varied target group as possible. Bryman and Nilsson (2018) explain the use of purposive sampling with as much variation as possible to ensure maximum variation in terms of interest.

The interviews were performed both face to face and online depending on the project managers circumstances. In order to make the respondents feel comfortable during the interviews, they were anonymous and could therefore share valuable information without being negatively affected in any way. Furthermore, the interviewees were asked if it was ok to record the interview. With that said, all interviews were recorded to allow the interviewers to be more active during the sessions and to follow up on interesting responses (Bell et al., 2022). The recordings were later transcribed and coded which was beneficial since information thus was repeated and more details were included. Thus, a better analysis of the data could be performed. In addition, significant quotes that strengthen the study's result were retrieved (Kvale et al., 2014).

To ensure the respondents anonymity and to not dehumanise them the interviewed persons will be called by fictive names. The names are Charlie, Louis, Sam, Robin, Eli, Alex, Otis, Jamie, and Kim, and will be divided randomly throughout the project managers. These names are chosen as all are gender neutral. Furthermore, the respondents have been chosen based on varied experience, age, gender, and location. Firstly, the range of years working as a project manager differed from 2-32 years, with a lot of variety. Secondly, years working in the building sector varied from 3-35 years, where everyone, except two respondents, has been working for more than 20 years in the sector. Working at the real estate company differed from 3-23 years, and mostly between 3-6 years. Additionally, two of the managers had a more comprehensive title, working as the manager for the project managers but without personnel responsibility. However, a project managers' work tasks are included in their title, so they are not separated from the others. The geographical location of the project managers differed across the country, however, most of the respondents worked in the south of Sweden.

3.3.2 Focus Group

A focus group is a group interview where several people are interviewed on a specific topic. Usually, a focus group consist of around four people that are being interviewed and the interview group explores a topic through various questions (Bell et al., 2022). As part of the empirical data collection, a focus group was conducted based on the results of the previously conducted interviews. The purpose of the focus group was to create a discussion about the identified challenges and to delve deeper into them by allowing a selected group to discuss the results. Also, to gain more knowledge about the organisational perspective of the encountered challenges. The focus group was planned to consist of two project managers, one of whom had already been interviewed, and two persons working more with sustainability connected to projects, at the company. Although, one of the project managers had to cancel due to illness. The two authors of the master thesis led the focus group and ensured that the discussion stayed within the topic. During the focus group, notes were taken, and the data was as soon as possible compiled in the result to have the information fresh in mind. Furthermore, the focus group was conducted on site at the office to achieve the best and most natural discussion possible. The respondents of the focus group will stay anonymous to ensure their integrity. Just like the respondents of the interviews, the focus group respondents will be called by gender neutral fictive names in the result and discussion. The names of the focus group respondents will henceforth be Billy, Dylan, and Elliot.

3.3.3 Participant Observations

According to Kawulich (2005), participant observations is a useful method for describing existing situations and processes. Musante (2015) similar explain participant observations as a method where the researcher participates in daily activities and interactions to gain information and learn more about the studied area. Through observing real-life situations, necessary and useful information can be retrieved. Furthermore, participant observations are appropriate to retrieve information concerning how much time is spent on various topics in real life. Therefore, to gain a greater understanding of the studied topic, the authors observed meetings and seminaries about sustainability. By performing participant observations, more information regarding how sustainability work functions in practice could be obtained and compared with the other data collected. During the participant observations, the authors took notes so the information could be compiled in the result.

3.4 Reliability and Validity

The reliability and validity of a study is of high importance to check the relevance and trustworthiness (Bryman & Nilsson, 2018). To achieve reliability and validity of the conducted qualitative research, four sub-criteria were taken into account. The first criteria were credibility which was considered by allowing the project managers to review the results before publication of the report to ensure correct interpretations of their answers, this concept is called response validation. The second criteria considered was transferability, as the interview study only covered a small group of people, detailed descriptions of the data were used to be able to determine whether the information is transferable to another area. The third criteria covered in the study was dependability. To increase the dependability, an explanatory approach was used including full explanations of all parts of the research process to make the target group aware of how the phases of the process have been conducted. A clearly explained and described process with verification of statements was further performed to reach confirmability, the fourth criteria (Bryman & Nilsson, 2018).

To further strengthen the reliability of the study, both authors participated in all interviews. In addition, the transcription was done soon after the conduction of the interviews to reduce the possibility of forgetting details. The collected data was then coded and analysed by both authors to achieve a valid structure and sorting of the information. Besides, the reliability of the study has been strengthened through triangulation, as both interviews, a focus group and participant observations were performed. These parts contributed to an increased data collection in the field that could be analysed and compared to produce more credible results (Bell et al., 2022). Another part of the study that contributed to more reliable data was the anonymity of the company and interviewees, hence, the respondents could tell vital information without feeling that it could affect them negatively in any way (Kvale et al., 2014). Anonymity of the company also helped to ensure that no sensitive or secret information was disseminated.

3.5 Analytical Method

The analytical method used for the qualitative data analysis was thematic analysis. Thematic analysis is a method where collected data is carefully identified and analysed based on patterns or themes. The method has been implemented in the study as the collected data from the interviews formed an initial coding scheme which in turn created categories based on an iterative process of constant comparisons (Bryman & Nilsson, 2018). The categories the transcription was divided into were *identified challenges*, *possible improvement areas*, *climate calculations*, *reuse*, and *choice of material*. The categorising was later used to structure the design of the discussion. The authors use of detailed systems for extracting structures in themes allowed the data to be used in the most appropriate way in accordance with the method.

4 Empirical Results

The empirical results are based on nine interviews with project managers at the real estate company, followed by discussions through a focus group and participant observations via seminaries and meetings about sustainability. The information about the company in section 4.1 are retrieved from internal documents.

4.1 The Real Estate Company

The empirical material of the study is retrieved from a real estate company with responsibility for owing, developing, and managing parts of the country's university buildings. The company is divided into three parts, the project department, the real estate department and the technology and service department. Since the company is a contracting authority, all their procurements of construction contractors are under the law of public procurement.

The company is one of Sweden's largest companies within the sector, which entails a major sustainability responsibility. To achieve a significant change with respect to increased sustainability, the company focus on carefully evaluating the needs for new construction and, as far as possible, investing in other alternatives as renovation and remodelling. Hence, the needs shall be analysed based on a four-step principle and always proceed from existing constructions. The first step in the four-step principle is to use the existing construction by analysing the need and consider other measures to re-building or building new. When the first step is not possible, the second step is to optimise the existing building, by streamlining existing resources, pursuing space efficiency and smaller tenant adaptions. The third step is re-building, through transformation and upgrading, keeping as much of the existing building as possible. The last option, the fourth step, is building new.

The company is working towards various sustainability goals, inter alia, the company has developed a strategy to achieve climate neutrality in the entire value chain by 2035. Furthermore, concerning the company's new buildings and refurbishments, the classification system Miljöbyggnad is followed, with the demand of gold level for new buildings and silver level for large refurbishment projects.

The real estate company performs carbon footprint management by creating project-specific targets, which are based on project-specific benchmarks for a comparable project. Due to increasing climate requirements, the target is a reduction of the baseline based on the year of project start. Reporting of the target figure is done at an early stage of the project. Climate calculations are related to the target figure and are carried out throughout the construction process, starting at the design stage, and ending at the end of construction production. The company's smaller projects work to reduce its carbon footprint by focusing on reuse and smart choices of materials and working methods.

To increase the environmental and social sustainability at the campuses, the real estate company has started to establish sustainability contracts with the universities. The sustainability contract includes several areas where the company and the university together shall contribute with activities for a more sustainable development. The contract contains information regarding how to, inter alia, increase the knowledge of cooperation concerning sustainable development, work to reduce the climate impact, energy use and waste and job regarding how to increase reuse and a circular economy.

Furthermore, the real estate company has its own project tool where every project is registered. The project manager can control, administer, and follow up on all project stages in a building project. The project tool contains several status-marked activities below every project stage with checklists, requirements and advice texts, examples, and templates as an aid through the project process. Additionally, the financial monitoring and climate calculation for the project is registered in the project tool.

4.2 Interviews

Nine project managers working at a real estate company were interviewed, the questions asked are found in appendix A and focused on the following topics: project management, sustainability, and renovation projects. The selection of the respondents and other related information can be found in section 3.3.1. The interviewed persons are called by the fictive names Charlie, Louis, Sam, Robin, Eli, Alex, Otis, Jamie, and Kim. Moreover, the project managers are involved in different types of projects, either new construction, renovation, or both. They can work on several projects at the same time depending on the size of the project. Thus, if they work on a large project, they only work in one. A large project in the studied company is defined as a project with a budget over 50 million SEK and small projects are under 50 million SEK. A small project is almost always a renovation project while a large project can be both new construction and renovation. From the interviews several challenges regarding ecological sustainability were identified, stated in figure 4 and further considered in the following sections.

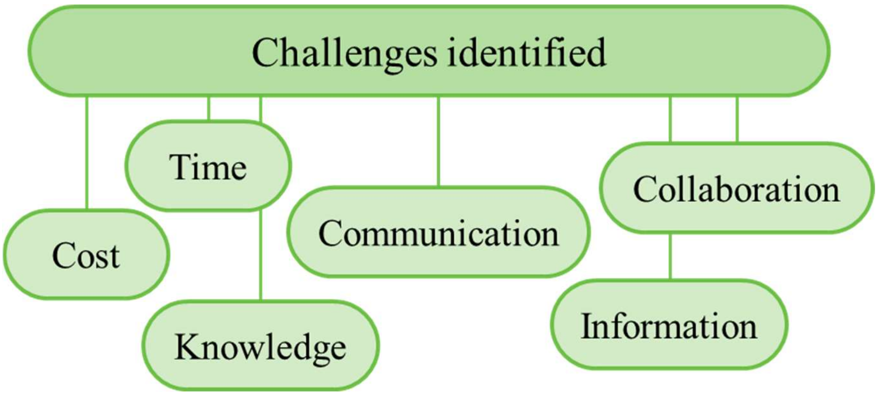

Figure 4. Challenges identified in the interviews.

4.2.1 Project Management

According to the project managers, their work role involves several parts. All project managers expressed coordination as a major part of their work role, to make sure the project runs as smooth as possible. A big part of the coordination responsibility is based on communication between different actors and stakeholders involved in the project. The communication of a project manager is mainly performed through meetings, e-mails, and telephone-calls. Almost all project managers explained communication as a crucial part of their work to make projects function. The majority of the project managers spend nearly all their work time on communicating through the named tools while a minority spend more time out at the projects, which also is a part of communication. Besides, the project manager needs to be a problem-solver and a decision-maker in order to achieve efficient projects. Furthermore, the role include work to support and help others involved in the project. At the same time, the project manager takes help from colleagues to solve tasks. One way to collaborate with colleagues is through a meeting called project dialogue, however, when asked about it the general perception is that it is not often performed due to lack of time. Project dialogue is a meeting where project managers discuss the project with experts within the company. Usually, the project manager role involves a lot of administrative office work including, inter alia, planning, reporting in a project tool and preparations for meetings, but as mentioned, it varies between the project managers. Additionally, the interviewees stated the project manager title as a work role with a lot of responsibilities which often result in a tight schedule.

The project managers state different opinions regarding the company's own project tool. They think the tool works well for financial monitoring. Moreover, the tool is used for gathering information, gaining control, and following the phases of a project. It is mentioned that the tool works especially well for small projects. Regarding sustainability aspects in the project tool, there are different perceptions. The majority of the project managers know that there are sustainability aspects to consider, but Sam mentions that the tool is not completely up to date regarding sustainability which should be kept in mind when using it. One of the project managers explain that they will enter climate calculations into the tool in recently started projects while others do not understand how they can work with sustainability in the tool.

On the topic of knowledge transfer, the project managers state that they gain knowledge by communicating with different people and through having good collaborations. Also, through looking at similar performed projects when starting a new project. An idea raised by Sam to achieve a higher level of knowledge transfer is that there should be a forum for communication in the company. When asking Otis how they work with knowledge transfer, they answered:

"Actually, probably too bad, but the contractor is always an exchange of experience. ... This is something that can be improved. But you are probably already working on something else, everyone is, which is the challenge."

All of the interviewed project managers share the opinion that the sustainability focus at the company has increased recently and is becoming a larger part of the projects. The majority of the project managers agree that the company has a strong focus on sustainability, but raising the issue that it is at a diffuse level which is difficult to interpret. However, interpretations vary regarding what sustainability at the company entails. Carbon footprint, reuse, and energy issues are focus areas that the project managers prioritise differently. Jamie defined sustainability like this:

"Sustainability is not replacing things that do not need to be replaced. When you replace something, you replace it with something that is as good as possible, and you consider the life spans."

According to the project managers -the management at the company is clear regarding the company's strong focus and prioritisation of sustainability. However, three project managers have no perception concerning how the support is from the management regarding their sustainability work. Eli mentioned that it can be hard to understand how to implement the demands in practice by saying:

"Sustainability is at the top of the agenda in every company forum right now, but at a very diffuse level. Difficult to absorb it in the projects. It would have been good if we could get specific examples of what gives effect."

Robin thought that while the management is understanding and supportive regarding sustainability, it is the customer who does not want to invest in it. Furthermore, the increased climate requirements affect the interviewed project managers work in different ways. Four out of nine mentioned the fact that there is more work to do and an additional aspect to consider. Challenges raised by the interviewees are that sustainability leads to increased costs and make their work more difficult as they perceive that there is no proven way of working with the topic.

From the interviews it appears that sustainability work differs from project to project. In small projects there is no budget that accommodate the work while, large projects often have a hired environmental coordinator but involve larger volumes of, inter alia, reused materials, which makes the work difficult. Comparing new construction to renovation, the project managers had different thoughts of the sustainability work. Kim said that it is harder in renovation as there is an existing building to consider while Charlie thought that:

"In a renovation project it requires the project manager to be much more creative, to dare to take more decisions. On a new construction project, the delivery times are much longer, and others do the work for you, you can be more like an administrator. Thus, much better relationship with the customer in renovation projects."

Furthermore, the ability to delegate sustainability work differs between projects. Three of the project managers express that sustainability work can be delegated in larger projects where there are more resources available for working with sustainability. However, challenges can be to find people to entrust, and to relinquish control.

4.2.2 Carbon Footprint

The climate footprint is of high priority for the real estate company. Based on the company's website and publications, the carbon footprint is an important factor to consider. The interviewed project managers generally agree regarding that the carbon footprint is a parameter to be focused on, but many of them are uncertain about how the work with climate calculations should be performed. The company is in the start-up phase regarding the implementation of climate calculations, which means that there is not a clear process for it yet.

Five out of nine project managers agree that they need to learn more about climate calculations and the carbon footprint as they express that there is uncertainty and lack of knowledge. Kim explains that they would like to learn more:

> *"I would like to know more about the carbon footprint of different products. For example, if you turn over a milk carton, it says how much climate impact it has, but that is not the case if you turn over a Masonite board. If I had the knowledge about this, there would be no need to have consultants for everything."*

Kim and Sam explain that they work a lot with the carbon footprint in an ongoing project, mainly focusing on concrete and steel, since those materials have the highest climate impact. In addition, Sam works with each discipline in the project to find ways to reduce their carbon footprint. Sam finds it easy to work and manage climate calculations but means that better data is needed, especially regarding renovation projects. Eli state that more work will be done concerning the carbon footprint in small renovation projects, but the process has not started yet, however, the project manager thinks climate calculations is a good tool to clearly see the carbon footprint of different materials.

4.2.3 Reuse

All of the project managers work with reuse, though some more than others. Those working in smaller projects work more with reuse than those working in large projects. Some find it easy to work with reuse while others find it difficult. It seemed that many of project managers supported the idea of reuse and to construct buildings so that products can be reused at a later stage. Many also thought that reuse need to be managed to reduce emissions in the industry but to do so, a wider market and a demand for reused products is required. The most frequently reused products today, according to the project managers are interior sections, like glass blocks and doors. The general perception of the project managers is that there are more products that can be reused but the management of reuse is difficult. There are logistical problems, and it is difficult to ensure guarantees, aesthetics, and requirements.

Charlie does not think it should take too long to use the reused products, making use of the products and adding that materials can go bad while waiting to be used. Also, warehouse management costs money and to get people to work more with reuse there must be some profit. Similarly, Jamie thinks it will be a few years now when products need to be stored and it will be costly until it is more interest in a second-hand market for building products.

"Reuse should be taken more seriously. In the beginning it was thought that you could just put it on a website and that someone would come and collect it straight away. That's not how it works in reality. ... A few more years and the second-hand market will take off. Used building materials from schools and universities could be used in the private market. When small builders have found the way into second hand material, it will take off, buying material for a cheap price. It is the economic management tool that works." – Jamie

How the work with reuse is carried out differ from project to project, often depending on size of the project. The project managers claim that in smaller projects they need to handle reuse on their own while in larger projects a coordinator for reuse may be employed. It is mentioned that the process of reusing materials is long and difficult, and when there is no one willing to take care of the material, it is thrown away instead of being stored, as this is too costly. Another concern about the reuse of products is how to get information about the material. The information about a product up for reuse needs to be easy to access and the management of the product not too expensive, otherwise it is not done. There are many parameters to assess, like sound and energy requirements. It is easy to set goals to reuse in projects but harder to make it in practice. Moreover, it is mentioned that the requirements do not have to be complicated when it comes to reuse, but it is needed to go to the site early to check the products to see what requirements they meet. Also, there is no contractor that will give warranties on old products so, it is important to agree with the customer that the reused products will be used to benefit them economically and environmentally.

The project managers expressed that the development of working with reuse need to be improved. According to Otis, a way to develop the work is to have a closer collaboration with the municipality and region as they have access to similar products and are close geographically. Whereas Robin thinks a change of mindset and more flexibility is needed and letting go of the aesthetics aspects to see an increase in use of reused products.

"What we need is to try to get customers to consider reused materials and more flexibility from architects. No tenant wants to pay full price for old things, so the price needs to drop. The architect needs to let go of prestige and requirements for how it looks. I think it is more about an attitude." – Robin

Lastly, depending on which project manager asked, knowing what product worth reusing is either difficult or easy. The majority of the project managers thought it was difficult because information about the components can be hard to find. While Jamie thinks it is easy to know what products are worth reusing, saying that there are technical lifespans for materials that can be found in different databases. Further, the project manager highlights the importance of looking at the whole picture, meaning looking at the climate impact of installing a new product versus keeping the old one. In addition, many products that can be reused are thrown away, because the products may not have the lifespan that a large company require but a smaller company might, therefore, it is important to handle products in an appropriate way.

"What has no value for someone may have great value for someone else."
– Jamie

4.2.4 Choice of Material

Four of the project managers mentioned the importance of choosing the right materials in building projects, a topic linked both to reuse and carbon footprint, but also to chemical content in the products that can affect the environment. To know the environmental impact of products, the company uses Byggvarubedömningen (BVB), where material choices are logged and derived. It can also be used to learn more about sustainable products. Kim mentioned that in a project it is important to make sure that all actors fill in BVB in time to get the best possible result. Also, when a product with negative environmental impact appears in a project, the project manager must check the market and make a choice, find something else or choose the harmful product. Furthermore, the respondents expressed that it is easy to choose the right products for projects, as it is simple to see which material has the lowest footprint in BVB and then choose that material. However, allocating time to choosing the right material is not always prioritized in a project.

"We do not spend much time investigating material selection." – Louis

4.2.5 Ideas for Improvements

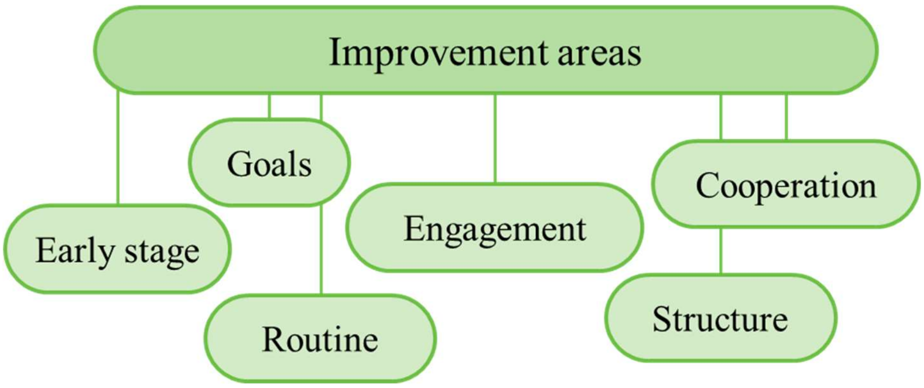

Figure 5. Encountered improvement areas based on the interviews.

All project managers interviewed had thoughts and ideas on what needs to change to make sustainability a higher priority. An overview of the encountered improvement areas is stated in figure 5. The respondents expressed that the first part of achieving more sustainability in the industry is to build and rebuild as little as possible, further, the importance of always consider the company's four-step principle when planning a new project is highlighted. Moreover, all project managers mentioned commitment as a crucial factor to succeed with sustainability. A strong commitment to sustainability by the project manager is currently required for it to become an integral part of a project. The interviewees stated that through project managers creating commitment among other stakeholders, sustainability will gradually become a more common part of the industry. Linked to commitment, project managers explain cooperation within a project as a basis for a functioning sustainability work. It requires disciplines and employees to work together and help each other to achieve increased sustainability.

Another crucial element for reaching sustainability in construction projects, according to the project managers, is to include the topic as early as possible. The respondents expressed that by working with sustainability in the pre-study, there is a greater chance of achieving a solid sustainability performance in the project. Furthermore, through including sustainability in the pre-study and performing inventory of the building early, there is time to perform better reuse and identify solutions regarding what does not need to be rebuilt or changed. Also, the respondents stated the importance of being on site as a project manager to get a real picture of how the project looks and works in order to make the right choices and priorities regarding sustainability. Time constraints are often a challenge with sustainability, which makes it particularly important to include it at an early stage, as it is otherwise easily neglected due to time constraints. To succeed with ecologic sustainability in renovation project Jamie highlights the importance of consider it as early as possible:

"You take it early, very early. You plan everything that needs to be done early. You delegate and are clear about what applies. It should not come suddenly. Lay the groundwork. Then you must have a functioning system for how it should be done. In renovation projects, much is about reuse but also the right choice of materials. If you take it early, you get the right choice of materials and get the reuse going. If it is highlighted early, it also gets the consultants involved. The early stage is the most important of all. What can be reused should also be reused."

Another important aspect, brought up, is to set clear, measurable sustainability goals, as this makes it easier for the project manager to steer the work towards the goals and get the others involved in the subject. Eli believes that sustainability work would be easier if there were specific, concrete examples of what makes a difference in sustainability. A database of examples was mentioned as something that could facilitate the implementation of sustainability in projects.

"Get good examples; copy them straight off. Then maybe tweak and develop it a little and later pass it on. Contribute our own examples to others. We need to move forward in a concrete way. Don't be afraid to try things out. One strategic goal is to be curious and courageous. When it's stated in governing documents, you are allowed to test and fail." – Eli

Moreover, it was mentioned by the interviewees that there is a need for clearer tools regarding sustainability, so project managers do not have to figure out how to implement it themselves. Also, the need for a concrete way to price the benefits of sustainability was expressed. Suggested was that the management could introduce a price on carbon dioxide equivalents to facilitate the sustainability work. Five out of nine project managers think that more information concerning the benefits of products is needed for better sustainability work.

Other factors raised by the project managers needed to succeed with the sustainability work is to have a broad perspective and consider the whole life cycle of buildings. It is important to reach out, not only focusing on the company and have a holistic view to achieve sustainability over the long term. Also, a functioning system for how sustainability is implemented in a project was mentioned as something required in order to succeed. Furthermore, one solution to achieve more sustainability in projects is continuity and to raise the subject at all project meetings. By constantly reminding everyone in the project about sustainability, a greater emphasis on the subject is created. The majority of the project managers explain that implementing sustainability requires creating an understanding of the importance of sustainability within the industry. The customer's interest in sustainability is crucial to achieve valuable work; therefore, the project manager needs to get the customer to understand the importance of sustainability. Another solution proposed to implement more sustainability in a construction project is to make it a routine, to get there, incremental improvements are required, further, it is necessary to take a few steps at a time. Also, a key to reach functional sustainability work is mentioned to be to dare to try new solutions and dare to fail. By constantly being creative and trying new things, good sustainability solutions will gradually develop. Lastly, the respondents stated that to achieve more sustainability in the industry, the culture needs to change, the industry needs to become more open to change and shift the perception regarding that everything must be modern and in top condition.

4.3 Focus Group

To reach more information regarding the identified results from the individual interviews, a focus group was assembled. The purpose with the focus group was to investigate the retrieved information through a discussion with three employees involved in sustainability at the company. The questions discussed are found in appendix B.

4.3.1 Working with Identified Challenges

The interviews revealed that project managers had different perceptions of what sustainability meant and what it entailed in their work. Hence, the focus group discussed to which extent this was a problem for the organisation. The discussion revealed that it is not an issue that sustainability is defined differently by the project managers, but it is important as an organisation to keep a clear line and emphasise the same aspects. Furthermore, it is crucial to know that the organisation has a strong sustainability focus and that the directives from the management are the same. The focus group stated that fact that the project managers can have different views of sustainability is good, as it means that the sustainability dialogue is continued, and the subject can be discussed more freely. Additionally, the focus group discussed that sustainability is a broad concept and it can be difficult to bring it down to a project level, making it particularly important to early outline which sustainability areas is the focus in every individual project.

Regarding the challenge of having to prioritise time or sustainability, the role of the organisation was discussed. As the company also works with the real estate management of the buildings, it has a long cooperation with the customers, which means long processes and a high level of trust. By this, the focus group stated that sustainability should not have to be deprioritised since the company is in a good position. The focus group mentioned that a challenge of prioritising sustainability in projects is to get everyone on the same level. Therefore, it is necessary to keep the dialogue alive and try to challenge the customer on the issue, otherwise it is easy for the customer to want to replace everything instead of reuse. Furthermore, when a project is under pressure, it is easy for a project manager to not have time and energy to push the sustainability issues further. Hence, it is important to create a team that works towards the same goal. Further, the focus group mentioned it to be vital to give mandate to others in the projects, so people can make decisions on certain issues, which also can lead to increased commitment in other disciplines. In order to create a good team with clear goals, it is important to conduct a dialogue at an early stage, set concrete goals and explain the purpose to create commitment among everyone involved.

The position of the company was also discussed regarding the budget in projects and how project managers should relate to sustainability costs. Elliot thinks the customer relation is crucial and said:

"This is a company where it is of high importance to have satisfied customers and thus, quality needs to be prioritized over cost sometimes."

The focus group expressed that there are new project managers at the company, which work very hard to stay within the given budget. However, it is a management issue whether the budget in projects needs to be increased to prioritise more sustainability. Thus, it is important to set a higher initial budget at an early stage so there is money allocated for sustainability in the project.

Finding the right information about sustainability in the organisation was identified as a problem through the interviews. In the focus group, opinions were divided regarding the problem. Billy wondered if project managers even search for information, Dylan and Elliot think it is unclear to find information, but Elliot thinks it is manageable and has found solutions to find the information needed. Everyone agreed that there are too many places where the information can be found, which makes it difficult to navigate and solid digitisation work is needed to make it smoother. However, if a project manager does not know where the information is located or cannot find the right document, they can always contact the people responsible. Elliot often contacts responsible people when to find information about sustainability in the company's project tool. Billy thinks the environmental programme comes in too late in the project tool process, and state that it should come earlier than the programme phase to be handled as early as possible in a project.

Regarding knowledge about sustainability, the focus group expressed that the organisation contributes to knowledge through training and information. The company have monthly project seminars that are mandatory for project managers. However, one challenge is that the project managers must be willing to absorb the knowledge in order to learn, thus; Dylan said:

"It is only when you are faced with a problem you are willing to learn about it."

In addition, as a project manager, it is needed to have courage and willingness to help each other, but some are afraid of losing time since taking help takes time. However, everyone in the focus group perceives the company as a helpful organisation and thinks it is easy to take help and help others.

4.3.2 Facilitating Potential Solutions

To facilitate sustainability planning at an early stage, the importance of doing it before the project has taken shape was emphasised. It is wanted to have the project manager involved at an early stage, even before he or she has any responsibility for the project; this favours cooperation, which in turn leads to clearer and better sustainability work. To further facilitate sustainability work in projects, Dylan believes that the project dialogue meeting format should be implemented in all projects, perhaps even having it several times during the project. Dylan further mentions that it is important to take notes during these meetings so things can be followed up. In a project dialogue meeting, Elliot emphasises the importance of the project manager preparing for the meeting by planning the topics to be discussed and where help is needed. The purpose of the meetings is to utilise the knowledge that exists within the company but can also be an incentive to increase commitment to sustainability.

Increased commitment to sustainability was further discussed. The participants expressed that it is important to consider peoples values and to discuss it in projects to create reflection and thoughts. Sometimes it is important to talk through topics and think out loud to create greater interest and understanding. Everyone thought that the commitment to sustainability had increased in general at the company, and that the lowest level of commitment has been raised. Billy believes that it will not be possible to get everyone personally involved in sustainability, but there should be a clear organisational commitment. In addition, sustainability has been a current topic for a quite long time now and some employees will simply not want to focus on it. However, the focus group stated that it should be clear that as an employee at this company you should work towards increased sustainability. Dylan said:

"Creating commitment to sustainability is a gradual process that takes time."

Cooperation in general was brought up as a challenge. Elliot stated that cooperation is connected to knowledge and if everyone in a group has knowledge of the subject, it is easier to cooperate. The projects' entrepreneurial form also affects the cooperation, it facilitates if the project has a collaborative form. Billy went on to explain that to achieve good cooperation on sustainability, a fairly broad strategy needs to be narrowed down to something concrete that can be implemented in projects. Similarly, Dylan said that it is important that sustainability permeates the projects. In addition, to have concrete goals that are communicated to everyone involved, will create discussions, opportunities and increase commitment. Here, the project manager has a major role in keeping the group together, raising the issue at meetings and explaining expectations and strategies, this will also benefit the collaboration. When it comes to cooperation on sustainability between the units within the company, the respondents are a little unsure how it works. The local management team should cooperate, but at the present moment it is unclear how this is done, to what extent and what topics are discussed. Furthermore, the group believes that the management needs to dare to invest more in sustainability. Through a pilot project, it is possible to invest and test new things regarding sustainability to drive change in the industry. According to the focus group, the company has the opportunity, through innovation, vision, and mandate, to test new things that can lead to change, but it must come from the management to be realised.

4.4 Participant Observations

To gain a broader perspective regarding how the company's sustainability work is performed in practice, the authors of the report participated in meetings and seminaries about sustainability. The following sections describe the information discussed during the observations.

Observed through a meeting regarding sustainability with focus on the climate was that attention regarding climate reductions in smaller renovation projects are increasing in the company. The small projects stand for a big part of the company's total climate impact, so the aim is to map and calculate small projects as it is done in larger projects. Further mentioning that the building sector is not used to doing climate calculations on renovation projects but thinking that it soon will be legal requirements to perform calculations on these projects as well. In addition, the company is developing a way to perform climate calculations in smaller projects since they want to implement it early in the building process to be able to make choices that affects the impact of the building, not as a climate declaration that Boverket asks for regarding new construction, which is made after the project is done. The focus on wanting to make choices in an early stage is because late choices in the process implies for higher climate impact. A problem at this stage in the development is that the company has few projects to compare with, so the calculated numbers are not comparable with others. This development of easy climate calculations is done to reach the company's climate goals and make sustainability reality. Highlighting the importance of trying things out and sometimes fail to find new ways forward. Additionally, the company has chosen to test a commercial sustainability platform for projects and products. There, they will test to calculate the climate impact on projects, where some of the project managers got the opportunity to try it out. The company is still in the test phase, so it has not been implemented in a finished project yet. Moreover, drawing attention to the climate goals set by the company, to be climate neutral 2035, meaning a reduction of 85% from 2019 and climate compensation for the last 15%. To reach this goal, sub-goals is to reduce the impact by 40% by 2025, and 65% by 2030. However, it was observed that they were uncertain about the company reaching the defined goals.

The meeting continued with discussing reuse and how the company are working towards a more circular building- and demolition process. The company wants to achieve a functioning process where possible reused material is managed directly and possibly to actors outside the company to minimise waste, with demolition knowing where the product is going. This to avoid warehouse management. To implement increased reuse, it was observed that it is important with good communication between actors and colleagues. Also, everyone needs to understand the bigger environmental perspective, if the price is the same to buy reused interior to buying new, the choice should be to take the reused as it barely has a climate impact. In addition to this the reuse question was raised at a project seminary with the message that the company will increase the focus on implementing reuse in building projects.

5 Discussion

In this chapter the empirical findings are discussed in the context of previous research. The topics covered are challenges identified, implementation in practice, the role of the organisation, difference between projects and facilitating measures.

5.1 Challenges concerning Ecological Sustainability

Lines et al. (2015) describe integrating sustainability as a challenge in the building sector. Hence, placing a higher focus on sustainability in projects implies a change. Both the literature study and the empirical data show that change in the construction sector is a challenge. According to Bal et al. (2013), change in the construction sector becomes a challenge because of the number of actors and different types of temporary projects. Further, Cameron and Green (2019) describe lack of communication and coordination among actors leading to difficulties when implementing a change. Therefore, to achieve a change in sustainability through the whole construction sector, cooperation, and willingness to offer and receive help among actors and projects is required. However, both the literature study, the interviews and focus group demonstrates that change takes time and needs to be a gradual process.

Project Management Institute (2021); Stanitsas et al. (2021); Walker (2015) describe the project manager as responsible for making the project function, especially resolve problems and ensure the planned time and cost. With that said, the project manager role includes a lot of responsibility which is confirmed in the interviews. As the project managers are responsible for driving the project, they also become responsible for the sustainability work in the project. Hence, lack of time, resources and knowledge are often hindrances for project managers to be able to focus on an additional factor, without de-prioritizing others. Furthermore, the interviews and focus group show that taking help sometimes is avoided because it takes time, which makes it even more difficult to work with sustainability. To achieve an increased focus on sustainability, it needs to be an obvious part of the project managers tight time-schedule, which it is not at present.

The interviews show that the sustainability work varies depending on the project manager. Some of the project managers focus on reuse, others on material choices, and several on energy issues. In previous research, sustainability is defined and described differently. Hence, it can be difficult to achieve a similar understanding of the concept. The focus group states that it is not a problem that project managers have different views on sustainability, but it must be clear how the company and organisation work with the topic. Therefore, it is important to have a clear line regarding sustainability through the organisation. In addition, Walker (2015) address that the ideal of an organisation is a group of individuals working towards the same goal. The interview study shows that the project managers work towards different sustainability goals as they have different perception of what the company's sustainability goals are and how the work should be performed in order to reach them. Thus, it does not exist a consensus among the project managers regarding their sustainability work.

In line with Femenias et al. (2015), who describe lack of clear guidelines and concrete goals as a barrier in renovation projects, the interviews and focus group indicates that it becomes difficult to perform sustainable renovation projects as they often do not have clear, measurable goals which makes the sustainability diffuse. Moreover, some project managers express that to reach a better sustainability work in projects there is a need for more flexibility in the sector.

5.2 Implementation in Practice

Stanitsas et al. (2021) claim that in order to implement sustainability in construction projects and go through a change, the project managers need to adapt to changes. From the participant observations, it however appears that change is not always welcome and appreciated by the customers. Hence, in many cases, the project managers need to engage and explain the importance and aim with sustainability for the customer. With that said, it becomes a responsibility for the project managers to perform sustainability work in projects. Thus, if the customer is not willing to focus on sustainability, the project manager ends up in a difficult situation as they need to satisfy the customer. Therefore, the project managers must have commitment to and knowledge about sustainability to be able to push it through a project.

Gluch et al. (2011); Hao et al. (2008); Larsson et al. (2016) emphasise knowledge within sustainability as a crucial factor on achieving an increased implementation of sustainability in the construction industry. Similarly, the interviews shows that lack of knowledge is a hinder for improved sustainability work among the project managers. However, the interviews and focus group show that the monthly project seminars at the company contributes to more knowledge in sustainability. Further, knowledge transfer is highlighted both in previous research and interviews. Gluch et al. (2011); Hao et al. (2008); Lingegård et al. (2021) claim lack of knowledge transfer between construction projects as a reason for a slow implementation of new concepts in the sector. Since the construction industry is very fragmented, it is especially important to spread knowledge among the personnel and actors. According to the interviews, knowledge transfer is performed to some extent through daily communication and when project dialog meetings are performed. However, the project managers agree that more organised knowledge transfer is needed to achieve an increased focus on sustainability.

According to the empirical findings, Byggvarubedömningen (n.d.), BVB, is used frequently at the company, not only to see how much a material impacts the climate but also to log what materials are used in a project. However, it appears to be inexplicit, not user friendly, and not all materials are available in the database, therefore, it is not always used. This leads to project managers having a lack of knowledge on how big impact different materials have. Also, a challenge brought up in the interviews is how to use BVB with reused materials, as there is no data about it or a way to document that it is reused. Furthermore, the project managers raise that they want more knowledge about the impact of products and materials. Relating to this, Larsson et al. (2016) express that the whole construction sector needs more knowledge regarding the climate impact of materials, not only at a company-level. However, data from the focus group showed that it is difficult to achieve more knowledge when the project managers do not have enough time, hence, new knowledge is not prioritized. Lastly, more knowledge about renovation is needed in the industry. Boverket (n.d.-g) state that it is harder to perform climate calculations on renovation projects because of different conditions and constructions than building new. The interviewees raise the same issue, expressing that more knowledge is needed in the industry and a clear process on how it can be done.

5.3 The Role of the Organisation

In line with the findings of Zhang et al. (2019), the interviews and the focus group stress that the management has a major responsibility when implementing a change. Zhang et al. (2019) claim the importance of having support and clear guidelines from the management. Likewise, the empirical data shows that it needs to be clearer from the management regarding what the change in sustainability entails, not only that a higher focus shall be on sustainability. The interviews state that more concrete goals, examples, and guidelines are needed from the management to make the project managers perform better sustainability work. Additionally, the focus group describes the need of a clearer line throughout the whole organization regarding sustainability to achieve an effective sustainability work. Furthermore, Lines et al. (2015) highlight the importance of leadership and someone responsible for leading a change, which is connected to good support from the management. Based on information from the interviews, the person responsible for a change with sustainability in a project often falls on the project manager. With that said, the project manager needs to have the right knowledge, time, money, and commitment to perform well-functioning sustainability work.

To maintain sustainability work in the sector previous research indicates that it is important that actors manage different responsibilities (Boverket, n.d.-d). Who has the responsibility varies, Boverket (n.d.-d) and Naturvårdsverket (n.d.-b) state that it is the client who is responsible for climate declaration, waste management and inventory of materials. Thus, it is the real estate company's responsibility. From the interviews it appears that the project managers think that the company's responsibilities generate possibilities to integrate more sustainability. One of the opportunities it implies is the possibility to integrate it early in a project and another one is that it can give them time to perform a comprehensive inventory, leading to more reuse and the possibility to explore ideas.

The interviews stress preserving products and materials rather than switching to something new before it is necessary. Connected to this, Miller and Ip (2013) describe a way to reduce the climate impact through using products their longevity. The interviewees highlight the company's responsibility in the matter, that they have a choice to not exchange a product if it is not needed. Hence, in line with the recommendations of Zhang et al. (2019), this is a way for the company to take responsibility for their emissions in society. Further, Aarikka-Stenroos et al. (2021) highlights the need for increased understanding in the building sector of what can be considered waste for one party could be valuable for another which is also addressed in the interviews.

5.4 Distinction between Projects

Concerning the difference in sustainability between small and large projects, there are separate perspectives addressed. According to Lines et al. (2015), it is easier to perform sustainability in smaller, shorter projects as it is easier to implement a change there. However, the interviews show that a majority of the project managers think it is easier to achieve a high focus on sustainability in bigger projects where there are more resources and a higher budget. Furthermore, it is easier to delegate sustainability in bigger projects and hire an environmental coordinator. In any case, the project managers agree that reuse is easier to perform in renovation projects since there is more material available. The interviews show that those projects managers working in small projects focus more on reuse than those working in large projects. However, both previous research and the interviews show that the management of reuse can be difficult, and it requires a smooth process where it is easy to handle the reused material. Since this is not the situation today it complicates the handle of reuse. A further difference between sustainability work in small and large projects is that in small projects, more sustainable responsibility lies with the project manager. According to the interviews, the project managers do not have enough time to focus on sustainability to a great extent which results in de-prioritization of the topic.

Furthermore, a challenge with sustainability in renovation projects is, according to the interviews, and in line with Glaumann et al. (2016), that they have fixed preconditions and boundaries which need to be considered. In addition, Bates et al. (2019) state that it is harder to see the benefit of sustainability in renovation projects and it is difficult to clarify the costs of it. Gluch et al. (2011) claim that a major hinder regarding sustainability in the construction sector is that it is too costly. Similarly, Aarikka-Stenroos et al. (2021) describe that reuse in many cases implies increased costs. Further, Zhang et al. (2019) express that a change implies increased costs and time which can lead to resistance and a negative attitude which makes the change more difficult. The results mainly show that reuse can imply higher costs if the material needs to be stored, therefore, the majority of the interview respondents do not think warehousing is a solution when working with reuse.

From the results it is seen that the company does not have any guidelines on how to reduce the climate impact in small projects. The demands to reduce the climate impact only concern new construction and comprehensive renovation projects. The idea of implementing guidelines in smaller projects is mentioned by the focus group. However, no plans on when to implement them are identified. Connected to this, Femenias et al. (2015) express in their study that it is common for the building sector that the company has recommendations regarding how to decrease the climate impact in new construction, but not in renovations.

5.5 Facilitating Measures

In order to increase the sustainability work in projects, the empirical data stress the importance of clearer directions from the management, more concrete examples and measurable sustainability goals. To achieve a change and increased implementation of sustainability in the construction sector, the literature review and empirical study identify several driving factors. Such as the climate roadmap by Fossilfritt Sverige (2018), that many actors in the sector have agreed upon. This is not a demand but rather a driver to reduce the climate impact of the company and a goal to work towards. The company has created their own climate goals to contribute to a higher sustainability. However, according to the participant observation, it is unsure if they will reach their goals.

Robichaud and Anantatmula (2010) claim that project managers knowledge on sustainability is of high importance to increase sustainability in projects. Likewise, the interviews show that project managers need to have the knowledge and push sustainability in a project in order to get it included. Increased knowledge and knowledge transfer among the sector and project managers results in a broader consensus and less ambiguity. According to Lingegård et al. (2021) and Project Management Institute (2021), communication and inter-organisational relationships is important factors to increase knowledge and sharing of that knowledge. Based on the interview results communication between colleagues differ at the company, some thinks it is easy to communicate while other find it hard.

The interviewees express that the company has an important role to create change in the industry. Thus, the company can put pressure on other companies, which according to Zhang et al. (2019) can be a driver for the industry. Zhang et al. (2019) describe market pressure to be a driver for construction companies to take more responsibility. Since the company is a state-owned real estate company that works with large, well-known customers, they can together make a difference. Also, as they work with public procurement and framework agreement which can be drivers to increase sustainability (Finansdepartementet OU, SFS 2016:1145; Lingegård et al., 2021). Through procurement it is possible to reduce carbon footprint and increase the use of green products and services. Besides, to prioritise sustainability work in a project the respondents mean that the customer has a major responsibility, explaining that the customer needs to be interested and willing to work with sustainability for it to function.

The results highlight the importance of the early stage in the building process in order to implement sustainability. This is in line with Nordstrand (2008) who state that it is a crucial phase as major decisions are made regarding the development of the project. Thus, it is important to include and plan the sustainability work at this point. Likewise, the data from the interviews show that sustainability needs to be included from the start and become a routine. It is shown to be crucial to define concrete goals and to have a clear purpose with sustainability among the actors at an early stage, in order to maintain the sustainability work. Moreover, in the interviews it is found to be important to perform a thorough investigation at an early stage of a renovation project. In line with this Glaumann et al. (2016) and Femenías et al. (2012) emphasise the need of a comprehensive investigation to succeed with renovation projects, to put time and resources to collect information about the existing building. Not only to succeed with the renovation project but to examine what materials and products to reuse. Naturvårdsverket (n.d.-b) similar explains that reusable components should be identified in advance of demolition.

Harala et al. (2023) proposes that in order to achieve a change in reuse, the sector needs to remove the negative attitude, increase the demand, and innovate together. Aarikka-Stenroos et al. (2021) express that the construction industry has great prerequisites for a successful reuse system. The empirical result show that the reuse focus needs to be considered at an early stage in a project. Further Aarikka-Stenroos et al. (2021) explain that to start working with reuse at an early stage, a communication structure and commitment between all actors in the sector is needed. Similarly, the project managers express that interaction between entrepreneurs and consultants increases the implementation of reuse. The participant observation shows that communication between actors and colleagues are crucial in order to be able to work with reuse. In addition, Aarikka-Stenroos et al. (2021) express reuse business models or individual product schemes as a solution to achieve increased reuse, also new reuse technologies. Moreover, the interviews state that a larger market and collaboration regarding reused products is factors that needs to be implemented to increase reuse.

6 Conclusion

The conclusion answers the previous stated research questions (see section 1.1.3). Concerning ecological sustainability in renovation projects from a project management perspective, related to challenges, factors for success, implementation in practice, role of the organisation, distinction between projects, and facilitating measures.

The study identifies several challenges regarding ecological sustainability which project managers face in renovation projects. Increased sustainability measures lead to a change which implies a challenge. The study show that change is difficult, but it is required to reduce the environmental impact of the building sector. Crucial factors identified to facilitate a change is good communication and cooperation between stakeholders. When sustainability measures increase in projects it becomes the project manager's responsibility. The results show that this implies a challenge since they already have many responsibilities areas to manage. To focus on an additional factor, the aspects time, cost, and knowledge are found to be hindrances for the project managers. Furthermore, the study indicates that because sustainability is versatile, it becomes a challenge. As it is many possible measures to consider it means that the project manager needs to choose and prioritise. The prioritising of measures is based on their own interests and perspectives and, therefore, effects the sustainability performance of a project. The research show that project managers focus on different areas and have separate views on what sustainability work implies, which can lead to lack of clarity in an organisation. In line with this, ambiguity is a challenge identified specific for renovation projects due to the fact that there are no clear guidelines or goals for sustainability. Thus, it becomes a challenge for the project managers as it is more difficult to concrete know what should be done in the projects.

Concerning implementation in practice, the study shows that the customer's view on sustainability is important for the work of the developer. The customers interest and knowledge affect the project's level of sustainability. Another aspect that impacts the integration of sustainability is the project manager's knowledge. The research show that to increase the knowledge, more knowledge transfer between stakeholders and projects is necessary. In line with this, it is found that lack of knowledge and information about materials becomes a hindrance to increase the sustainability in practice. To facilitate the realisation of increased sustainability, more knowledge is needed regarding materials impact on the environment.

The results indicate that the role of the organisation is important for the sustainability performance. The management has a responsibility to facilitate the change that increased sustainability implies. In addition, it is shown that the client has many responsibilities regarding sustainability which provides possibilities to influence when and how it is integrated in a project.

Moreover, the findings of the research show that challenges regarding sustainability differs depending on the size of a project. In small projects the sustainable responsibility increases for the project manager as it includes decreased time and budget. Further, the study show that renovation projects often is a challenge regarding sustainability as it is difficult to beforehand see what the environmental impact of the measures will be. It is also found that the measures could lead to increased and hidden costs which are difficult to anticipate.

The research identifies that certain driving factors are necessary to increase the sustainability in a renovation project. Market pressure and procurement are factors found to have impact on sustainability. Overall identified factors to increase the work with sustainability in projects are knowledge, communication, cooperation, and engagement. In addition, early stage is repeatedly mentioned in the study as an important factor to succeed with sustainability. It is shown that time and money is needed to integrate and prioritise sustainability in a project. Also, the findings highlight the importance of prioritising reuse early in projects to be able to perform investigations and identifications of reusable components. It is found that this should be the first step in a renovation project in order to not overlook components that could be used again.

6.1 Recommendations

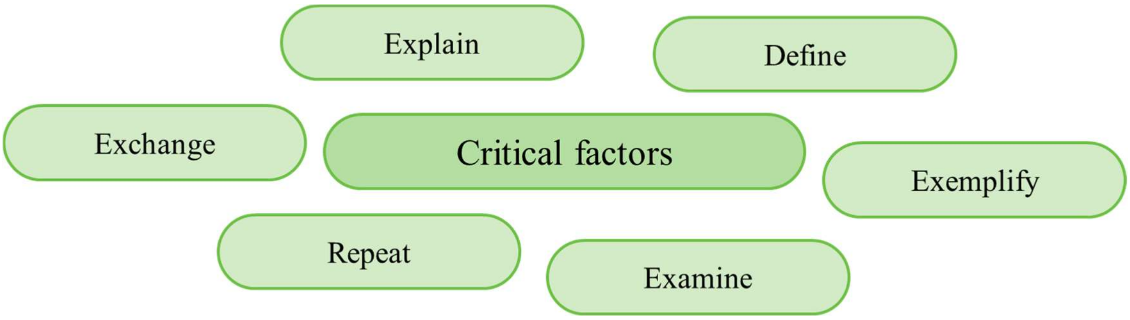

Figure 6. Overview over identified critical factors.

Based on the findings, several recommendations are proposed to serve as incremental steps to implement effective sustainability work. The recommendations are compiled into critical factors (see figure 6). The identified factors are fundamental prerequisites for the potential success of sustainability efforts. At a company level a measure to facilitate the project manager's sustainability work, is that the organisation should be clear and concrete regarding which sustainability aspects that shall be prioritised. Also, express how the project managers should work with the aspects. Clearer guidelines implies that the project managers cannot take as many initiatives on their own, however, how to conduct the sustainability work becomes more concrete. Further, it makes the organisation's approach to sustainability clearer in the sector, not only as a company that works with sustainability but how it actually is done. This can make the company to a good example for others to follow, and a driving force in the industry. When the company has achieved a clear approach on sustainability, the cooperation between the departments at the company can increase. Thus, the customer contacts can be improved as the departments have a similar view on the sustainability performance of projects.

The company can also create guidelines for the project manager to use in renovation projects and identify concrete examples to learn from and replicate. This can generate new methods and ideas, which later can be shared with others. In addition, the company can create a forum for communication where examples of how to solve renovation specific issues can be discussed, both in projects, between actors, and within the company. Improved exchange of information leads to more knowledge transfer and in turn increased knowledge.

At a project level, the factors identified in the study are examination, defining goals, explanation, and repetition. Thus, when starting a renovation project, the first thing to do is a thorough investigation of the existing building/location. Examine what parts and components that can stay put, which could be reused in the same project and what components could be reused somewhere else. In the design phase, perform climate calculations on different scenarios to examine the opportunities and see what measures have the least impact on the environment. Plan, discuss, and collaborate with the customer, colleagues and involved parties to find the most sustainable solutions. Define clear sustainability goals for the specific project and how the work will be carried out to reach them. Explain the sustainability measures and goals for every stakeholder involved and highlight what the aim is and what the effects will be. Based on the findings, creating a routine for sustainability in renovation projects is needed. Through repetition of sustainability measures and goals at every project meeting, communication, knowledge, interest, and engagement can be increased. This leads to consensus, new ideas, and improvements, and in turn increased sustainability. Also, through repetition of measures, obtain clearer planning, to easier see what is needed in each phase of the project, which can lead to a better collaboration between stakeholders. In conclusion, it is recommended to address these critical factors in order to have the prerequisites to succeed with sustainability work. The expectation with addressing the critical factors is to make it easier for project managers to work with ecological sustainability in renovation projects.

The findings of the research are based on one company but could suit other organisations as well. Especially, it could be relevant for similar organisations with a client perspective to consider the findings. Besides, other organisations in the construction sector can benefit from the study since building projects often involve actors from different organisations and thus are linked to each other. The recommendations could also fit other project-based organisations, outside of the building sector. Even an organisation working with the subject but does not experience the identified challenges could use the study to show why it is working in their organisation. Through the critical factors, explain how the organisation is working with them, to get insights of why it works which could be helpful in order to reflect on the organisational and project management role.

6.2 Future Research

Suggested future research is to perform similar research but setting it in a larger context. Consider more stakeholders and the connection between them. Thus, further studies at other client companies are suggested to include a more general client position in sustainable project management and to investigate the generality of the findings. Studies at other construction companies are also preferrable to include a broader perspective of the sector in the researched area. It would also be interesting to use the recommendations in a renovation project to test the reliability and function of them. Perform a case study on the project to follow up and complement the critical factors. Finally, this master thesis show that the building sector generally needs more research and knowledge about renovation projects as they become a more common part of construction projects.

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Appendix A

Interview questionnaire:

Introductory questions

- Is it okay if we record the interview?
- What is your professional role?
- What project(s) are you currently working on?
  - Tell us a bit about that project.
  - Size of the project (in million SEK)
- What is your background/education?
- How long have you worked at this company?
- How long have you worked in the construction industry?

Main questions

- At what stage of a project do you enter as a project manager?
- How do you conduct your daily work?
  - What does a working day look like?
- What are your thoughts about the project tool?
  - How do you use it?
  - Do you use it to work with sustainability in a project? How?
- What is your view on what is called project dialogue (meeting) in the early stages?
  - And the meeting called a sparring meeting?
- How do you work with knowledge transfer between projects?
- How much help do you take from colleagues?
  - For example, if you know that someone has a certain competence you need.
- What is sustainability for you?
  - What does that concept include?
- How do you think this real estate company works with sustainability?
  - In remodelling projects?
  - Do you see any differences in small/large projects?
- How do you work with sustainability?
  - How highly do you prioritise sustainability in your work?
  - How much do you work with sustainability in your projects?
- How do you learn more about sustainability?
- In your work, which things are easy to handle regarding sustainability?
- What are the challenges of implementing sustainability in projects?
  - When do the biggest challenges occur?
  - When are it most likely to fall through?
- How do you feel that increasing climate requirements affect your work?
- Can you as project manager work to increase sustainability in a project? How?

- How do you feel the support from management is?
  - Can you delegate to others, regarding sustainability work? What?
- Does anything need to change to make sustainability easier/more manageable in your work? What?
  - Where in the construction process does a change need to happen?
- Do you have any thoughts on what you would like sustainability work to look like to simplify your everyday life?
- What are your thoughts on reuse?
  - Something you think about/implement in the projects you are involved in?
  - How do you think the work with reuse will develop?
- Have you been involved in any remodelling/renovation projects?
- What are the differences between working as a project manager for a remodelling project vs. a new building?
- What are the differences/challenges regarding sustainability in remodelling vs. new construction?
- How to succeed with the sustainability issue in a refurbishment project?

Closing questions

- Anything you want to add?

Appendix B

Focus group questionnaire:

- Is it a problem that it exists different perceptions about what sustainability is in the organisation?
    - Is it good or bad that there is no consensus?
    - Is it important to create a consensus?
    - How can an organisation achieve consensus?
- How can the organisation make sure that sustainability is not being deprioritised under time pressure?
- How should a project manager relate to sustainability when the budget is exceeded?
- What is needed to develop so that a project manager easily could access information about sustainability?
    - How to know what documents to prioritize?
- Should it be more sustainability factors in the company's project tool?
    - If so, what aspects?
    - How to ensure that it is done?
- How can the organisation contribute to the project managers knowledge on sustainability?
    - How to achieve a similar level of knowledge?
- How to facilitate the planning of sustainability work in the early stage of a project?
- How does the organisation create a bigger engagement regarding sustainability?
- How to engage project managers to focus on sustainability?
- How can you get stakeholders to collaborate on sustainability work in the projects?
- How does the company collaborate regarding sustainability issues?

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