KTH ROYAL INSTITUTE
OF TECHNOLOGY

Degree Project in Industrial Ecology

Second cycle, 30 credits

The act of climate declaration of buildings

A study of construction engineers' approach and competence for implementation of the act

AMANDA HASTH

Stockholm, Sweden 2022

The act of climate declaration of buildings

A study of construction engineers' approach and competence for implementation of the act

AMANDA HASTH

Supervisor
SOFIA LINGEGÅRD

Examiner
OLGA KORDAS

Supervisor at Sweco Sweden
BJÖRN BOBERG

Degree Project in Industrial Ecology

KTH Royal Institute of Technology

School of Architecture and Built Environment

Department of Sustainable Development, Environmental Science and Engineering

SE-100 44 Stockholm, Sweden

Lagen om klimatdeklarationer av byggnader

En studie om konstruktörers förhållningssätt och kompetens för genomförande av lagstiftningen

AMANDA HASTH

Handledare
SOFIA LINGEGÅRD

Examinator
OLGA KORDAS

Handledare på Sweco Sweden
BJÖRN BOBERG

Examensarbete inom Industriell Ekologi

KTH Kungliga Tekniska Högskolan

Skolan för arkitektur och samhällsbyggnad

Institutionen för hållbar utveckling, miljövetenskap och Teknik

SE-100 44 Stockholm, Sverige

Abstract

The construction sector is an important actor in the work of reducing CO_2 emissions, and keeping global warming under 2°C. From 1 January 2022, a new legislation entered into force in Sweden regarding climate declaration for new buildings. The study aims to investigate how the act may impact construction engineers' daily work, and if they possess the competence the act require. Furthermore, the study explores construction engineers' and Sweco's approach towards such change, and identify how Sweco as an organization should manage the change in order for a sufficient implementation.

A qualitative method was applied, primary data were collected through five semi-structured interviews with one sustainability coordinator, three construction engineers, and one project manager. The interviews covered the current project conditions, Sweco's work with the act of Climate Declaration, the awareness and approach among construction engineers, and their competence for complying with the legislation. A literature review was conducted to identify common obstacles and necessary actions within change management.

The result identified that the implementation of the act will require a change in attitude towards sustainability. Today, construction projects address the factors: quality, time, and cost as measures for success. The ignorance of sustainability targets will not continue as projects must comply with the act. From the perspective of Sweco's management, it is reasonable that the construction engineers will provide A1-A4 of the act, since the construction engineers' work will be dependent on the emission limitation the act will require.

Nevertheless, although, all interviewees understand the importance of the sustainable transition the industry need, the construction engineers feel rejection towards providing what the act require. This is founded in the identified limited knowledge the construction engineers possess regarding LCA and emissions related to materials. The result indicates, however, that it is possible to change their mindset and achieve readiness with direct and right communication. Yet, the lack of knowledge remains even if readiness is achieved. Hence, the result show that Sweco with a favorable organizational structure needs to improve their sustainability work and provide obligatory education for the engineers.

It is moreover concluded that the communication regarding the change and sustainability in general within construction projects must be prioritized, to solve the implementation hindrances that may arise. First, the construction engineer has to entry projects in an early stage, which is not always the case. Second, construction projects' time and cost budgets are interpreted as tight. Hence, it is important to make a sufficient time estimation of the time the construction engineers require in order to comply with the act, and further include it in the budget.

All interviewees have, however, high trust that the industry will solve the implementation of the act as it is today, but the future limitations of emissions that will be implemented is perceived to be the major obstacle. Luckily, there is still time to anchor the change within the industry, but it is important to start working for it now, as change takes time.

Keywords: Change management, Climate declaration, Construction engineers, Construction industry, LCA, Project management, and Sustainable development.

Sammanfattning

Byggsektorn är en viktig aktör i arbetet med att minska utsläppen av koldioxid, och hålla den globala uppvärmningen under 2°C. Från den 1 januari 2022 trädde en ny lagstiftning i kraft i Sverige om klimatdeklaration av nya byggnader. Studien syftar till att undersöka hur den nya lagstiftningen kan komma att påverka byggingenjörers dagliga arbete och om de besitter den kompetens lagen kräver. Vidare utforskar studien konstruktörers och Swecos förhållningssätt till sådan förändring, och identifierar hur Sweco som organisation bör hantera förändringen för att få en tillräcklig implementering.

En kvalitativ metod användes, primärdata samlades in genom fem semistrukturerade intervjuer med en hållbarhetskoordinator, tre konstruktörer och en projektledare. Intervjuerna omfattade de aktuella projektförutsättningarna, Swecos arbete med klimatdeklarationen, medvetenheten och förhållningssättet bland konstruktörer och deras kompetens att följa lagstiftningen. En literturundersökning genomfördes för att identifiera vanliga hinder och nödvändiga åtgärder inom förändringsledning.

Resultatet identifierade att genomförandet av lagen kommer att kräva en förändring i attityden till hållbarhet. Idag används faktorerna: kvalitet, tid och kostnad som mått på byggprojektets framgång. Ignoransen av hållbarhetsmål kommer i och med lagstiftningen inte att kunna fortgå. Från Swecos lednings perspektiv är det rimligt att konstruktörerna tillhandahåller A1-A4 av lagen, eftersom konstruktörernas arbete kommer att vara beroende av den utsläppsbegränsning lagen kommer att kräva.

Trots att alla ingenjörer i studien förstår vikten av den hållbara omställning som branschen behöver, är konstruktörerna avvisande mot att tillhandahålla vad handlingen kräver. Detta bygger på den identifierade begränsade kunskap konstruktörerna besitter om LCA och materialrelaterade utsläpp. Resultatet tyder dock på att det är möjligt att förändra sitt tänkesätt och uppnå beredskap med direkt och rätt kommunikation. Men bristen på kunskap kvarstår även om beredskap uppnås. Resultatet visar därför att Sweco med en gynnsam organisationsstruktur behöver förbättra sitt hållbarhetsarbete och tillhandahålla obligatorisk utbildning för ingenjörerna.

Det dras vidare slutsatsen att kommunikationen kring förändringen och hållbarhet generellt inom byggprojekt måste prioriteras, för att lösa de genomförandehinder som kan uppstå. Först och främst måste konstruktören komma in i projekt i ett tidigt skede, vilket inte alltid är fallet. För det andra tolkas byggprojekts tids- och kostnadsbudgetar som snäva. Därför är det viktigt att göra en god tidsuppskattning av den tid konstruktören behöver för att följa lagen, och vidare inkludera den i budgeten.

Alla intervjupersoner har dock hög förtroende för att branschen kommer att lösa genomförandet av lagen som den ser ut idag, men de framtida begränsningar av utsläpp som kommer att genomföras, uppfattas vara det största hindret. Som tur är finns det fortfarande tid att förankra förändringen inom branschen, men det är viktigt att börja jobba för det nu, eftersom förändring tar tid.

Nyckelord: Byggindustrin, Förändringsledning, Hållbar utveckling, Klimatdeklaration, Konstruktörer, LCA och Projektledning.

Acknowledgments

First of all, I would like to thank my supervisor Sofia Lingegård at KTH for providing me with great feedback, helpful discussions with critical and fruitful perspectives, and support throughout my thesis writing process.

I would like to thank the study's interviewees at Sweco, which made this research possible. Not only by giving me their time and trust in participating, but also by the commitment the rewarding conversations entailed. I would also like to thank the supervisors I have had at Sweco, Björn Boberg, for the discussions regarding ideas and questions, and for providing contact with the interviewees of the study. Additionally, thanks to all employees I have meet at Sweco, who has shown interest in my work and made me feel welcome during my time there.

Thanks to Mostafa Ahmadi, and Mårten Skoglund for invaluable feedback on the thesis and for pushing me forward. Thanks to Justina Wahlqvist for always believing in me, and the extra pep needed when the academic self-confidence sometimes waned. Finally, I want to thank my family and all my friends for the support and care during the two last challenging years, and for always cheering me on.

Uppsala, June 2022

Amanda Hasth

Table of Contents

1. Introduction

This chapter introduces the background of the thesis, followed by the aim and research questions of the study, and finally its delimitation.

Earth, with its living organisms, faces an acute risk of exceeding several tipping points with irreversible consequences if global warming is not kept below 2°C (Rockström et al., 2009; WWF-UK, 2021). Although warnings and scenarios focus on the future, consequences of global warming do already occur and has an impact on nature and people (WWF-UK, 2021). Extreme weather occurs, precipitation patterns are changing, sea levels are rising, ecosystems are destructed, and species are dying (Rockström and Klum, 2012; WWF-UK, 2021). Keeping Earth within thriving conditions is therefore vital for all living organisms (Rockström et al., 2009). Humanity needs to take actions, especially since anthropogenic activities are responsible for climate change. The dominant cause of the crisis is greenhouse gas (GHG) emissions, where one of the main drivers is the release of carbon dioxide, CO_2, from burning fossil fuels for energy (WWF-UK, 2021).

In particular, the building sector has a high consumption of energy, and is therefore a part of the cause. Despite a slowing of growth of the building sector through 2019, the sector has reached higher levels of CO_2 than ever. Thus, the sector is responsible for 35 percent of global energy consumption, and 38 percent of CO_2 emissions at a global level. Where the building construction industry accounts for five respective ten of those percent (United Nations Environment Programme, 2020).

The generation of emissions from buildings' constructions are estimated to grow further (Lucon et al., 2014; IEA, 2020). Driven by a continued used of carbon-intense processes such as coal, oil, and natural gas for heating, and the use of building materials with high embodied carbon emissions. Globally, the building industry account for approximately 50 percent of the demand for cement and 30 percent of steel (United Nations Environment Programme, 2020). Thus, the sector is an important actor in the work of reducing CO_2 emissions, and keeping global warming under 2°C.

Laws, regulation, and stricter limit values are tools to ensure improvement of companies, thus, decrease of their environmental impact. The European Commission has an objective to reduce CO_2 emissions from the building industry by up to 90 percent by 2050 (European Commission, 2011), and Sweden has established an objective to reduce CO_2 emissions to net-zero by 2045, an obligation imposed by the Paris agreement (UNFCCC, 2015; Regeringskansliet, 2017). Further, from 1 January 2022, a new legislation entered into force in Sweden regarding climate declaration of buildings, by The Swedish National Board of Housing, Building and Planning (Boverket). The requirement for a climate declaration applies to the construction of new buildings. This means that builders must report the impact the new building have on the climate (Boverket, 2021a). The purpose of this legislation is to mitigate the climate impacts of buildings. It will, firstly, require emissions from the production and construction phases of newly constructed buildings to be reported. Furthermore, it will stipulate the limit values for different building types and the emissions levels acceptable from a whole building in the coming years (Ibid.).

Construction engineers are responsible for ensure the bearing constructions durability, additionally, design and dimension the bearing structure and produce drawings of it. Hence, the construction engineer is one actor in construction project that thus will be affected by the new legislation, and may need to review and improve their daily work. Sweco, which is a consulting company within community building, plays a part in the building sector. In Sweden, Sweco offers a wide range of services in architecture, building construction, installation, infrastructure, water and environment,

project management, energy systems, IT for community development, and industry (Sweco, n.d.a). Sustainability development plays a crucial role in conducting the operations of Sweco, and considering their operation and the global carbon emissions, it would be relevant to analyze Sweco's performance.

1.1. Aim and Research questions

The overall aim with the study is to review how Boverket's legislation regarding climate declaration of buildings may impact construction engineers' daily work, and identify hindrances and opportunities the new legislation may entail from a construction engineer and corporate perspective. Possible causes for prevailing conditions and necessary measures to improve the possibility of an efficient implementation of the act will further be discussed. To meet the aim, following research questions will be addressed:

I. How are construction projects approaching sustainability today?
II. What may the new legislation imply for construction engineers' profession?
III. What are the main opportunities and hindrances for construction engineers to provide the requirements of the act and how can Sweco improve their work to overcome such hindrances?

The study will first investigate construction engineers' approach towards sustainability in projects today. More specific, gain knowledge regarding what success factors are addressed in projects, whether there are sustainability targets that needs to be achieved. Furthermore, how sustainability is communicated within projects and at Sweco. In addition, investigate Sweco's construction engineers' ability to impact construction projects environmental performance in projects, and construction engineers' awareness and approach regarding the climate declaration act.

Secondly, this study will explore what the new legislation may imply for construction engineers' profession. Requirements of the act will be compared to the conditions of construction project today. Based on construction engineers' knowledge and ability to perform actions, and the approach towards sustainability in the industry. Thus, changes of construction engineer's daily practice, likewise knowledge gaps and short comings within projects and the profession will be identified.

The study will lastly address the main opportunities and hindrances for Sweco's construction engineers to provide the requirements of the act, and further, analyze how issues concerning implementation of climate declaration can be solved. This will be done from an organizational perspective, based on the conditions and ability Sweco has. But also from a project perspective, what the new legislation of climate declaration may require from the project group.

1.2. Scope of the study

Environmental performance is a comprehensive term, with several issues and impacting parameters. Thus, this study has limited the scope to only cover the impact of greenhouse gas emissions, and the primary structure of a construction. Further, the study focuses on construction engineers' perspective, and how the legislation impacts their daily work. However, a company perspective is applied in the third research question, when it comes to possibilities and hindrances with improving the environmental performance of building design.

Sweco is a consultant company, acting at a global scale. However, since the study focus on the Swedish environment, only projects established in Sweden will be covered. Furthermore, in the construction industry, there are both private and public contractors. In this study however, only projects of private clients are included. This is because the exploratory interview and discussions

with the supervisor from Sweco indicated that projects with private clients may be more time-pressed and therefore interesting to investigate how the implementation of the legislation will affect the engineer's work and their ability to comply whit it. Further, since industrial constructions are excluded in the act, the construction engineers included in the study have experience or work during the time the study was carried out with housing projects.

Although the act only covers certain stages in the construction process, all of those may not be adequate for construction engineers to handle since most of the data required by the act is due the construction's use stage. Therefore, the study has strict the scope down to only investigate construction engineers' possibility to provide the requirements linked to the constructions bearing parts A1-A4, i.e., the parts that construction engineers are designing and thus able to impact and have knowledge about.

2. Theoretical framework

In this chapter is the data from the literature review presented, it covers the act of climate declaration of buildings, life cycle assessment, change management, and sustainability project management.

Achievement of sustainability goals and targets are vital and hence got a high priority in today's society. It cannot least be seen in that it is a subject addressed in both research and politics, and sustainability goals has become an important measure and indices of construction project success (Oke and Aigbavboa, 2017). Sustainability development was outlined by the Our Common Future report (Brundtland Report) 1987, released by the United Nations World Commission on Environment and Development (WCED, 1987). Where sustainability describes as meeting the needs of present generation while ensuring future generation can meet their own needs and flourish. A common approach to sustainable development includes three pillars: economic, environmental, and social. The three areas are required, and need to support each other in order to achieve sustainable development (European Commission, 2022). At a company level, there are approaches that emphasize that environmental performance enables potential differentiations for businesses, additional benefits, including cost savings, may be obtained from it (Pechancová et al., 2019). Thus, sustainability development does not need to be at the expense of business, and should not be perceived that way.

The concept Corporate Social Responsibility (CSR) has been developed over the years, it refers to the responsibility enterprises has to society including the three pillars (Borglund et al., 2021). A development can be seen where company's responsibility is extended to include more phases and links in the value chain (Ibid.). At the same time, companies are expected to react and meet varying expectations from different stakeholders. A stakeholder is defined as a party either affected by the company's operation or has the possibility to influence it in some way (Ibid.). Legislations and regulations need to be complied with, focusing on e.g., circularity, sustainability reporting, carbon accounting. Meantime, climate change is putting new demands on constructions and climate adaption has become necessary for construction companies to maintain in the industry.

Environmental management can be defined as how an organization or a company manages, leads, and develops its environmental work. Tools, methods, and strategies are evaluated and critical reviewed, to later be applied by and incorporated in governments and companies. However, this process does not have to be in that order, because the approach and mentality is to act right now - no time to lose. Thus, sustainability development can be perceived as a trial-and-error concept driven from both a top-down perspective with legislations, and from a bottom-up with requirements from consumers or clients. This puts a pressure on business to be more sustainable, which is good for development but may also foster greenwashing behavior or create selective communication of sustainability performance in companies (Testa et al., 2018; Pimonenko et al., 2020).

Following chapter introduce the new legislation of climate declaration of buildings and life cycle assessment, continuing with change management and sustainability project management.

2.1. Climate Declaration of Buildings

The new legislation of climate declaration is thus putting a pressure on the construction industry. Governmental regulation is essential for reliable environmental performance (Du, 2015). The legislation on climate declaration of Buildings is the first of its kind, since it based on data from the actual construction (IVL, 2021). The act aims to reduce the climate impact from the construction phase of constructions (Boverket, 2022a), through accounting of GHG emissions in a lifecycle

perspective. The climate declaration is required in order to get the final approval for the building (Boverket, 2021b). Thus, the building cannot be taken into use unless a climate declaration has been established. It is the constructor's responsibility to establish the climate declaration of the new building, submit it to Boverket, and save the documentation for at least five years (Ibid.). Although the constructor may delegate parts of the establishment to other actors, it has always the formal responsibility to ensure that the climate declaration complies with the requirements (Ibid.).

The new legislation on climate declaration of Buildings is applied to new constructions, for which an application of budling permit has been submitted to the Building Board on 1st January 2022 or later. To allow affected actors to adapt to the law in a slower pace, already built constructions are not included in the requirement for a climate declaration, regardless of whether any measures are taken in connection with the existing construction or not, e.g., reconstruction, extension, etc. But, there are a plan to also include such actions later on in the future.

Constructions included in the act are buildings, not other constructions such as: wind turbines, sports grounds, amusement parks, tunnels, parking lots, etc. (Boverket, 2021c). Nevertheless, as now, Boverket (2021c) have some further exceptions regarding the inclusion of buildings, namely those constructions that:

- have time-limited building permits, which are intended to be used for a maximum of two years
- does not require a building permit according to ch. 9 6, 7 or 9 §§ PBL
- used for industrial or workshop purposes
- are outbuildings for agriculture, forestry, or other similar industries
- does not have a gross area greater than 100.0 m²
- are intended for the total defense and buildings that are important for Sweden's security
- built by some state developers
- is built by private individuals and it does not take place in business

Additionally, the whole building is not covered in the legislation. It is restricted to include the primary structure, the climate screen, and non-bearing interior walls (Boverket, 2022b). Thus, earthworks, installations, inner surface layers, or fixed furnishing is excluded in the regulation. In order to reduce the constructions' climate impact, Boverket's recommendation is to in an early phase involve an architecture, construction engineer, or environmental consultant, in form of influencing the choice of materials in the construction (Boverket, 2021b).

The legislation has restricted the construction's lifecycle to include following three phases: construction stage, use stage, and final stage. Each phase is later divided into different information modules, which describes the processes in the lifecycle (Boverket, 2021d). Thus, a complete lifecycle assessment is not required as the legislation is established today, see Table 2.1 for all modules included in the declaration. Additionally, there are currently no limit values or requirements for maximum permitted GHG emissions, since the aim now in the beginning is to spread knowledge and understanding regarding environmental impact from constructions in the construction industry. The plan is to introduce limit values for the construction stage (modules A1-A5) from 2027, and decreasing it gradually till 2043 (Boverket, 2020a).

Data required in the LCA for materials is based on volume. However, during the design phase of the construction process it can be difficult to establish exactly which materials and their amount that will be used, thus as the process continues more detailed and sufficient data can be gathered.

Boverket have developed an open database with relevant climate data to support the calculation of the constructions climate impact (Boverket, 2020b).

Reduction of material use within the construction, more sustainable production of materials, and use of materials that have less climate impact is possible improvements linked to materials in order to reduce the construction's total climate impact. Further, the construction can be designed for flexibility of use, and with the mind to increase the ability for material reuse (Naturvårdsverket, n.d).

Table 2.1 Stages and processes included in the climate declaration act.

Stage		**Module**	
		Prefix	**Processes**
Construction stage	Product stage	A1	Raw material supply
		A2	Transport
		A3	Manufacturing
	Construction process stage	A4	Transport
		A5	Construction/installation on-site processes
Use stage		B1	Use
		B2	Maintenance
		B3	Repair
		B4	Replacement
		B5	Refurbishment
		B6	Operation energy use
		B7	Operation water use
End-of-life stage		C1	Deconstruction
		C2	Transport
		C3	Recycling/reuse
		C4	Disposal
Benefits and loads outside the system limit		D	

It is difficult to find research on the new legislation, as it came into force this year. But, Sadri et al. (2022) states that the act's required knowledge regarding climate impact during the construction phase among actors in the market is low. The authors have further identified 'implemented tools and techniques', 'project planning in the construction phase', 'construction waste management', 'supply chain management', and 'performance of individual contractors' as five common sustainability related issue in the construction industry. Additionally, it is emphasized that the act of climate declaration may imply a price escalation in properties and housing due to an increase of the production and construction costs. However, the Council on Legislation referral evaluate that risk as insignificant (Ibid.).

2.2. Life Cycle Assessment

A lifecycle perspective is important in the transition towards sustainability development (Borglund et al., 2021). LCA support CSR strategies, and the sustainability reporting of environmental performance (Malmqvist et al., 2011). A life cycle assessment approach a product or a service through its whole life cycle, with all the stages from raw material extraction, design and manufacture, to use and disposal, i.e., from cradle to grave. LCA tools enables improvement and reduction of a product or a service environmental impact, by increasing recycling and reuse of

materials (Borglund et al., 2017). Meanwhile, waste is thus minimized. Furthermore, LCA prevent shifts of environmental burden within the product's or service's lifecycle (Finnveden et al., 2009), which otherwise may be a consequence if improvements are made without consideration to earlier or later stages.

With respect to constructions, the tool consider the amount of energy use and energy embodied in building materials, and transports, and evaluate the advantages of recycling (Malmqvist et al., 2011). The holistic approach LCA entails can guide the decision makers in the choices of the building's components/techniques/process to reduce the environmental impact (Finnveden et al., 2009; Nair et al., 2021). Choices made in the design phases, have often significant environmental impact over the buildings' life cycle (Nair et al., 2021). For example, choice of materials (Figueiredo et al., 2021).

Due to the legislation of climate declaration is LCA tools in Sweden's building industry expected to be widespread (Nair et al., 2021). Nevertheless, at present, there is a lack of integration of LCA in routine building related tools and lack of LCA expertise (Ibid.). The tool is perceived to be highly data-demanding and work-intensive, thus consequently expensive (Finnveden et al., 2009; Malmqvist et al., 2011; Nair et al., 2021). Further, a high degree of knowledge is perceived to be a requirement for LCA to be used as a building tool (Malmqvist et al., 2011). Another disadvantage is the accuracy and difficulties to interpret the results, as practitioners are facing uncertainties and variations in the results of different LCAs (Nair et al., 2021).

Research have recognized the need of reliable simplifications in the application of LCAs in buildings, and simplified LCA methods have been suggested (Nair et al., 2021). Nevertheless, a simplified LCA may reduce the reliability of the results (Ibid.) The data used in LCA have significant effects on the results (Finnveden et al., 2009; Nair et al., 2021). Thus, a general problem with applying LCA in the design phase of the building process, is that it applies in a stage where optional solutions are many and the ability of product data are limited (Malmqvist et al., 2011; Nair et al., 2021). Therefore, generic data for environmental impact needs to be used (Nair et al., 2021). Later in the process, as it is possible to perform better LCAs is the utilization of the results for alternative designs restricted (Ibid.).

Although simple LCA have uncertainties, research have stated that it might be better to initial start with a simplified method to overcome barriers and increase the use of LCA in the industry (Malmqvist et al., 2011). But, the user needs to be aware and understand the impact data have on the result, therefore simplifications needs to be based on relevant and well-reasoned assumption whether a process play an important role or not (Ibid.). It is further recommended that LCA tools is better integrated to BIM-models or CAD tools, since it is less time consuming (Malmqvist et al., 2011; Nair et al., 2021).

Green building rating systems is a driver in the construction industry for a life cycle approach. In Sweden, LEED, BREEAM SE, and Miljöbyggnad are three commonly used green building rating systems. Each rating system has its own characteristics and may therefore be applied in different scenarios (Prameswari et al., 2021). However, a common indicator for all is the calculation of the buildings' primary construction's climate impact (SGBC, 2019; BRE Global Ltd and SGBC, 2022; U.S. Green Building Council, n.d.). In order for a construction to be classified according to the classification systems, an LCA needs to be conducted and the structures' impact needs to obtain a value within the set limit value. Thus, the three rating systems aim to reduce the constructions environmental impact.

2.3. Change management

The foundation in sustainability development and environmental impact reduction is change. In order for our society to adapt to the constantly new condition the environment require, and the regulations government establish, organizations need to change, as for employees' way of practice and knowledge (Lines et al., 2015; Dalla Valle, 2021a; Bolpagni et al., 2022).

Legislation is a top-down perspective of achieving sustainability, where organizations are forced to comply with it whether they want it or not. Therefore, basic knowledge about GHG accounting and circularity will be required to keep up with the transition, and for the industry to develop specialized skills within sustainability e.g., carbon accounting (Bolpagni et al., 2022). Dalla Valle (2021) suggest that the transformation towards sustainability and application of the necessary life cycle approach in the construction industry require an introduction of a new competence, which lead, monitor, and manage the life cycle assessment in projects. Further, the author emphasizes the importance of collaboration, communication, coordination, and information among the project members, and the change of mindset of the actors engaged in the design process.

The transformation in the construction industry to become more sustainable, involve all actors and assets of building process. It is a growing digitalization and spread of tools, and a required increase of specialization of competence. Nevertheless, the intangible resources may be ignored as they are not visible for everyone as the tangible resources (Dalla Valle, 2021a). Hence, it becomes essential for organizations within the construction industry to have a sufficient change management and develop a positive attitude towards the transition (Endrejat et al., 2021).

2.3.1. *Leadership*

Leadership can be distinguished as the ability to influence a group toward fulfilling a vision or a set target (Kotter, 2012). Major change initiatives only generate moderate results, or fail terribly (Ibid.). In change management the change agent which lead the transition, needs to develop a change vision, communicate it to align support, create inspiration for members to overcome obstacles, and establish a positive attitude (Kotter, 2012; Lines et al., 2016; Vos and Rupert, 2018). Yet, a common error in change management is lack of anchoring the change in the corporate culture and inadequate communication (Kotter, 2012; Vos and Rupert, 2018; Endrejat et al., 2021), where the construction industry is not an exception (Lines et al., 2016).

To obtain a successful transformation, it is necessary to address barriers that undermine transformation efforts. Moreover, successful implementation of change requires an approach which understand the complexity of the phenomena (Higgs and Rowland, 2011). There are evidence that leadership behaviour has a significant effect on the success of the change processes (Higgs and Rowland, 2011; Lines et al., 2015; Endrejat et al., 2021). Lead by example is a powerful strategy, where members will grasp the change better than if its only communicated in written words (Kotter, 2012). Higgs and Rowland (2011) have identified three types of leadership behaviours that agents have undertaken in change management situations. They are the following: shaping behaviour, framing behaviour, and creating behaviour.

The first is categorized as agent-centric, where the leader influence and control what gets done, and makes other accountable for allocated tasks. Second, framing behaviour, challenge others to deliver the change, goals and limits may be stretched to the extent of what is possible. The leadership behaviour is aimed to design and manage the transition. Lastly, creating behaviour, here the leader focus on the members of the change, and creates individual and organizational capabilities which can induce the change (Higgs and Rowland, 2011).

2.3.2. *Communication*

For a transition to be a success it needs to be communicated, so all members have a common understanding of the goals and direction (Whelan-Berry and Somerville, 2010; Kotter, 2012; Lines et al., 2016; Endrejat et al., 2021). Dialog between members is also a driver for engagement and readiness, which is other important factors for change success (Kotter, 2012; Lines et al., 2016; Dalla Valle, 2021a).

Communication of change should be as simple and direct as possible, which is a difficult task (Whelan-Berry and Somerville, 2010; Kotter, 2012). Research has further shown evidence that it is important to communicate right information at right time. However, change communication is not a point effort, it is an ongoing action and important throughout the change process (Whelan-Berry and Somerville, 2010). Changes which impact members day-to-day operations need to be communicated before actions are implemented (Lines et al., 2016). Since, members need time to process changes and thus crucial to individual acceptance and readiness (Whelan-Berry and Somerville, 2010). But in order to sustain momentum, highlight import issues and further motivate members to work on the change, communication regarding the change needs to be addressed continuously (Whelan-Berry and Somerville, 2010). Change communication is usually effectively when multiple forums are used to reach out to members, it can be small and big meetings, formal and informal, etc. (Kotter, 2012).

Thus, with trust and a common goal shared by members in change, a powerful team can be created, where a sufficient teamwork is present. Such team need broad expertise, leadership, and talk and joint activities (Kotter, 2012). Lack of communication in change management often leads to limited capabilities among members and resistance to change (Kotter, 2012; Lines et al., 2015; Vos and Rupert, 2018; Endrejat et al., 2021). However, acceptance of change may be a more difficult task than communicate the change (Kotter, 2012; Lines et al., 2016). Hence, regardless leadership type, two-way communication is always more efficient then one-way (Whelan-Berry and Somerville, 2010; Kotter, 2012). The leader, thus, needs to listen and act on members thoughts and questions in order for change to happen.

In the construction industry, communication needs to be handled sufficient at different levels since change often involves many stakeholders and organizations. Companies have become braver over time in their communication, by letting sustainability issues be a part in their overall brand (Borglund et al., 2021). Internal communication is important in the implementation of change, and collaboration and knowledge exchange between business units has shown favorable for achieving sustainable practices (Oladinrin and Ojo, 2021).

Furthermore, the external communication of an organization's needs to be sufficient as well. In order to be able to impact the supply change, which the life cycle approach require, and gain data and knowledge regarding processes, transparency and communication between companies are essential (Borglund et al., 2021; Dalla Valle, 2021a). Transparency also increases the company's trust and reliability (Du, 2015; Pimonenko et al., 2020).

Due to the complexity of a construction, different competence is required and needs to interact within projects. Hence, it is important in the transition towards a life cycle approach in the design phase that all members understand their impact and how each decision they make further impact other disciplines (Dalla Valle, 2021b). Thus, a systematic holistic approach needs to be addressed, as for a high level of communication and collaboration within the projects.

2.3.3. *Readiness*

To achieve success of change, members' support is critical (Endrejat et al., 2021). Lines et al. (2015) states that change cannot be forced to go faster than members are comfortable with, it is a longer-term and strategic process. The first reaction to change among members' may be a feeling of insecurity (Vos and Rupert, 2018). Resistance is a rational phenomenon, yet, it is common assumption that it arises from the individual (Endrejat et al., 2021).

Hence, for those who hopes for a quick fix approach to change implementation may only exacerbate resistance from members (Lines et al., 2015). Therefore, readiness and patient are thus important for change to occur. However, studies indicate that a majority of members reacts favourable to change (Lines et al., 2015; Aldossari et al., 2021), and members who resist the change may nevertheless adopt to the change if it is forced by a top-down approach (Hassan and Mouakket, 2016).

It has been seen that a projects size, scope, and duration play a significant role for resistance to change. Where least resistance is encounter in construction scoping, small size, and short duration projects (Lines et al., 2015). Readiness can be achieved with the settlement of realistic expirations of the members (Ibid.). Sufficient resource capacity, such as education, and change agents which lead the adoption have further positive impact on readiness (Lines et al., 2015; Vos and Rupert, 2018; Aldossari et al., 2021; Endrejat et al., 2021). Additionally, support from political or government entities also contribute to successful adoption (Aldossari et al., 2021).

However, regarding change agents, Vos and Rupert (2018) indicate that agents and members differ in their perception of which leadership style reduces resistance in situations, therefore, it is important that agents are aware of leadership styles and recognize what the members need in diffident situations. The deep of the change play a role in the perception. In deep changes, members view shaping behaviour from the agent as resistance decreasing, while the behaviour increase resistance in low depth changes (Ibid.). Yet, their research further shows that agents underestimate their ability to reduce the resistance.

2.3.4. *Alignment and knowledge*

When a participant understands the change and wants to act on it, it is crucial that one also has the opportunity to do so. If members feel powerless, they cannot, or will not be a part of the transition process. Four common obstacles for implementation of the change vision according to Kotter (2012) are: structure, skills, systems, and supervisors.

Structures in the organization needs to be favorable to the change and compatible with it. Because if not, the structure will undermine and hinder the change from happen (Kotter, 2012). As for the structure, it is important that needed systems and tools for the change are available. Otherwise, it impossible for members to performed what is expected. Nevertheless, tools and systems become worthless if the practitioners do not possess sufficient knowledge or skill about how to use them. Participant with right education and skills do not feel disempowered, and are thus able to provide what is needed for the change to happened (Kotter, 2012; Lines et al., 2016). Therefore, training and education may be required in the transition to obtain necessary experience and skill.

Finally, a manager that undercut needed change and is not confronted with one's attitude may cause members to give up (Kotter, 2012). However, an unwillingness to confront such behavior is common in change efforts, and discourage may spread instead. Such manager impact and may even prevent the implementation of the change in the organization's culture (Ibid.). A positive attitude and commitment among all involved in the change are therefore essential in a transition.

2.3.5. *Culture*

The urgency of sustainability development is widespread in developed countries, and sustainability awareness issues in the construction industry is known. Yet, the construction industry is often labelled to be a sector with a traditional approach (Matinaro and Liu, 2017). Alwan et al. (2017) has identified ingrained culture as a cause against strategic sustainability development. Hence, the aspect of culture becomes important in the contraction industry for a transition towards a more sustainable approach.

Organizational culture refers to the collective norms, values, and principles that prevail among the members (Kotter, 2012; Stanitsas et al., 2021). The culture direct people on how to behave in the organization, and are thus powerful for influencing human behavior. Regardless of level, it can be hard to address the culture directly since it is near invisible and hard to change (Kotter, 2012). Shared values within an organization are generally harder to change than norms of behavior, because they are often more deeply integrated in the culture. According to Kotter (2012), a change can come undone if it is not anchored in the culture, even after years of efforts. But, when it is done the new values and norms tend to remain, as it has been seen that even if members are changed, shared values tend to persist over time (Ibid.).

It is acknowledged by Hurlimann et al. (2018) that legislation is both an opportunity and a barrier for the construction industry to respond to climate change. But, their results further indicates that a strong culture of corporate responsibility can be beneficial in order for projects to deliver beyond the minimal standards.

A common way for organizations to integrate corporate responsibility and a sustainability approach is to apply sustainability reporting. Additionally, it further implies communications of actions to third party such as stakeholders. Since self-regulation is shown to be inadequate for transparency and achievement of sustainability goals and target (Du, 2015), there are several available tools and framework for companies to use in order to achieve transparent and sufficient reporting of sustainability goals and performance.

The aim with sustainability reporting is to present and describe the real world, hence, transparency is required in order to achieve the benefits it can entail (Borglund et al., 2017). In addition, the report needs a balance between positive and negative performance (Ibid.). By applying frameworks is a common language between companies created, which enable the reader to make its own assessment based on review, evaluation, and comparison of the performance (Borglund et al., 2017). Further, it is shown that sustainability reporting has resulted in increased attention, awareness, and knowledge regarding sustainability (Ibid.). In addition, frameworks force companies to take responsibility for their actions by answering for their environmental performance.

However, weighting reporting occurs, where neutrality is ignored, which makes it hard to review and follow up the company's goals and plans. Instead, the reporting becomes more of a brand advertising to conquer clients, where companies tend to promise and only focus on future aspirations and goals. But, to present the company from its best may imply greenwashing (Testa et al., 2018).

According to research, a significant variable influencing greenwashing among companies is masking of real economic goals in official documents and websites. Thus, transparency in reporting sustainable goals and achievements, not only economics goals, will eliminate greenwashing (Pimonenko et al., 2020). Furthermore, it is important that the reporting not only focus on what is

measurable, since it otherwise will ignore aspects of sustainability that are likewise important (Borglund et al., 2017). Research advocates the importance of fulfilling environmental responsibility in substance rather than in false claims, and that public disclosure of environmental performance are useful for environmental management. (Du, 2015). Hence, as greenwashing is reduced, a right picture of the company is provided, which also increase the trust and reliability for the company brand (Du, 2015; Pimonenko et al., 2020).

Nevertheless, research have shown conflicting evidence weather sustainability reporting maintain a higher standard or not, and the debate regarding how the quality of sustainability reporting is affected by being a voluntary measure or a requirement has not led to any consensus (Dhaliwal et al., 2012). Some of the details in the frameworks are kept free, which on one hand become one of its weaknesses, since it allows companies to approach the reporting differently (Borglund et al., 2017). Thus, the common language may not be as common, and the reporting may be misused and mislead readers. On the other hand, the more standardized approach by addressing frameworks and guidelines is perceived as a limitation in some cases, where stakeholders' and companies' interpretation of sustainability differ from the framework's (Bradford, 2014; Borglund et al., 2017).

European Commission have established Directive 2014/95/EU (European Commission, 2014) regarding sustainability reporting, also called the Non-Financial Reporting Directive (NFRD). Large public-interest companies with more than 500 employees must comply with the law, which entail that information regarding the company's development, performance, position and impact of its activity related to environmental matters, social matters and treatment of employees, respect of human rights, anti-corruption and bribery, and diversity on company boards needs to be disclosed (European Commission, n.d). However, according to the directive is it voluntary to apply certain framework for the reporting.

But this is about to change, the Commission emphasize the correlation between companies' sustainability management and completeness and profitability, referring to research indicating that companies which encounter lower capital costs and generally appears to be associated with lower risk seems to place a greater value on sustainability (The Swedish Agency for Growth Policy Analysis, 2018). Recently, 2021, the Commission adopted a proposal for a Corporate Sustainability Reporting Directive (CSRD), which amend the existing reporting requirements of the NFRD. CSRD introduces more detailed reporting requirements, and a requirement to report according to mandatory EU sustainability reporting standards. Where the standard will build on and contribute to international standardization initiatives, while tailored to EU policies (European Commission, n.d). The new directive will be implemented in 2023 (Regeringskansliet, 2021).

2.4. Sustainability project management

A majority of today's organizations integrate project management into their construction projects, to handle issues and deal with added value creations (Stanitsas et al., 2021). However, since construction projects are complex and include several stakeholders and phases, the measure of success of a construction varies (Oke and Aigbavboa, 2017). There are individual and collective goals for all members involved in a project, but one discipline may only measure success objectives related to its expertise rather than see the project from a holistic perspective as the client need (Ibid.).

Research have stated the need for project management to evolve towards the sustainable "path", especially in the construction sector (Saad et al., 2019). The traditional measures of construction projects success are based on the iron triangle principle, including the three pillars: cost, time, and quality, is still a popular approach (Oke and Aigbavboa, 2017; Saad et al., 2019). However,

performance variables have increased as the demand by clients and other stakeholders has required emergence of others (Oke and Aigbavboa, 2017). Where, sustainability measures are one of those, and thus now often a requirement in construction project (Ibid.).

Use of sustainable indicators in projects are a way to achieve sustainability success, since such factors are important key features in the process (Stanitsas et al., 2021). Nevertheless, different disciplines within the project may come from different companies, applying different business models, approaching sustainability differently, and have varying internal goals. Hence, various variations of success variables and criteria related to sustainability have therefore emerged (Oke and Aigbavboa, 2017). It is important, however, in order to achieve success, that all project members are working towards the same goal and understand its definition.

Additionally, for sustainable project management to be sufficient, the dimensions of sustainable project products, processes, organizations commitment to sustainability, and sustainability aware persons need to be included. Thus, implementation obstacles range from insufficient capabilities for sustainable management to lack of important stakeholders' attention (Carvalho and Rabechini, 2017). The supply chain is also a relevant aspect in sustainable project management, in order to achieve a low-carbon transition (Carvalho and Rabechini, 2017; Sadri et al., 2022). However, it may be difficult to select subcontractors who provide sufficient materials, since the limited available options (Carvalho and Rabechini, 2017; Sadri et al., 2022) and entailing uncertainties with new materials such as reuse (Hwang and Ng, 2013; Sadri et al., 2022). On the other hand, increased demand for more sustainable materials may create pressure and entail the supply chain to improve their manufacture (Sadri et al., 2022).

The project manager play an important role in the success of construction projects, where the most desirable skills are within schedule and planning, communication, and transformational leadership (Hwang and Ng, 2013; Tabassi et al., 2016). It is important that all stakeholders are involved, collaborate, and share knowledge during the planning and design phase, as these stages have a significantly impact on the project's completion and success (Al Nahyan et al., 2019). However, Prameswari et al., (2021) have found that the aspect of 'effectiveness of project planning and controlling' in green constructions projects, lacks in its performance.

3. Methodology

This chapter present the used research methods: literature review and semi-structured interviews, and information regarding the analysis of the data.

A qualitative case study methodology approach was applied in order to meet the research questions of the study. Use of case studies are common in social science project, it allows an in-depth exploration and building a holistic understanding through a clearly defined and relevant context (O'Leary, 2017). This supports the aim of the study, to create an in-depth understanding of construction engineers' profession and how the new legislation may impact and change their daily work.

The organization that was studied was Sweco, a large organization with a broad competence within construction design. Hence, Sweco was suitable for the study since it aimed to investigate the implementation of the climate declaration act, and the size of the organization ensured available adequate data collection. Furthermore, Sweco is an interesting case, in the sense that they believe sustainability is important and strives to be a forerunner in the field. In chapter *4.1. Case study-Sweco*, is Sweco presented more in-depth.

When conducting a qualitative study, it is common to address at least two different methods for the same phenomena to minimize bias and establish credibility (Bowen, 2009). Therefore, the study consists of a literature review and interviews. Where, the first will gather secondary data, while the latter provide the study with primary data (O'Leary, 2017). The data were later analyzed by a general analytical procedure for qualitative data, see section *3.3. Qualitative data analysis*. Data gathered from the literature review is presented in chapter *2. Theoretical framework,* whereas information from the interviews is introduced in chapter *4. Results.*

The study continued with the literature review in order to find a theoretical framework and read research within topics relevant for the study. Those areas are presented in section *3.1. Literature review*. When an overall understanding for the subject was gathered, the interview guide for the first more exploring interview were developed, and later conducted. Hence, the literature review gave an insight as how the semi-structured interviews should be conducted, in terms of concept to focus on and questions to ask. Thus, the literature review was the foundation in the research questions of the study and hence the development of the interview guides. However, the review of literature continued paralleled with the first interview and continued even throughout the developing of the second interview guide. But was finalized before the conduction of the remaining four interviews. For visualization of the research process of the study, see Figure 3.1.

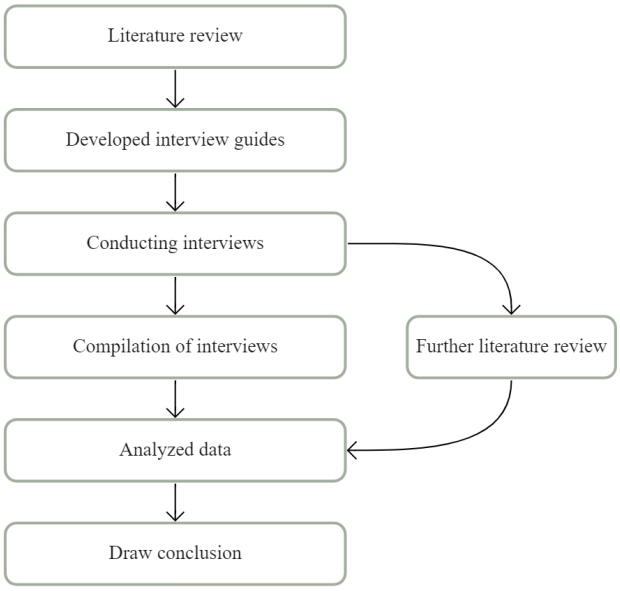

Figure 3.1 The study's research process.

The two methods answer different research questions. The first research question: *How are construction engineers approaching sustainability in projects today?* was answered through the interviews, while the literature review answered research questions II: *What may the new legislation imply for construction engineers' profession?,* and lastly was research question III: *What are the main opportunities and hindrances for construction engineers to provide the requirements of the act?* answered through both interviews and literature review, see Figure 3.2.

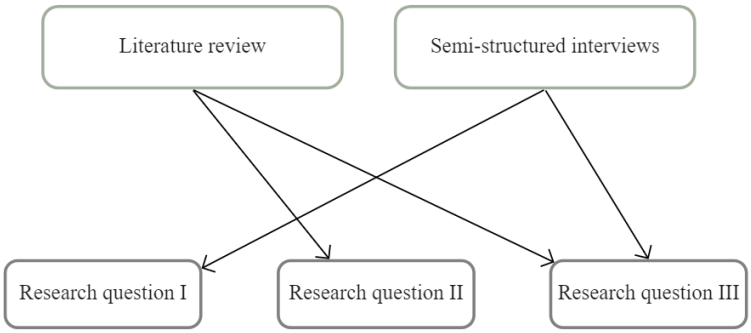

Figure 3.2 How the used methods apply to the study's research questions.

3.1. Literature review

A narrative research review is a common method for establish and justify the study and research questions (Bryman, 2016). A literature review was therefore carried out to gather deeper and broader knowledge and find latest research needed to support the report. The literature established an understanding of the meaning of the new legislation and how it may affect the work of construction engineers. Further, the literature review made it possible to connect the company's sustainability work and strategies more in-dept with literature, and enabled reflection on common hindrances within environmental management for construction projects with both primary and secondary quantitative data.

The reviewed articles were mainly peer-reviewed articles retrieved gathered from KTH digital library. Supplemented by information gathered from recognised international organisations such as

the UN, and information about Sweco available through their annual and sustainability report and website. The review of literature within following areas:

- *Change management*
- *Climate declaration*
- *Green rating systems*
- *LCA tools*
- *Leadership*
- *Organization culture*
- *Project management*

In order to narrow down the scope of the articles, since the areas are broad and have many search results. Following words were added in the search, either was one word or several used at the same time:

- *Construction engineers*
- *Construction industry*
- *Construction projects*
- *Communication*
- *Readiness*
- *Sustainability*
- *Sweden*

3.2. Semi-structured interviews

Since the aim with the study is to identify hindrances and possibilities with company's sustainability work and environmental performance, the interviews were semi-structured and open-ended. The method allows exploration of each interviewees' knowledge and perspective more in-dept, while the data collection still was systematic for each interviewee (Kvale and Brinkmann, 2009; Bryman, 2016; O'Leary, 2017). Thus, it was possible to retrieve as much information as possible.

There are ambiguities in research about how many respondents a qualitative study's sample size should consist of (Bryman, 2018). There is literature that argues for a minimum sample size of 60 respondents and a maximum of 150, while others have concluded that the sample size for qualitative research studies can vary within 5-530 (Ibid.). Nevertheless, the focus and aim of the research is likely to be significant for the sample size. Likewise, theoretical saturation is a common measure in qualitative research, which determine the sample size of the study (Ibid.).

Since this study examined a relative heterogeneous papulation i.e., construction engineers, theoretical saturation was considered to be achieved with a smaller sample group. Data collected from five respondents were interpreted as sufficient in relation to theoretical saturation. The interviews provided detailed data, where gender and years of experience did not indicate to be decisive for the respondents' answers and perspectives on the subject. The interviewees for the study were provided by the supervisor at Sweco after consultation. The interviewees needed to be construction engineers at Sweco Sweden and have experience of working with private clients and non-industrial constructions, due to the scope of the study and the legislation. The supervisor gave the author names of different suitable employees, which the author of the study e-mailed and asked if they had time to participate in the study. Thus, the sampling consists of key informants that have been hand-picked for the study (O'Leary, 2017).

Semi-structured interviews were conducted with a sustainability coordinator of Sweco, and four building designers at the company, to obtain knowledge and understanding regarding project conditions, Sweco's work with the act of climate declaration, the awareness and approach among employees, and their competence for complying with the legislation.

Key informants in qualitative research may put them in an unethical position regarding the organization they are employees at (O'Leary, 2017). They may be uncomfortable to talk about the organization or share their perspective, which risk decrease the validity of the research. Therefore,

to make the respondents more comfortable and gather open and honest data the interviewees will be kept anonymous in this study, and are thus referred to as Coordinator 1, and Engineer 1-4 in the study.

Since the study aim to investigate what is planned at the strategic level and what it looks like in practice, the interviewees had different positions, backgrounds, and expertise within Sweco. Coordinator 1 has worked as a sustainability coordinator at a national level for almost three years, but has a background before that as a construction engineer. The work tasks now have been developed over time and by demand since Sweco did not have sustainability coordinator before. Coordinator 1 is responsible for develop the sustainability-organization at Sweco, and construction engineers' competence regarding sustainability.

Engineer 1-4's experience within the profession is widespread, it varies from a half a year to 40 years. Engineer 1-3 are modelling construction engineers, which in addition to modeling the construction in 3D also means coordinating with other disciplines within projects. Engineer 3 also works parttime with sustainability questions as a coordinator at the region level, it implies that the Engineer 3 has more insight into the company's sustainability performance and action plans compared to the engineers who 'only' work with modelling. Further, Engineer 4 which is working as a project manager bring a more holistic perspective to the study, since the project manager has closer and more communication with the client and responsibility over the project compared to the modelling engineers.

Thus, the knowledge and perspectives among the interviewees vary. The sustainability coordinator, considered an expert in the field (ibid.), is situated higher up in the organization than the Engineers 1-4. Thus, the construction engineers are more of insiders (ibid.). In Table 3.1 is an overlock of the conducted interviews presented.

Table 3.1. Interviewees of the study.

Interviewee	Title	Location of the interview	Time of the interview
Coordinator 1	Sustainability coordinator	Microsoft Teams	40 minutes
Engineer 1	Construction engineer	Sweco's office in Stockholm	40 minutes
Engineer 2	Construction engineer	Microsoft Teams	35 minutes
Engineer 3	Construction engineer, parttime as sustainability coordinator	Microsoft Teams	50 minutes
Engineer 4	Project manager	Microsoft Teams	60 minutes

Two different interview guides were developed, one for Coordinator 1 and one for the Engineers 1-4, see appendix A and B. Since both interview guides were based on Kvale and Brinkmann (2009), and O'Leary (2017) they followed the same structure, but included different questions. The interview guides consisted of four phases: (1) a briefing phase, followed by (2) a warm-up phase, (3) main phase, and (4) a debriefing phase. It is important to make the interviewees as comfortable as possible, so they will talk openly and freely and ease into the main questions (Kvale and Brinkmann, 2009; O'Leary, 2017).

The second phase, warm-up phase, introduced the interviewee to the subject to ease the transition to the main phase (Kvale and Brinkmann, 2009; O'Leary, 2017), by collecting general information about the interviewees, and their relation to sustainability. During the main phase were the study's

research questions addressed in different themes. The interview closed up with the debriefing phase, where the interviewees could add comments or further thoughts (Kvale and Brinkmann, 2009).

The themes covered in the interviews were: (1) current situation, (2) conduction of a climate declaration, and (3) LCA-tools. The aim with current situation were to gain knowledge regarding how construction engineers address sustainability in the project today, and their ability to influence material decisions in projects. Furthermore, understand how the sustainability work at Sweco is structured higher up in the organization and comprehend what expectations and target are set for construction engineers when it comes to sustainability.

The second theme explored construction engineers' approach and knowledge regarding the implementation of the new legislation, and how Sweco work for complying with the act and which actions is taken to improve construction engineers' knowledge about sustainability. Last theme covering LCA-tools, aimed to identify construction engineers' knowledge and skills within the subject. Furthermore, investigate what tools and aids Sweco provide for construction engineers.

The current situation was interesting to get an insight of, in order to contrast it to how the interviewees perceive the implementation of the climate declaration legislation. Likewise, interesting to contrast different levels of the organization, how the sustainability work and action at the higher level of the organization is expressed among the construction engineers. In this way, knowledge gaps, challenges, and opportunities for the implementation of the legislation were identified.

Before the interview was conducted, the interviewees got the ability to read the interview questions. All five interviews took between 40-60 minutes each, and were conducted face-to-face or online. Since the pandemic, many engineers are still working from home, and some of the interviewees was located in other cities in Sweden. Hence, each interviewee was able to decide how they preferred that the interview was conducted, see Table 3.1.

The interviews were conducted by the author. In addition to recording the interview, notes were also taken by the author for relevant following-up questions. Thus, the interview guide was followed, but specific questions to the different interviewees were added along the way to retrieve as much relevant and specific information to their knowledge. Further, since Swedish is the native language for both the author and the interviewees, the interviews were conducted in the native language to minimize impact of language-barriers and limitations (van Nes et al., 2010).

According to van Nes et al. (2010), qualitative research is considered valid when findings are communicated in such way that the reader of the study understands the meaning as it was first expressed in the originating data. Hence, in contrast will language differences generate additional challenges that might result in loss of meaning and thus loss of validity of the study. This become important to consider and ensure in this study as translation and entailing interpretation from Swedish to English was inevitable. However, no language differences were present in the data collection, summery, and during the analyses. Because, the recommendation is to stay in the native language as long as possible in order to avoid potential limitations (ibid.). On further recommendation, quotes have been avoided since translated words are literally not the interviewees own anymore, and possible wordings and formulation have in some cases been discussed with the study's supervisor from KTH.

3.3. Qualitative data analysis

A general analysing procedure for qualitative data was applied, which enabled a systematic analysis (O'Leary, 2017). The qualitative data analysis according to O'Leary (2017) consists of six steps, and involves lots of reding and rereading of the data throughout the process. First (1) bias and nothing overall impressions was identified in order to separate interpretations from the analysis of data, second (2) data were reduced, organized, and coded. Since the interviews were recorded, they were re-listened and summarized in script, to later be read and organized to categorises and themes. This was conducted directly after each interview as all information were fresh to memory

The themes used in this study were based on the research questions of the study and the interviews main areas. The data were coded according to the same themes as the interview guide: the current situation, conduction of a climate declaration, and LCA-tools. During the coding, a matrix was created as a summery for each interview. All matrices were read through several times, and opportunities and hindrances for each theme were identified. To even link the data into different situations or stakeholders, data in each theme was coded into following subcategories: The construction engineer, projects, clients.

Thereafter, (3) data from all five interviews were merged into one document. Patterns and interconnections between themes were searched, to later be (4) related to literature since findings became more apparent as data were reduced and structured. Further, data from interviews were compared to literature, to build greater depth of understanding. Which entailed (5) verification and building theories of data, to finally be able to (6) draw conclusions which meet the study's research questions.

3.4. Evaluation of methodology

Semi-structured interviews are a common method for seeking logic of a situation or understanding the interviewees 'world' Collis and Hussey (2014), which this study aimed to regarding the implementation of the climate declaration act. Collis and Hussey (2014) further state that the order of the interviews may be important, regarding the balance of emerging issues. Therefore, the study first interviewed the suitability coordinator, in order to explore and understand the organization before interviewing the construction engineers. However, the fact that new perspectives and topics could be revealed in a later interview where managed by ensuring the ability to return to all interviewees with questions. It appeared, nevertheless, not to be an issue for the study and thus not necessary.

Moreover, it is important that interviewees feel at ease when conducting interviews (O'leary, 2017). According to O'leary (2017) may online interviews add a certain 'dis'ease if they are not comfortable with the interview form. Nevertheless, due to the current pandemic, all participants are now accustomed to such communication. Furthermore, the respondent received the mandate to decide in which forum the interview would be held. Consequently, it is excluded to constitute an impact on the results of the study.

The use of hand-picked key informants in studies has a higher risk of sampling bias, and the conclusions made may be more limited (McCombes, 2022). However, it is a common method in exploring and qualitative research (Ibid.), which reflect the aim of this study since it is to examine and develop an understanding of a relatively small heterogeneous papulation i.e., construction engineers. Yet, in order to make the study's sample as representative of the population of construction engineers at Sweco as possible, and thereby reduce its limitations, variation in years in the profession and gender was a factor in the selection of interviewees. Nevertheless, in the

results, gender and years of experience did not indicate to be decisive for the respondents' answers and perspectives on subjects. Hence, the use of hand-picked key informants was considered to be an adequate sampling method for the study.

For qualitative research, where interviews belong, findings usually have a high degree of validity, but low reliability (Collis and Hussey, 2014). Validity refers to how well the interviewer gathered the knowledge and experience of the interviewees, and are thus, achieved when the study measure what was intended. Reliability is achieved when repeated trails will show the same results and consultation, i.e., it refers to the accuracy and precision of the results (O'leary, 2017). It is generally low fir interviews, because even if the same interview guide is used with the same interviewees, it is not likely that they answer the same as they did the first time. Thus, variations between the datasets would occur and a lower reliability.

A challenge with qualitative research is to retrain the integrity of the data (Collis and Hussey, 2014). In order to minimize such limitations, the data were analysed systematically and followed recommendations given by O'Leary (2017). Furthermore, since the interviews were recorded, the author could get familiar with the data before the analysis as Collis and Hussey (2014) argue is important. Nevertheless, a potential problem with a general qualitative analysing procedure is that the value of the analysis depends on the authors' quality of interpretation (Ibid.).

4. Results

In this chapter is the qualitative data gathered from the interviews presented. It is divided into three parts, the first part cover Sweco and their sustainability work, the second section addresses the prevailing project conditions, while the last part covers the new legislation.

4.1. Case Study – Sweco

Sweco is a decentralized organization, constituting of 17 500 employees spread in different business units located mainly in the northern Europe (Sweco, 2021). Sweco Sweden is one of those units. In 2020, Sweco Sweden contributed to 36 percent of the total consolidated sales, and thus the nation contributing the most. The same year, a major part of the sales for Sweco Group, with 37 percent, were within the segment of Buildings and Urban areas (Sweco, 2021). The construction engineers this study cover are positioned within that business segment at Sweco Sweden.

4.1.1. *Sweco's sustainability approach*

According to Sweco's communication to third party, sustainability is business critical. In close collaboration with clients and suppliers, Sweco aims to plan and achieve the future's sustainable cities. The company stress the importance in taking responsibility in the transition towards a sustainable society and sustainable development (Sweco, n.d.b). Thus, Sweco has established ambitious sustainability goals and the importance to achieve these targets have clear driving forces within the company.

Sweco is also promoting that the organization applies an ambition to always deliver better than the client's demand, in order to influence the transition to sustainability in the industry and impact the whole supply chain. The company strives to be a frontrunner, which according to Sweco means that if goals are sharpened in the outside world, they will also sharpen their own, despite already ambitious goals (Sweco, n.d.c). To achieve this, Sweco has developed and applied the Sweco model, which is founded on four pillars: Client focus, Best people, Internal efficiency, and Decentralized organization (Sweco, 2021).

Sweco is further a company with ambitious sustainable goals and targets. This applies to both internal and external sustainability goals, and especially those applied in Sweden (Sweco, n.d.b). Sweco have establish sustainability goals and targets that applies for all business units. However, since local conditions and legislations vary does local supplemental guidelines and regulations exist.

The major target for Sweco Sweden is to be climate positive in 2030, whereas the target is 2040 for the whole Sweco group (Sweco, n.d.d). The goal is based on 2020's emissions, and Sweco is complying the Swedish climate target, where a maximum of 15 percent of emission reductions can be achieved with other than own emission reductions (Sweco, 2021). For Sweco Sweden, the target includes all three scopes of emissions, whereas Sweco Global has excluded scope 3 emissions.

To integrate target and achieve those is Sweco committed to several sustainability initiatives. Including the higher level of ambition of the *Science Based Targets initiative* (SBTi) (Science Based Targets, n.d), which entail that emission reduction targets in line with the ambition for 1.5 C are set. Furthermore, Sweco is a member of the UN's Global United Nations Global Compact (UNGC) and work according to the ten principles (United Nations Global Compact, n.d). World Business Council of Sustainable Development (WBCSD).

Sweco also address sustainability frameworks and strive to align its operation to them in order to succeed. In the climate commitment is all three scopes, Scope 1, 2, and 3, according to the

Greenhouse Gas Protocol comprised (Sweco, n.d.c). Moreover, assessment of climate-related risks is in accordance with recommendations from Taskforce on Climate-Related Financial Disclosures (TFCD) (Sweco, n.d.e).

Sweco work with all the 17 SDGs (United Nations, n.d), within their own operation. But they also aim to help clients navigate the goals in projects. On Sweco group level, five goals been identified which are most business critical. Those are: Goal 6, 7, 9, 11, and 13 (Sweco, n.d.f). But, for the business segment buildings and urban areas are SDGs 11 (sustainable cities and communities) and 13 (climate action) the most business-critical according to their own analysis (Sweco, 2021). Further focus is placed on five targets: 11.2, 11.3, 11.6, 13.1 and 13.2, covering access to sustainable transport systems for all, inclusive and sustainable urbanization, reduction of environmental impact of cities, strengthen resilience and adaptive capacity to climate-related natural disasters, and integrate climate change measures into policies and planning (Sweco, 2021; United Nations, n.d)

Nevertheless, according to Sweco's sustainability report, it seems like the company only account emissions and have set targets for their own operation, such as buildings they operate in and travels for their employees (Sweco, 2021). Thus, projects Sweco contributes in and those entailing emissions are not affected by the carbon neutrality target. It is difficult to understand how Sweco evaluate and work towards sustainable constructions as a product in their operation. But, in the report it is stated that they have many opportunities to influence outcomes in a more sustainable direction, since they are included from an early stage in projects (ibid.).

4.1.2. *Sweco's sustainability organization*

Sweco Sweden's sustainability organization operate at different levels: national, regional, and group level (Engineer 3). Coordinator 1 is located at the national level and responsible for a work group consisting of construction engineers from all Sweco's business regions in Sweden, where Engineer 3 is a part of that group. The goal with the organization according to Coordinator 1 is to improve the overall knowledge regarding sustainability at region and group level. It will be achieved through education, workshops, provide necessary tools, calculation support, support for dialogue with customers, and information meetings in forms of seminaries/webinars or information through written channels such as mail and intranet (Coordinator 1). Additionally, Coordinator 1 adds that the sustainability organization aim to build pride and spread information about what Sweco do within the company.

In the beginning of Sweco's sustainability work as it is organized today, it was established that construction engineers had a low lowest knowledge level concerning sustainability (Coordinator 1). But, by continuously examining the demand and competence of construction engineers, it has been shown that the request of tools and education has increased, likewise the competence level (Coordinator 1). The transition has been noticed among construction engineers as well, Engineer 1 and Engineer 4 believe that Sweco pushes for education opportunities and that more colleges are talking about sustainability at work. Nevertheless, Engineer 1 can see that the discussion often coincides with the education occasion. Engineer 2 perceives that Sweco's sustainability work have developed to be more practical than theoretical, which Engineer 2 believes is good. Engineer 2 prefers concrete actions, instead of the fancy words that Engineer 2 believe usually abound about sustainability.

However, the perception about the education opportunities that Sweco provide differ between the engineers. It is optional to attend (Coordinator 1, Engineer 3 and Engineer 4), but Engineer 1 feels more or less obligatory to take part in education, whereas Engineer 2 has low knowledge about education occasions and subjects they cover. Engineer 4 appreciates the sustainability organization

and the work they provide, and has not perceived the education opportunities as popular among Sweco's employees due to the number of visitors. Hence, as a project manager Engineer 4 feel a responsibility to remind and encourage those construction engineers Engineer 4 is working with, so people attend and improve their knowledge. Nevertheless, Engineer 4 understand that employees may not attend due to that sustainability is a broad subject, and may be perceived a bit overwhelming and fuzzy.

Although Engineer 1 participates in the education provided for construction engineers, Engineer 1 is unsure whether or not Sweco have sustainable targets for construction engineers in projects. Engineer 1 believes that the goal with the education is to improve the knowledge regarding sustainability and create a forum for discussions. Engineer 1 further believes that the education has been relatively concrete, tools for being more sustainable has been discussed and presented. But, beyond that, Engineer 1 has never heard any guidelines or Sweco's expectations of how a construction engineer should behave in projects in order to be sustainable. Hence, Engineer 1 consider that it is up to Engineer 1 to make that kind of occupational choice in projects. Nevertheless, Engineer 1 appreciate Sweco's allowance of own responsibility, and the ability to tackle problems and solve them in your own way. But emphasize that clearer guidance and management regarding Sweco's goals within project would be preferable.

Engineer 2 is also unsure if Sweco applies sustainability targets on construction engineers, and add that it will require such external pressure from Sweco or clients in order for Engineer 2 to take actions. But Engineer 2 have trust in the company's strategies and believe that Sweco knows what they are doing, due to that the company's goals are aligned with the global ones. This perception is shared with Engineer 1, 3, and 4. Furthermore, Engineer 2 believes that the trust in Sweco results in that Engineer 2 do not question the company's measures, but adds that it might be good to question and follow up if Sweco meets the goals that are set and discussed internally.

Sweco has as a requirement when starting a project that a project plan should be established. It is the project managers responsibility to conduct it, and the plan include pre-selected goals concerning the environment (Engineer 4). Those are, moreover, according to Engineer 4: Sweco environmentally manage their projects by (1) the choice of environmentally friendly products, (2) the choice of sustainable solutions, (3) optimization of energy and/or building materials. Further, Sweco prescribes screwed steel constructions that minimize welding on site and where the work steps can be performed in a safe environment (Engineer 4). However, Engineer 4 question if not Sweco should add more goals to the plan, for project to work towards.

4.2. Construction projects today

As a construction engineer in projects, you are according to Engineer 1 obligated to ensure that the construction achieve the technical requirements of carrying capacity in order to not collapse. Engineer 3 explain that the construction therefore is dimensioned with respect to the prevailing conditions, to handle all loads given for the project, and to obtain a certain fire resistance. Furthermore, Engineer 3 emphasizes the important role loads have for the dimension and type of material.

However, Engineer 4 perceive that the industry applies safety first with the use of proven methods, founded in the mentality of doing as you always have. This according to Engineer 4 may entail oversizing of constructions, which thus have a larger environmental pressure than necessary. Construction engineers can be better on conducting more specific calculations according to Engineer 4.

4.2.1. *Ability to impact material decisions*

It emerged from the interviews with Engineer 2, Engineer 4, and Coordinator 1 that the project form impacts construction engineer's ability to impact decisions regarding material and design of the bearing structure, due to construction engineers' entry and position in projects. According to Engineer 4, it is possible to impact material decision as a project manager since Engineer 4 enter the project in an early stage and is responsible for maintaining the contact with the client. Engineers 2 and 3 have the same view of the building process, they believe that during earlier stages, the project is applying a larger perspective, but as time goes questions become more specific and detailed.

Engineer 4 describes the process, such as that Engineer 4 and the architect raise the issue of material selection to the client in the beginning of the project. During the projects progress, Engineer 4 raises the question of optimization with the construction engineer who do the model so that materials can be saved. Thus, together they discuss a solution that feels simple but reduces material and construction. Nevertheless, Engineer 2 has heard from project managers that they also can feel locked by the requirements from the clients, thus, not able to impact the bearing constructions shape or material. This occurs according to Coordinator 1 when the construction engineer entry after that the architect and the client already has locked the structure of the construction.

To enter the project in a late phase entail that the engineer has less possibility to impact material decision according to Engineer 1, 2, and 3. Both Engineer 1, Engineer 2, and Engineer 3's experience is that it is possible to influence decisions such as material optimization in order to minimize the use of materials, but they have never had the mandate for material choices, whether the construction should be in wood or steel for example.

Although, the construction engineer may have the ability to optimize the construction, such decision is always discussed with the project manager according to Engineer 1, as situations arise were optimization of materials conflicts with other displacement requirements, e.g., acoustics. According to Engineer 1, 2, and 3, it can be difficult to achieve a project's all technical requirements. Engineer 1 add that guidelines facilitate the coordination of solutions and requirements, so that they know what to prioritize in problem situations, even if the decision in the end is the clients.

4.2.2. *Sustainability targets in projects*

On the question whether sustainability goals have been addressed in projects, different perspectives and experiences emerged. Coordinator 1 believe that clients in the industry have begun to build up an interest in sustainability. Engineer 1, 3, and 4 confirms the development. But Engineer 3 has identified that the industry lack competence regarding sustainability, and emphasize the importance of obtaining a larger picture of projects and its impact in order to understand the issue.

Coordinator 1's perspective is that each construction engineer is responsible to work towards sustainable material decisions, or at least try to do so since it is the client's decision in the end. Nevertheless, Engineer 1 and Engineer 2 believe that sustainability goals from clients often are not measurable or concrete enough to know how to act on them in projects. Thus, Engineer 1 considers that sustainability within in projects is about the choices one take as a construction engineer. In addition, Engineer 3 believe that Engineer 3 applies a broader perspective regarding sustainability than others within projects, due to that Engineer 3 has worked more with sustainability issues.

Engineer 2 is unsure whether sustainability goals ever have been addressed in any of Engineer 2's projects. Two possible explanations according to Engineer 2 are that it either has not been

communicated sufficiently or overshowed by other goals and aspects, such as time and cost, which are considered more important.

The hypothesis is strengthened by the other interviewees, since it emerged that sustainability aspects tend to be ignored by time- or cost budgets. According to Coordinator 1, Engineer 1, and Engineer 2 is the phenomena perceived to be a relatively common in construction projects. In one of Engineer 1's projects were several proposals with different materials provided for the construction in an early stage, however, Engineer 1 interpreted it as the deciding factor were cost since the steel construction were chosen instead of the wood construction. Engineer 4 agrees on this opinion, with the experience that clients is positive to build construction with wood but that the cost is the crucial factor in the end.

On the other hand, it emerges from the interview with Engineer 3 and Engineer 4 that this issue has occurred not only in relation to sustainability actions, but due to technical ones as well. Where the client wanted to use green concrete for the construction, but with respect to the carrying capacity it was not possible. Engineer 3 adds, however, that it is almost always possible to find another solution to the problem and meet the clients wishes.

Construction projects are aimed to contribute to society, people, and the planet, meanwhile, time and cost are two large drivers which put significant press on projects (Engineer 2). On the question of how Sweco's construction engineers' performance are measured, with respect to success of projects, were the answer from all the interviewees consistent. It is time and cost budgets that steer the project, and those requirements are set by the client.

All interviewees agree on that time- and cost pressure may arise due to that the construction engineer enters the project in a late phase, the construction phase. It occurs that the construction engineer is modelling at the same time the construction is erected on the construction site, thus, the delivery for the construction engineer is forced to ensure that the work on construction site is not stopped (Engineer 2).

Planning and project structure emerge as two important aspects in order to minimize the risk for unclarities in projects (Engineer 1, Engineer 2, Engineer 4). Engineer 2 believes that people's ability to perceive time for actions does not always reflect the time it takes in reality. Engineer 2 further explain that it is difficult to perceive time due to that each project is unique and needs to adapt according to different conditions, such as project form, type of construction, level of requirements, budget, surroundings, etc. Engineer 1 has interpreted projects as messy due to time- and cost pressures which create stress among project members, but due to the projects structure were success of the project achieved anyway.

Engineer 4 seems to be aware of these perceptions, since Engineer 4 actively work with communication, and towards a healthy work environment within projects. According to Engineer 4's experience is clarity and achievement of a healthy work environment contributing to efficient teamwork within the project. Where a good relationship results in more projects with the same client and create a positive attitude to the work among the project members according to Engineer 4. Engineer 4 further adds that it is favorable for a project when a team constitutes of members that have worked together before, they know the boundaries, what to ask, who to ask, and how to collaborate.

4.2.3. *Communication in projects*

Except ignorance of potential sustainability project goals have all interviewees experienced that time and cost pressure also entail lack in communication. It becomes short with consequences such

as missing out important and necessary information about the project, for example project conditions, motivations for technical solutions, etc. Engineer 2 has experience of often having to draw information and conditions regarding the project from the project manager, information which should be addressed at a start-up meeting, but which instead appears late in the project process. Engineer 3 has experience of forgetting to inform disciplines that are depending on the construction engineer's work. Engineer 2 further addresses that time for reflection do not become a priority in such cases and thus is not material or material dimension questioned, even if it would be possible.

All interviewees emphasize the importance of sufficient communication and structure in projects, since they believe it enables teamwork and reduce time pressure. Engineer 3 believes the foundation in collaboration is to give everyone the chance to participate, trust each other, listen, and try to understand other members point of view. Engineer 2 is on the same path, and adds that information and insight in projects are uplifting, educational, motivating, and constitutes a driving force. This also applies to sustainability goals, according to both Engineer 1 and 2, who believes that it would be preferable if it was mentioned what the project aimed for, so they as a construction engineer knew what to achieve.

But even if all members have the same goal, it is important according to Engineer 3 to remember that all people function and work in different ways, therefore are adaption and compromises necessary to address in projects. Furthermore, communication needs to be prioritized in projects in order for it to be adequate. Engineer 4 emphasizes the importance of not only sending out important information, but that the information reaches those concerned. Important information can be deadlines, folder-structures, etc.

The interviewees have experienced that project size plays a role in how communication and teamwork take place, likewise, the goal differs with the size of the project. In smaller projects, Engineer 1 and 2 have experienced that economic aspects are the only driving forces, while larger projects may apply an environmental aspect to a certain extent, such as the implementation of environmental certification of buildings. But even if constructions are certified, Engineer 1 or 2's work as construction engineers have never been affected by it. In addition, according to Engineer 1, environmental certifications are performed based on economic benefits. Furthermore, in small projects where the number of project members is kept low, it is according to Engineer 1 and 2 easier to communicate since there are fewer middlemen, thus, you know who to contact concerning questions and the communications become more direct. According to Engineer 3's experience has subprojects in larger project helped to ease communication and get right information in time. However, Engineer 3 emphasize that no project has flawless communication.

4.2.4. *Experience and knowledge feedback*

On the question of whether experience and knowledge feedback occur in projects, the answers vary depending on the interviewee's perspective. According to Engineer 4, all project managers at Sweco are obligated to fill in contact information of the client in the business system when establishing a project. Furthermore, a date is also given when a feedback request is supposed to be send to the client. The question cover if the client would recommend Sweco to other projects. The answer given by the client is a number between 1-10, were Sweco account 9 or 10 as positive. Furthermore, the answer reaches the project manager and one's group manager. Engineer 4 question if the scale and method is equitable, due to Engineer 4's perception that it is few clients who rate that high. Additionally, Engineer 4 question why a client would give a consultant full score, when such feedback according to Engineer 4 may be perceived that the consultant does not need to develop its work further.

Engineer 4 believes the project feedback system is lacking due to that it is not obligatory for the client to answer, and with respect to the projects managers' responsibility to decide a date for the request of feedback. Thus, the system allows the project manager to set a date whenever during the project time, which according to Engineer 4 is used to get higher rate. Engineer 4 gives an example, some project managers send the request when everything in the project is according to the plan, i.e., the client is satisfied, whereas other set the date to after the delivery, i.e., disagreements may have arisen during the project time and the client is not as satisfied. Although the later may risk a lower rate, it is according to Engineer 4 what every project manager should do. Engineer 4 motivates it with that the delivery is one's work and responsibility, and before that it is unsure whether the project have complied with the budget of time and cost.

Engineer 4 further add, beyond Sweco's project feedback system may a follow-up meeting be conducted, with or without the client. If the client attend, the meeting consists of the project manager only, or include all disciplines' technical managers within the project. Either way, Engineer 4 emphasizes the importance of transfer the feedback to all members in the project, oral or written. However, the acceptance of oral internal meetings with the project manager and construction engineers varies between different group managers at Sweco according to Engineer 4. Since the project is ended, the time for the meeting cannot be charged on the project, hence, it becomes administrative hours on Sweco. Furthermore, Engineer 4 addresses that when a group manager chases a high billing rate within the group, administrative hours do not align with the target.

Even though feedback is considered important and developing for the team and each member by all the interviewees, Engineer 2 believe that feedback does not always reach all the way to the construction engineer. Engineer 4 works for continuously pass on feedback during the project, to include project members. However, Engineer 4 is of the opinion that it seldom is positive feedback that one hears within the industry. Engineer 2 agrees on the statement and believe that it would be desirable to know how the project is going in general, not only when things do not work out as expected.

According to Engineer 3, larger projects are generally bad on passing on and learning from feedback. But, at the same time Engineer 3 adds that time pressure, phase in the building process, and the load of work tasks affect one's ability to reflect and process given feedback.

4.3. The act of Climate declaration in projects

Coordinator 1 is of the opinion that people at Sweco and in projects want to work with sustainability, and that many also have a private interest in doing better. The interviewees consider sustainability important. They describe that sustainability is about managing available resources, minimize the environmental pressure that humanity places on the earth, and securing a future for the next generation. Engineer 1, 2 and 3 perceives its working group at Sweco as positive for sustainability, where Engineer 1 feels influenced by an active group leader, who promotes and talks about sustainability. Whereas Engineer 4's working group do not discuss or focus on sustainability that much.

4.3.1. *Approach towards the act*

All interviewees address a positive attitude towards the act of climate declaration. Engineer 1 believes that people who possesses professions which affects the earth and the climate in the way that a building does have a great responsibility to work with sustainability. Engineer 1 perceives, however, that there are many empty words in the industry, and no real will. The interviewee further believe that the industry could continue as it is, although the consequences are known. Therefore,

according to Engineer 1, can and should the industry become much better at it. Where the only way to act according to Engineer 1 is through pressure from the public and to make sustainability profitable, due to companies' financial priorities.

Furthermore, all interviewees believe it is good that the legislation consider the constructor the responsible one, since it forces the client to include sustainability in projects from an early stage. Coordinator 1 and Engineer 3 emphasize the importance of working towards the same goals in projects, and with the new legation all project members will be obligated to do so even when it comes to sustainability. Moreover, Coordinator 1 believe the act constitutes a driving force for change within the industry, which is requested and highly necessary in order to meet Sweden's and the global goals. There is no time to lose according to Coordinator 1 in order for the industry to do a transition towards more sustainable solutions, and further believe that the industry cannot wait for new materials to solve the problem, the industry must act with what is available.

It emerged that the knowledge regarding the legislation of climate declaration varies among the interviewees. Coordinator 1, and Engineer 3 have deeper knowledge then the rest, and Engineer 2 is the one with lowest insight. Coordinator 1 and Engineer 3 are activity working with the legislation as one of their tasks, and Engineer 1 and Engineer 4 have obtained insight about the act through presentations by Boverket and Sweco. Nevertheless, all interviewees share a high believe in Sweco's capacity to deliver what is expected for compliance with the act.

Coordinator 1 states that the construction engineer has gone from thinking that sustainability has been someone else's responsibility to now working with it themselves. Now, according to Coordinator 1 it is about for the construction engineer to start daring to discuss sustainability with the client, which would not be strange to do given that the construction engineer already today discusses areas of knowledge about which they are not an expert in with the client. Engineer 3 believes stepping out of their comfort zone gives mixed feelings, useful and educational but also scary. Coordinator 1 further point out that it is business critical for Sweco to start doing so, otherwise they will lose projects and the opportunity to make society better.

Here, it is the project managers responsibility to act since they have most contact with the client according to Coordinator 1. Engineer 4 agrees, as a project manager Engineer 4 is prepared to sell in sustainability in projects, as Engineer 4 already do with other competence areas required in projects. Engineer 3 also believe it is the projects manger's responsibility to manage sustainability in projects, e.g., through sustainability meetings.

4.3.2. *Implementation*

On the question how the act should be complied with in projects, answered Engineer 3, that not all construction engineers at Sweco have the same goals and interest in sustainability, and due to the division of responsibilities of the law, Engineer 3 believes that compliance will not be put on the construction engineer. A better solution according to Engineer 3 is if an external person who has the skills required conduct the declaration. Engineer 2 answered the same, that a profession working with certifications or similar should conduct the climate declaration. Engineer 2 further address that it would entail that the declaration is conducted sufficiently, in the right way and more professionally than if Engineer 2 performed it.

Both Engineer 2 and Engineer 3 believes such competence already exist at Sweco. Therefore, Engineer 3 emphasizes that no construction engineer at Sweco should feel obligated to conduct the calculations. Hence, if a construction engineer wants to conduct the calculations it becomes more of a skills development according to Engineer 3. But, as the interview with Engineer 3 continues,

the opinion changes to that all construction engineers should be able to carry out an LCA as required by the act.

And, when Engineer 2 gets the information that limit values of emissions will be implemented in the act, and that it will ultimately be about optimization and material decisions, Engineer 2 then believes that it probably is best if the construction engineer conduct the calculations regarding the bearing construction, because otherwise it will be difficult to know how the construction's emissions are related to the requirement. Engineer 4 share the perspective, it will be sufficient if information regarding the bearing construction's emissions is manage by the right profession, because if the construction needs to be e.g., optimized to comply with targets, it can be done at once.

In addition, Coordinator 1 stress the fact that it is important for Sweco to keep the possibility to impact decisions in projects and thus deliverer better than the client or legislation demand. Hence, Coordinator 1 believe it is crucial regardless of whom conduct the calculations of the act that the construction engineer possess knowledge regarding the bearing construction's emissions and how to minimize those. But, Coordinator 1 believe that it is best if the construction engineer provides the climate impact required by the legislation since sustainability experts do not possess the same understanding of the construction as the modeller. Furthermore, Coordinator 1 state that it will be easier to quality review the work when one knows the model.

4.3.3. *Competence to comply with the act*

Engineer 3 agree that it is a matter of perception and basic knowledge to comply with the legislation, regardless of whether the execution of the declaration ends up with the contractor or the construction engineer. Engineer 3 further adds, the more involved they are in the process of carrying out the declaration, the clearer it will become to the construction engineers how they must work towards sustainability in projects.

Engineer 2 emphasizes that if the LCA calculations become the construction engineer's responsibility it will entail one more aspect to include in its daily work, and thus require more time of them in the project. Nevertheless, Engineer 2 to not really mind it since construction engineers already are used to manage and consider other technical requirements in their work, e.g., fire, moisture, and acoustic. But at the same time, Engineer 2 stress the fact that time is a big factor whining the profession, and it may occur that there is no time left to learn new things. Engineer 1 shares the views with Engineer 2, that sustainability will only be one more aspect to include in the daily work, and with Coordinator 1, that sustainability will be a governing parameter in projects, and thus important for Sweco to ensure the construction engineer's competence in order to be competitive in the industry.

However, according to Coordinator 1 and Engineer 4, does Sweco's construction engineers more or less already possess the capacity to comply with the legislation, only that they do not believe in it themselves. For Sweco is, therefore, the priority in order to comply with the act, according to Coordinator 1 to get designers to think of sustainability as a guiding parameter in the projects, and work to secure employees in sustainability issues.

Engineer 2 has never carry out a LCA, and do not really know how much time or how difficult it is to perform one. But, with education and support from Sweco, Engineer 2 is determined that it will be possible for the construction engineer to carry it out in projects. Engineer 2 state that guidance makes one more confident and that makes it more fun, in addition it reduces the feeling that the task is overwhelming. Coordinator 1 emphasize that Sweco wants to build such confident among the

construction engineers, and know that they must have done it a few times to feel confident in the execution of a LCA. Engineer 2 believes, however, that it is not only up to Sweco to guess what everyone needs, each employee must also communicate requested knowledge.

Engineer 1 and Engineer 3 has completed one LCA as training and state that it is not a difficult task and established a better understanding of materials climate impact, but likewise does not feel confident enough to provide it in a project context. However, Engineer 1 believes that performing the calculation should not be the difficult part of the legislation, since an easy tool will not require much from the engineer. Hence, Engineer 1 consider that Sweco should put effort in the tool rather than having to train everyone in the tool. Engineer 4 believe that it will become necessary for construction engineers to have an easy tool to obtain a quick overview of the construction's emissions, with respect to future value limits of the act.

4.3.4. *Potential hindrances*

Coordinator 1 has identified two hindrances for a sufficient implementation of the legislation. First, if the entrepreneur becomes responsible for the climate declaration, Coordinator 1 believe that the conduction of the act risk to start in a too late stage. Second, that the construction engineer will not enter the project at a sufficiently early stage. Engineer 4 share the same view, limit values of emissions will be difficult to achieve if technical solutions are set without involvement of a construction engineer. In addition, Engineer 4 believe that architects today are not used to collaborating with other disciplines, since they often work out a version of the construction alone with a client. Furthermore, the client does not possess the technical expertise the act requires, without the client's focus is on availability and inner surface layers.

Therefore, Sweco works to get their architects and other architects to understand the benefits if construction engineers entry projects in an early stage (Coordinator 1). According to Coordinator 1, can point efforts by the construction engineer be enough in order to minimize the amount revisions.

Engineer 1 and Engineer 3 believe it might be difficult to get the declaration into the project routines, but Engineer 1 has high faith in that projects will solve the implementation of the climate declaration, because projects are used to manage and solve clear problems. Which the act is according to Engineer 1. Engineer 4 states that, as long there is no limit values for emissions, there are no obstacles for projects to comply with the legislation. But when projects have to meet emission limit values, more will be required from each project member and the project as a whole according to all interviewees.

Engineer 1 envisages that there will be a focus on local materials to reduce transport distances, as Engineer 1 imagine that transports account for a significant part of the materials' emissions, and increased use of recycled materials. Nevertheless, in what detail the construction engineer can impact material decisions is uncertain. Engineer 1 know that injunctions can be used for influencing the choice of material supplier, but is unsure whether the construction engineer can specify requirements on the place of manufacture. According to Coordinator 1 and Engineer 4, geographical locations cannot be prescribed, as there must be opportunities for competition, but product properties such as emission limit values is possible.

Engineer 4 believes the limit values will increase the request of reuse of materials, in order to comply with the act. However, according to Engineer 4 is it not common to reuse materials today, and therefore it is difficult to find available such materials. In one of Engineer 4's project where recycled bricks were used, they needed to import the materials from Denmark which entailed

dimensions deviating from the Swedish standard. Engineer 4 emphasizes that it may sound easy to replace materials with re-use, but it requires a lot of work to ensure sufficient, but it entails much work to ensure adequate properties and consider potential consequences for the building process. Furthermore, Engineer 4 believe that it requires experience to know that the opportunity of re-use exists.

Last, entailing issues with the legislation according to Engineer 4, is if the limit values of emissions (1) hinder potential future re-building of constructions, due to the construction being too optimized for additional loads. Or, (2) affect the shape of the construction by limiting possible designs.

5. Discussion

In this chapter is the findings from the interviews compared with the data from the theoretical chapter. The purpose is to identify possible causes for the results and necessary measures to improve the possibility of an efficient implementation of the act. The chapter is divided into four sections, the first cover the approach to sustainability within the industry, the second address construction engineers' readiness to implement the act, the third part consider life cycle assessment, and the last section discusses the anchoring of change within Sweco.

5.1. Approach to sustainability

The result of the study acknowledges Oke and Aigbavboa (2017) and Saad et al. (2019) in that construction projects still address the iron triangle principle, cost, time, and quality, as measures of success. It emerges however that clients occasionally apply sustainability goals in projects, which earlier research also has identified (Oke and Aigbavboa, 2017). Where, sustainable indicators in projects are a way to achieve sustainability success according to Stanitsas et al. (2021). Yet, the interviewees interpret those as not measurable and concrete enough to know how to act and what is expected of them as construction engineers. This may be a hindrance for a transition towards a sustainable project management, since Oke and Aigbavboa (2017) emphasize the importance of that all project members understand the goal definition in order to achieve success.

Time and cost appear to not only be driver for project success, but the factors are also putting a lot of stress on projects members since budgets is interpreted as tight, which further results in that potential sustainability targets are ignored by the project and the construction engineers. Nevertheless, sustainability targets can no longer be ignored due to implementation of the act.

It emerged that even Sweco address the iron triangle for construction engineers, although they are an organization with ambitious sustainability target. At the level of the construction engineer, it is ambiguous whether Sweco applies any sustainability targets at all, since the only measures are handled by the project manager. Nevertheless, the project manager interprets the actions as vague and believe they would be discussed and improved further. This may be a reason why they are not communicated to construction engineers in projects, and additionally result in the identified desire that Sweco should specify their requirements and guidelines on how construction engineers are supposed to act in order to be more sustainable.

Consequently, a gap between present and desired approach towards sustainability within projects has been identified. The act of climate declaration will require projects and members to change the approach towards sustainability and of their established way of working, regardless of it is the construction engineer or an external profession that perform prefix A1-A4. The act of climate declaration will imply measurable sustainability targets for construction projects to achieve, which is important for collaboration. In addition, compliance of the act will solve the current problems with ignorance and confusion of sustainability measurements.

Research argue that change cannot occur faster than the participant is comfortable with (Lines et al., 2015). However, since the change is due to a legislation, the construction engineers and Sweco are forced to comply with it (Bolpagni et al., 2022, which is also known among the interviewees. They understand the importance to gain required knowledge to be able to comply with the legislation, and thus stay competitive in the industry. Furthermore, the engineers show a high belief in that Sweco as an organization with its ability to manage challenges will provide what is necessary for compliance with A1-A4 of the act. Which may ease the implementation since lack in

organizations commitment to sustainability otherwise is considered to be an obstacle (Carvalho and Rabechini, 2017).

Nevertheless, what actions it implies for Sweco is unsure among the construction engineers since the engineers without insight in Sweco's sustainability organization have uncertainties regarding Sweco's sustainability objectives. The identified lack in communication may entail an issue for compliance with the act, because according to Carvalho and Rabechini (2017), sustainability aware persons need to be included in projects in order for sufficient sustainable project management. Hence, construction engineers need to possess required capability, and cannot except that someone external will solve the issues with sustainability.

5.2. Construction engineers' readiness for change

All interviewees show an understanding of how urgent it is for the construction industry to alter and improve their sustainability, which research argue are important for a transition to occur (Endrejat et al., 2021). However, it can be concluded that the driving force differ between the interviewees, where the majority feel a private interest and responsibility. Whereas one interviewee needs external pressure to change their way of working. The requirement of external pressures in order for change to occur, is common within change management and is shown to have a significant effect on the success of the transition processes (Higgs and Rowland, 2011; Lines et al., 2015; Hassan and Mouakket, 2016; Endrejat et al., 2021).

The act will put an external pressure and force change to occur as the interviewee require, but additionally, the leadership behaviour plays an important role in sustainability development (Higgs and Rowland, 2011; Lines et al., 2015; Hassan and Mouakket, 2016; Endrejat et al., 2021). The interviewees, furthermore, request guidelines and support from Sweco to be comfortable and confident enough to comply with the act. Hence, Sweco cannot rely on that all construction engineers will take own initiative for sustainability, or rely on that the construction engineer understand what they need to request in order to comply with the act.

The results further indicate that the interviewees who possess a private interest of sustainability are those who have attended and learned from the education opportunities, whereas the one with lower interest has not taken part of it at all. Again, research state the importance of including sustainability aware persons in projects in order for sufficient sustainable project management (Carvalho and Rabechini, 2017). Yet, Sweco's schedule occasions are voluntary and thus it is possible for the construction engineers to not attend, which together with absence of time leads to ignorance of sustainability, like it tends to do in projects. Which is the opposite to what research emphasize, all members in a transition needs to have a common understanding of the direction of the change (Whelan-Berry and Somerville, 2010; Kotter, 2012; Lines et al., 2016; Endrejat et al., 2021). Therefore, obligatory education opportunities may be a solution to eliminate ignorance of sustainability among construction engineers, and thus establish a common level of knowledge.

Although the interviewees understand and feel responsibility for sustainable development, the results indicate that the first feeling that emerge with respect to change in the daily work is rejection and resistance to manage it themself. It is in line with Endrejat et al. (2021), where resistance is stated to be a rational phenomenon. All except the Coordinator 1 believe that an external profession should manage the act and provide required calculations. Yet, as more information is given to the engineers during the interviews, they overcome their rejection and determine that it might be better after all if the construction engineer carry out the requested LCA. Thus, in agreement with the opinion of the sustainability organization. This prove the importance for Sweco to further communicate the change to construction engineers, and as Whelan-Berry and Somerville (2010)

state, change communication needs to be addressed continuously and in order to sustain momentum, important issues and further motivation is necessary.

Lines et al. (2015) and Aldossari et al. (2021), state that the majority of all percipients within change is favorable to it in the end, the result of this study seems not to be an exception. The engineers' change of mindset is supported by research, according to Della Valle (2021) is it necessary among actors engaged in the design process in order to achieve sustainability development, and Endrejat et al. (2021) argue that developing a positive attitude towards the transition is essential for organizations within the construction industry. In this case is the change based on a deeper understanding that information the construction engineer will be incident to in projects, will be available to them directly if they carry out the LCA. Hence, in projects, middle hands are avoided, and communication channels are shorted, which all engineers have experienced as preferable. This may prove that when communication of change is simple and direct, and that right information is given, readiness can be achieved, which Whelan-Berry and Somerville (2010) and Kotter (2012) argue.

According to Kotter (2012) and Lines et al. (2016) may acceptance of change be a more difficult task than communicate the change. Here the result indicates the opposite, because Sweco is apparently lacking in the work of achieving readiness for carry out the LCA A1-A4 of the act require, and even if acceptance of change prevails among construction engineers, communicational issues due to time and cost pressures may remain within projects. The result indicate that planning and project structure are two important aspects in order to minimize the risk for unclarities in projects, which research also emphasize (Dalla Valle, 2021) and acknowledge as a shortcoming (Sadri et al., 2022). Therefore, when construction projects must comply with the legislation, it becomes important to budget time for the performance of the act in respect to planning and, thus, avoid increased stress in projects.

At the same time, it emerged from the interviews that it can be difficult to predict the time required for different task within projects. In addition, research has shown that settlement of realistic expirations of members, and sufficient resource capacity have positive impact on readiness (Lines et al., 2015; Vos and Rupert, 2018; Aldossari et al., 2021; Endrejat et al., 2021). Thus, since the act is new, and little experience of the requirements exist among the construction engineers, Sweco should improve such training for the engineers, to establish the time needed for carrying out a LCA and furthermore, make the construction engineer more comfortable and confident with the task.

In projects, the project manager plays an important role for success of projects according to both the results and research (Kotter, 2012). The result identified communication regarding sustainability as desirable and important in order for sufficient teamwork, which Hwang and Ng (2013) and Tabassi et al. (2016) strengthen as an important skill the project manager has to possess. The project manager has the closest communication with the client and ability to impact decisions, which the project manager in the study seems to know, as they are using its mandate to impact and are ready to take its responsibility to include sustainability as a steering parameter in project. Therefore, the project manger the study interviewed is interpreted to has achieved readiness for the change, in the order to manage and communicate requirements with construction engineers within projects, and further discuss the subject with the client.

5.3. LCA

The act will require life cycle assessments for the construction, which according to Nair et al. (2021) and the result of this study is a lacking knowledge among construction engineers. The interviewees indicated that they are more comfortable with optimization of the construction, rather than material

decisions with respect to emission reduction and carrying out a LCA. This may not be interpreted as strange, since a high degree of knowledge is perceived to be a requirement for LCA to be used as a building tool according to research (Malmqvist et al., 2011), and Dalla Valle (2021a), state that tools and emissions which are intangible resources often are ignored.

Sweco has, however, several LCA tools available for the construction engineers to use, but they do not feel comfortable enough to use them, because too little theoretical information and time for practice have been available. Thus, the result indicates a feeling of disempowerment, in line with research (Kotter, 2012; Lines et al., 2016). The construction engineers ask for more education in order to be able to comply with A1-A4, which of course Sweco should provide. It is important however, that the construction engineer do not only receive education regarding the use of tools. Research also emphasizes the importance of the performer's ability to interpret results due to uncertainties and variations, and to understand the significant effects the data have on the results (Finnveden et al., 2009; Nair et al., 2021). Especially since the LCA tools available at Sweco are simplified, which, nevertheless, research have suggested (Nair et al., 2021).

Furthermore, as limit values of emissions are developed within the act, it will not be enough to carry out a LCA, choices of materials, dimensions and technical solutions becomes crucial for compliancy with the legislation. Due to that material choices made in the design phases, often have significant environmental impact over the buildings' life cycle (Figueiredo et al., 2021; Nair et al., 2021). The results indicate that this requirement of deeper knowledge of material emissions the construction engineer needs to possess is the biggest obstacle to complying with act. Yet, time exist before such actions are implemented, thus, it is possible to improve knowledge and create readiness among the construction engineers before it impacts their day-to-day operation, which according to literature is important (Whelan-Berry and Somerville, 2010; Lines et al., 2016). Sweco, should therefore, focus on education regarding material emissions and how the construction engineer is supposed to act to optimize and prescribe emission limits of materials.

The act will, furthermore, put pressure on the supply chain as low-carbon materials needs to be used, which is an important factor in the transition (Carvalho and Rabechini, 2017; Sadri et al., 2022). The result has, however, identified hindrances such as limited available options of such materials, and entailing uncertainties with use of recycled materials. Which also Hwang and Ng (2013), Carvalho and Rabechini (2017), and Sadri et al. (2022) have acknowledged. Hence, it becomes important for the construction engineer to be aware of the consequences material decisions has for other disciplines or in later stages in the building process.

The act is aimed to be implemented at an early stage in the building process, which also Sweco understands. It is necessary due to the ability to impact decisions in that stage, but in respect to the LCA it will probably imply use of generic data for environmental impact (Nair et al., 2021). Therefore, the construction engineer will work with the LCA as an ongoing process, where generic data will be exchange as alternative designs is restricted (Boverket, 2020b; Nair et al., 2021).

Hence, expect limited knowledge, another hindrance for compliance with the act, according to the result, are the construction engineer's late entry in projects. To overcome the issue, Sweco has already started communicating what is necessary in order for a sufficient implementation of the act with other discipline. Which is in line with research, a systematic holistic approach needs to be addressed, were all members understand their impact and how each decision they make further impact other disciplines (Dalla Valle, 2021b).

5.4. Anchoring change

This report studied the implementation of the new legislation of climate declaration. How the act will be implemented in project is still unclear, even the strategic level at Sweco do not know what to expect, since it is the client's decision in the end. The aim with the act is, however, aligned with Sweco's driving force, and their aim to plan and achieve the future's sustainable cities. Hence, Sweco's ambition that the construction engineer should performed A1-A4 of the act, enables them to achieve their aim and take responsibility in the transition towards a sustainable society and sustainable development. The construction engineer can further deliver better than what is required of the act and the client.

Sweco's organizational structure, with its sustainability organization, is favorable and compatible for compliance with the requirements of the act, since the sustainability organization is already established and working for improvements within the area. Such alignment is according to research found to be important for change to happened Kotter, 2012). Hence, the system is not perceived as an obstacle for compliancy with the act.

5.4.1. *Competence*

From the interviews it emerged that the perspective of construction engineers' knowledge level in relation to A1-A4 of the act are not aligned between those who are higher up in the organization and the construction engineers themselves. The sustainability organization believe the construction engineer has the required competence, but are at the same time aware of construction engineers' insecurity of their sustainability competence. Hence, it is interpreted as a two-way communication exist within Sweco, which research argue is the most efficient way (Whelan-Berry and Somerville, 2010; Kotter, 2012).

Sweco is furthermore acting on the construction engineers' questions and thoughts, as they work for improving the construction engineers' insecurity with education and information, which Whelan-Berry and Somerville (2010) and Kotter (2012) emphasized as important for change to happened. Yet, Sweco may approach the change too lightly because the results indicate that the sustainability organization do not reach out to all construction engineers at Sweco with education and information meetings, even if it is available for everyone, and readiness is not achieved even if the construction engineers understand the need of transition.

According to Higgs and Rowland (2011), a successful implementation of change requires an approach which understand the complexity of the phenomena. Sweco's leadership strategies reflect what the engineers in this study desire in order to be ready for compliance of the legislation, and Sweco seems to understand their ability to affect the construction engineers in the change. Which according to the literature is important in a transition (Vos and Rubert, 2018). Nevertheless, although, the sustainability organization understands the importance of education, and works for improvement in line with research. The effort does not seem to be enough in order for construction engineers to comply with act now.

According to the study, the major factor is the lack of communication from the sustainability organization, which entailing consequences of rejection, and lack of confidence and readiness for compliance with act among the construction engineers. Which are consequences in line with the research by Kotter (2012), Vos and Rupert (2018), and Endrejat et al. (2021). Furthermore, even the engineers that have participated in education oppertunites did reject to provide what A1-A4 of the act require. Hence, more education is needed in order to establish reediness among construction engineers, where the engineers express shaping behavior characteristics of a leader, such as guiding,

education and support from Sweco. Which is a common leadership style in deeper changes (Higgs and Rowland, 2011).

5.4.2. *Organizational culture*

Sweco's approach of being a forerunner and establish high competence, may be interpreted as well implemented in the organization, since all interviewees have a high belief in the organization to solve the implementation of the act. Nevertheless, the engineers rely on other employees to do so, due to their low self-confidence in sustainability.

A common error in change management is lack of anchoring the change in the corporate culture. Sweco is promoting sustainability as important and crucial, with ambitious targets and compliance with different sustainability initiatives. At the same time, the engineers do not know what is expected of them in projects, and they desire guidelines on how a sustainable construction engineer should act according to Sweco, which can be linked to organizational culture. The results indicate that Sweco, apparently, is better on communicating actions and targets to third party than they are to their employees.

Nevertheless, Sweco can improve their organizational culture, with respect to sustainability, in order for employees to gain understanding how to act in projects. The result show that all interviewees promote knowledge feedback, which also research emphasize is important for change to happened and achieve sustainable practice (Kotter, 2012; Lines et al., 2016; Dalla Valle, 2021a; Oladinrin and Ojo, 2021). Nevertheless, it is not always accepted from the group manager. This may entail disempowerment and hinder employees' opportunities for education within the area (Kotter, 2012; Lines et al., 2016). Sweco should, therefore, work on managers focus on billing rate, and thus, unwillingness of administrative hours, since it undercut the change. In addition, if not such unwillingness is confronted it may spread instead and prevent the implementation of the change in the organization's culture (Kotter, 2012). Thus, if group mangers instead lead by example, as Kotter (2012) argue is a powerful strategy for implementing change, and promote knowledge feedback it may be incorporated in the culture to stay. There is still time to ensure competence, but it is important to start working for it now, as change takes time.

6. Conclusion

The results of the study confirm the literature, construction projects today mainly measure success based on the parameters: time, cost, and quality. The results show that clear sustainability goals are lacking in private clients' projects but also within the organization, and there is a lack of competence in the area. Nevertheless, organizations (Sweco and their clients) and employees (construction engineers) show a willingness for the transition, and the act of climate declaration may reduce the prevailing confusion and powerlessness regarding sustainability. Improving competence within LCA needs to be a priority for organizations in the industry, in addition to ensure a positive attitude towards the change that is about to come, and increase employees' self-confidence so that sustainability is discussed. For the sustainable development of the industry, and compliance with the law, this essential knowledge should be established regardless of project form, type of client, etc.

The study has examined a large company, with an established sustainability organization. Hence, the results are based on the organizations' existing sustainability work, knowledge, and structure. Therefore, companies with similar organizational structure and size may be able to apply the results of the study directly, while smaller organizations may not possess the same opportunities and hindrances as identified in the study. They may not have an adapted structure, possess the broad knowledge within the organization, and the ability to improve the organization's sustainability work in accordance with the results. At the same time, they may not have communication problems as a major obstacle, which the study identified was the case for Sweco. All organizations should, nevertheless, be able to use the results to gain knowledge and as a guide of what should be taken into account for a successful implementation of the act.

Furthermore, whether the results, regarding the identified obstacles that exist in private project conditions, can be applied to projects with clients other than private ones is ambiguous. The obstacle with the implementation of the act, which is due to the construction engineer's late entry, may be applicable to projects with public clients, i.e., projects that are affected by public procurement. But, on the other hand, it is not certain that the construction engineer will play the same central role in the implementation of the act in such projects. This regardless of whether the project is carried out by Sweco or another company, as it depends rather on the project structure and not the company structure.

To achieve readiness among construction engineers within the construction sector will not only be favorable for compliancy with the act in Sweden. From a broader perspective will such positive attitude contribute to manage and achieve sustainability targets at a national and global level, e.g., Paris agreement, and carbon neutrality goals. This results in a reduction of the sector's contribution to greenhouse gas emissions, which is crucial. Thus, the work of establish readiness should not be limited to constriction engineers or special to Sweden. The sector is complex and all active in the industry are important and need to collaborate in order to succeed at a global level with the change that sustainability require and reduce the sector's environmental impact.

Previous degree projects and research which cover the act have focus on materials' emissions and calculations of buildings' environmental impact as a qualitative measure. This study contributes to the field with knowledge regarding the attitude towards the climate declaration act, and a perspective of how a larger construction company aims to comply with the legislation. The focus has been on environmental management and by studying theoretical approaches and examining how a company has done in practice, the study has contributed with how resources should be

allocated within the audited organization to overcome challenges, achieve a more effective implementation of the legislation, and thereby improve its sustainability organization.

6.1. Further research

The act of climate declaration will be a step in the crucial transformation of the construction industry to become more sustainable. It will lead the industry in the right direction to achieve the environmental quality goals and net zero emissions by 2045. However, there are still uncertainties regarding the implementation of the legislation, and during this study new perspectives and questions arise. Below are suggestions for future studies:

- Research which evaluates and follow up projects and organizations implementation of the act may be of relevance in order to improve the industry furthermore.

- The act will implement emission limit values for buildings, nevertheless, but it should be investigated what are reasonable values regarding different building types. Furthermore, why should not industry buildings be included in the act?

- As the demand for materials with low carbon dioxide emissions will increase, it is necessary to examine how the logistics and supply of recycled materials should be handled in order to be able to meet this demand.

- The industry has generally low knowledge of LCA, but with legislation this will change. There are, nevertheless, various tools available for LCA, more or less time, cost, and knowledge-intensive, thus, which tool is most beneficial for the implementation of the LCA required by the act for the different stages within the building process?

- In this study private clients where investigated, but how does public procurement affect the implementation of the law?

- One of the interviewees expressed concerns regarding that the act will impact the cost. Will the legislation lead to further rising house prices, in a market where prices are already considered high today? How does this affect the economic divide that exists in society?

- Another concern is the impact the act will imply on the design expression of the budlings. To what extent will the aesthetics of buildings be affected by the legislation? How is this received by affected actors?

7. References

AL NAHYAN, M.T., SOHAL, A., HAWAS, Y., and FILDES, B., 2019. Communication, coordination, decision-making and knowledge-sharing: a case study in construction management. *Journal of Knowledge Management*, Vol. 23, No. 9, p. 1764–1781.

ALDOSSARI, K.M., LINES, B.C., SMITHWICK, J.B., HURTADO, K.C., and SULLIVAN, K.T., 2021. Employee Reactions to Adoption of Alternative Project Delivery Methods within the AEC Industry. *International Journal of Construction Education and Research*, p. 1–18.

ALWAN, Z., JONES, P., and HOLGATE, P., 2017. Strategic sustainable development in the UK construction industry, through the framework for strategic sustainable development, using Building Information Modelling. *Journal of Cleaner Production*, Vol. 140, p. 349–358.

BOLPAGNI, M., GAVINA, R., RIBEIRO, D., and ARNAL, I.P., 2022. Shaping the Future of Construction Professionals. *Industry 4.0 for the Built Environment*. M. Bolpagni, R. Gavina, and D. Ribeiro, eds., Vol. 20, p. 1–26.

BORGLUND, T., DEGEER, H., SWEET, S., FROSTENSON, M., GRAFSTRÖM, M., LERPOLD, L., NORDBRAND, S., SJÖSTRÖM, E., and WINDELL, K., 2021. *CSR and sustainable business*. Second edition. Stockholm: Sanoma Utbildning.

BORGLUND, T., DEGEER, H., SWEET, S., FROSTENSON, M., LERPOLD, L., NORDBRAND, S., SJÖSTRÖM, E., and WINDELL, K., 2017. *CSR and sustainable business*. First edition. Stockholm: Sanoma Utbildning.

BOVERKET, 2020a. *Regulation on climate declarations for buildings*.

BOVERKET, 2020b. *Tidplan för insatser och åtgärder inför krav på klimatdeklarationer*.

BOVERKET, 2021a. Klimatdeklaration av byggnader [online]. Available: https://www.boverket.se/sv/byggande/hallbart-byggande-och-forvaltning/klimatdeklaration/ [Accessed 2021-11-25].

BOVERKET, 2021b. Planera för klimatdeklaration av byggnaden [online]. Available: https://www.boverket.se/sv/klimatdeklaration/gor-sa-har/planera/ [Accessed 2022-03-03].

BOVERKET, 2021c. Dessa byggnader ska klimatdeklareras [online]. Available: https://www.boverket.se/sv/klimatdeklaration/omfattas/ska-deklareras/ [Accessed 2022-03-03].

BOVERKET, 2021d. Klimatdeklarationens omfattning [online]. Available: https://www.boverket.se/sv/klimatdeklaration/gor-sa-har/omfattning/ [Accessed 2022-03-04].

BOVERKET, 2022a. Om klimatdeklaration [online]. Available: https://www.boverket.se/sv/klimatdeklaration/om-klimatdeklaration/ [Accessed 2022-03-03].

BOVERKET, 2022b. Byggdelar som ingår [online]. Available: https://www.boverket.se/sv/klimatdeklaration/gor-sa-har/byggdelar-som-ingar/ [Accessed 2022-03-03].

BOWEN, G.A., 2009. Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, Vol. 9, No. 2, p. 27–40.

BRADFORD, M., 2014. Sustainability Reports: What Do Stakeholders Really Want?, Vol. 16, No. 1, p. 6.

BRE GLOBAL LTD and SGBC, 2022. BREEAM SE: Svensk manual för nybyggnad och ombyggnad [online]. Available: https://www.sgbc.se/app/uploads/2018/10/BREEAM-SE-sve-130501-2.0-160223.pdf [Accessed 2022-03-09].

BRYMAN, A., 2016. *Social research methods*. Fifth Edition. Oxford ; New York: Oxford University Press.

CARVALHO, M.M. and RABECHINI, R., 2017. Can project sustainability management impact project success? An empirical study applying a contingent approach. *International Journal of Project Management*, Vol. 35, No. 6, p. 1120–1132.

DALLA VALLE, A., 2021a. Key Findings, Possible Stakeholders and Outlook for Life Cycle Practice. *Change Management Towards Life Cycle AE(C) Practice*, p. 121–127.

DALLA VALLE, A., 2021b. Assessment Framework Proposal to Steer Building Process Towards Life Cycle Perspective. *Change Management Towards Life Cycle AE(C) Practice*, p. 47–55.

DHALIWAL, D.S., RADHAKRISHNAN, S., TSANG, A., and YANG, Y.G., 2012. Nonfinancial Disclosure and Analyst Forecast Accuracy: International Evidence on Corporate Social Responsibility Disclosure. *The Accounting Review*, Vol. 87, No. 3, p. 723–759.

DU, X., 2015. How the Market Values Greenwashing? Evidence from China. *Journal of Business Ethics*, Vol. 128, No. 3, p. 547–574.

ENDREJAT, P.C., KLONEK, F.E., MÜLLER-FROMMEYER, L.C., and KAUFFELD, S., 2021. Turning change resistance into readiness: How change agents' communication shapes recipient reactions. *European Management Journal*, Vol. 39, No. 5, p. 595–604.

EUROPEAN COMMISSION, 2011. *Communication from the commission to the European Parlament, the Council, the European Economic and Social Committee and the Committee of the regions: A roadmap towards a competitive low carbon economy in 2050*. Brussel.

EUROPEAN COMMISSION, 2014. DIRECTIVE 2014/95/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL - of 22 October 2014 - amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups -, p. 9.

EUROPEAN COMMISSION, 2022. Sustainable development [online]. Available: https://ec.europa.eu/trade/policy/policy-making/sustainable-development/ [Accessed 2022-02-21].

EUROPEAN COMMISSION, n.d. Corporate sustainability reporting [online]. Available: https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en [Accessed 2022-02-16].

FIGUEIREDO, K., PIEROTT, R., HAMMAD, A.W.A., and HADDAD, A., 2021. Sustainable material choice for construction projects: A Life Cycle Sustainability Assessment framework based on BIM and Fuzzy-AHP. *Building and Environment*, Vol. 196, p. 107805.

FINNVEDEN, G., HAUSCHILD, M.Z., EKVALL, T., GUINÉE, J., HEIJUNGS, R., HELLWEG, S., KOEHLER, A., PENNINGTON, D., and SUH, S., 2009. Recent developments in Life Cycle

Assessment. *Journal of Environmental Management*, Vol. 91, No. 1, p. 1–21.

HASSAN, M.K. and MOUAKKET, S., 2016. ERP and organizational change: A case study examining the implementation of accounting modules. *International Journal of Organizational Analysis*, Vol. 24, No. 3, p. 487–515.

HIGGS, M. and ROWLAND, D., 2011. What Does It Take to Implement Change Successfully? A Study of the Behaviors of Successful Change Leaders. *The Journal of Applied Behavioral Science*, Vol. 47, No. 3, p. 309–335.

HURLIMANN, A.C., BROWNE, G.R., WARREN-MYERS, G., and FRANCIS, V., 2018. Barriers to climate change adaptation in the Australian construction industry – Impetus for regulatory reform. *Building and Environment*, Vol. 137, p. 235–245.

HWANG, B.-G. and NG, W.J., 2013. Project management knowledge and skills for green construction: Overcoming challenges. *International Journal of Project Management*, Vol. 31, No. 2, p. 272–284.

IEA, 2020. Tracking Buildings 2020 [online]. Available: https://www.iea.org/reports/tracking-buildings-2020 [Accessed 2021-11-03].

IVL, 2021. Krav på klimatdeklaration för byggnader fick grönt ljus [online]. Available: https://www.ivl.se/toppmeny/press/pressmeddelanden-och-nyheter/nyheter/2021-07-02-krav-pa-klimatdeklaration-for-byggnader-fick-gront-ljus.html [Accessed 2022-03-04].

KOTTER, J.P., 2012. *Leading change*. Boston, Mass: Harvard Business Review Press.

KVALE, S. and BRINKMANN, S., 2009. *InterViews: learning the craft of qualitative research interviewing*. 2nd ed. Los Angeles: Sage Publications.

LINES, B.C., SULLIVAN, K.T., SMITHWICK, J.B., and MISCHUNG, J., 2015. Overcoming resistance to change in engineering and construction: Change management factors for owner organizations. *International Journal of Project Management*, Vol. 33, No. 5, p. 1170–1179.

LINES, B.C., SULLIVAN, K.T., and WIEZEL, A., 2016. Support for Organizational Change: Change-Readiness Outcomes among AEC Project Teams. *Journal of Construction Engineering and Management*, Vol. 142, No. 2, p. 04015062.

LUCON, O., ÜRGE-VORSATZ, D., ZAIN AHMED, A., AKBARI, H., BERTOLDI, P., CABEZA, L.F., EYRE, N., GADGIL, A., HARVEY, L.D.D., JIANG, Y., LIPHOTO, E., MIRASGEDIS, S., MURAKAMI, S., PARIKH, J., PYKE, C., and VILARIÑO, M.V., 2014. Buildings. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

MALMQVIST, T., GLAUMANN, M., SCARPELLINI, S., ZABALZA, I., ARANDA, A., LLERA, E., and DÍAZ, S., 2011. Life cycle assessment in buildings: The ENSLIC simplified method and guidelines. *Energy*, Vol. 36, No. 4, p. 1900–1907.

MATINARO, V. and LIU, Y., 2017. Towards increased innovativeness and sustainability through organizational culture: A case study of a Finnish construction business. *Journal of Cleaner Production*, Vol. 142, p. 3184–3193.

MCCOMBES, S., 2022. Sampling Methods | Types and Techniques Explained [online]. Available: https://www.scribbr.com/methodology/sampling-methods/ [Accessed 2022-06-02].

NAIR, G., FRANSSON, Å., and OLOFSSON, T., 2021. Perspectives of building professionals on the use of LCA tools in Swedish climate declaration. *E3S Web of Conferences*, Vol. 246, p. 13004.

NATURVÅRDSVERKET, n.d. Klimatet och bygg- och fastighetssektorn [online]. Available: https://www.naturvardsverket.se/amnesomraden/klimatomstallningen/omraden/klimatet-och-bygg--och-fastighetssektorn/ [Accessed 2022-03-16].

VAN NES, F., ABMA, T., JONSSON, H., and DEEG, D., 2010. Language differences in qualitative research: is meaning lost in translation? *European Journal of Ageing*, Vol. 7, No. 4, p. 313–316.

OKE, A.E. and AIGBAVBOA, C.O., 2017. Measures of Project Success. *Sustainable Value Management for Construction Projects*.

OLADINRIN, O.T. and OJO, L.D., 2021. Characterisation of the drivers of environmental management system implementation. *Engineering, Construction and Architectural Management*, Vol. ahead-of-print, No. ahead-of-print.

O'LEARY, Z., 2017. *The essential guide to doing your research project*. 3rd edition. Thousand Oaks, CA: SAGE Publications.

PECHANCOVÁ, V., HRBÁČKOVÁ, L., DVORSKÝ, J., CHROMJAKOVÁ, F., and STOJANOVIC, A., 2019. Environmental management systems: an effective tool of corporate sustainability. *Entrepreneurship and Sustainability Issues*, Vol. 7, No. 2, p. 825–841.

PIMONENKO, T., BILAN, Y., HORÁK, J., STARCHENKO, L., and GAJDA, W., 2020. Green Brand of Companies and Greenwashing under Sustainable Development Goals. *Sustainability*, Vol. 12, No. 4, p. 1679.

PRAMESWARI, F.R., RACHAMAWATI, F., WIGUNA, I.P.A., and ROHMAN, M.A., 2021. Importance and Performance Ratings Analysis for Implementation of Green Construction on Building Project. *IOP Conference Series: Earth and Environmental Science*, Vol. 799, No. 1, p. 012015.

REGERINGSKANSLIET, 2017. Riksdagen antar historiskt klimatpolitiskt ramverk [online]. Available: https://www.regeringen.se/pressmeddelanden/2017/06/riksdagen-antar-historiskt-klimatpolitiskt-ramverk/. [Accessed 2022-01-05].

REGERINGSKANSLIET, 2021. Direktiv om företagens hållbarhetsrapportering [online]. Available: https://www.regeringen.se/faktapromemoria/2021/05/202021fpm-108/ [Accessed 2022-02-16].

ROCKSTRÖM, J. and KLUM, M., 2012. *The human quest: prospering within planetary boundaries*. Bokförlaget Langenskiöld.

ROCKSTRÖM, J., STEFFEN, W., NOONE, K., PERSSON, Å., CHAPIN, F.S.I., LAMBIN, E., LENTON, T.M., SCHEFFER, M., FOLKE, C., SCHELLNHUBER, H.J., NYKVIST, B., DE WIT, C.A., HUGHES, T., VAN DER LEEUW, S., RODHE, H., SÖRLIN, S., SNYDER, P.K., COSTANZA, R., SVEDIN, U., FALKENMARK, M., KARLBERG, L., CORELL, R.W., FABRY, V.J., HANSEN, J., WALKER, B., LIVERMAN, D., RICHARDSON, K., CRUTZEN, P., and FOLEY, J., 2009. Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society*, Vol. 14, No. 2, p. art32.

SAAD, M.H., NAZZAL, M.A., and DARRAS, B.M., 2019. A general framework for sustainability assessment of manufacturing processes. *Ecological Indicators*, Vol. 97, p. 211–224.

SADRI, H., POURBAGHERI, P., and YITMEN, I., 2022. Towards the implications of Boverket's climate declaration act for sustainability indices in the Swedish construction industry. *Building and Environment*, Vol. 207, p. 108446.

SCIENCE BASED TARGETS, n.d. About us [online]. Available: https://sciencebasedtargets.org/about-us [Accessed 2022-02-02].

SGBC, 2019. Indikatorer i Miljöbyggnad [online]. Available: https://www.sgbc.se/certifiering/miljobyggnad/certifiera-med-miljobyggnad/indikatorer-i-miljobyggnad/ [Accessed 2022-03-09].

STANITSAS, M., KIRYTOPOULOS, K., and LEOPOULOS, V., 2021. Integrating sustainability indicators into project management: The case of construction industry. *Journal of Cleaner Production*, Vol. 279, p. 123774.

SWECO, 2021. *Sweco Annual Report 2020*.

SWECO, n.d.a. Om Sweco Sverige [online]. Available: https://www.sweco.se/om-sweco-sverige/ [Accessed 2022-01-05].

SWECO, n.d.b. En hållbar förebild [online]. Available: https://www.sweco.se/hallbarhet/ [Accessed 2022-01-28].

SWECO, n.d.c. Klimatmål [online]. Available: https://www.sweco.se/hallbarhet/klimatmal/ [Accessed 2022-02-01].

SWECO, n.d.d. Our 2040 Target [online]. Available: https://www.swecogroup.com/sustainability/our-2040-target/ [Accessed 2022-02-02].

SWECO, n.d.e. Commitments and Initiatives [online]. Available: https://www.swecogroup.com/sustainability/commitments-and-frameworks [Accessed 2022-02-02].

SWECO, n.d.f. Sustainability Strategy [online]. Available: https://www.swecogroup.com/sustainability/sustainability-strategy/ [Accessed 2022-02-02].

TABASSI, A.A., ROUFECHAEI, K.M., RAMLI, M., BAKAR, A.H.A., ISMAIL, R., and PAKIR, A.H.K., 2016. Leadership competences of sustainable construction project managers. *Journal of Cleaner Production*, Vol. 124, p. 339–349.

TESTA, F., BOIRAL, O., and IRALDO, F., 2018. Internalization of Environmental Practices and Institutional Complexity: Can Stakeholders Pressures Encourage Greenwashing? *Journal of Business Ethics*, Vol. 147, No. 2, p. 287–307.

THE SWEDISH AGENCY FOR GROWTH POLICY ANALYSIS, 2018. From Voluntary to Mandatory Sustainability Reporting, p. 40.

UNFCCC, 2015. Conference of the Parties on Its Twenty-First Session; Adoption of the Paris agreement. [online]. Available: https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf [Accessed 2022-01-05].

UNITED NATIONS, n.d. The 17 Goals [online]. [Accessed 2022-02-02].

UNITED NATIONS ENVIRONMENT PROGRAMME, 2020. 2020 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector [online]. Available: https://globalabc.org/sites/default/files/inline-files/2020%20Buildings%20GSR_FULL%20REPORT.pdf [Accessed 2021-11-01].

UNITED NATIONS GLOBAL COMPACT, n.d. The Ten Principles of the UN Global Compact [online]. Available: https://www.unglobalcompact.org/what-is-gc/mission/principles [Accessed 2022-02-02].

U.S. GREEN BUILDING COUNCIL, n.d. LEED Credit libary [online]. Available: https://www.usgbc.org/credits?Category=%22Material+%26+resources%22 [Accessed 2022-03-09].

VOS, J.F.J. and RUPERT, J., 2018. Change agent's contribution to recipients' resistance to change: A two-sided story. *European Management Journal*, Vol. 36, No. 4, p. 453–462.

WHELAN-BERRY, K.S. and SOMERVILLE, K.A., 2010. Linking Change Drivers and the Organizational Change Process: A Review and Synthesis. *Journal of Change Management*, Vol. 10, No. 2, p. 175–193.

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (WCED), 1987. *Our Common Future*. New York: Oxford University Press.

WWF-UK, 2021. Feeling the heat: The fate of nature beyond1.5°C of global warming [online]. Available: https://www.wwf.org.uk/sites/default/files/2021-06/FEELING_THE_HEAT_REPORT.pdf [Accessed 2021-11-11].

8. Appendix

Appendix A – Interview guide for sustainability coordinator at Sweco

Aktivitet	**Frågor/Kommentarer**	**Uppskattad tidsåtgång**
Introduktion	Jag läser en master inom hållbarhet på KTH och gör nu mitt mastersarbete här på Sweco. Arbetet ämnar undersöka hur den nya lagstiftningen från Boverket, gällande klimatdeklaration, kommer påverka konstruktörer. Arbetet undersöker även nuläget, vilka hållbarhetsmål och framgångsfaktorer som finns för konstruktörer i projekten. Är det okej om jag spelar in intervjun?	5 min
Strukturerade frågor *Uppvärmningsfas*	Intervjupersonens bakgrund 1. Vad är din position på Sweco? 2. Hur länge har du arbetet med detta? 3. Vad är dina huvuduppgifter som hållbarhetskoordinator? Intervjupersonens relation till konstruktörer 4. Hur är din position kopplad till konstruktörer inom Sweco? 5. Hur ser kommunikation ut mellan dig och konstruktörer?	30–45 min
Huvudfas	Nuläge – konstruktörer i projekt 6. Vilka hållbarhetsmål ställer Sweco på konstruktörer i projekt? 7. Varierar det beroende på vilken fas i byggprocessen konstruktören arbetar i? 8. Hur ser strategierna ut för att konstruktörerna ska ha möjlighet att uppfylla målen? 9. Hur säkerhetsställs det att det efterföljs? 10. Finns det återkoppling mellan olika konstruktör-grupper på Sweco? 11. Det går att läsa på Swecos hemsida att ni ska leverera bättre än vad kunder begär, hur mycket bättre är det? 12. Vem är tänkt att betala för detta? 13. Vilka faktorer, sett från konstruktörens perspektiv, anser du behöver uppfyllas för att ett projekt kan anses vara en framgång? Klimatdeklaration 14. Vad känner du till om det nya kravet på klimatdeklaration? 15. Vad tror du den största utmaningen med att klimatdeklarera är? 16. Vad anser du är fördelarna med den nya lagstiftningen?	

	17. Hur arbetar ni med den nya lagstiftningen? - Anpassar redan nu eller avvaktar tills kravnivåer är satta? 18. Anser du att konstruktörer har möjlighet att påverka leveranskedjan?	
Debriefingsfas	Har du några frågor eller skulle du vilja tillägga något?	5 min
Avslutning		5 min

Appendix B – Interview guide for construction engineers at Sweco

Aktivitet	**Frågor/kommentarer**	**Uppskattad tidsåtgång**
Introduktion	Jag läser en master inom hållbarhet på KTH och gör nu mitt mastersarbete här på Sweco. Arbetet ämnar undersöka hur den nya lagstiftningen från Boverket, gällande klimatdeklaration, kommer påverka konstruktörers arbetsroll och arbetsprocess. Arbetet undersöker även nuläget, vilka hållbarhetsmål och framgångsfaktorer som finns för konstruktörer i projekten. Är det okej om jag spelar in intervjun?	5 min
Strukturerade frågor *Uppvärmingsfas*	Intervjupersonens bakgrund 1. Hur länge har du arbetet som konstruktör? 2. Vad sitter du i för projekt just nu? Intervjupersonens relation till hållbarhet 3. Vad innebär hållbarhet för dig? 4. Hur är inställningen till hållbarhet i din arbetsgrupp?	30–45 min
Huvudfas	Nuläge – konstruktörer i projekt 5. Vilka framgångsfaktorer arbetar du som konstruktör efter i projekt? Dvs, hur mäts projekten? 6. Finns det några hållbarhetsmål i projekt som du arbetar mot? - Vilka är dessa? - Vilken anser du är viktigast? - Skulle du säga att det skiljer beroende på vem som är beställare? 7. Har Sweco några hållbarhetsmål på dig som konstruktör som du arbetar efter i projekten? 8. Finns det några vanligt förekommande begränsningar i projektstrukturen för att du ska kunna genomföra ditt dagliga arbete på ett bra sätt? 9. Hur skulle du beskriva kommunikationen och samarbetet i projekten? 10. Har du möjlighet att påverka beslut som tas angående stommen? - Kommer konstruktören in i rätt skede i projekten? - Känner du att du har möjlighet att påverka leveranskedjan? Klimatdeklaration 11. Vad känner du till om det nya kravet på klimatdeklaration?	

	12. Vad tänker du angående att det är beställaren som är ansvarig att upprätta deklarationen? 13. Vad tror du den största utmaningen med att klimatdeklarera är? 14. Vad anser du är fördelarna med den nya lagstiftningen? 15. Hur arbetar Sweco den nya lagstiftningen? - Anpassar redan nu eller avvaktar tills kravnivåer är satta? 16. Viken typ av styrning tror du att du behövs i projektet och från Sweco vid genomförandet? 17. Hur skulle du föreslå att lagen implementeras i projekt? Om konstruktören skulle ansvara för att leverera LCA för stommen. 18. Hur känner du inför det åtagandet? - Är du trygg med den uppgiften? - Har du den kunskap som krävs? (materialoptimering/hantera verktyg) - Vad skulle du behöva från projektet och Sweco för ett sådan uppgift? - Anser du att det är en förändring av din profession? 19. Vad är din uppfattning om de LCA verktyg som Sweco har arbetat fram och erbjuder?	
Debriefingsfas	Har du några frågor eller skulle du vilja tillägga något?	5 min
Avslutning		5 min

TRITA-ABE-MBT 22620