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Green construction project procurement

(Qualitative case study examining barriers and enablers to green procurement in Norwegian construction projects with a special focus on environmental product declarations, their obstacles, and impact on green procurement)

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Abstract

The construction industry is one of the largest consumers of natural resources, energy, and waste. Procurement in the construction industry has, over several decades, focused on cost minimizing principles with an unwanted side-effect: negative environmental impact from production and transportation of construction materials. Green procurement is by scholars and industry professionals suggested as a solution to tackle environmental challenges caused by traditional procurement, but the Norwegian construction industry struggles with the transition. From our initial meetings with Backe Entreprenør AS, documentation on materials' environmental impact was pointed out as an underlying challenge.

The purpose of this master thesis was to investigate the current barriers and enablers to green procurement in Norwegian construction projects, especially examining environmental product declarations (EPDs), their obstacles, and their impact on green procurement. Therefore, this thesis address two research questions. To answer these research questions, we have conducted an exploratory case study about Backe Entrepenør AS with abductive reasoning. The data collection consists primarily of interviews and meetings with industry professionals.

We have identified several important barriers and enablers to green procurement in Norwegian construction projects. Our findings reveal that the most significant barriers are "lack of documentation on material's environmental impact" and "lack of a common unit and standardization of information." Further, the most prominent enablers: "Standardization, implementation, and use of environmental and reusable data," "increased demand and stricter legal requirements for choosing environmental products and materials," and "inter-organizational collaboration, learning, and knowledge transfers." Our conclusion elaborates that EPD implementation and utilization of EPDs are prerequisites for green procurement. Without sufficient documentation on the materials´ environmental impact, it is not possible to determine whether a material decision is environmentally friendly or not. However, EPD must be seen in conjunction with the materials' performance specifications.

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List of Abbreviations

BF	Buying Firms
BIM	Building Information Modeling
CSF	Critical Success Factor
CE	Circular Economy
C&D	Construction and Demolition
DB	Design – Build
DBM	Design – Build – Maintain
DBFM	Design – Build – Finance – Maintain
ECI	Early Contractor Involvement
EEA	European Economic Area
EMS	Environmental Management Systems
EPD	Environmental Product Declaration
EU	European Union
EV	Electric Vehicle
FDV	Forvaltning, Drift og Vedlikehold
Gr SCM	Green Supply Chain Management
HVAC	Heating, Ventilation and Air Conditioning
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LCA	Life-Cycle Analysis
LCC	Life-Cycle Costing
NGO	Non-Governmental Organization
NSD	Norsk Senter for Forskningsdata
PDF	Portable Document Format
R&D	Research and Development
SDS	Supplier Development for Sustainability
SMEs	Small and Medium-sized Enterprises
SPM	Sustainable Project Management
SSB	Statistisk Sentralbyrå
SSM	Sustainable Supplier Management
TCO	Total Cost of Ownership
TEK17	Bygteknisk Forskrift
UN	United Nation

1.0 Introduction

1.1 Background and motivation for the study

As one of the world's largest economic ecosystems, the construction industry has a key role in achieving global sustainability goals with emissions reductions and energy savings (McKinsey, 2021). The construction industry is a complex environment that delivers the infrastructure and built environment we all use daily. It is an industry that concerns us all and plays a crucial role in our lives and society. Today, measured in value creation, the construction industry is the second largest industry in Norway. Only the Oil and Gas industry is larger (Bygballe et al., 2019). In 2020, the construction industry had a NOK 627 740 million turnover, divided into 58 093 companies and 260 587 employees (SSB, 2022b). In other words, the industry has a central role in the Norwegian economy, and it is one of the largest consumers of natural resources, energy, and waste (Deloitte, 2020). On a global basis, the construction industry accounts for 40% of all material consumption. In addition, 39% of all energy and process-related emissions originate from this industry. Compared to the global industry, the Norwegian construction industry stands out positively with elements of renewable energy sources in buildings, resulting in lower emissions (Sintef, 2020). However, the construction industry´s total share of Norwegian greenhouse gas emissions is estimated to be 15%, which is still too high if we want to achieve a sustainable society. Furthermore, the sector accounts for the highest waste generation annually, with as much as 25% of the total waste accounts (Sintef, 2020).

Today's construction projects involve many different activities and various stakeholders, which makes them challenging to analyze and control. Often, it is suppliers and subcontractors outside the construction organization that are responsible for material procurement. The literature suggests that the construction organization is no more sustainable than its supply chain and that suppliers and subcontractors affect the organization's sustainable performance at the industry level. Therefore, every decision made by one of these subcontractors affects the process of achieving the company's sustainability goals and reducing material consumption and waste generation (Ershadi et al., 2021b). Lack of environmental data and control over the construction project's life cycle is a common problem in this industry and a significant driver of the high greenhouse gas emissions in the

sector (Akadiri, 2015). In a report from 2019, emissions from imported construction materials accounted for 44 % of the total environmental impact from the Norwegian construction industry (Asplan Viak, 2019). Emissions from imports has not been accounted for earlier, highlighting the importance of sustainable sourcing of building materials.

Green procurement has, since the 1990s, been known as an effective way to reduce negative environmental impacts from production and consumption (Rais et al., 2018). It is defined as: "*Procurement activities of products, services and works considering environmental criteria and standards that conserve the natural environment and resources which minimizes the negative impact of human activities*" (Rais et al., 2018, p. 2). It assures sustainable consumption and production practices by respecting the planet´s biophysical constraints. A green procurement strategy is used to promote environmentally friendly building techniques and goods during the planning phase (Anuar et al., 2021). Despite the still high material consumption and waste generation in the construction industry, it seems challenging to fully adopt green procurement. This can be due to the industry's low willingness to change well-established routines (Sintef, 2020). The sector has a reputation for minimal innovation compared to other industries. In a research from 2011, it was said that scholars and industry practitioners had expressed an increased interest in construction innovation (Eriksson & Westerberg, 2011). However, not much has changed despite the increased interest, and innovation capacity is still low compared to other industries. Statistics from 2021 conducted by SSB have placed the construction industry's innovation capacity second lowest of the 45 industries surveyed (SSB, 2021). Therefore, to achieve UN sustainability goals with emissions reductions and energy savings (GlobalABC, 2020), significant changes are required within construction projects and their procurement processes.

Our motivation for conducting this thesis is based on several aspects. Last year, it was announced a public hearing about changes in legislation, more specifically, chapter 9 and 14 in TEK17 (Norwegian legal requirements for construction) (*Direktoratet for byggkvalitet*, 2021). One of the important changes was related to minimizing the environmental impact of construction materials. From our initial meetings with Backe Entrepenør AS, we also got indications that the Swedish

climate declaration act could influence a change in the Norwegian legislation. As a result of these changes, there will be stricter requirements for environmental documentation on construction materials, forcing construction companies to use green procurement to a greater extent. Therefore, considering all the challenges described above, the Norwegian construction industry can benefit from new knowledge about green procurement and its challenges. Backe Entrepenør AS also stated difficulties in obtaining environmental product declarations (EPDs), that challenge the possible legislative change. We want to investigate what prevents full implementation of green procurement and how changes can be made in the context of material procurement to reduce the footprint in Norwegian construction projects. Several studies have previously examined barriers and enablers to green procurement, but we can see that few have focused on Norwegian construction projects (Ageron et al., 2012; Alqadami et al., 2020; Ershadi et al., 2021b; Han et al., 2017; Kadefors et al., 2021). Moreover, we thought it could be interesting for the industry as well as scholars to see how procurement in construction projects could influence the environmental impact from a supply chain perspective.

As we continued the work with this thesis, revised changes in chapters 9, 14, and 17 in TEK 17 were publicly announced on 01.06.2022, effective from 01.07.2022 (Lovdata, 2022). As a result, green procurement will gain even more prominence in the industry and possibly force a change in the way of working. Making this thesis highly relevant and valuable.

1.2 Research question

Since there are still major challenges with green procurement in construction projects that challenge future requirements, we want to dive deeper into the current barriers and the solutions to overcome them. We have therefore established the following research question:

RQ1: ***What barriers prevent green procurement in Norwegian construction projects, and what are the enablers to overcome these?***

As we already in our initial meetings with Backe Entrepenør AS identified that obtaining EPD data on materials is challenging and a barrier to green procurement, we would like to shed light on the main obstacles with EPDs and investigate how

the use of EPD can impact green procurement. The paper will therefore address a second research question:

RQ2: ***What are the current challenges with Environmental Product Declarations (EPDs), and how are they affecting green procurement?***

1.3 Scope

To answer the research questions in a valuable way, we have chosen to do a case study about Backe Entrepenør AS. This makes it easier to get in touch with all types of stakeholders in a construction supply chain, which we believe is essential to provide a comprehensive explanation of the problem statements. We need information from raw material suppliers all the way up to the main contractor (Backe Entreprenør AS) and the client to be able to answer these research questions. Since there are so many different product categories in the industry that establish countless supply chains, we also have in this thesis focused on stakeholders within the category: Heating, ventilation, and air conditioning (HVAC).

2.0 Literature review

In this chapter, existing literature relevant to our research questions is presented. Since our first research question is about barriers and enablers to green procurement in Norwegian construction projects, our literature review focuses on literature regarding construction projects, green procurement, and enablers and barriers to adopting green procurement. The literature uses many different terms to describe green procurement. As we have focused on the environmental aspect of green procurement, we considered literature describing “Environmental-,” “Sustainable-,” “Responsible-,” “Circular-” and “Green Procurement” as relevant. As an essential aspect of green procurement, literature regarding green supplier development and selection is also collected. Concerning our second research question investigating challenges with environmental product declarations and EPDs impact on green procurement, we have also collected literature regarding EPD documentation and circular economy as a further step to green procurement. The first part describes the main characteristics of construction projects and green procurement and the barriers and enablers. The second part explains the role of EPD in green procurement, and the last part shows our conceptual framework.

2.1 Construction projects

Before diving into the literature regarding green procurement, it is essential to know how the construction industry works. Understanding how the construction industry operates helps us get an overview of how building projects are carried out and how to improve them from a green perspective.

The critical distinction between building and manufacturing is that construction is project-based and discontinuous, whereas manufacturing involves continuous processes and relationships (Segerstedt & Olofsson, 2010). A construction project is a one-time endeavor with many unique futures (Zou et al., 2007). They are carried out by temporary organizations at unique locations (Ekeskär et al., 2022). The discontinuity of project demand, the uniqueness of each project in technical, financial, and socio-political dimensions, and the complexity of each project in terms of the number of actors involved make supply chain management particularly difficult in project-based industries (Segerstedt & Olofsson, 2010). Santana (1990) defines it as *"the sum of planned activities, material or otherwise, of an organization to convert an idea or a design for engineering or construction work to fulfill human or economic needs within limits of quality, cost and duration"* (Santana, 1990, p. 102). There are usually several phases to developing a project, which require a range of specialized services. From initial planning to project completion, a typical project goes through successive and distinct stages that require input from various stakeholders, including engineers, financial organizations, architects, lawyers, insurance and surety companies, machine and materials suppliers, contractors, and manufacturers (Clough et al., 2000). Construction projects are unique, complex, time-consuming, and require a high level of consultants involvement, trust-building, and third-party engagement. Therefore, procurement methods in the construction industry are well-developed, including privatization, outsourcing, and build-operate-transfer (Zwikael, 2009).

A construction project, regardless of the scope, involves many different skills, materials, and hundreds of operations. The process must follow a natural sequence of activities that comprises a complex pattern of individual time requirements and sequential relationships among the many segments of a project (Sears et al., 2015). Generally, a client provides funding for a project while construction firms provide skills and manage the procurement processes (Winch, 2009). A paradox is that the

industry is run with a top-down approach, neglecting the knowledge of human resources available in the supply chain (Vennström & Eriksson, 2010). You can divide a construction project into two process stages, the design phase and the execution phase. Winch (2009) suggests a lack of coordination between these two phases. Architects decide which materials will be used in a building, but they are not responsible for the sourcing or quality of these materials (Winch, 2009). A construction project´s material costs account for 60-65% of the project´s total cost. Thus, purchased materials should meet the exact requirements for supporting the architectural design (Tserng et al., 2006). Procured materials of low quality may necessitate higher maintenance costs for the client (Chen & Nguyen, 2019).

The success of a construction project is an important issue both for the buyer, user, and the constructor itself. In today's construction sector, with a high degree of complexity and stakeholder involvement, clients and contractors face significant challenges in delivering a project successfully. Usually, a project is considered a success when it is delivered on time, without having exceeded the budget and when the quality of the project is satisfied by all (Ramlee et al., 2016). Moreover, the project's environmental performance is also regarded as a critical success factor (CSF), as construction projects affect the environment in numerous ways across their life cycle (Chan & Chan, 2004; Ramlee et al., 2016).

2.1.1 The differences between public and private construction projects

A study by Boyne (2002) highlights that the main difference between private and public sectors is connected to the firms' ownership. In contrast to private companies owned by entrepreneurs or shareholders, public organizations are owned jointly by political governments. Public organizations are more heavily controlled by political forces than market forces such as the private sector (Boyne, 2002). While private organizations use their capital resources to carry out projects for business purposes, public organizations depend on public funds for infrastructure development (Ershadi et al., 2021b). In other words, the private organization focuses more on its profits than community-related gains. This can also be seen in the procurement context between the two sectors. Hawkins et al. (2011) discuss the "accountability gap" between private and public projects. Compared to private organizations, public firms put a greater emphasis on rules and regulations. Private organizations focus more on internal organizational procedures when purchasing goods (Hawkins

et al., 2011). Public procurement is regulated by EU directives (Stentoft Arlbjørn & Vagn Freytag, 2012).

In terms of environmental and social issues, public sector organizations are considered leaders. Their primary role is to deliver public policy and create social welfare. Compared to private organizations, which are driven solely by maximizing shareholder value, the public sector's responsibilities are more directly related to sustainable development (Kaur & Lodhia, 2019).

2.2 Procurement in construction projects

The literature is often using terms such as "procurement," "purchasing," and "sourcing." Procurement and sourcing are often used to describe the strategic aspect of market research, selecting suppliers, tendering processes, contracting, and supplier management. Purchasing is usually used more practically for short-term operational day-to-day acquiring of materials and goods. While some authors state that supply chain management is replacing purchasing, others regard procurement and purchasing as two dependent functions within supply chain management with a different focus (Miemczyk et al., 2012).

Traditional procurement in the construction industry often involves inviting several providers of the same product/service to prepare proposals for one-off contracts based on design documents prepared in advance by the client. The tenderer with the lowest one-off price is usually awarded the contract (Pesämaa et al., 2009). The general assumption behind this decision is that the price is satisfying and that the decision-maker can achieve a positive and enjoyable result. In today's construction environment, it is difficult for the decision-maker to assess the quality of modern, complex industrialized products solely on the basis of objective criteria while avoiding subjective characteristics. A significant reason for this is environmental laws and regulations that make completely accurate decisions difficult. In such situations, procurement decisions are often based on previous experiences, reputation, legitimacy, quality standards, or other quality factors (Pesämaa et al., 2009).

While the majority of contributions to management and marketing literature regarding supply chain interactions focus on continuous exchanges in long-term

buyer-supplier relationships, there is a scarcity of research on discontinuous exchanges in project-based industries like construction (Segerstedt & Olofsson, 2010). How the client deals with procurement affects the relationships between project participants to such a degree that it must be evaluated thoroughly. Cooperation, competition, and integration are determined by how roles and authorities are distributed among project participants. Therefore, the client's role in procurement is an improvement area because traditional procurement often results in adversarial relationships. Further, clients often use the same procurement procedures regardless of the project's specifications because they like to use routine procedures that are considered safe. The client needs a deeper understanding of how procurement practices affect project performance (Eriksson & Westerberg, 2011).

One of the most critical roles of the client is to select a contractor with the proper knowledge and expertise for the given project. Optimally, a multi-criteria decision model should be used when selecting a contractor, but clients have traditionally placed a high emphasis on price. Multi-criteria decisions to evaluate and pre-qualify contracts may include *"bid pricing, technical competence, managerial capabilities, previous experience, reference items, environmental and quality management systems, financial stability, and collaboration skills"* (Eriksson & Westerberg, 2011, p. 200). By shifting the focus from a low bid price to other essential criteria, the client can reduce the risk of cost and schedule growth, and improve project quality, environmental performance, work environment, and innovation (Eriksson & Westerberg, 2011). Eriksson et al. (2020) have investigated collaborative building projects in Sweden and the Netherlands. Traditional contracts are often based on design-bid-build contracts. Four different procurement strategies were identified: Collaborative design-build contracts (DB contracts), Early contractor involvement (ECI), and long-term integrated contracts based either on design-build-maintain contracts (DBM) or design-build-finance-maintain contracts (DBFM) (Eriksson et al., 2020). In DBM contractual agreements, the client engages the contractor at the beginning of the project. The contractor is responsible for design, building, and maintenance activities. DBM contracts have a life cycle approach and involve a significant change to all actors in the supply chain. To become genuinely circular, construction projects must change from a "price per product" model to a "price per service delivered" model (Lingegård et al., 2021). According to Eriksson et al. (2020), collaboration is multi-dimensional and can be divided into four dimensions: Scope, depth, duration, and intensity. "*Scope*

encompasses the number of companies and actors involved in collaboration. Depth refers to how many hierarchical levels and different functions and roles within the companies are involved in collaboration. Duration relates to how long the actors collaborate. Intensity regards how much and how actively the actors collaborate" (Eriksson et al., 2020, p. 9). Their finding suggests that a broader scope can increase efficiency and hamper innovation. A higher level of depth is hard to achieve since it requires experience but can be very rewarding for the company by boosting innovation and providing quicker decision-making. Prolonged duration and early involvement boost building efficiency and innovation and increase project delivery time. Tendering costs can be reduced with ECI contracts. However, Early involvement can increase tendering costs in DB, DBM, and DBFM contracts. There are also pros and cons related to long-term maintenance responsibilities. Pros include reduced long-term maintenance costs by an increased focus on LCC costs and increased innovation. However, achieving efficiency in DBM and DBFM contracts can be complicated. Lastly, collaboration intensity has a positive impact on innovation and efficiency. From their findings, Eriksson et al. (2020) have derived two suggestions: Companies should: 1. "*Adopt a long-term learning perspective when developing and implementing new strategies,"* and 2. "*Establish routines for inter-project learning and knowledge sharing"* (Eriksson et al., 2020, p. 35).

A recent literature review by Khoso et al. (2022) emphasizes that existing contractor selection models found in the literature often are too complex and hard to apply in practice. They suggest that new models should deviate less from the basic principles of tendering and be more aligned with the system (Khoso et al., 2022). Previous research has focused on project partnering, notably between clients and contractors. The role of subcontractors and suppliers as well as the multi-actor character of the construction process has received little attention (Bygballe et al., 2010). Contractors, especially contractors with external project management, tend to focus on client satisfaction instead of creating the best product (Vennström & Eriksson, 2010). As suppliers and subcontractors perform almost 70-80 % of the gross work in construction projects, tight integration between contractors, subcontractors, and suppliers is crucial for success. However, contractors tend to do the opposite (Eriksson & Westerberg, 2011).

Bygballe et al. (2010) highlight the importance of long-term orientation towards relationships and prioritization of whom to pursue strategic partnerships with. Companies can take advantage of opportunities created by relational interaction, such as a group of suppliers working together to implement the same standards and technology across projects and stakeholders. Informal and causal working environments can enhance collaboration beyond formal procedures. When the client is more invested in the procurement process of contractors and subcontractors, the client can achieve a higher economic and environmental performance, project quality, and project time management (Eriksson & Westerberg, 2011).

2.3 Green procurement in construction projects

The purchasing function in an organization is crucial for sustainable procurement because an organization is not more sustainable than its supply chain (Krause et al., 2009). Therefore, to achieve a higher level of sustainability, a collaboration between business partners is key to effectively implementing sustainable project management (SPM) principles in a supply chain (Ershadi et al., 2021a). Responsible procurement and SPM principles have several advantages for the organization and the rest of its supply chain: reduced waste, optimal resource usage, brand recognition, and prevention of environmental impacts (Krause et al., 2009). The purchasing function is the starting point of material flows into a company and is an essential communicator with external stakeholders (Green et al., 1996; Schneider & Wallenburg, 2012). In sustainable development, an organization must look beyond its borders, highlighting the importance of the procurement function (Meehan & Bryde, 2011).

Earlier, operational managers were not directly involved in environmental management frameworks. Instead, different departments in the organization were responsible for improving sustainability in their respective department. After the quality revolution in the 1980s and the supply chain revolution in the 1990s, it was clear that tighter collaboration and integration with ongoing operations were necessary (Srivastava, 2007). The importance of green supply chain management (Gr SCM) has been fueled by the impact industrialization and globalization have had on our environment. Despite the focus on green activities, Gr SCM is also about good business sense and increasing profits. Gr SCM practices can reduce

environmental impacts from the industry without lowering quality, performance, reliability, and increasing energy utilization and costs (Srivastava, 2007).

Green procurement has since the 1990s been known as an effective way to reduce negative environmental impacts from production and consumption. The term "Green" represents activities that minimize environmental impact: recognition, integration, and implementation (Rais et al., 2018). Green procurement can be defined as: "*Procurement activities of products, services and works considering environmental criteria and standards that conserve the natural environment and resources which minimizes the negative impact of human activities*" (Rais et al., 2018, p. 2). However, the scope of green procurement differs between researchers. According to Khan et al. (2018), "*Green procurement integrates environmental considerations with the combination of cost and quality into the procurement process. For instance, green procurement involves the purchase of sustainable technologies, products, and services for water, energy, waste and material efficiency, such as recycling, in council buildings, facilities, offices, works and fleets*" (Khan et al., 2018, p. 2). Green procurement can assure sustainable consumption and production practices by respecting the planet's biophysical constraints. During the planning phase, green procurement aids in the promotion of environmentally friendly building techniques and goods. As a result, green procurement in the construction sector is critical (Anuar et al., 2021). Organizations must implement sustainable sourcing in their purchasing function (Schneider & Wallenburg, 2012). The organization should use contractual agreements for addressing sustainability objectives and activities to subcontractors and suppliers. It is crucial to design the contracts so it has mechanisms dealing with significant sustainability risks and misconduct (McMurray et al., 2014).

According to green procurement practices, the environmental criteria should be regarded during the early stages of the procurement process, including planning and tender evaluation (Saferi et al., 2018). Wong et al. (2016) think about green procurement as a broader term, considering all lifecycle stages, including raw material extraction, transportation, manufacture, product packaging, storage, and handling, as well as product usage and recycling or disposal (Wong et al., 2016). Green construction should be viewed as a process rather than a final result and consider the whole project's life cycle (Bohari et al., 2017). Green procurement can

decrease operational energy usage in buildings by purchasing better building materials. Green wall materials can save 33-60% of energy consumption, and high energy-efficient buildings can save between 14-20% (Shen et al., 2017). Green procurement in building projects has helped contractors save money and resources throughout the project's lifespan. Green construction saves the majority of funds in utility and maintenance expenditures (Khan et al., 2018).

Ershadi et al. (2021a) also highlight that sustainability principles should be integrated into all stages of project procurement. In the pre-procurement and planning stage, incorporating sustainability principles has a positive impact because it can affect the firm's sourcing decision; local suppliers capable of meeting the required standards are given preference above other suppliers, which helps grow the local community. In the later stages of executing project procurement plans, procurement teams are better at maintaining optimal resource use by implementing sustainability principles, minimizing environmental impact, and unnecessary purchases (Ershadi et al., 2021a). Suppliers can contribute to the organization by implementing sustainable practices and activities (Delmonico et al., 2018).

Responsible construction procurement requires a long-term approach that considers how the facility or infrastructure will be used by its owner in the future (Ershadi et al., 2021a). Buildings, facilities, and infrastructure have a long-life cycle, but over the past years, organizations have merely considered the first costs for making decisions on facility capital expenditures. After taking financial and operational associated costs into the picture, the first costs account for only about 2 percent of the total cost of ownership (TCO). Reduction in energy and water consumption, maintenance costs, building-related issues, and an increase in comfort and productivity are benefits of green building practices (Hodges, 2005). A way to reduce TCO is to build with more durable materials, resulting in reduced maintenance costs. There are also costs related to the environmental impact of a building over its lifetime, estimated by doing a life cycle analysis (LCA). According to Hodges (2015), the most sustainable practice is considering all of these factors when designing and building new buildings. Choosing durable materials lengthens a building's lifetime and is as vital as choosing environmentally friendly materials (Hodges, 2005).

2.3.1 Green supplier selection and green supplier development

Green supplier criteria are often included in tender evaluations together with other factors, including price, technique, and organization (Varnäs et al., 2009). A literature review conducted by Fallahpour et al. (2012) identifies the most appropriate criteria for green supplier selections as: Environmental Management System (EMS), environmental performance and competencies, design for environment, corporate and social responsibilities, ecological efficiency, environmental authentication, environmental cost, logistics dimensions, green organization activities, environmental certification, and suppliers' green image. Furthermore, recent literature emphasizes pollution control, green research and development, recycling, number of obtained ISO standards, resource consumption, greenhouse gas emissions, green packing and labeling, green warehousing, green technology, green transportation, energy management system, hazardous material management, reuse/remanufacture, carbon footprint tax and environmental training, and eco-design (Fallahpour et al., 2021).

Varnäs et al. (2009) conducted interviews and revealed that the environmental criteria used in tender evaluations had a poor effect on the tender outcome. In most situations, the environmental criteria were given a maximum weighting of 10%. It was only in some cases assigned a higher weighting to the ecological standards. One of the key reasons for using environmental preferences in procurement and supplier selection was identified as an Environmental Management System (EMS) inside the client organization. It was also noted that EMS was important during the stage of creating environmental requirements and criteria. Another crucial component in adopting environmental evaluation criteria was management commitment. This research supports the notion that successful environmental purchasing programs require committed executives (Varnäs et al., 2009).

Standardization tools such as ISO 14001 certification may be the most prominent green supplier selection criteria. However, it can be risky to merely use ISO 14001 as a criterion because it only verifies that an environmental improvement process is in place. Two ISO 14001-certified companies can be very different in actual environmental performance. For instance, one company can be the best in class while the other is in its beginning phase of implementing green practices. Further, suppliers in different countries comply with various regulations and institutional

frameworks, influencing their future goals, obligations, and commitment to green procurement (Roehrich et al., 2017).

A study by Mokhlesian (2014) points out that there are few differences between supplier selection practices in green and conventional procurement in the Swedish construction industry. Technical and business features are not that different, and the process of traditional and green procurement is therefore almost identical. Further, if the client is not demanding green initiatives, the rest of the supply chain has low motivation for green practices. Contractors also seem to value partnerships with clients over alliances with suppliers. Nevertheless, good partner relations with suppliers make it easier to meet the client's demand (Mokhlesian, 2014). A strong business relationship between upstream and first-tier suppliers is necessary before green supply chain practices can be adopted (Roehrich et al., 2017). According to Khahro et al. (2021), long-term stakeholder commitment is necessary for green procurement. The true benefits of green procurement can only be realized if all stakeholders are involved with mutual understanding and dedication throughout the project lifecycle (Khahro et al., 2021).

Despite the growing demand for a more environmentally friendly construction procurement process, some clients and contractors have been unwilling to embrace green practices due to the government's lack of legislative enforcement (Wong et al., 2016). Further, organizational purchasing preferences for green materials will determine to a large extent, the level of their green procurement performance (Shen et al., 2017). If corporate guidelines are not implemented, it is not given that the purchasing function will implement sustainable practices on its own initiative. Research shows that purchasing practitioners merely procure goods with the best quality and availability for the lowest price, even though a more sustainable substitute is available. It is, therefore, important that sustainability pressure is exerted by top management within the organization (Schneider & Wallenburg, 2012).

Supplier development is about taking a long-term approach with selected suppliers. According to Liu et al. (2018), traditional supplier development is defined as: "*Any activity undertaken by buying firms to improve supplier performance and/or supplier capabilities, to meet the buying firms' short- and/or long-term supply*

needs" (Liu et al., 2018, p. 101). Because of today's situation, buying firms (BFs) must consider their supplier's environmental performance, economic performance, and ethic-social related performance. Therefore, supplier development is not merely addressing issues in the supply chain but is also interrelated with the supplier selection and evaluation (Liu et al., 2018).

Even though organizations are addressing sustainability and responsibility in their reports, the literature regarding supplier development for sustainability (SDS) is scarce. Prior studies about green supplier development practices are mostly single case studies that address suppliers' environmental performance. These studies' relevance is limited in today's climate because they cannot reflect on real-world problems of SDS with more than two stakeholders. In the literature, there is also limited research about the evaluation and selection of SDS practices and no theoretical models that can explain SDS formation (Liu et al., 2018). Further, Liu et al. (2018) conclude that the current studies are insufficient for business decision-makers to design and develop their own SDS practices or to help them understand the strengths or weaknesses of their operations. To keep track of SPM tasks that are to be accomplished by external and internal teams, the organization must implement effective controls. Subcontractors and suppliers must provide metrics that ensure their operations follow environmental standards and waste management regulations (Ershadi et al., 2021a).

Liu et al. (2018) introduce three roles to ensure proper supplier development for sustainability: Facilitator, inspector, and driver. Facilitators are organizations that provide knowledge/resources for SDS and are mainly increasing the supply chain coverage. Inspectors are neutral and offer a scientific ground for SDS practices, suggesting goals and benchmarks to the organization. Inspectors are improving supply chain performance. The drivers are the management that gives pressure and incentives to initiate SDS practices. Liu et al. (2018) cannot find evidence suggesting drivers contribute to supply chain coverage or performance. The research provided by Liu et al. (2018) is interesting because it has a more considerable supply chain scope than prior studies and involves neutral actors to solve the principle-agent problem.

Over the years, the purchasing function in the organization has become more critical as organizations outsource their operations and activities. As a result, the supply chain may generate more than 80 % of the value of a final product. It is no longer a competition between single business entities but between supply chains (Zimmer et al., 2015). Even though the literature is rich on topics regarding sustainable supplier selection, Zimmer et al. (2015) cannot find any existing comprehensive literature reviews on sustainable supplier monitoring or development. Half of the existing articles related to this topic were published between 2012 and 2014 and are therefore not considered in literature reviews from 2013-2015 (Zimmer et al., 2015). Further, Zimmer et al. (2015) find that most papers cover the electronic and automotive industry and only one article that is covering the construction industry on sustainable supplier management (SSM). Research regarding the social aspect of sustainability is scarce. It might be because it is harder to measure and quantify the social aspect and the increased attention towards the environmental part. Therefore, Zimmer et al. (2015) suggest that we need better formulations of criteria and qualifications and more research and emphasis on supplier monitoring and development. This is consistent with the findings of Liu et al. (2018).

2.3.2 Circular Economy in construction

As a further step in green procurement, mentioning the term circular economy is essential. Geissdoerfer et al. (2017) define the circular economy as "*a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling*" (Geissdoerfer et al., 2017, p. 759). The circular economy has become a popular topic and is high on the political agenda (Kalmykova et al., 2018). The primary motivation of the circular economy is the transition to a closed-loop system to significantly reduce or eliminate virgin resource input and waste output (Geissdoerfer et al., 2017). Environmental issues like biodiversity loss, air, water, and soil pollution, resource depletion, and excessive land use are major problems for the earth's life-support system (Geissdoerfer et al., 2017). By transitioning into a circular economy, the European Commission has estimated a 600-billion-euro annual gain for the European manufacturing sector alone (Korhonen et al., 2018).

Construction materials in buildings and infrastructure account for a significant portion of global material use and embodied carbon. Although it is estimated that a building on average has a design life of 50 to more than 100 years, the lack of timely adoption measures makes it impossible to avoid increased material- and energy use, demolition, and obsolescence. A circular economy in the construction context is a regenerative approach that minimizes waste, maximizes material efficiency, and reduces environmental impact (Guerra et al., 2021). In contrast to the current linear extract-produce-use-dump practice in the construction industry, CE practices promote maximizing the lifetime of products and materials; Once a raw material is extracted, or a product is made, it has economic value that should be sustained for as long as possible (Korhonen et al., 2018).

One fundamental principle of CE is the globally used waste hierarchy shown in Figure 2. This concept places the various waste minimization methods by levels of importance. It begins with the most desirable method; reducing waste at the source. This is about reducing excess waste. In construction, this entails more efficient use of materials or reduced material packaging. It is the material manufacturers and those who design the buildings which have this responsibility. The next option is to reuse materials at the end of their lifespan. Said in another way, use the product/material more than once. For this to be possible, the buildings have to be designed for deconstruction, and the materials should have a long lifespan. If reusing the materials is not possible, the following solution is to recycle or compost them. Recycling is about finding another solution to use materials that cannot be reused. Generally, this involves changing the material's shape to use it as another material for other purposes. Composting is only a solution for organic materials and is about breaking down materials into nutrient-rich soil. The fourth solution is recovering, which implies processing the waste and using it in one or another valuable way. This can, for example, be combusting solid waste for energy utilization. The last and least desirable option is disposal in a safe manner. This is only a solution for non-value materials (Purchase et al., 2022).

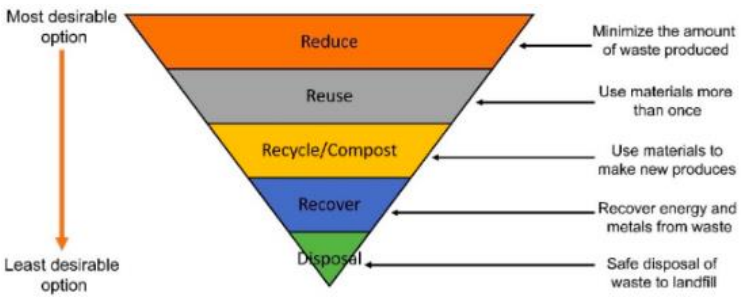


Figure 1: The Waste Hierarchy (Purchase et al., 2022)

From a thermodynamic perspective, it is most beneficial to reuse, remanufacture and refurbish products before recycling products back to raw materials. Recycling is always energy-intensive and should be the last resort before dumping (Korhonen et al., 2018). According to Benachio et al. (2020), there is a lack of consideration to waste management and waste reduction in the earlier phases of a construction project, affecting the number of waste generated by construction and demolition (C&D). Disposed materials in the end-of-life phase account for 50 % of the total C&D waste generated. Most building materials are disposed at their end of life since there is no potential for reuse (Benachio et al., 2020). In addition, there is a lack of information regarding the importance of recycling and its potential benefits. Few actors understand the essence and importance of recycling materials to reduce C&D waste (Purchase et al., 2022). In a study by Guerra and Leite (2021), 9 of 17 interviewees cited lack of knowledge and awareness of circularity as the main obstacle (Guerra & Leite, 2021).

2.4 Barriers to green procurement in construction projects

A major part of construction projects involves acquiring items, equipment, machinery, and services. It is challenging to identify and control different construction materials and equipment from sources outside of construction organizations throughout the project life cycle. The challenges range from delays to buying unsustainable materials that may include environmental risks (Ershadi et al., 2021b). According to experts, many construction projects fail to consider sustainability in their procurement processes due to the lack of integration between strategies, activities, procurement processes, and sustainability objectives (Ershadi et al., 2021b). Moreover, the construction industry is fragmented, with many actors with very different interests. Lack of vertical integration due to competition considerations, costs associated with information sharing, and logistics

coordination can hinder green procurement and the circular economy (Górecki et al., 2019). Further, the construction industry is an industry with limited resource availability and a lack of qualified subcontractors, and a resource commitment, making purchasing managers' options very limited when it comes to choosing suppliers and products (Han et al., 2017). Building materials are generally procured by contractors and developers based on the lowest price without considering environmental performance (Bygballe et al., 2010). This may be linked to insufficient incentives to conduct sustainable procurement.

The lack of laws and regulations has been recognized as a barrier to green procurement in construction projects (Lewis et al., 2015). Especially within the private construction industry, which does not follow the public procurement regulations (Stentoft Arlbjørn & Vagn Freytag, 2012).

The Swedish government has recently imposed stricter regulations on the Swedish construction industry, where the implications of The climate Declaration Act are closely inspected. Sadri et al. (2022) discuss several aspects of the Swedish Climate Declaration Act with a practical impact. From now on, Swedish construction firms must calculate and report on their climate impact, but the legislation lacks minimum requirements. Without minimum requirements or suggestions, it is hard for the industry to evaluate its levels. Further, procurement can become more expensive as the contractor must procure building materials with lower environmental impact, at least in the beginning. Furthermore, the whole supply chain can be affected because contractors must choose suppliers on other terms than before. Delegation of responsibility is also not well enough negotiated within the industry, and subcontractors and suppliers need the right expertise and skills to make the right decisions. The industry may need to implement new contractual agreements and governance. Environmental data is essential when producing life cost analysis, highlighting the importance of environmental product declaration. Supply chains may become less complex as suppliers try to minimize transportation (Sadri et al., 2022). The findings by Sadri et al. (2022) highlight the importance of laws and regulations and their practical implications. Industry participants also address a major concern related to the design of the new law and fears it promotes greenwashing (Sadri et al., 2022). Central government plays a central role and must

design policies that explicitly foster incremental changes toward green transformation (Orderud & Naustdalslid, 2020).

Cost is an extremely important factor for a construction project as it is considered one of the most important performance indicators of its success (Purchase et al., 2022). According to a study by Ageron et al. (2012), the increase in the cost of using green materials is the most significant barrier impeding business organizations from implementing green procurement practices (Ageron et al., 2012). Construction companies are more concerned about their profits rather than taking care of the environment (Bilal et al., 2020), especially SMEs (small and medium-sized enterprises). They have been slow to adopt environmental practices since they only perceive financial costs and do not understand the relationship between environmental practices and profit (Ormazabal et al., 2018). A study about green property development costs in China emphasizes that using green procurement materials increases building investment costs by 8,5% to 13,9%. In the USA, is the average cost increase by 1,84% compared to non-green buildings. The big difference is a result of that China is still in an early stage when it comes to green procurement practices, which increase the investment costs significantly (Zhang et al., 2011). As a result of high investment costs, the developers may refrain from carrying out green procurements. They will not risk achieving a weaker financial result than possible (Shen et al., 2017). Interviews conducted by Sadri et al. 2022 revealed that some practitioners fear increased procurement costs in the short term. *"Higher requirements also demand more expensive solutions in the short term. Construction will be more expensive by meeting these requirements, and because the building companies are obviously driven by the earned profits, they will have to charge buyers and/or tenants to offset these additional costs, which could increase the price"* (Sadri et al., 2022, p. 7). However, other practitioners are more positive *"Although costs may increase during the construction phase, which is a short-term effect, in the long run and during the operation and maintenance phase, these costs can be compensated"* (Sadri et al., 2022, p. 7). Moreover, construction professionals have poor experience with buying green materials, and there have been technical concerns about their use, affecting purchasing decisions and the use of green materials (Shen et al., 2017).

Lack of environmental product information and tools and data to compare material alternatives are also mentioned as two of the most comprehensive barriers affecting the procurement of green materials. In the Journal of Building Engineering, research confirms that construction professionals struggle to make material choices regarding environmental impact due to the lack of material information (Akadiri, 2015). As a result, they are choosing materials they are familiar with without knowing exactly how good they are (Akadiri, 2015). No available technology and data lead to the use of materials of low quality (Purchase et al., 2022). A survey done by Deloitte about barriers to a circular economy in Norway also confirms that there are insufficient tools and systems to document and share information about materials and their quality (Deloitte, 2020). This applies to the construction industry in general (Hart et al., 2019; Ormazabal et al., 2018). Moreover, although several tools exist for evaluating materials' environmental impact, they have been criticized for lack of criteria that reflect the sustainability advantages or disadvantages of different building material alternatives. This means that building professionals have little reason to choose one material over another (Akadiri, 2015). In addition, the construction industry lacks common standards and methods for collecting and handling digital data. There is no specification of what data is necessary and how the data should be handled. This data type is essential in a circular perspective to help extend the life cycle and ensure access to critical documentation concerning maintenance, rebuilding, and rehabilitation (Deloitte, 2020).

The current linear business model (take – make – dispose) itself is often mentioned as the underlying barrier to circularity and, thereby green procurement. Product and process innovation is not enough to become circular; fundamental changes in the current linear business model are required (Guerra et al., 2021).

The literature suggests the client is a "driver" of innovation and change in construction projects (Lindblad & Karrbom Gustavsson, 2021). A client's perceived barriers to changing the construction process towards increased client control of the end result can be divided into three categories: Attitudinal, industrial, and institutional barriers. Attitudinal barriers are related to the client's short-term focus, lack of business ethics, the narrow focus on projects instead of processes, and their top-down attitude towards the rest of the industry. Industrial barriers are related to how the industry organizes the construction process after traditional

methods and production processes and the industry's conservative culture. Institutional barriers relate to contract standardization and conventional procurement procedures and laws. Attitudinal and industrial barriers were most important from the client's perspective. Institutional barriers were perceived as non-critical by Vennström and Eriksson (2010), which contradicts Kadefors (1995), who found institutions as barriers to change. Vennström and Eriksson (2010) conclude that the difference is because they consider barriers from the client's view and that Kadefors (1995) regards the whole supply chain.

In Table 1, the most critical barriers to green procurement identified in the literature are summarized and categorized based on Vennström and Eriksson (2010) three categories for barriers. We have chosen to use their categories because these categorizations cover all the identified barriers in the literature and because they are based on change processes.

Barrier category:	Barriers:	Source:
Industrial	Lack of (vertical) integration between different activities and processes	(Ershadi et al., 2021b) (Górecki et al., 2019)
Attitudinal	Actors with different interests	(Górecki et al., 2019)
Institutional	Lack of laws and regulations	(Lewis et al., 2015) (Sadri et al., 2022)
Industrial	High investment cost	(Ageron et al., 2012) (Shen et al., 2017) (Sadri et al., 2022) (Bilal et al., 2020) (Ormazabal et al., 2018)
Industrial	Limited resource availability and a lack of qualified subcontractors	(Han et al., 2017)
Industrial	Insufficient tools and systems to document and	(Deloitte, 2020) (Hart et al., 2019)

	share information about materials and their quality	(Ormazabal et al., 2018)
Industrial	Poor experience with purchasing green materials	(Shen et al., 2017)
Industrial	Technical issues with the use of green materials	(Shen et al., 2017)
Industrial	Lack of data and material information	(Akadiri, 2015) (Deloitte, 2020)
Institutional	Lack of common standards and methods for collecting and handling digital data	(Deloitte, 2020) (Akadiri, 2015) (Hart et al., 2019)
Industrial	The current business model	(Guerra et al., 2021)
Attitudinal	Top-down approach	(Vennström & Eriksson, 2010)

Table 1: Summary of barriers to green procurement in construction projects

2.5 Enablers to green procurement in construction projects

As our literature review shows, the construction industry has many barriers to green procurement. Enablers of green procurement can facilitate the conditions needed for overcoming these barriers.

Incorporating lifecycle cost analysis into procurement and basing contract assessment on these costs can motivate investing in more energy-efficient structures. Tendering that includes environmental parameters can also be used as a motivator for developing an environmentally sustainable construction (Sterner, 2002). EPD databases should be required by law, which would improve the accuracy of embodied CO_2 estimations (De Wolf et al., 2017). Wong et al. (2016) agree with De Wolf et al. (2017) and highlight that it is necessary to create a credible public database of green procurement that includes specific figures on emissions and energy consumption of various materials (Wong et al., 2016).

Hwang and Tan (2012) surveyed green sustainable development in the Singaporean construction industry. There are three main elements to consider overcoming barriers and bringing initiatives to realization. First, the government should provide economic incentives for professionals, research and development, and the usage of green products and technologies. Second, public education is necessary to increase the demand for green solutions. Third, the industry must use "*high-performance green building delivery systems that allows design and construction to be integrated*" (Hwang & Tan, 2012, p. 348). According to Zhang et al. (2020), the government should impose subsidies to speed up the development of sustainable transportation. There are several aspects the government must carefully consider when choosing subsidies for freight transportation. One strategy discussed in the literature is to impose subsidies with the purpose of moving transportation from road to rail. Another approach is to invest more funds in R&D of electric vehicles (EV) and EV infrastructure. Transportation time and flexibility are important factors the government must consider (Jiang et al., 2020; Samimi et al., 2019; Tamannaei et al., 2021; L. Zhang et al., 2020). However, although the Norwegian government has already reduced tax on electric vehicles, which has increased car sales, they are now struggling with decreased tax revenues. Surging fuel prices, as well as high road taxes for fuel cars, have a negative impact on people's driving patterns, which again reduces payments to the government. A paradox is that the revenues gained from fuel taxes are used to subsidize electric transportation, but as the demand for fuel decreases, there are less revenues available. The government must develop better models for infrastructure taxation and, at the same time, provide incentives, so people are willing to transition to electric vehicles. Shifting from dirty to clean transportation takes time and costs (Hodari, 2021).

The most important enablers to green procurement by Wong et al. (2016) are *"Regulations and standards of green procurement by the government," "Lifecycle considerations and green construction technology," "Executive management's commitments and requirements," "Green principles and techniques to reduce environmental effects," "Green design incorporated with financial benefits," "Mutual collaboration between stakeholders"* (Wong et al., 2016, p. 868). From their empirical study, interviewees responded that green material standards and specifications should be publicly available. The existing green label scheme is

constrained in two ways according to the green principles and techniques: The green materials available on the list are limited, and there is insufficient information about the green specifications. The respondents proposed that the plan should be updated to incorporate more categories and provide a universal standard for various green construction materials. Staff should be given more precise green procurement standards to help them understand the notion of sustainable construction and "Green construction." To ensure that green procurement is implemented successfully, developers, contractors, and suppliers should create an in-house green procurement list (Wong et al., 2016). Voluntary rating schemes such as BREEAM are an enabler for green procurement (Alwan & Gledson, 2015; De Wolf et al., 2017).

Government should act as a role model and influence industry practitioners to adopt green procurement practices through incentive schemes. Examples of incentive schemes are subsidies or tax exemptions for green procurement practices. Green procurement should be implemented in all public projects and publicly advertised for the industry to follow. The government should also set requirements for contractors for green materials. As part of the bidding procedures, more green construction and reusable materials should be specified in the contract specifications or tender requirements. Environmental engineers' role in providing professional advice on the environmental performance of green products during material and facility selection should be emphasized to promote contractors' engagement in green procurement. Environmental engineers could use this method to track down and audit the sources of green building components. Suppliers´ active participation in boosting green procurement is also important, as it helps supply more green construction material options and performance details in the local market. Creating a fully functional green material market would aid in the promotion of green procurement and facilitate a steady reduction of material costs (Wong et al., 2016).

The organization should use contractual agreements to address sustainability objectives and activities in the supply chain. It is crucial to design the contracts so it has mechanisms dealing with major sustainability risks and misconducts (McMurray et al., 2014). Attaining project objectives related to the environment and climate change may be significantly impacted by the choice of contract model (Sanchez et al., 2015). Clients nowadays perform separate procurement processes

for design, building, and maintenance in construction. Clients' expertise and competencies in sustainable construction are essential in today's climate. Since constructability is dependent on design and maintainability is dependent on construction, procurement process separation may reduce constructability and maintainability in construction projects. Project innovation can also be affected by the clients´ technical specifications, leaving little room for the contractor and their suppliers. When clients are using contracts based on traditional competitive tendering on price, contractors have no incentive to be innovative, reduce their life cycle costs, or increase quality. Instead, they use trusted solutions and existing knowledge within their organization (Lingegård et al., 2021).

Stricter legislation and policies promoting green material use are considered enablers in the Romanian construction sector. The use of green building materials as a competitive advantage of differentiation in the local construction market and pressure to implement environmental production policies/legislation in the construction field (Simion et al., 2019).

Bohari et al. (2019) have identified several enablers of green procurement: Defining common green performance objectives, defining the scope and meaning of green policies that support green adoption, material selection based on project green criteria, integration of monitoring and reporting system, project briefing, waste management promotion, evaluation plan development, training, implementation of environmental values, and knowledge sharing (Bohari et al., 2019). The organization should facilitate regular training of employees, and develop a reward and incentive system for sustainable practices (Samar et al., 2020). Inadequate training of SPM principles may be addressed by conducting a training needs assessment in sustainability areas and developing effective training programs for employees. Metrics must be maintained so that the procurement team can keep track of objectives (Ershadi et al., 2021b). Further, sustainability programs and reports to stakeholders should be redesigned to become more effective and follow the requirements of internationally recognized certifications and accreditations of sustainable practices (Samar et al., 2020).

In the tender phase, the most impactful enablers are "tender notice specified requirements" for green projects and "green monitoring evaluation" in the tender

instruction. There is a need for specific requirements for a project to become green, so the tenderers know the requirements. Further, better compliance with standards and rules shows better leadership and creates motivation to act in compliance with existing regulations, laws, and requirements. The project's life cycle cost can also be minimized by actions taken during the tender phase (Anuar et al., 2021). Additional assistance is required during the tendering process to ensure that sustainability principles are effectively integrated into the evaluation of potential suppliers and the selection of tenders (Ershadi et al., 2021a).

A comprehensive list of key enablers to green procurement by Alqadami et al. (2020) covers many of the enablers provided in the literature. Life cycle analysis, public procurers as role models, and cooperation between government, consultants, and suppliers to develop a database for green specifications are the enablers that are considered most important. The list includes, but is not limited to: *"Consideration of whole life costing and value of money," Public procurers to facilitate publicity of actions towards greener approach," "Cooperation and synergy between government, consultants and suppliers," "Develop a reliable and accessible database of green specifications," "Conducting research on cost-saving proof by green procurement," "Transparency on procurement decision making process," "Evaluating alternative procurement methods to achieve objectives," "Selecting materials based on low risks to the environment"* (Alqadami et al., 2020, p. 7).

According to Kadefors et al. (2021), cutting-edge testing and broader distribution of best practices should interact over time to drive development. In infrastructure building, the ability to cut carbon emissions is strongly linked to design and construction optimization. Important enablers are therefore collaborative project delivery methods where expertise and competence are shared. Infrastructure clients' overall capabilities to achieve resource efficiency and innovation in their projects, including the ability to establish collaborative contracting models, must be addressed in the policies (Kadefors et al., 2021).

Table 2 summarizes the most important enablers to green procurement identified in the literature.

Enabler category:	Enablers:	Source:
Institutional	Life Cost Analysis (LCA) & EPD	(Sterner, 2002) (Wong et al., 2016) (Anuar et al., 2021) (Alqadami et al., 2020) (De Wolf et al., 2017)
Institutional	Incentives from Government	(Hwang & Tan, 2012) (Simion et al., 2019) (Samar et al., 2020) (Alqadami et al., 2020)
Industrial	Green development & research	(Bohari et al., 2019) (Samar et al., 2020) (Alqadami et al., 2020) (Kadefors et al., 2021)
Institutional	Regulations, certification schemes, and requirements	(Wong et al., 2016) (Bohari et al., 2019) (Anuar et al., 2021) (Simmion et al., 2019)
Industrial	Monitoring, reports, and evaluation	(Bohari et al., 2019) (Anuar et al., 2021) (Ershadi et al., 2021b)
Industrial	Green material and higher energy efficiency requirement	(Simion et al., 2019) (Bohari et al., 2019) (Alqadami et al., 2020)
Attitudinal	Mutual collaboration, learning and knowledge sharing	(Wong et al., 2016) (Bohari et al., 2019) (Ershadi et al., 2021a) (Kadefors et al., 2021)
Industrial	BREEAM	(De Wolf et al., 2017) (Alwan & Gledson, 2015)
Industrial	Training of industry practitioners	(Bohari et al., 2019) (Ershadi et al., 2021b) (Samar et al., 2020)
Industrial	Integrated design and construction	(Hwang & Tan, 2012) (Kadefors et al., 2021)
Industrial	Waste management	(Bohari et al., 2019)

Institutional	Educating the public to increase public demand	(Hwang & Tan, 2012)
Institutional	Collaborative contracting models	(McMurray et al., 2014) (Lingegård et al., 2021) (Eriksson et al., 2020)

Table 2: Summary of enablers to green procurement in construction projects.

2.6 Environmental product declaration (EPD) as a parameter for green buildings and materials

Due to the increased focus on sustainability in the construction industry, environmental product declarations (EPDs) and life cycle analysis (LCAs) have become more important (Andersen et al., 2019; Passer et al., 2015). Construction products' environmental performance is a determinant and important factor affecting a building's environmental sustainability. EPDs have been used in the construction industry since 2012 and are based on the European standard EN 15804 (Durão et al., 2020). It is created to measure and standardize the life cycle footprint of a product category. By using an EPD, the procurer is able to analyze a product's environmental impact and make more well-informed decisions (Sparrevik et al., 2021). It makes it easier to track materials' environmental performance upstream and has become an influential tool in purchasing (Nußholz et al., 2019). The EPD gives the user the ability to make informed decisions in the context of the building as well as it enables the builder to procure products and materials with the lowest environmental impact (Sparrevik et al., 2021). Consequently, it stimulates competition between manufacturers of construction materials to produce more eco-efficient products (Zabalza Bribián et al., 2011).

A study done by Green building Council in Iceland (IGBC) and a Nordic project team consider some aspects of EPD use. The study points out that the main obstacle with EPD is connected to lack of market demand (Jónsdóttir et al., 2015). The result is that the industry points fingers at one another (Andersen et al., 2019). Today, there are mainly building owners, consultants, and contractors who are asking for EPDs. Producers and providers do not have the same interest (Jónsdóttir et al., 2015). Moreover, lack of knowledge about documentation and high implementing costs are also noted as other obstacles to EPDs (Jónsdóttir et al., 2015). Ibáñez-Forés et al. (2016) also mention these obstacles in addition to the lack of

international standardization and incentives from governmental instances (Ibáñez-Forés et al., 2016).

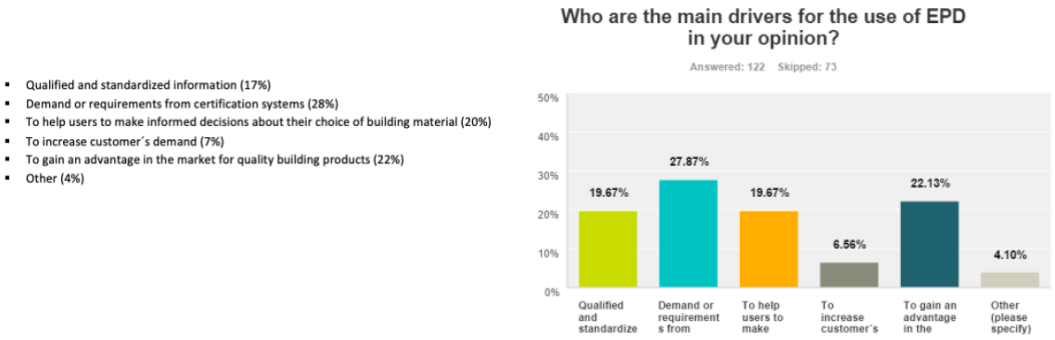


Figure 2: Drivers for the use of EPD – Producers (Jónsdóttir et al., 2015)

The main incentive to implement EPD for building owners is reducing environmental impact. Compared to producers, their interests are different. Their main incentive to use EPD is linked to demand and building certifications. Producers are asked for EPD usually in relation to the use of building certification systems and when their customer has a strategy to use environmental products (Jónsdóttir et al., 2015). Buliding certifications such as BREEAM, is the strongest incentive to use EPDs (Jónsdóttir et al., 2015; Passer et al., 2015).

2.6.1 EPD´s impact on circular economy

According to a study done by Andersen et al. (2019), EPDs do not provide any specific information on circular economy. Instead, there is mentioned that EPDs can be used in building-level LCAs, which can have an important effect on circular economy if the EPD includes the LCA about the end-of-life stage and the product´s recycling potential. Sparrevik et al. (2021) claim, however, that the use of EPDs will enhance circularity in the long run. Since EPDs enable builders to procure materials with the lowest emissions, suppliers will be encouraged to use more recycled materials to reduce their environmental impact. As a competitive advantage, the manufacturers will also improve their production processes with lower energy use and more sustainable transportation methods (Sparrevik et al., 2021).

2.7 Conceptual framework

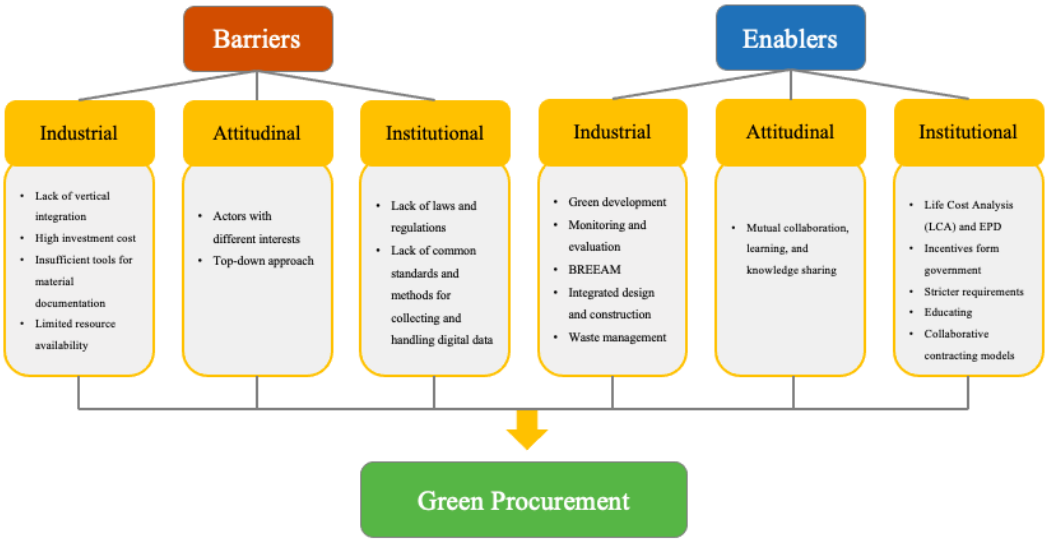


Figure 3: Conceptual framework

Based on our first research question, we have developed a conceptual framework with the purpose of directing our research in the right direction (Figure 2). This visual framework clarifies the concepts and the connections between the central aspects of the thesis. The literature identifies several industrial, attitudinal, and institutional barriers and enablers to adopting green procurement in construction projects. Our second research question, which emphasizes environmental product declarations (EPDs), is not specifically displayed in the framework but is considered an institutional enabler to green procurement. This enabler has received little attention in today's literature. All barriers and enablers are important to adopting green procurement in the Norwegian construction industry, and EPD was already mentioned as an important tool in our initial meetings with Backe. We want to use this framework to see if the industry has changed, examining differences in literature versus practice.

3.0 Methodology

In this chapter, the chosen research methodology is presented in five parts: First, an explanation of the choice of strategy, followed by the research design. Then, a detailed description of the data collection, explaining what has been done and how it has taken place. Further, a description of how we analyzed our data. Lastly, a quality discussion of the thesis based on four criteria: Credibility, transferability, dependability, and confirmability.

3.1 Research Strategy

You can define a research strategy as a plan on how to answer a research question. Bell et al. (2019) describe it as a *"general orientation to the conduct of business research"* (Bell et al., 2019, p. 35). In the same book, quantitative and qualitative strategies are highlighted as the main research approaches and strategies. The difference between these two approaches is that the quantitative approach emphasizes quantification in the collection and analysis of data, while the qualitative focuses more on words and images.

This paper investigates the barriers and enablers to achieving green procurement in the Norwegian construction industry through a qualitative research strategy. In particular, it discusses how the lack of environmental documentation affects green procurement. Few studies have been undertaken on green procurement in the Norwegian construction industry, especially on how EPD impact green procurement, which indicates that we would not get a deep understanding of the research area with the use of a quantitative strategy. Considering the objective of the research and nonquantifiable data affecting the procurement process, a qualitative approach is appropriate. A qualitative approach is also convenient, as we focus on one single product category (HVAC) when investigating the barriers and enablers to green procurement. Using this strategy, understanding increases through the local perception (Bartunek & Seo, 2002). Furthermore, the qualitative approach is a more descriptive method that has provided more details about the subject (Bell et al., 2019). In addition, it has also given us more flexibility and the opportunity to gain a deeper understanding of the problem. By using this strategy, it has been possible to change direction under the research process, and when the data collection is underway, something we have been entirely dependent on as new information from interview participants has constantly emerged (Bell et al., 2019).

An essential part of the research strategy is how we conduct our reasoning. Bell et al. (2019) state mainly three different methods; deductive, inductive, and abductive reasoning. Abductive reasoning is a combination of the two others that address what the deductive and inductive ignore: the interpretation and meaning, motives, and intention from daily life (Blaikie, 2007). This research examines barriers and enablers to green procurement in a complex environment, and our data collection was like a puzzle where we sought explanations and solutions. During our data

collection, surprises occurred. Abductive reasoning is described as an approach that turns uncertain facts into a matter of course and which contributes to less confusion about phenomena (Mantere & Ketokivi, 2013). An abductive approach involves going back and forth between theory, the framework, the case study, and the empirical study (Dubois & Gadde, 2002). During our analysis, new information emerged, which required corrections and additions to the theory. Therefore, abductive reasoning is implemented in our qualitative research strategy.

3.2 Research Design

To provide a plausible and comprehensive explanation of the research questions that the reader will understand, it is crucial to have a structured and consistent research design. A research design is defined as a framework of research methods and techniques for analyses and collection of data. The importance of the context lies in the explanation of the type of research and reflection on decisions about the priority, considering a range of dimensions of the process (Bell et al., 2019). Bell et al. (2019) examine five different research designs: Experimental design, cross-sectional design, longitudinal design, case study, and comparative design. When choosing a research design, it is important to first know the problem structure. Understanding the barriers and enablers to achieving green procurement in the Norwegian construction industry and EPDs impact on green procurement is a complex case. Therefore we have used an exploratory research method (Ghauri & Grønhaug, 2005).

The most appropriate design in exploratory research is a case study design (Bell et al., 2019). A case study is a recommended design used in business research. It focuses on a bounded system or situation in a geographical location, for example, a workplace or organization (Bell et al., 2019). For this thesis, to get valuable information considering our research questions, we have chosen to write about Backe Entreprenør AS, a Norwegian construction company. In our case, we have investigated Backes's whole supply chain within one product category when investigating barriers and enablers, from manufacturers and subcontractors to suppliers and constructors. The barriers and enablers associated with sustainable procurement are the objects of interest and what we want to provide an in-depth elucidation of. When analyzing trends in supply chains, case studies can provide a beneficial contribution to theory, as they provide good examples and test theories

(Dubois & Araujo, 2007). Moreover, a case study is most desirable in our qualitative approach because it enables us to use observations and unstructured interviews that are very helpful in the generation of a comprehensive and detailed examination of a case (Bell et al., 2019).

Many researchers have criticized case studies and their external validity and generalizability. It is said that case studies are situation-specific rather than representative so their findings cannot be applied in general to other cases (Bell et al., 2019). Generalization is normally based on a significant set of samples, something that is not satisfied through a case study with a focus on one single organization or company (Yin, 2014). Regardless of this criticism, a case study design is chosen because it provides us with unusual access to empirical data and because Backe, the company we are writing about is considered a typical contractor company and one of the leading contractor firms in the industry. In addition, the manufacturers, subcontractors, and suppliers linked to Backe are considered industry suppliers, making data from these applicable to all construction companies. The case study will help us understand how Backe and its suppliers consider green procurement, and our findings will contribute to the industry.

3.3 Data Collection

Data collection is the most important step in a good research project (Bell et al., 2019). To answer the research question in a trustworthy manner, it is completely necessary to use credible and understandable data. In a case study, there is no specific way of collecting data, which means that the method is not just based solely on participant-observer data and ethnography (Yin, 2014). Reliable data for a case study can be obtained through interviews, surveys, ethnographies, archival data, and observations (Bell et al., 2019). Bell et al. (2019) mainly state two types of data in qualitative research that address these methods: Primary and secondary data.

3.3.1 Primary data

Primary data is data that is collected and analyzed by the researcher itself, using methods like interviews, surveys and censuses, experiments, and letters. It is collected directly from the source and not influenced by others' views and judgments (Bell et al., 2019). We used two sampling methods and conducted semi-structured interviews and meetings as our primary data collection.

A purposive sampling method has been used in this research, which means that the participants involved are not randomly selected. This method strategically selects participants who are relevant to the research questions (Bell et al., 2019). There are several approaches to purposive sampling. In this research there has been used a combination of what Bell et al. (2019) call snowball sampling or chain sampling and what Teddlie and Yu. (2007) describe as sequential sampling. Snowball sampling is about first contacting people that are relevant to the research and then using these for establishing contact with others. In this research, it was valuable to get in touch with companies within Backe's supply chain. To not be entirely dependent on Backe, we used them only to get in contact with a few participants. The following participants were selected based on information we received from these new contacts and so on. We make sure that these contacts were also in Backe´s supply chain. This is how the sampling took place from the client to the raw material supplier. The other technique used, known as sequential sampling, is a method where participants are added as the research evolves. This method is very familiar with the snowball sampling method but implies that participants are selected based on interesting findings during the process (Teddlie & Yu, 2007). Sequential sampling has been used where we have experienced that there has been a need for information/data outside Backe's supply chain.

To achieve theoretical saturation, a qualitative study's sample size is ordinarily challenging to determine. However, rather than focusing on the appropriate sample size, Bell et al. (2019) claim that you should be clear about what kind of method you used and why you selected that technique, and explain why the sample size you used is appropriate. A construction project is a complex environment with hundreds of stakeholders involved, which means that we could use a huge number of participants. The selection is based on the fact that it covers one single product category (HVAC) and its whole supply chain. We have information from production to assembly of this product that can be used as a good example of other materials and the industry as a whole. We also have participants who have a broad knowledge of product information that can cover all of Backe's partners. Therefore, we do not see the need for more participants in this research to analytical generalize the findings. This study's sample size is 11 participants, as shown in the table below.

Interview participant	Stakeholder	Participants role	Interview date
P1	Contractor	Category Manager	14.03.2022
P2	Subcontractor	Department Manager	06.04.2022
P3	Supplier	Head of Nordic Sales	15.03.2022
P4	Supplier	Head of quality and sustainability	21.04.2022
P5	Supplier	Marketing Manager Construction	19.04.2022
P6	Supplier	Quality and HSE Manager	16.04.2022
P7	Raw material supplier	Product Manager	08.04.2022
P8	Software company	CEO	04.05.2022
P9	Contractor	Director of Sustainability	27.05.2022
P10	Recycling company	National Key Account Manager	01.06.2022
P11	Client	Project Manager	01.06.2022

Table 3: List of participants and their business roles

Semi-structured interviews have been conducted to answer the research questions with empirical data. Semi-structured interviews are planned lists of questions on specific topics to be answered (Bell et al., 2019). This method has given us the opportunity to have an open dialog with the interviewees and access valuable firsthand data. Semi-structured interviews are known to be more flexible than other more structured forms. Although the interview process is based on an interview guide of already planned questions, the questions do not have to follow the way

they are outlined in the guide (Bell et al., 2019). Semi-structured interviews have made it possible to ask questions that are not included in the interview guides, as we have picked up things of interest said by the interviewees. To gain access to valuable answers, it is crucial to develop the right questions and choose informants with different perspectives on the questions asked (Eisenhardt & Graebner, 2007). Therefore, several of the informants and questions were prepared in collaboration with Backe. Considering our need for better knowledge of how the environmental data are collected today and where the problems arise, we believe this method to be the most valuable. No one has better insight than the people who are facing the problems in their daily life. For the research, their knowledge was essential. The interview outcome has been information about the current procurement process in construction projects, barriers and enablers to green procurement, and information regarding EPDs and their importance.

A total of 11 interviews have been conducted with an average duration of 40 minutes. One with a client, two with contractors including Backe, four with material suppliers, one with a raw material supplier, one with a software solution partner of product information sharing, and two responsible for material recycling (Table 3). According to these informants, three different interview guides were created. One unique version for the software solution informant (Appendix 2), one for the two informants within material recycling (Appendix 3), and one for the other interviewees (Appendix 1). To provide a more comprehensive understanding of the research questions, the interview guides and the interviews were formulated in Norwegian, the informants' native language. As a result, it was easier to explain the questions the informant did not understand and create a more natural flow during the interview.

With the exception of one interview done face to face at their office, all of the interviews were conducted on Microsoft Teams. During the interviews, both notes and audio recordings were carried out after approval from the informants. After all interviews, the recordings were transcript. Transcription is an excellent opportunity to make a more thorough examination of what was said during the interviews and perform a repeated analysis of the answers when investigating the findings (Bryman & Bell, 2015).

In addition to interviews, there have been several meetings with Backe. The meetings have, in the same way as the interviews, been held on Microsoft Teams due to simple and rapid feasibility. In these meetings, we discussed the findings from the interviews. In addition, we received a lot of inside information about how things currently work related to the issues the research addresses. As shown in Table 4, there have, in total, been conducted six meetings.

Meeting	Date
1	26.10.2021
2	13.01.2022
3	28.01.2022
4	08.02.2022
5	15.02.2022
6	21.04.2022

Table 4: List of completed meetings

3.3.2 Secondary data

Secondary data is data that is collected by others than the researcher itself and which is available in databases. This data collection can, for example, include censuses, information collected by government apartments, and data that were originally gathered for other research purposes (Bell et al., 2019). Our secondary data collection consists mainly of public documents but also contains organizational documents in the form of company descriptions and environmental considerations.

Public documents such as literature reviews and research articles are relevant and vital data to fulfill our primary data. Public documents are statistical information that is publicly available on the internet and easy to collect (Bell et al., 2019). The literature that has been used represents varied information about several aspects of the construction industry, from the construction project's development and today's procurement process to environmental considerations and product declarations. Bryman and Bell (2015) state that there are two different methods of collecting literature: a structured search strategy and a chaining technique (Bryman & Bell, 2015). In this research, a chaining technique has been conducted where we have linked references to the problem statement's keywords to find valuable articles and reviews. There have been used keywords such as "construction projects," "green

procurement," "sustainability," "EPD," and "circular economy." When we understood these concepts individually, we connected them in a larger context.

In addition to public documents, there have been used organizational documents. These have been given by some of the informants as a supplement and additional details regarding the questions in the interviews. These documents contain, among other things, information on environmental criteria when choosing suppliers and various EPDs on materials. In spite of their limited use, these have provided evidence and an overview of what an EPD looks like in practice.

3.4 Data Analysis

In a qualitative study, there are no rules for how to analyze data. Moreover, the data is often difficult to analyze as it comes from both interviews, observations, and documents that typically comprise a large corpus of unstructured textual material (Bell et al., 2019).

One of the most common tools for analyzing data in qualitative research is referred to as thematic analysis (Bell et al., 2019). This method is about identifying, analyzing, and interpreting themes or codes (Clarke & Braun, 2017). A theme represents a category that provides the researchers with the basis for making a contribution to the literature pertinent to the research focus by developing a theoretical understanding of their data (Bell et al., 2019). To get familiar with the data collected, generate insight and simplify our analysis, there have been conducted a thematic analysis in this research. We will describe our data analysis through three sequential steps:

First of all, all interviews conducted were recorded and transcribed in the exact same way they were presented. This method made it possible to examine the interviewees' words in greater detail and reduce the risk of missing important information. The next step was analyzing the data collection and creating codes. All the transcripts were uploaded to NVivo, a recommended tool for sorting data. With NVivo, we created codes manually based on themes we considered relevant to the research questions and the interview guides. We roughly sorted important topics and linked relevant comments to each topic. The codes used are shown in appendix 4. Lastly, the findings were presented in the order of the interview guides. The data

have been used as quotes to substantiate claims and strengthen our understanding. Even though recordings, transcriptions, and coding are highly time-consuming (Bell et al., 2019), it has made the process of processing the data more manageable and more understandable, resulting in higher research quality.

3.5 Research quality

A high degree of quality is important to do good research. If the data that are collected are ambiguous or not correct, the research is considered useless. We need credible and correct data to develop a valuable conclusion. Trustworthy and good research is characterized by ensuring validity, reliability, and replicability (Bell et al., 2019). However, when it comes to qualitative research, there have been discussions about the relevance of validity and reliability. Many researchers argue that you should use other evaluating criteria than in quantitative research (Bell et al., 2019). Therefore, we have focused on Guba and Lincoln's alternative criteria for evaluating our qualitative research. This evaluating method focuses on credibility, transferability, dependability, and confirmability (Bell et al., 2019). All of these have to be fulfilled to show trustworthiness in our research and to make it valid for further investigation and practice.

3.5.1 Credibility

Credibility is considered to be the most important criterion of all four when it comes to trustworthiness (Bell et al., 2019). It is a very important criterion to ensure research value. If our findings cannot be trusted and believed by other researchers, then they cannot be used for further research or practices. The main point of our research is to come up with useful information construction companies can take into consideration when working on their daily operations. To ensure credibility, our paper is carried out according to good practices, and our findings are shared with our participants (Bell et al., 2019). During the research, we have had an open dialog with our collaboration partner Backe and shared all of our findings with them continuously. In addition, when we have analyzed our findings from our interviews, we have sometimes sent the results back to the interviewees for control. That enabled us to ensure that we had understood our findings right and that no misunderstandings arose. Furthermore, by mapping our findings from the literature and data from our informants, we found a connection that increases the research's credibility.

3.5.2 Transferability

Transferability is also relevant according to the useful aspects of our research. This is about whether our material and findings could be generalizable and useful in other proposes. A case study is often a very detailed study of a smaller group or specified topic, which makes it difficult to make it representative so that the findings can be applied more generally to other cases (Bell et al., 2019). Guba and Lincoln state that it is a "thick description" which makes a case study generalizable (Bell et al., 2019). According to that, we wanted to focus more on the depth rather than the breadth of our research to ensure quality. Therefore, we have provided a very detailed description of our findings, such that they are easy to interpret. Furthermore, our research has a high transferability as all the informants represent companies considered "industry providers", making the data applicable for the entire industry and not only for Backe.

3.5.3 Dependability

As an equivalent to reliability in quantitative research, dependability has become a relevant criterion to show value in qualitative research (Bell et al., 2019). Bell et al. (2019) describe this as to which extent it is used as an "auditing approach." It is important to ensure that every part of the research is correctly described and accurately completed. For example, that the problem formulation is relevant, that the selection of research participants is elaborated, and that the data analysis is well established (Bell et al., 2019). Therefore, several of our participants have been carefully selected in collaboration with Backe. In addition, Backe has taken part in deciding what should be investigated to make it valuable for the company and the industry. Furthermore, if a research article shows dependability, there have been people acting like auditors to establish how far proper procedures are being and have been followed under the research process (Bell et al., 2019). We believe that having a supervisor involved in our research who continuously has given us feedback and controlled our work has contributed to ensuring dependability. Our structured and stable research framework has also helped us to have more control over the working process and provided us with more knowledge for further investigations.

3.5.4 Confirmability

Confirmability is the last criterion we have to address to ensure trustworthiness in our qualitative research. This concerns the confidence that the researcher has acted in good faith. Confirmability is achieved if the findings are based on the participants' information and other credible facts, and personal value and own twists have not been permitted to form the conduct of the research (Bell et al., 2019). To establish confirmability in this research, the interview guides are discussed and established in collaboration with Backe. In this way, we can guarantee that none of the questions have been asked with our individual beliefs or hidden purpose. In addition, the research and the interview guides are approved by The Norwegian Centre for Research Data (NSD). Furthermore, it is also important to mention that neither we nor anyone else has any personal gain in interpreting these findings in a certain way.

4.0 Empirical findings and analysis

In this chapter, the empirical findings are presented. To formulate the data from the interviews, we have decided to present the findings in a summarized text with associated quotes. Before analyzing the data, we will provide a short description of Backe Entreprenør AS, the company used as a basis for the data collection.

4.1 Company description

Backe Entreprenør AS is a daughter company of AS Backe, one of Norway's leading construction organizations, owned mainly by Backe Holding AS. The company acts as a contractor firm, managing a complex supply chain with many different actors (Figure 4). Backe Entreprenør AS is also a holding company that exists of over ten daughter companies representing different geographical areas in Norway. Local presence, close distance to customers, knowledge, and quality are the fundament of Backe Entreprenør AS. According to statistics conducted by SSB, Backe Entreprenør AS had a net profit before tax of 125 173´ NOK in 2021 (SSB, 2022a).

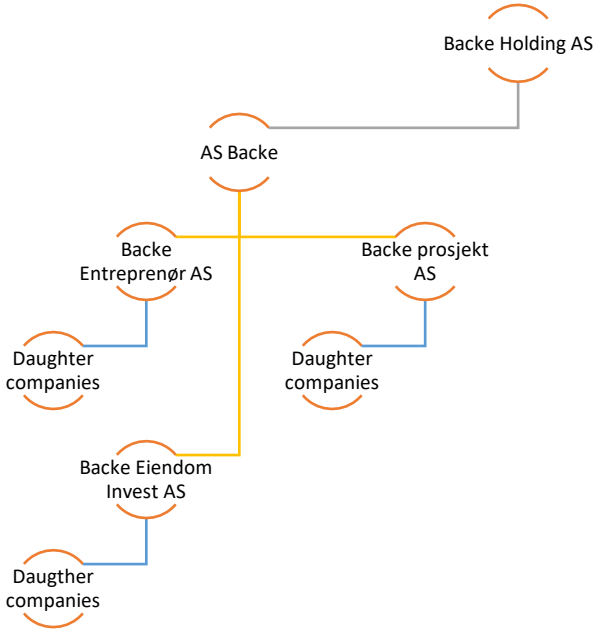


Figure 4: Organization map

Backe Entreprenør AS collaborates with many subcontractors and suppliers in the Norwegian construction industry. To simplify our data collection and get in contact with all different types of stakeholders in Backe Entrepenør's supply chain (Figure 5), we decided to limit our scope to a category segment called HVAC, which is heating, ventilation, and air conditioning. In the Backe Group, there are in total 60 suppliers within this segment. In 2020, procurement of materials and services within HVAC accounted for 215 million NOK. A budget of 216 million NOK is planned for 2022.

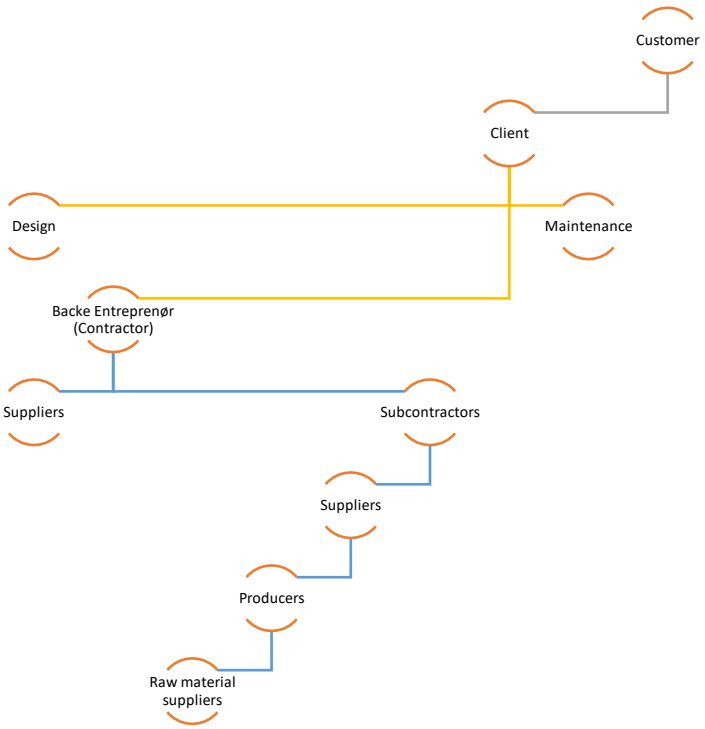


Figure 5: Basic supply chain map of Backe Entreprenør

4.2 Procurement strategy and practices

4.2.1 Green procurement strategy

Green procurement and sustainable buildings are becoming increasingly important for construction firms, considering FNs sustainability goals and the goal of emissions reduction in the industry. Therefore, Backe has developed a sustainability strategy that clarifies how they themselves can contribute to creating a more sustainable future.

Figure 6: Backe´s sustainability strategy (AS Backe, 2022)

This strategy involves reducing the climate footprint by a 10 percent yearly reduction in energy consumption and the amount of waste. Further, establish better logistics processes and increase material recycling. They work to have a source sorting rate of 90 percent. To achieve this, they plan to work more closely with their suppliers and subcontractors, cooperate with them to make more sustainable choices, motivate them for innovation, and increase the share of green procurement across the entire supply chain (AS Backe, 2022).

Based on these goals, there will be more and more BREEAM-certified projects, which implies an increase in the number of green procurements.

> *"Going forward, we have chosen that as many projects as possible should be BREEAM certified." – P11*

4.2.2 Procurement ordering practices

Construction projects are complex, and there is no doubt it can be difficult to manage the physical flows of raw materials, material components, products, and

modules in the supply chain. Actors within Backe's supply chain use different tools and communication platforms, and materials arriving at construction sites are not scanned on the material level. To keep track of documentation and material compliance, every subcontractor and supplier working on a project with Backe Entreprenør AS has to use "Cobuilder Collaborate," a platform that organizes and keeps track of product information throughout all stages of a construction project. The platform analyzes all parties' product information and automatically identifies documentation deviations. We asked our interviewees about their ordering process to better understand how well material flows are tracked and to map what type of communication they used.

Backe Entreprenør AS, as the main contractor, buys services via technical subcontractors. For example, within HVAC, they buy both delivery and installation of function/equipment. This is purchased through a contract proposal electronically. Through the description in the contract proposal, they have an impact on what kind of equipment the subcontractor buys. They usually have three different equipment options and choose what they consider gives the most value for money.

> *"We choose the equipment that we think gives the most value for money; the highest quality for the lowest price possible. We use a contract called 8417, which is a turnkey contract. This is an electronic contract that is completed according to specifications." – P1*

As a subcontractor, materials and equipment are basically ordered from suppliers by email, but urgent orders can be made by phone. For suppliers, it is often used a combination of email, phone, and contracts. There are large variations among the suppliers. Raw material suppliers and the largest suppliers have computer systems like order portals and purchase all their equipment from there.

> *"All new suppliers must put all their products we will buy from them into a computer system. Our purchasers order items inside this system. The supplier receives an electronic order. We always receive a confirmation by email. Everything in stock goes through this system." – P5*

"We use email, telephone, internet, SAP, and web-hop for suppliers. SAP is the main source of information and communication through email and the web." – P7

4.2.3 Supplier selection and requirements

Organizations in the Norwegian construction industry must follow laws and regulations from the Norwegian government as well as regulations and laws set by the European Commission. In addition, many organizations use standards set by NGOs such as ISO, Miljøfyrtårn, UN Global Compact, Svanemerket, and Grønt Punkt. Many suppliers and subcontractors regard these standards as a requirement for tender consideration set by the contractor or the client. Companies must carefully evaluate their business partners in today's business climate, and there is no acceptance of child labor or inhuman working conditions. One of our interviewees responded that they would not buy "minerals of conflict" as a step toward more sustainable procurement. All of our interviewees answered that new suppliers had to undergo an assessment. Requirements for supplier selection differ between projects, especially for projects that are considered green. For green projects with a greater focus on the environment, it is required that suppliers can document environmental impact through EPDs or by assessment. A green KPI can be that a percentage of the biggest suppliers are certified by Miljøfyrtårn, UN Global Compact, ISO 14001, or similar. The majority of our interviewees responded that ISO 14001 certification was the most used certification scheme. Raw material suppliers and suppliers without ISO 14001 can be used in some cases if they can document a similar system. For ordinary projects, supplier selection is weighted on availability, delivery options, price, and sustainability. Producers and suppliers tend to weigh the environmental criteria more than subcontractors and main contractors. Availability, delivery option, and price are the most important factors when selecting a supplier for ordinary projects. Demands set by customers have an impact on which criteria are set in supplier selection.

"Sometimes, we are required to use suppliers who can document environmental data. Delivery options and price have the greatest effect. We have to deliver documents for projects with documentation requirements, but there has been no decisive requirement that you can document so and so much sustainability." – P2

"There are several factors that need to be considered. A fairly comprehensive risk assessment is made of key suppliers. Both economic aspects, environmental aspects, etc. Price is an important point, but there are a number of aspects that underlie our choice." – P4

"Our environmental impact is that we have to choose manufacturers and make demands on them. We set requirements for suppliers and manufacturers via dialogue and external customers´ requirements and assess them against the suppliers' opportunities. Then we choose the supplier who can offer the best option in terms of availability, environment, and price." – P7

One of our interviewees acknowledged that he never emphasized certification schemes in supplier selection and that the biggest suppliers in Norway were considered qualified suppliers, implying the importance of big companies leading the change towards circularity.

4.2.4 Standards and certifications

Standards and certifications have become a requirement for doing business in the construction industry. All of our interviewees reported usage of at least one international or national standardization/certification scheme. All of them are ISO 14001 and 9001 certified, fundamental standards for good practice in environmental management. This is required as a supplier or subcontractor of Backe Entreprenør. In addition to ISO certificates, some interviewees also motioned Miljøfyrtårn, Eco-label, Grønt Punkt, and UN Global Compact as other implemented standards. The reason for complying with a standardization scheme varied between our interviewees. While some companies did it because of corporate responsibility, others reported it only as a requirement for doing business with other companies. Some did it only for building certification purposes, like BREEAM certification.

"When we are such a large company, we must follow the certificates and standards that all serious players must have." – P7

One of our interviewees acknowledged that they did not have the environment in mind when they decided to get certified, but as a strategy to get qualified in tender competitions.

4.2.5 Supply chain compliance and revision

There are several ways companies can ensure that requirements and criteria are followed as agreed on. The most common way is to set requirements and demand specific documentation. When a contractor demands EPDs, they force subcontractors and suppliers to think about sustainability when they make choices and provide documentation on construction materials' environmental impact. Our interviewees responded that revisions and physical attendance were frequently used to ensure that their business partners acted as agreed on. A list of materials indented to be used can be requested before the project start. One of our interviewees worked for a company that imported products from Asia under its own brand. To ensure that their suppliers acted according to agreements, they opened an office in Asia. Physical controls were performed to verify that their suppliers delivered according to agreements, as well as ongoing supplier evaluations.

> *"When we demand EPD, sustainable products, and the type of information regarding sustainability, we force the suppliers to think about sustainability when they make decisions. (...) When they hand over documentation and FDVs, we finally know what they have delivered." – P1*

> *"We follow up by visiting our suppliers, ensuring that they deliver on what they say. (...) We conduct ongoing supplier evaluations to ensure that the conditions outlined in the agreement are met." – P5*

4.3 Barriers to green procurement in construction projects

4.3.1 Lack of documentation on materials´ environmental impact (EPD)

As previously argued in this analysis, EPD and other product data are necessary to determine whether a material decision is sustainable or not. Contractors struggle to collect EPDs from subcontractors, suppliers, and manufacturers. Implementing EPDs in Backe's supply chain is still a work in progress, and it is currently impossible to collect EPD on every product and material used in their construction projects. When we asked the subcontractors and suppliers, they experienced the

same issue. They told us that their manufacturers only had EPD on a smaller sample of their assortment, mostly on popular products or products with a higher known carbon footprint. EPDs require calculations, and if they include transportation, it is even harder to make good estimates. Since EPDs are currently not required in a legal context, manufacturers and suppliers are implementing EPDs only because they are asked for them by contractors and clients. It is insecurity to economic risk tied to development and implementation. We consider this as an industrial barrier because the development and implementation of EPDs are still in an early phase in the Norwegian construction industry.

> *"There are too few products that have EPD." – P9*
>
> *"You do not get it, and you can ask, but the answer is: sorry, we do not have it." – P1*
>
> *"There are still many products that do not have article numbers. We do not have data, which makes it difficult for Bream certification." – P2*
>
> *"EPDs are what we get the least of when it comes to environmental data." – P5*

4.3.2 Lack of a common unit and standardization of information

One informant argued that there is no common unit for data processing. It was mentioned that too many types of data documents and variables make it difficult to standardize the material data and make them visible, understandable, and reusable. Some people still use PDF for material documentation, which does not work. Actors are also developing and using their own data standards, and it is tough to compile unstandardized information from different actors in a way that makes the data usable. As the situation is now, subcontractors and contractors receive an overwhelming amount of PDFs, and these are primarily collected, stored, and only inspected if a deviation is registered. Backe has tried to cope with this problem by using a platform called Cobuilder-collaborate for data management. However, they still experience issues because the platform needs standardized data to work efficiently. We consider this as an institutional barrier.

"Many of our environmental data-related problems are due to the lack of a common unit, a communication platform. You must have reusable data." – P8

"It is not standardized how they collect data." – P3

"Standardized data will help. PDF is just a hassle; it does not work." *– P8*

4.3.3 Lack of knowledge of green procurement processes

The lack of a common unit for environmental data can be seen in the context of a lack of knowledge of green procurement processes. Some informants said that sustainability was a relatively new phenomenon. Further, it was difficult to manage, as they had never been involved in these processes before. They were not expected to make green decisions, and they did not have any prior experience from education or professional career with green procurement. On the contrary, others had a greater focus on green procurement, but they experienced that their suppliers had less experience with it. We consider a lack of knowledge of green procurement processes an industrial barrier as the industry holds on to well-known processes.

"Many people we work with have not worked with green procurement and encountered this problem before. The maturation process has been slow, but we are trying our best to adapt to the new reality." – P3

"Sustainability is something that is our main thing these days. This is something we focus on. We work a lot with it, and all our product managers work with the suppliers. It is very in the starting pit even with many of our suppliers. They do not know exactly how to handle it." – P5

4.3.4 Lack of laws and regulations

The construction industry is an industry that, for several years, has experienced lack of requirements from the authorities. The technical regulations for buildings are about to change, but until then, according to our informants, there are few requirements for sustainability in the construction industry that are strict enough. They claim that requirements specifications are too easy to ignore. Currently, environmental product data is requested for documentation and revision purposes,

but the information itself is not commonly used as a product selection criteria in purchasing. Contractors are also not demanding sustainable materials outside BREAAM projects. Lack of product documentation is not regarded as a critical issue, and there is no actual legal enforcement.

> *"In the legal context, it seems that people do not think it is so bad to use products without product documentation." – P8*

> *"Due to the lack of demand, suppliers haven't been interested in obtaining these data." – P1*

In the Norwegian construction industry, many of the legal requirements in relation to construction can be found in "Byggteknisk forskrift." In our neighbor country Sweden, the Swedish construction industry must comply with a new law. From the first of January 2022, the Swedish construction industry must follow a new act called the "The Climate Declaration Act." The new Swedish act is of high relevance and interest to the Norwegian construction industry that is currently improving "Byggteknisk forskrift" regarding sustainability and green performance. New changes to "Byggteknisk forskrift" are valid from the first of July 2022 and were first announced on the first of June 2022. We consider the lack of laws and regulations as an institutional barrier.

4.3.5 Construction firms do not take sustainability seriously

Our information indicates that construction firms do not take sustainability seriously enough. It is only taken into account to achieve points for environmentally certifying buildings, not because they are interested in sustainability. They only take it seriously when they have to. The Norwegian construction industry is mostly concerned about the social aspects of sustainability, while the environmental ones receive little attention. We consider this as an attitudinal barrier.

> *"There has not been much choice up sustainability so far. If, for example, we have a BREEAM project, and consult with suppliers if they have any documentation on any of the goods we buy. That´s good. We have not made any particular choices based on that, by having it has only been a plus." – P2*

For some actors, sustainable certification schemes are entirely used as a strategy to become selected in tender competitions.

> *"We have chosen to become an environmental lighthouse only because some projects require certification. It is not because we are genuinely concerned about the environment."*

> *"Some people think this is crap and takes time."*

This barrier is strengthened as an informant with a central role in construction projects has not been involved in sustainability at all.

> *"Sustainability is not something we consider in a regular tender. Until today, nor in the last five years, I have not yet touched on sustainability as a topic; it has not been considered. EPD is requested, and environmental data is often requested, but sustainability as a whole is not much considered. What is being looked at is that the company has a healthy financial relationship and that the workers who work there have a collective agreement."*

4.3.6 Lack of products that are considered green

In today's market, there is a shortage of green products and products with environmental documentation, making it difficult to determine their environmental impact. Some of our interviewees described that it is not possible to purchase the quantity wanted from sustainable suppliers, which forces them to buy less sustainable products. European producers of green materials with EPDs do not produce enough, which means that they have to buy from Asian suppliers with completely different sustainable requirements. This has a significant impact on transport emissions. Considering the covid 19 pandemic and the ongoing war in Europa, this shortage has become a bigger issue. Especially in the steel industry, where more sustainable producers have limited production. We consider lack of products that are considered green as an industrial barrier.

> *"Today, it is about getting hold of it. (...) We buy from China today because we do not get enough steel from other more sustainable suppliers." – P6*

"It is quite often that the client has ambitions to deliver a building with a high energy factor, energy class, but there are no products that have these descriptions" – P1

"Accessibility is a problem for assessing sustainability 100%." – P2

4.3.7 Little willingness to change already established routines

The construction industry is very conservative, with little willingness to change already well-implemented processes and practices. The sustainable transformation will take time, and our informants said it could be risky to try out something new, especially when it has an economical price tag. We consider low willingness to change as an attitudinal barrier.

"You would have banged your head against the wall in this business. There is zero willingness to change. You will not believe how little willingness there is to think new." *– P8*

"The construction industry is a fairly conservative and heavily overgrown industry that is difficult to change. It takes time, and many measures must be taken." – P11

"The biggest barrier is the willingness to change and low margins." – P9

4.3.8 Lack of communication about circularity

Communication was highlighted as a major barrier to a circular economy and green procurement by our informant from a large recycling company. We consider a lack of communication about circularity as an attitudinal barrier because it relates to how different actors perceive their own level of wisdom.

"They do not talk to each other." – P10

Another complaint was the lack of early project involvement, not being included in the tendering process, and poor inter-organizational collaboration with circularity. An actor in Backe's supply chain working with waste management said they could have been involved earlier in the process. By the time of involvement, many of the

important choices have already been made. Earlier involvement and communication could result in choices that would significantly impact waste reduction. They also have independent agreements with the majority of Backe's suppliers, but they are never in the same room discussing how to manage the waste as a supply chain. It is not a closed circle.

> *"I talk with Backe's sustainability manager and my colleague talks with the supplier's sustainability manager. But all of us are never in the same room discussing how we all can work better together as a supply chain. It is not a closed circle. I have asked for this many times, but it seems that it is difficult to understand that it is necessary" (...) "We are not included early enough, even though we push to be included already in the tendering phase." – P10*

4.3.9 The current business model

One of our interviewees criticized the current business model as a major barrier to green procurement. It was mentioned that it did not facilitate sustainability and that major changes had to occur without specifying precisely what these changes entailed. It has to facilitate better document management. How companies use subcontracting and laws as tools for risk management hampers green procurement, and the issue is in practice pushed onto the subcontractor.

> "*There is a management problem in all construction companies that do not want to change their business model" (...) "If you look at the legislation and practices, no contractor will take responsibility for what a subcontractor installs." – P8*

4.3.10 Low margins – cost management conquers green procurement

All of our informants argued that the project- and the material price are considered more important than sustainability due to low margins in the industry. Several claimed that there is high price pressure, resulting in sustainability not being emphasized if it has a higher price. They are concerned about earning as much money as possible. We consider low margins as an industrial barrier.

"Everyone talks about wanting to be sustainable, but as soon as there is a cost, it stops. Before my current job, I worked in a company that was selling environmental concrete, but as soon as it cost more money, customers were not interested." – P5

When we asked the informants what their respective companies emphasized when choosing new suppliers, sustainability was given little or no emphasis. Price and availability were considered important.

"Should I be completely honest here, that may not be the answer you want to hear, but sustainability is another factor, but if I enter a percentage, it is probably 3 percent, maybe 5. In some projects, there is a lot of environmental focus, in others, there is less, and in others, there is nothing." – P1

"Quality and availability and cost first and foremost. The environmental part is further down the list. The client often wants environmentally based choices, but it's a cost. If it is not described, we do not choose anything other than based on costs." – P2

"Purchase price and availability, I will be so honest and say that this trumps the majority of requests now rather than sustainability. It is a tough market, smaller customers who have tough budgets that trump price and availability." – P7

4.3.11 Complex environment

Construction projects are complex with many stakeholders involved; Therefore, sustainability must often be seen in a larger context, making it challenging to deal with. One thing is transport, another is the choice of material and its emissions, but its quality must also be taken into account. One of our interviewees emphasized the importance of a holistic view. From revisions of finished projects, they found out that many of the products they thought were sustainable performed much worse than intended in a holistic view because of transportation. We consider the complex environment of construction projects as an industrial barrier.

"If you choose a sustainably produced product, but the transport is not very sustainable, perhaps the durability is low, and the product must be replaced after a certain time, then it all falls apart. Sustainability is about getting the solution that is best over time, and that is also sustainable in the future." – P11

4.4 Enablers to green procurement in construction projects

4.4.1 Interorganizational demand for green procurement

One of our interviewees pointed out that green procurement is everyone's responsibility, and it is hard to disagree with that statement. However, strong competition in the industry makes it hard for contractors, subcontractors, suppliers, and manufacturers to make sustainable choices. When companies are under price pressure, decisions are tied to the budget. Low margins and the risk of losing the tender competition force many to choose materials within their budget that satisfy the legal requirements. If the requirements come from the top, everyone must follow the same rules, making it easier to choose greener alternatives despite strong competition. We consider inter-organizational demand for green procurement as an industrial enabler.

"I would lift this up, saying that this is everyone´s responsibility. It is the responsibility of the client, contractor, subcontractor, suppliers, and manufacturers. We must all make sustainable choices so that the world gets better, and everyone must work together" – P11

"What good is that the state and some municipalities set it as a requirement and that the client/contractor also sets it as a requirement. The more pressure we get on this, the more pressure we can put on our suppliers" – P5

"If the client wants greener options without it is costing anything more, then we lose the competition, and then it is everyone else who takes the cost. The main thing is that the demand must come from the upper joint. If you lose the competition, it is in vain." – P1

"It is Norwegian laws, European regulations, contractors, of course, who set the demands. We are a supplier into this system, so we have to comply with the requirements that are." – P4

"I often think that the environmental assessments are left with the client. We are under price pressure. If we have to pay 7% more for a product that is slightly more sustainable that is not accounted for in our budget, we cannot choose that product. There have not been many opportunities to make sustainable decisions so far." – P2

4.4.2 Increased demand and stricter legal requirements for choosing environmental products and materials

Some of our interviewees were already informed about the new change in TEK 17. Others predicted tougher requirements but did not mention that they were aware of the new law change. Some of our interviewees think it is easy to use products without proper documentation because there is no actual enforcement in the Norwegian construction industry. Document revisions are not performed to such a degree, and many do not consider the consequences of using products without documentation.

"New regulations are coming in the near future that will replace Norwegian legislation. One thing that will be important is the regulation of building materials. What has previously been an environmental requirement becomes a legal requirement. All companies must deliver EPDs." *– P8*

Before this new law change, demand for sustainable building materials and products was mostly related to BREEAM-certified projects. Our interviewees pointed out that increased demand for green building materials and products is very important and that it would be easier for the industry if the demand came from the contractor, the client or legislation. From a holistic view, demand for green building materials and products has been low, and suppliers and manufacturers have not bothered to obtain them for all of their products. The new law change will increase the demand from clients, contractors, subcontractors, suppliers, and manufacturers, forcing the whole supply chain to obtain EPDs that can be used to evaluate

emissions and environmental impact. How these new regulations are designed will have a practical implication for future green procurement practices.

> *"We have previously said that they must be ISO certified or equivalent, but I think there will be much tougher requirements to be able to document improvement programs. They must show and be able to document how they can reduce their emissions and waste to landfills by considering raw material use and the reuse of materials. I think it is going in that direction. It is not enough just to show up with an ISO 14001 certificate." – P4*

Tougher requirements should also be gradually increased within a reasonable time frame, so everyone has time to satisfy the new requirements. The industry is pretty quick to adapt when they are faced with mandatory requirements.

> *"You see, for example, with fossil-free construction sites, that the industry manages to change quite quickly when requirements are set. I think this is going to happen pretty quickly. But I know that some contractors have to enter into a dialogue with the client that this is not something they can deliver on. That they are unable to meet the specific requirements that are set." – P5*

4.4.3 Green decision-making in early phases and early contractor involvement

It can take several years from a plot to be bought until a building is finished and delivered to a customer. It is therefore very important to make sustainable decisions as early as possible, with the future requirements in mind. It is often too late to make green decisions at later stages. The client is usually the participant that follows the process from the beginning to the end and thereby has the option to use its experience and knowledge to make green decisions early on and through the process. We consider early contractor involvement an institutional enabler because it relates to contracting.

> *"We are the link involved for as long as possible in the process and the actor that can influence the totality. Already with the choice of plot and the purchase of plot, we can influence smart choices, facilitate sustainability and pass this on to our customers. There is legislation that determines how*

much we can impose on our buyers, but we have the opportunity to convey our thoughts." – P11

"We try to facilitate green decision making by including the contractor early in the process, preferably when we make the requirements specification." – P11

4.4.4 Standardization, implementation, and use of environmental and reusable data

Environmental data is essential for green procurement documentation, revision, decision-making, and maintenance. It is hard for purchasers to make an informed decision without proper information. Environmental data helps reduce the footprint, as industry professionals can make better decisions, choosing the materials with the lowest environmental impact. Usually, product information is spread across many documents, and it can be exhausting to compile the data because companies are using different standards. It would be much easier for the industry if everyone were aligned and used the same framework, procedures, and documentation standards. Data has to be reusable. This is a very important step because it makes it easier to handle the data electronically and calculate the footprint. Reusable data means that you can define a unique object based on standardized data and the object's physical properties, such as length, height, width, and weight. An example of this can be that you want to lay parquet on the floor and calculate the footprint of the parquet used to cover the area. Standardized data for different types of parquet can be used together with the dimensions of the parquet and the areal of the floor to calculate the footprint, occurrence of environmental toxins, or similar. Our interviewee emphasized that standardization of data to specific standards was a requirement set by legislation in some countries abroad. We consider standardization, implementation, and use of environmental and reusable data as an institutional enabler.

"I would say that product data in itself helps to reduce the footprint because you can increase the service life on the basis that you have data on who installed, what the warranty period was, i.e., all data that can be taken into a data template. You must have reusable data. You must introduce requirements for the value chain for delivery of product data using data

templates that make the documentation visible and make the data reusable." – P8

4.4.5 Development of greener materials

Many manufacturers are developing more sustainable products and materials, which should be bought and used in future construction projects. Our interviewee told us that CO_2-neutral steel is a big contribution to greener procurement in the construction industry. It is used to reinforce buildings and has many useful properties in construction. Emissions from the steel industry can be divided into the extraction of raw materials, manufacturing, and transportation. From a procurement perspective, there can be considerable differences in footprint between different suppliers because their supply chains can differ substantially. For example, steel is an alloy mainly consisting of iron with a small fraction of carbon. Coal is today the primary source of carbon. Countries that mine and produce iron ore and coal are not necessarily using it to make steel but rather exporting it to countries that produce steel. For instance, while Australia is the biggest producer of iron ore, China is the biggest producer of coal and steel and primarily imports iron ores to produce steel. Iron ores are rich in iron oxides, and coal is used to separate the iron from oxygen, which results in high CO_2 emissions. While steel alloys consist of up to 2,1% of carbon, the biggest emissions from steel production come from the separation of iron and oxygen to produce a purer version of iron that is needed for steel production. Coal and iron ores are heated up in a furnace, producing crude iron and CO_2. One of the most promising technologies in the future of steel making is to use hydrogen instead of coal to remove the oxygen in iron ores, where the result is iron and water instead of iron and CO_2. In the future, Norwegian steel suppliers can cut their emissions by buying steel from Scandinavian steel producers that use hydrogen instead of carbon. Further, they can cut their transport emissions by sourcing iron ore from countries closer in the distance. Until new technologies, materials and products are ready, it is important to upgrade existing equipment, use better energy sources, and recycle. We consider the development of greener materials as an industrial enabler.

"Our owner has started with recycling, green energy sources, and new technology. It is a project where they produce fossil-free steel. When green energy is also used, which they receive via the energy supplier, the steel

becomes CO_2 neutral in production. This is a little ahead of time. As of now, it is important to upgrade existing equipment, streamline, find better energy sources and use recycling. New technology will be used in the future." – P7

"We have steelworks in Scandinavia. The closer they are, the more sustainable they are. Replace coal with hydrogen. I believe that everyone is concerned about the same thing and that there will then be fair competition." – P6

4.4.6 Supplier development and long-term business relationships

Tighter collaboration with suppliers over time can increase knowledge and risk sharing, simplify data gathering processes, and create healthier business relationships. Some of our interviewees responded that they had long-term business relationships with suppliers and that it was necessary for stable business conditions. Due to strict regulations, one cannot simply choose any supplier on the market as several requirements must be satisfied. We consider supplier development and long-term business relationships as an industrial enabler.

"We are interested in a supplier over time, and in developing this supplier link over time." *– P4*

4.4.7 Interorganizational collaboration, learning, and knowledge transfers

A prerequisite for more sustainable procurement is organizational processes and routines. Inter-organizational use of standardized data requires inter-organizational collaboration. Actors in the Norwegian construction industry are not aligned. Inter-organizational processes and collaboration can also be established to tackle circularity and waste management problems. After the new law change in TEK17, construction businesses must sort at least 70 % of their waste, up from 60 %. The best way to reduce waste is by making choices early before the waste is generated. According to P9, shared expertise is essential for industrial processes. Howewer, when we asked P10 about their business processes with Backe, we found room for improvements. P10 works for a company that recycles waste from Backe, and they also have independent agreements with almost every subcontractor, supplier, and manufacturer in Backes´ supply chain. According to P10, they have several times

asked Backe about early involvement, but instead, they are involved after the materials have arrived, reducing P10´s room for maneuver. If P10 was involved at an earlier stage, they could help Backe choose materials that were easier to recycle. Moreover, they experience that construction companies orders more than the needed quantities and that functional untouched products and materials arrive in the containers. They are also usually given notice too late about the arrival of waste shipments, making it hard for them to prepare their downstream solution. Therefore, we consider inter-organizational collaboration, learning, and knowledge transfer as attitudinal enablers.

> *"Absolutely, shared expertise is essential as it is absolutely crucial for industrial processes." – P9*

> *"I do not understand why newly onboarded engineers are used to dealing with waste sorting. They do not know anything about it, they do not care about waste, and it is not what they want to do." – P10*

4.5 Environmental product declaration (EPD)

4.5.1 Product documentation and environmental data

Documentation is a vital part of the construction industry and is demanded for revision and other purposes. Backe Entreprenør demands documentation from its suppliers and subcontractors to ensure that materials used in the buildings are within the given requirements. Levels of environmental toxins must, for example, be within a given range and cannot exceed the limit. It is essential to determine whether a material choice is sustainable.

> *"The problem is there if it is difficult to get things documented. You need documentation that says it is a sustainable choice to make good decisions." – P11*

Aforementioned, Backe uses the software "Cobuilder Collaborate" as a project database for documentation purposes. In the construction industry, most product specifications are about functionality, capacities, and material and substance content. Information about environmental impact is stated in a document called "EPD," Environmental Product Declaration. If it exists on a specific

product/material, it is usually available on the supplier's website, in addition to EPD Norge´s database. If it is not available, it must be requested.

> *"EPD is often located on the supplier´s website. If this does not exist, a solution must be found together with the supplier to satisfy the customer's needs." – P7*

In the Norwegian construction industry, EPDs are still a work in progress. In today's construction projects, there are major challenges in obtaining environmental material data such as EPDs. Backe Entreprenør confirms that they are missing material data from several of their suppliers. Several of our interviewees noticed the challenges of EPD, as the following quotes reflect:

> *"EPDs are what we get the least of when it comes to environmental data."*

> *"If a product is made up of 2000 units, we cannot retrieve background data on each product. We see that the client wants this, but it is too much work."*

> "*Collection of environmental data is still work-in-progress. The steel industry is very conservative. Developing a new steel quality often takes 30 years. European steelworks are very good at making EPDs, but not all. With Asian steelworks, it's worse. The adaptability in Asia is great, so once they start, it goes fast, and this will definitely come in the future*."

> *"The second challenge is the availability of data for our customers, and there is a digitization race going on around EPDs." Environmental documentation is a requirement for being able to deliver in the Norwegian building industry. We experience that there are products from Russian suppliers in the market that are not concerned with the same regulations as us."*

There are indications that enforcement of legislation is not good enough when it comes to material declarations and that it then receives little priority from suppliers. Therefore, due to a lack of monitoring and control, material selection is often made on the basis of profit rather than the absence of environmental documentation. Only

in the context of building certifications like BREEAM does environmental product documentation get a priority.

> *"If you ask what people care about, there is certainly no discrepancy, not on product information. In cases where you break the law, it is not so bad because no one is watching you. In the BREEAM context, where you have auditors, it is different. In the legal context, it seems like people do not think it is bad to use products without product documentation. It's a bit like that. If, for example, a facade should have been fire-impregnated and it starts to burn anyway, it puts focus on documentation. But it easily falls through because people are concerned about making money." – P8*

However, we see an increased focus on EPDs and other types of material documentation among the suppliers. This is in accordance with the changes in "Byggteknisk forskrift" (TEK17), which enter into force on 1 July 2022. This regulation imposes stricter requirements on documentation of environmental toxins on building materials. One of our interviewees said that they initially would focus on implementing EPDs from their biggest suppliers. The more pressure they and their competitors get on implementing EPD, the more pressure they can put on their suppliers. As long as there exist uncertainties as to whether EPDs will become a legal requirement in the future or not, there are fewer incentives for actors in construction projects to spend money on development and implementation.

> *"For us, it is about working with our suppliers and making demands on them. We work with creating systems for establishing EPDs on our products. Sustainability has come to stay and is something you have to contribute to. Development happens fast. It is easy to become a bit stuck and not know what to do. Whether it will be EPD or not, for example. There are several things that can come. New documentation practices are in the near future. I think it will be easier to document in certain areas." – P5*

> *"They may have started making EPDs on the products they sell the most, the ones that account for 80 percent of sales." – P1*

Producers and suppliers are developing or waiting for a solution that will speed up the process. An “EPD generator” or “EPD calculator” is under development and will soon be used to generate EPDs.

> *“So, what we are working on now is developing our own EPD calculator. So that we can actually punch in data from their supplier portal, then our end-user can get an EPD, at least on given products. What is most interesting to us now are EPDs. Or CO_2, the footprint.” – P5*

> *“It will probably be part of the "aha" experience we get when we start working with our own products in the EPD generator. Then we will probably make other choices. Then we will probably get new routines for demanding and working sustainability when it is in place.” – P3*

> *“Getting an EPD project for us is difficult. That's why we make it ourselves. Today, this is generic, but we have bought a generator that can create accurate project EPD in the time ahead.” – P6*

4.5.2 EPD, cost, profitability, and risk

The majority of our interviewees responded that products with an EPD are or will not be more expensive for customers than products without. However, the feedback suggests that there are many uncertainties surrounding it, as EPD often is seen in connection with quality.

> *“Do not experience it. The goods that have the best quality are those that have EPD, so there is a connection there.” – P4*

In addition, most of the products with an EPD are produced in Europa. If we compare European goods with Asian goods, European goods are more expensive.

> *“Compared to Asia, yes, but not all products that Asia can offer. If we isolate Europe and think about EPDs and prices, there are no big differences. If we think of the world as a whole, European goods are more expensive than Asian goods.” – P7*

Products without EPD are also not necessarily less sustainable than products with EPD. There are the producers and the suppliers who are taking the cost of implementing EPD. Contractors and subcontractors are pushing the cost of development and implementation over to their suppliers. We also find a mixed response on whether the development and implementation of EPD will reduce profitability.

> *"I do not think the profitability decrease, as the products they have complied the performance requirements and are of good quality. They have not focused on delivering this data type, but the products are not necessarily bad. They may have started making EPDs on the products they sell the most, the ones that account for 80 percent of sales. I do not think they add this extra cost to the price." – P1*

> *"The products will probably be more expensive when they receive EPD. We take the cost of investing in an EPD generator. If we were to have zero emissions today, we would not be able to buy it, and the price would probably double." – P6*

> *"No, I do not think EPDs will cost more for us. We use subcontractors on some projects, and then it is they who are responsible for purchasing. On a BREEAM project, for example, we may have been asked to use a specific supplier with EPD instead of someone else, but I do not know if it has a price difference. We pay the subcontractor for assembly plus goods. I'm not sure if it has price consequences." – P2*

4.5.3 Willingness to pay for green products – products with an EPD

The willingness to pay more for sustainable products varies from project to project. In BREEAM projects, for example, where there is a requirement for sustainable material choices, there is a greater willingness to pay. In such a project, Backe entreprenør and other providers are not competitive if they are not willing to pay more for green products, resulting in giving the project to someone else. In other contexts, some are willing to pay more for sustainable products as part of their social responsibility.

"Everything within reason. The emissions we have cut have not cost anything to our customers. It's a bill we've taken ourselves. Because we believe that it is our part of social responsibility within sustainability." – P5

If all the players in Backe's supply chain have to buy/use green materials at a higher price, their customers must be willing to pay for it. Otherwise, it is not financially justifiable. Ultimately, it is the client and the end-user who must be willing to pay for green products, which sometimes can be more expensive. When we asked Backe entreprenør AS and its subcontractors and suppliers about their experience with the client´s willingness to pay, the majority said that the client normally is not willing to pay more for sustainable products and products with EPD. Only those who are forced to do so, big public companies, are willing to pay more.

"The client asks for sustainable materials but is not willing to pay for it. That is what we experience. I think it's the price that decides this. They are probably not willing to pay more, but at the same time not willing to buy if you do not have it." – P6

"Have no feeling for it. In the industry today, it's about having an EPD. If you have it, there is a "check" in the box." – P3

"No, I do not think so. They do not want to pay more for it. They just want it. They think it is not financially justifiable, but that they choose it on some projects to be their face to the outside world." – P2

When we asked an interviewee representing Backe´s client, the answer was different. The client is willing to pay more to some extent. As long as the choices are still financially profitable, green materials and products with low EPD are something they want to use. However, there are limits to how much money that can be spent on green procurement. The financial aspect is also important in sustainability. Clients must consider the most optimal configuration within their budget, implying that money is spent on green solutions with the biggest effect on environmental impact. Contractors and subcontractors can therefore experience that the client is not interested in all of their green solutions for a construction project.

The interviewee emphasized that they needed a certain income to be able to continue their business. They cannot lose money on every project.

> *"It is often the case that the more sustainable solutions cost a little more. If it costs a little more, it´s fine, and a little more than that as well, but it can come up to a level where we have to draw the line. (…) We must have a certain income that gives us the opportunity to continue, but at the same time give us the opportunity to make the best choices within certain limits." – P11*

4.5.4 EPD & decision-making in procurement

Environmental data as selection criteria is secondary to technical material specification requirements in today's practices. Materials must satisfy technical specifications and performance data such as capacity and strength before they can be evaluated on EPD data. Products must be technical substitutes and comply with other requirements before CO_2 emissions can be regarded. Making sustainable decisions is also difficult because higher quality and better performance can result in higher CO_2 emissions. Sometimes, a contractor has to use a product without available EPD data because it is the only product that fulfills the function specified by the client.

> *"The thing is that product data cannot be seen in isolation because there are so many rules (…) There are also infinitely large differences in footprints on products with a lifespan of 15 and 20 years. For example, window glass with better insulation properties is thicker, heavier and takes up a bigger volume than thinner window glass." – P8*

> *"There may also be only one supplier who can supply a unit with integrated cooling, but he does not have environmental data on it. Then we have to choose this product even if it only comes with performance data and not environmental data because this is the only product that fulfills the function." – P1*

4.5.5 EPD as a requirement for doing business in the future

According to two of our interviewees, suppliers and contractors that cannot deliver on requirements set by the client or legislation are not competitive in the future. Moreover, manufacturers and suppliers must sometimes declare their products at a very detailed level, often beyond the requirements of an ordinary EPD. Domestic and sometimes international legislation must be satisfied. Suppliers that fail to declare their product according to requirements risk not being selected in tender competitions. For BREEAM projects, the fulfillment of requirements is graded; If you end up in the "red" field, you may not be selected as a supplier. Suppliers must ensure that their data is available to the contractor and client, or they may not be considered in supplier qualification processes.

> *"There is no doubt that sustainability has come to stay. I think in a few years it will be so big. If you want to survive as a manufacturer and contractor, then you have to meet these requirements. Otherwise, you are no longer competitive." – P5*

> *"We as a supplier must ensure that our data is available in the systems that Backe and other contractors and end-users use. If our data is not available in those calculation programs, we may not be selected in the long run." – P4*

4.5.6 EPD in context with circularity and how documentation affects recycling and reuse

According to our informants, product documentation such as EPD is absolutely necessary to make the best choices according to sustainability and circularity. It is essential for manufacturers, wholesalers, suppliers, contractors, waste players, and clients (i.e., the entire value chain) to make choices related to the reuse and material recycling of building materials. Good data will lay the foundation for industrial processes for material recycling (a prerequisite for material recycling). Furthermore, good data also enables reuse and provides security for the products´ functionality and environmental friendliness. In addition, good data - combined with models/digital twins - enables dialogue between the client and, for example, users (tenants) connected to new stakeholders, redevelopment, etc.

As a recycling company, you need to know what the products contain. Data, preferably EPD with a life cycle analysis, is necessary when products are to be sorted. Our informant from a recycling company claims that construction companies deliver poor product documentation, making it difficult for them to recycle materials. Construction firms frequently use a residual waste code that does not say how the products should be treated. As a result, they have to spend a lot of time looking at what the product is made of, and who could handle it.

> *"What is very unfortunate is that those who develop the data sheets very much fall back on a residual waste code. When they write it in a data sheet, we do not know what to do because it does not really say anything about how it should be treated. It's really just a support code. It is very bad because it only says: "other waste from construction and demolition work (...) Product data is absolutely necessary for things to be able to recycle materials. We need to know what the product contains (...). We can material recycle 60% of a construction site. The product data sheets are good for sorting correctly. It's silly when they are very incomplete and do not define specifically." – P10*

If the data were more detailed, things would be much easier:

> *"If the product data sheets had been more detailed and without "easy-to-use" sorting codes, it would be easier for us to recycle more effectively." – P10*

The main reason why construction firms are using the code 170904 is a lack of competence and a desire for a 100 % sorting rate. In BREEAM projects, where they are revised on the sorting level, they are so concerned about achieving a 100 % sorting rate that they throw everything as residual waste. Sometimes they even buy extra materials that are recyclable to achieve a higher degree of sorting because it is cheap. The narrow focus on sorting has degraded the benefits of material waste sorting.

5.0 Discussion

This chapter discusses our findings from interviews and meetings in relation to the literature. To structure the discussion and make it clear, it is divided into two different parts; where the first one addresses the first research question: ***What are the most significant barriers that prevent green procurement in Norwegian construction projects, and what are the enablers to overcome these?*** We have investigated if there is any gap between earlier studies and current practices. The next and last part goes into detail about EPDs, explaining current obstacles and their impact on green procurement. This part reflects the thesis's second research question: ***What are the current challenges with Environmental Product Declarations (EPDs), and how are they affecting green procurement?*** The discussion involves everyday use, access, and challenges related to green procurement and circular economy.

5.1 Barriers to green procurement in construction projects

5.1.1 Institutional barriers

Our findings highlight that it is easier to make sound decisions when you have a complete picture of a situation and thereby tricky to navigate when the available information is fragmented. The lack of a common unit and standardization of data is an important barrier to green procurement identified in a report by Deloitte (2020) conducted on behalf of the Norwegian government. The literature is scarce on this topic concerning construction and mostly related to BIM integrated procurement models or standardization of processes in construction projects. This barrier's implication on green procurement is comprehensive because it impairs sound decision-making and effectively hinders the use of data in an analytic setting. One cannot efficiently compare substitute products and materials with a different environmental performance from a key supplier or between other suppliers that satisfy the technical and legal requirements, and decision making is thereby based on prior experience and familiar procurement patterns. Backe has a requirement for all of their sub-contractors and suppliers to use Cobuilder – Collaborate, but they do not have the IT infrastructure needed to effectively share information with the platform. Data is usually provided through digital PDFs and therefore collected for revision purposes instead of analytical purposes that can enhance operational performance. We believe that main contractors like Backe have a significant

unrealized potential in data management, but it can be a demanding and costly task to align their suppliers. Backe's suppliers are also supplying their competitors. Our impression from the interviews is that the suppliers are reluctant to implement new technology if there is a cost and a risk tied to it, which is consistent with Shen et al. (2017). The suppliers also perceive the added benefit related to standardization of information as the contractor's and client's profit, and they struggle to see how it will impact their margins positively. In general, we also see that main contractors risk losing the tender competition to other contractors if they set requirements that their suppliers cannot deliver on. These combining factors cause inertia that can be hard for a single contractor to solve alone. We believe the whole industry must participate in collaborative activities to implement a common standard for information sharing and standardize the information.

Today's laws and requirements set by legislation are considered a barrier to green procurement by Lewis et al. (2015) and Sadri et al. (2022), which is consistent with our data analysis. Demand for product documentation and environmental information has historically been scarce in Norwegian construction projects, and contractors have not regarded lack of documentation as a significant issue. If you ask a contractor for a list of all materials and their properties used in a specific building project, there will most likely be "black holes" in that list if the project is not BREEAM certified. Poor inventory management can also be quite costly, as excess materials are sent to recycling or disposal instead of returning it to the supplier. The essence of green procurement is to transition from traditional procurement methods that cause direct or indirect negative impacts on the environment. We need stricter laws and requirements that promote this transition. Moreover, flexible and "soft" legislation can, in some cases, alter current practices to become less sustainable. One of our interviewees pointed out that some actors in the Norwegian construction industry use the procurement function for practices we consider greenwashing. To increase the percentage of overall sorted construction material waste, they buy excess cheaper materials they know are recyclable. Instead of changing their procurement and waste management routines, they simply buy their way out of the situation because it is cheap and looks good on the paper. Greenwashing due to liberal and "soft" legislation was one of Sadri et al. (2022) concerns regarding the new "The climate Declaration Act" in Sweden. By Norwegian legislation, two of the environmental legal requirements for buildings

are that buildings shall be designed and constructed in a way that minimizes the negative load on natural resources and the environment and that the waste should be handled accordingly (Lovdata, 2022). From our perspective, greenwashing practices found in our data analysis are intentionally not permitted by Norwegian legislation. The problem is that actors that are buying excess "green" materials easily go under the radar because they are purchasing green materials. Recycling is an energy-intensive process and is, therefore, worse than reusing the material (Korhonen et al., 2018). Based on our interviews, we believe that legislation enforcement in the Norwegian construction industry is weak and that the government should assign more resources to enforcement. In our opinion, competition and actors' interests can no longer be the baseline of procurement processes.

Vennström and Eriksson (2010) and Kadefors (1995) have contradicting opinions on whether institutional barriers are essential in change processes. The two studies are quite different as Vennström and Eriksson (2010) emphasize the clients perceived barriers to change, and Kadefors (1995) regards the whole supply chain. We believe that both studies have value because the clients' perceived barriers to change is a plausible barrier to green procurement. Our findings suggest that institutional barriers are important to green procurement and that the lack of standardization of information in Norwegian construction projects hamper green decision-making. The clients' little focus on standardization can explain today's situation, but we believe it will change in the near future when the client receives stricter requirements from legislation.

5.1.2 Industrial barriers

A quick scholar search online on "Green procurement processes" gives multiple results. There is an extensive collection of methods and ideas available to be implemented. However, our study revealed that several actors in the construction supply chain are still in the starting phase of implementing green procurement processes. Some are progressing more than others and have a green procurement criteria in their strategy, but they struggle to find qualified suppliers. None of our interviewees responded that they used a specific supplier selection framework from the literature, which was not a surprise as Khoso et al. (2022) argued that methods found in the literature are case-specific and too complex for practical purposes.

However, almost all of our interviewees reported that they were certified by either ISO 14001, Miljøfyrtårn, UN Global Compact, or similar and that they also required that their suppliers were certified as well in most cases. Regarding certifications, the literature has mixed opinions on the impact of environmental standardization schemes. Some scholars argue that these schemes are costly, provide little information on how to improve, and have no minimum emissions requirements. Others argue that they have an impact because they force companies to have a green mindset and to report on their improvements. These concerns are addressed in the literature by Curkovic and Sroufe (2011) and Morris (2004). Further, using standardization schemes as a dummy variable for selecting suppliers can result in a collection of selectable suppliers with a huge variation in actual environmental performance. It is easy to use certification schemes as criteria because you don't need any prior experience with green procurement to use it as a dummy. On the contrary, there is a need for education and experience in green procurement to do more comprehensive assessments that can have a more considerable impact on the supply chain level. Some of our interviewees had more knowledge about green procurement than others. Many wanted to develop more green practices with their suppliers but struggled because their suppliers did not have enough experience with it. This is consistent with the findings of Ageron et al. (2012) and Shen et al. (2017). We have categorized lack of knowledge of green procurement processes as an industrial barrier because procurement professionals seem to favor well-known traditional procurement processes.

When we asked our interviewees if they assessed green procurement on the material level, it was a consensus that this was only for BREEAM-certified projects where they were evaluated on total CO_2 footprints and environmental impacts. Environmental choices were related to the project budget. Our interviewee, that represented a client, regarded sustainability from a holistic point of view considering all economic, social, and green aspects, implying that even though there is possible to buy greener solutions from all suppliers, they will only prioritize the solutions that give the lowest footprint from the economic resources assigned to the project. It is therefore risky for main contractors to spend too many economic resources on green procurement, and they must also comply with what is specified in the contract. Our findings are consistent with the findings of Ageron et al. (2012), Shen et al. (2017), and Sadri et al. (2022). Interviewees representing suppliers and

producers also told us that they wanted to sell more of their greener assortment but that buyers were reluctant to spend more because of their budget. Our impression is that sustainability in the form of the triple bottom line is very skewed towards the economic aspect because the environmental aspect is more dependent on the economic aspect than the opposite. If a company is declared bankrupt, it cannot continue its operations; The economic element has a significant impact on the existence of a company. It is possible to spin it around and say that the economic performance is affected by the environmental performance because a company can lose its customers if they get bad publicity. However, we experience that the B2B market has a relaxed attitude in this setting compared to the B2C market, maybe because the legal requirements are also relatively relaxed. There is currently not enough demand, as well as supply for green materials, which substantially impacts the price of greener materials and solutions. Almost all of our interviewees pointed out this. The current situation with the COVID-19 pandemic and the War in Ukraine has disrupted supply chains worldwide, forcing a limit on product availability and surging prices, making it even harder to prioritize the environment.

The literature and our interviewees consider the availability of green construction materials as an obvious barrier to green procurement. The supply of available green construction materials must increase, or companies cannot change their procurement practices. New research indicates that the production of materials used in construction projects accounts for a substantial part of the industry's total emissions when imports are included in the calculations (Asplan Viak, 2019). Many of the materials used in the Norwegian construction industry are produced abroad and have not been accounted for in earlier analyses.

One of our interviewees pointed out that construction projects generally use a business model that makes it harder to solve problems related to green procurement and circularity compared to other industries. Vertical integration is absent, and the whole sector relies on project-based opportunities, increasing complexity. One of the critical reasons for this is that actors are supplying other industries, as well as the construction industry, and one cannot simply vertically integrate every supplier needed in a construction project. Backe Entreprenør, Backe Prosjekt, Backe Eiendom Invest AS, and BAS Maskinutleie are vertically integrated into the same organization, but there is no further vertical integration with subcontractors,

suppliers, and manufacturers. Several of the processes and activities in Backe´s supply chain that are performed by subcontractors, suppliers, and manufacturers are done after specifications and requirements are set by contracts. Procurement processes and goals can be pretty different between organizations. Thus, actors performing procurement activities for their respective companies follow different guidelines and have other goals. Lack of vertical integration between important activities and processes is identified in the literature as a barrier to green procurement in construction projects (Ershadi et al., 2021b; Górecki et al., 2019). In our data analysis, one of our interviewees emphasized two important aspects. Firstly, they were not involved early enough in processes, and that the damage was already done at the point of involvement. Secondly, they had arrangements with almost all suppliers and subcontractors of Backe's supply chains, but the processes were rather individual than holistic.

5.1.3 Attitudinal barriers

From our data analysis, we have identified several barriers that can be categorized as attitudinal barriers. According to some of our interviewees, construction firms do not take sustainability seriously, and there is little willingness to change already established routines. In the literature, we find attitudinal barriers, such as "Top-down approach." From our interview with P1, we discovered that Backe as a contractor, did not consider sustainability in a regular tender. It was not required by them or the client to weight sustainability if it was not a BREEAM project. However, when we talked with the client, we discovered that their new strategy involved BREEAM certification of as many projects as possible. From our point of view, this is a good decision because it shows that the client is willing to change and takes sustainability seriously. Moreover, the literature finds a top-down approach in construction projects, meaning that the client acts as the "brain" of the supply chain (Vennström & Eriksson, 2010). We see both in the literature and from our data analysis that it is important for the contractor to satisfy the client. The clients' requirements are regarded as the supply chain's room of maneuver, and it is essential that it includes green procurement. What we find interesting is the variation in focus on green procurement through a construction supply chain. It seems to us that suppliers and manufacturers have focused more on green procurement compared to the main contractor, primarily because they work with many other actors that have asserted pressure on them. As we have argued earlier,

it is essential that transformation comes from the decision-makers like the client and that the transformation does not stop at a certain supply chain level. Several interviewees told us that they have sustainable products but that the subcontractors or contractors do not want them if they are more costly. We have to ask ourselves the causal causes of these attitudinal barriers. In our opinion, it can be related to actors with different interests and a lack of communication about sustainability. For example, one of our interviewees emphasized that contractors tend to assign graduates to manage waste from construction sites rather than including experienced professionals in their supply chain. According to the same interviewee, graduates had little experience with waste management and were not invested in their work because they wanted to work in other areas of construction management. Actors with different interests are identified in the literature as a barrier (Górecki et al., 2019), and we find this barrier directly and implicitly described in our data analysis. Lack of communication about sustainability was also recognized as a barrier in our data analysis. Furthermore, another barrier we found in the literature related to "willingness to change" is that procurement professionals have little experience with green procurement and that there are technical concerns related to the applications of green materials (Shen et al., 2017). These barriers have also been mentioned indirectly in our analysis.

5.2 Enablers to green procurement in construction projects

5.2.1 Institutional enablers

Incentives from the government are identified as an enabler of green procurement by Hwang & Tan (2012), Simion et al. (2019), Samar et al. (2020), and Alqadami et al. (2020). None of our interviewees suggested incentives from the government as an enabler, but we did not ask specifically if they considered that as a key enabler. However, since they emphasized low margins as a key barrier, it seems reasonable that incentives from the government are appreciated. Everyone has to contribute, and if the public is unwilling to pay more upfront for housing, they can contribute to the green change through taxes that the government can distribute to green procurement through subsidies. Incentives from the government, such as subsidies for green material selection and R&D, have, from our perspective, two major benefits: Firstly, subsidies for green procurement can increase the demand for green materials in construction projects as it will keep the price at a reasonable level. Secondly, R&D can increase the supply of green materials in construction

projects, which in return can push the price further down to such a level that subsidies are no longer required. It is important to work on both sides of supply and demand, and subsidies from the government are, in our opinion, an effective tool. One of today's crises with economic implications for the construction industry is the surging fuel prices. Transportation of materials is essential in construction projects, and higher transportation costs decrease Backe's supply chain´s room for maneuver. The Norwegian government has not yet subsidized fuel prices and is currently watching the situation. According to the literature, subsidizing dirty fuels such as gasoline and diesel increases the transition time to greener alternatives (Hodari, 2021; Zhang et al., 2020). The government should rather impose subsidies for the R&D of greener transportation alternatives and infrastructure. The Norwegian government has already removed the tax on electric cars, but it can be pretty costly for a company to change its entire vehicle fleet that is already financed by loan or equity. Companies need incentives to replace existing vehicles, and there must be available infrastructure for freight by electric vehicles; Vehicles used in construction projects carry heavy loads, which takes a toll on battery capacity. Subsidies from the government can also, as discussed earlier, help the industry to direct more funds into green R&D. From our interviews, we got information that new sustainable solutions are ready for implementation in the near future. Zero-emission steel and concrete can substantially impact the supply chain's carbon footprint. Still, they must be affordable and easy to distinguish from other materials, as we have discussed earlier. Incentives from the government can speed up EPD development and implementation of EPDs, which can help procurement professionals make better decisions.

Stricter regulations from the government with respect to which standards to use can promote less risk and uncertainty. An example of stricter regulation of industry standards in relation to positive green benefits is the new deal on common phone chargers in EU countries. The new law is beneficial for consumers, as well as the environmental waste impact. By 2024, all phones must use the same charger connection, and companies are not allowed to use other standards. Companies such as Apple must then comply with the new law and cannot use their current solution (European Parliament, 2022). The idea is to reduce unnecessary and harmful differentiating of products as well as solutions. Stricter regulations and requirements are perceived as an enabler for green procurement by Wong et al.

(2016), Anuar et al. (2021), and Simion et al. (2019). Tougher regulations and legal requirements are, in our opinion, effective as they force everyone in the industry to take new measures and develop new practices. However, there exist uncertainties that if the regulations and requirements are set too high at a too fast pace, many manufacturers and suppliers may struggle to adapt. According to secondhand information found online, several leading actors in the Norwegian construction industry believe that the requirements stated in TEK 17, as well as the new changes that are in place from July 2022, are not ambitious enough. Actors that take green procurement seriously believe that stricter requirements will increase their competitive advantage, which again will improve their margins. The government does not have enough insight and thereby struggles to set proper requirements for the Norwegian construction industry (Nikolaisen, 2021; NTB, 2022; Simenergi, 2021). This is consistent with the literature, as well as our data analysis, where the majority of our interviewees want stricter requirements from either the client or legislation, as it can foster a competitive advantage for serious actors.

One of the enablers found in the literature is collaborative contracting models (Eriksson et al., 2020; Lingegård et al., 2021; McMurray et al., 2014), and one of our interviewees stated "early contractor involvement" as an enabler for green procurement, which is a collaborative contracting model. Further, an interviewee specified current contracting models as a barrier. From the literature's perspective, today´s utilized contracting models hamper inter-organizational collaboration as they keep manufacturers, suppliers, and subcontractors at an arm's length. From our interviews, we got the impression that the client's role is to know a little bit about everything and use their wide knowledge to hire specialized services with the right knowledge and qualifications. From their perspective, they were the actor with the longest involvement in a construction project. They thereby had the possibility to make choices that could improve the environmental performance of a project. P11 told us that they tried to involve the contractor as early as possible to discuss measures that could improve the project´s quality as well as environmental performance before the tendering process. When we asked if they had processes that ensured knowledge transfers between actors doing maintenance on their buildings and the procurement at the contractor, P11 emphasized that they did evaluations after every project and that they tried to involve the contractor in this process. In our opinion, the client could involve procurement professionals,

maintenance professionals, and recycling and reuse professional that represents companies in their supply chain in these evaluations. This could foster an environment for discussion, tighter collaboration, and closer business relationships. From our data analysis, "Green decision making in early phases and early contracting involvement" and "Collaboration, tighter collaboration, shared expertise between procurement departments and organizations that specialize in reuse, recycling and remanufacturing, and new procurement processes" are considered enablers to green procurement that we believe can be beneficial for main contractors like Backe. Moreover, "Mutual collaboration is identified in the literature as an enabler for green procurement (Bohari et al., 2019; Kadefors et al., 2021; Wong et al., 2016).

Our data analysis highlights "Lack of a common unit and standardization of information" as a barrier to green procurement. We have also identified "Standardization, implementation, and use of environmental data, and reusable data" as an enabler for this barrier. The lack of common standards and methods for collecting and handling digital data is recognized as a barrier by Hart et al. (2019), Akadiri (2015), and in a consultancy report conducted on behalf of the Norwegian government (Deloitte, 2020). "Standardization, implementation, and use of environmental data and reusable data" is, in our opinion, an enabler and a prerequisite for effective IT integration and also a foundation for advanced data analytics. Procurement in the digital age requires better data management capabilities, and we also believe that companies that utilize their data in procurement have a competitive advantage. The future requirements will also force companies to weigh criteria other than price, which increases the importance of standardization, implementation, and use of environmental and reusable data.

5.2.2 Industrial enablers

Backe has, as we know, not considered sustainability in a regular tender because their interest has been to satisfy their client. Now that the client has a goal to BREEAM certify almost all of their projects in the future, Backe must consider sustainability for a more significant percentage of their projects. Our findings suggest that inter-organizational demand for green procurement, especially from the top of the supply chain, as well as stricter requirements and legislation, are enablers that decrease the variation in interests between actors in a construction

supply chain. This is consistent with the literature. Almost all of our interviewees emphasized that demand for green procurement must come from the top as it decreases boundaries caused by competition and influences the supply chain to pursue the same goals.

Another prerequisite and enabler for green procurement is the development of greener materials. Both Bohari et al. (2019), Samar et al. (2020), Kadefors et al. (2021), and our collected data suggest "research and development of green materials" as an enabler to increase the supply of "greener" materials. It is from our perspective four main factors that decide how "green" material is: Production, transportation, durability, and reuse and recycling properties. With regards to environmental impact, it is production and transportation that are the two most important direct factors. Durability and reuse- and recycling properties are indirect factors that reduce material consumption and, thereby, environmental impact from production and transportation. We believe that emissions reduction from production and transportation has the most significant impact. Therefore, it is necessary to make procurement choices that address this issue. Research and development of green construction materials can, in our opinion, foster new industries in Norway or neighboring countries that can make domestic and short-distance sourcing more favorable than global sourcing. We need to increase the supply of available "greener" materials. Research and development of green materials sourced nearby can reduce the environmental impact of production and transportation. Nearby sourcing from new supporting industries can also increase economic benefits through value creation and new jobs. Subsidies from the government for the research and development of green materials and industries can speed up the process and decrease the economic risk related to research and development. R&D of greener materials can also in our opinion provide a competitive advantage. It is naive to believe that the construction industry has hit a technological ceiling. Many of the current technical patents that are used today are designed without the environment in mind. We believe that new inventions can provide cheaper and more environmentally friendly materials at the right scale. The utilization of abundant domestic resources in combination with new green technology can become a starting point for a new Norwegian export adventure.

Our data analysis identified supplier development and long-term business relationships as enablers to green procurement, but the literature is scarce concerning supplier development for sustainability (SDS). The literature highlights supplier development and long-term business relationships as a requirement for responsible construction procurement and that it can reduce a building's total cost of ownership . Supplier development is in the literature also related to supplier selection and evaluation of green performance (Liu et al., 2018). Changes in legislation have practical implications for procurement as Norwegian companies must procure materials with the least environmental impact from the 1 of July 2022. Procurement professionals in the Norwegian construction industry can benefit from long-term business relationships and supplier development to secure the supply of "greener" materials. Higher legal requirements can decrease the available procurement options, as procurement professionals must exclude suppliers that are not qualified. There is also a risk that qualified suppliers will struggle to meet the market demand for green materials, thus shifting the most beneficial configuration from short-term to long-term supplier relationships. Supplier development may, in our opinion, increase the contractors' or subcontractors' value creation because it can foster a collaborative environment with positive synergies to research and development. We believe that deeper and stronger supplier relationships can enhance environmental performance and amplify competitive advantage, which is also backed up by the literature (Liu et al., 2018). The construction industry is also known for project-based procurement (Segerstedt & Olofsson, 2010). We want to highlight that clients, contractors, and sub-contractors with a homogenous project portfolio can benefit from long-term business relationships and supplier development.

5.2.3 Attitudinal enablers

"Inter-organizational collaboration, learning, and knowledge transfers" was identified in the data analysis and the literature by Wong et al. (2016), Bohari et al. (2019), Ershadi et al. (2021a), and Kadefors et al. (2021) as an enabler for green procurement. What we want to emphasize is the importance of inter-organizational collaboration, learning, shared expertise between procurement departments and organizations that specialize in re-use, recycling and remanufacturing, and new procurement processes. Traditional procurement methods are still in use in the Norwegian construction industry. We believe that "inter-organizational

collaboration, learning, and knowledge transfers" can speed up the transition towards greener procurement practices. As our data analysis shows, valuable insight exists from actors in a construction supply chain that does not necessarily come through to the contractor or the client. Whether it is because of attitudinal barriers or because they do not consider it as important insight in a holistic view are essential to address. Moreover, we believe that inter-organizational collaboration is necessary for inter-organizational standardization of information. The Norwegian construction industry is not aligned, and valuable information is spread across different documents. One of our interviewees told us that self-declarations of materials in some cases can contain more specific environmental data than EPDs. Norwegian legislation focuses more on how the environmental impact should be calculated and data quality, rather than on how the information is effectively obtained.

From our data analysis, "training of industry practitioners" was not directly suggested as an enabler for green procurement. However, since our interviewees suggested shared expertise between procurement departments and organizations that specializes in re-use, recycling, remanufacturing, and new procurement processes as enablers. In addition, stating little knowledge of green procurement as a barrier, we believe that "training of industry practitioners" in green practices is a valid enabler in Backe's supply chain. "Training of industry practitioners" is highlighted as an enabler by Bohari et al. (2019) and Ershadi et al. (2021a). In our opinion, Backe and its suppliers can benefit from training in green procurement practices and gain a competitive advantage in the future by developing a collaborative environment that includes industry practitioners, academic institutions, and government. Bringing everyone together can help speed up the process of creating green procurement frameworks and methods that are easy to understand and can be used in practice. We want to emphasize that the government needs proper insight and training in green procurement practices so they can enhance the legal framework. Training procurement professionals, management, and the government are necessary to increase their knowledge of green procurement and reduce existing uncertainties. Training can also decrease some of the attitudinal barriers found in a construction supply chain.

5.3 Environmental Product Declaration (EPD) as a parameter for green procurement

When discussing the problems surrounding EPDs and the challenges that arise when these are not possible to utilize, it is essential to first talk about the importance of EPDs. If EPD is not an important tool, it is no problem when it is not used.

In the literature, it is said that the project's environmental performance is essential to determine whether a construction project is successful or not (Chan & Chan, 2004). To reduce a construction project's environmental impact, green procurement has been a helpful tool. Green procurement in construction projects involves buying materials and services that minimize emissions and waste (Rais et al., 2018). According to our analysis, it is not possible to select such materials without sufficient documentation of emissions. One of our informants claims that this is the very foundation of green procurement. Without adequate documentation and concrete figures that can be mathematically analyzed, it is hard to calculate a project´s total environmental impact and stamp the project as successful.

As a client or main contractor, you are responsible for the construction project and making it sustainable. However, in a construction project, it is often subcontractors who are responsible for the procurement processes (Winch, 2009). The client can announce requirements for material specifications, but in the end, it is the subcontractor who takes the material decisions. When the client is more invested in the procurement process of contractors and subcontractors, the client can achieve a higher economic and environmental performance (Eriksson & Westerberg, 2011). Therefore, the documentation itself is essential for you as the client to be able to document sustainable choices and achieve environmental success for your construction project. Subcontractors and suppliers must provide metrics that ensure their operations follow environmental standards and waste management regulations (Ershadi et al., 2021b). It is hard to believe that we humans are competent enough to make the best choices when it comes to the environment, especially with today's modern and complex products.

EPDs include specific measures that make it possible to analyze an individual product's environmental impact. With this tool, you can already in the purchasing phase, choose products with the lowest emissions (Sparrevik et al., 2021). Looking

back at what green procurement means, buying materials that minimize emissions, we get a visible perspective of how valuable this tool is. It is, as one of our informants called it: the very foundation of green procurement. If you have an EPD on all materials used in a construction project, you will get measures on the entire project's environmental impact and easily prepare an environmental account, a requirement in today's construction projects. In building certifications such as BREEAM, EPD is one of several alternatives for different types of documentation requirements (Appendix 5). This also makes it very attractive when classifying buildings, something Backe and other construction firms have an increasing interest in. It was stated that BREEAM certifications will be more prominent in the coming years.

The question is whether this documentation is really as necessary as our findings and literature suggest and, therefore, should be used as a starting point for material decisions. When we look at what an EPD contains, it is about CO_2 equivalents on building materials. We have to ask ourselves if this is enough to determine the most sustainable material decision. A product with a low EPD measure is good for the environment, but it is not a given that it is the best product to choose. There are many factors to take into account in green procurement. In the analysis, it was mentioned that a product with a low EPD sometimes has a significantly shorter lifespan than a product with a high EPD. For example, if you buy a product with a low degree of environmental footprint and this product has to be replaced after ten years, it may be more profitable and sustainable to choose a product with a higher footprint that does not have to be replaced until after 15 years. EPD must be seen in the context of the performance specifications of the product. Hodges (2005) confirms these findings by highlighting that choosing durable materials is just as crucial as choosing environmentally friendly materials.

According to Shen et al. (2017), a barrier to green procurement is poor experience with green procurement and lower quality. Our empirical findings show a connection between EPD and material quality. An informant stated that the products that have EPD are also the products of the best quality. The products with an EPD are usually also European materials, as there, for example, are other requirements for material quality in Asia. However, materials have to satisfy technical specifications, such as capacity, before they can be assessed on EPD data.

In pursuant to the changes in “Byggteknisk forskrift,” effective from the 1 of July 2022, it will be stricter requirements for environmental documentation on construction projects (Lovdata, 2022) that will force manufacturers, suppliers, contractors, and builders to work with evidence for materials footprint. In this regulation, it is said that all types of material documentation must be submitted if they exist. It is no direct requirement for EPD on the materials, but it can be suggested that the information this tool provides is valuable in this context. It can also be seen as a competitive advantage in the industry to have this type of documentation available. In the near future, it may be a requirement to produce EPDs. Several informants speculated on this. In the analysis, it is mentioned several times that a supplier without EPD on their products will not be competitive in the future. That there is a risk of not being chosen as a supplier if there is a requirement for EPD and you do not have this available. According to Zabalza Bribián et al. (2011), EPD will also force manufacturers to produce more environmentally friendly products with low EPD, which increases competition between different actors.

According to the definition of green procurement provided by Rais et al. (2018): “*Procurement activities of products, services and works considering environmental criteria and standards that conserve the natural environment and resources which minimizes the negative impact of human activities*,” the transport of materials is a central part of “procurement activities” and should be taken into account when evaluating a construction project total environmental impact. Due to the complexity of construction projects, with many stakeholders involved and often long transport distances, transport emissions are often a significant part of a construction project´s total emissions. Therefore, to conclude that the construction project is sustainable and successful, the transport emissions must be minimized. A major problem mentioned by one of our informants is the lack of documentation on transport emissions of materials. This documentation should be included in the product's EPD, which it rarely does. If transport emissions had been included in the material’s EPD, it would be even easier to calculate a total environmental account of a project and minimize the emissions.

5.3.1 EPDs in relation to circular economy

To get a broader perspective of EPDs importance, we also want to discuss how it affects the circular economy, as EPDs can be considered essential measures in green procurement which is the first step in a circular economy. The circular economy has become a goal for the industry as it is one of the main contributors to material flows and waste generation.

According to Andersen et al. (2019), an EPD is only useful in the context of a circular economy if it contains an LCA analysis, which directly tells what and how the product should be treated at the end of life. In appendix 6, we see a typical EPD, which includes an LCA analysis where it is described in detail the amount that can be treated and how it should be managed when it no longer can be used as it was intended. Lack of consideration for waste management and waste reduction in the earlier phases of a construction project is mentioned as a barrier to a circular economy by Benachio et al. (2020). An EPD with an LCA analysis provides a good picture of the material´s potential for reuse and can be used as a basis for decision-making when choosing materials. Therefore, we can conclude that if the LCA analysis is included in the material's EPD, the EPD is valuable for those who process the material at the end of their lives and who must assess how and whether it is possible to reuse it. Reusing materials is one of the most desirable and important methods for waste minimization in the circular construction industry (Purchase et al., 2022). EPD and the respective LCA analysis of a product were considered important by a representative of a large recycling company.

Furthermore, Sparrevik et al. (2021) describe that using EPDs will enhance circularity in the long run. As EPDs enable builders to procure materials with the lowest emissions, suppliers will be encouraged to use more recycled materials to reduce their environmental impact. As a competitive advantage, the manufacturers will also improve their production processes with lower energy use and more sustainable transportation methods. Based on our empirical findings, we get the impression that EPDs are essential for manufacturers, wholesalers, suppliers, contractors, waste players, and clients to make choices related to the potential of recycling and reuse of building materials. Choosing materials that have a potential for reuse are required to be considered in the new amendment in "Byggteknisk forskrift" which enters into force on 1 July 2022 (Lovdata, 2022). Further, poorly

documented materials are challenging to sort and recycle. It was said that materials' potential for reuse and recycling is rarely described in today´s EPDs. This results in the need for a material analysis before further processing can begin, a time-consuming and costly process. Today is the code 170904, often the only documentation you get on building materials on how to treat them at the end of life. This is only a residual waste code, which does not really say much about the product's properties for further use. The EPD analysis of products is important to calculate material recovery versus incineration. In other words, look at the profitability difference concerning the environment by building new versus reuse.

5.3.2 What is preventing the use of EPDs?

According to Jónsdóttir et al. (2015) and Ibáñez-Forés et al. (2016), one of the most prominent challenges with EPDs is their existence. Although today we have far more EPDs available in the market, our analysis indicates that this is still a huge problem. As already discussed, it will be more important to document materials emissions in accordance with new legislation and building certifications. Today, construction firms are struggling to obtain this type of documentation. EPDs are sometimes requested, but it often stops there. We need to identify the cause, where the problem occurs and who is responsible.

When Backe as the main contractor receives a requirement from the client to deliver EPDs on the materials used in the construction project and passes this requirement on to its subcontractors and suppliers, they often experience that this documentation does not appear. This is usually because the manufacturers do not have EPD documentation on their materials. According to EPD Norway and EPD International databases, there are still very few materials that have an EPD. But this will change, more suppliers seem to establish so-called EPD calculators that can calculate CO_2 equivalents on their construction products. As many as four informants talked about being in the establishment phase regarding such a tool. One problem related to this EPD calculator is that it will only be possible to make a generic EPD and not an exact EPD. It is the material manufacturers who have the opportunity to calculate the precise EPD. The material manufacturers are often located abroad and do not have the exact requirements as the Norwegian construction companies. In China, for example, where large quantities of construction materials are produced, they are still in an early stage when it comes

to green procurement (Zhang et al., 2011) and EPD is therefore not particularly established.

According to the literature, there are problems related to market demand. That there are only building owners and contractors who request environmental documentation (Jónsdóttir et al., 2015). This corresponds with what we have found in our analysis. It is the client who primarily asks for EPDs. They are the ones who will hand over the building and be revised on sustainable performance. Based on our findings, EPD documentation is only requested in connection with building certifications, such as BREEAM, where environmental material documentation is required. In a survey done by Jónsdóttir et al. (2015) for IGBC, the result was the same. The majority of those who participated (28%) stated that the main driver for having an EPD is in connection with demand and requirements for building certifications. We can therefore conclude that EPD is mainly used as a documentation unit rather than an information unit. As a subcontractor or supplier, the information an EPD provide is not of interest and is something they do not consider when purchasing materials. They are more concerned about the material price. Therefore, they do not request this documentation either from their suppliers. All participants we have been in contact with stated that EPDs was not a selection criterion when choosing products/suppliers/manufacturers.

Few studies have investigated EPDs, and few have examined the issues Backe describes. As a way to dig deeper into why EPD is difficult to obtain, we have also investigated whether it is related to the nature of the product or investment costs. There have been several references in this thesis to the fact that the construction industry has extremely low margins and is under severe price pressure. Consequently, new investments are seldom prioritized (Sadri et al., 2022). Jónsdóttir et al. (2015) mention high investment costs as an obstacle to using EPD. According to our analysis, it is difficult to determine whether EPD investments reduce the already low profitability in the industry. Some claim it is an extra cost to create EPD documentation, while others do not. It can be difficult to determine for contractors, subcontractors, and clients as they often pay a total price for materials and installation. It is the manufacturers and suppliers who create the EPDs for the materials and products that can decide if it leads to an extra cost. These claim that there is an extra cost to this implementation but that it is a necessity to

participate in future projects and therefore no problem. We can therefore conclude that the cost of implementation does not greatly affect the existence of the EPD. Another factor that affects the existence of EPD is that the products with an EPD are often considered more expensive due to production in Europe, where stricter requirements are set for this type of documentation. Asian products, where there is less documentation of material emissions, are often cheaper than European products. According to our analysis, the European, sustainable manufacturers also often produce materials of higher quality, making it difficult to determine whether the product's price is determined by the degree of EPD data or quality. Based on our analysis, price trumps sustainability in the choice of materials. Therefore, if possible, cheaper material alternatives will be prioritized. In particular, this applies to contractors, subcontractors, and suppliers. The client is willing to pay more for products with EPD to some extent as they are revised on their sustainable performance.

We see a connection when it comes to EPD and the availability of sustainable products. The European "sustainable" producers are not able to satisfy the demand in the Norwegian market. Therefore, Norwegian suppliers are forced to buy materials from Asian manufacturers, who do not have EPD on their products. Delivery security is essential in this industry and is often described in the analysis as the most important criterion together with the price when selecting new products/suppliers.

Furthermore, other factors that may affect the use of EPDs are requirement specifications, and laws and regulations. In a BREEAM context, we see that EPD is not a requirement, but only an alternative to the type of documentation that the certification requires. Instead of an EPD, the product can have the Nordic Ecolabel, be ECO product, or have a datasheet stating that the product does not contain environmental toxins (Appendix 5). This means that actors do not necessarily have to use it and simply refrain from obtaining it. On the other hand, no laws today specifically state that EPDs must be submitted for projects. As previously mentioned, EPD is only collected if it is easily accessible or if strict requirements are set for it in contracts. However, today, there are a few of these requirements. Although such requirements are set for some projects, it is too easy to avoid them.

This can apply especially to private construction projects that do not have the same requirements and specifications as public projects (Boyne, 2002).

Another problem mentioned in the analysis is obstacles with EPD due to the complexity of the product. Sometimes a product contains countless different materials, making it very time-consuming and complicated to prepare an EPD. Several suppliers and manufacturers have not started with it. It also seems from the analysis that several actors do not quite know how to use the information the EPD provides and therefore do not necessarily see its effect and fail to obtain it. This problem is also mentioned as an obstacle by Jónsdóttir et al. (2015).

To increase the availability of EPDs, stricter requirements must be set for this type of information. This applies to all participating actors in a construction project. Not just the client, as it is today. Moreover, the analysis shows that the client is willing to pay more for products with a low EPD to a certain extent, thus as long as it is financially justifiable, which explains why some products with EPD receive more demand than others. Several suppliers we have contacted claimed that the client wanted low EPD (sustainable products) but was unwilling to pay for it. This was also mentioned as a problem for why some actors in Backe's supply chain did not bother to speed up the implementation and development of EPDs.

6.0 Conclusion

This chapter will present our conclusion to our qualitative master thesis. Firstly, we will explain the theoretical implications and answer our two research questions. Secondly, we will highlight practical implications, explaining how the study contributes to the industry. Lastly, we will present the limitations and recommendations for further research.

6.1 Theoretical implications

Existing literature on green procurement in construction projects is generally abundant, but our literature search revealed that the literature was scarce when we limited the search to the Norwegian construction industry. Our first research question, "*What barriers prevent green procurement in Norwegian construction projects, and what are the enablers to overcome these?"* was designed to identify

the most important barriers and enablers in Norwegian construction projects for comparison with existing literature. Our findings have theoretical implications as they confirm general and case-specific findings from existing literature in addition to specifying the most important enablers and barriers to green procurement in Norwegian construction projects. Moreover, we have identified relationships between barriers and made connections to the relevant enablers. We did not identify any new barriers or enablers that were specific to Norwegian construction projects. Furthermore, we shed light on green procurement in construction projects from a supply chain perspective, as our study involves upstream and downstream actors in relation to the main contractor. Our conclusion is that two of the biggest barriers to green procurement in Norwegian construction projects are "*Lack of documentation on environmental impact from building materials*" and "*Lack of a common unit and standardization of information."* They hamper the ability to make informed decisions from structured information. Further, we want to emphasize that these barriers are mostly related to the company's low margins and the lack of laws and regulations. The most important enablers to these two barriers are, in our opinion, "*standardization, implementation, and use of environmental and reusable data*" in combination with *"increased demand and stricter legal requirements for choosing environmental products and materials"* and "*inter-organizational collaboration, learning, and knowledge transfers."* The literature is scarce on topics related to standardization, implementation, the use of environmental data and reusable data, as well as green supplier development, and our thesis has thereby provided more insight to the theory.

As we received an early indication of problems related to the lack of EPD documentation, mentioned as a barrier to green procurement by Backe, we wanted with this master thesis to investigate this problem in more detail and shed light on the challenges and its impact on green procurement. Therefore, we wanted to answer a second research question: *What are the current challenges with Environmental Product Declarations (EPDs), and how are they affecting green procurement?* Our findings suggest that Environmental product declarations (EPDs) are essential to assess materials' environmental impact. Without concrete measures on CO_2 equivalents, it is not possible to determine whether a material decision is sustainable or not. Based on previous studies and our findings, there are major challenges in obtaining this type of documentation. Both Jónsdóttir et al.

(2015) and our analysis indicate that the biggest challenge is related to market demand. That there is only the client who requests this type of documentation when buildings are to be certified. There are many paths to building certification, and one does not necessarily need EPD data for this purpose, which results in their lack of existence. Further, our findings show that suppliers and subcontractors are more concerned about the material's price than sustainability, which means that the lowest price is often preferred as long as quality standards are satisfied. This often involves the purchase of materials without EPD data. Our analysis shows that there can also be challenges and time-consuming processes in creating this documentation on complex products. Ibáñez-Forés et al. (2016) and Jónsdóttir et al. (2015) also mention high implementation costs as a barrier to EPD implementation, but according to our analysis, this is not considered a relevant problem related to their existence. There are indications that EPD has an implementation cost but that having this type of documentation is a prerequisite for being competitive in the market. Furthermore, it is manufacturers and suppliers who must create EPDs on their products, and many of these stay abroad where the same requirements are not set for this type of documentation. There is a lack of legislation specifically dealing with EPD data, and it is difficult to predict whether it will be that in the future. The construction industry is constantly changing, and new forms of documentation can phase out EPD data. Our findings have theoretical implications as there is very little information available regarding EPD data that explains its importance and challenges. Our master thesis confirms the already stated problems and adds new information to the literature.

6.2 Practical implications

Our findings have practical implications for industry practitioners as we have identified barriers and enablers for green procurement in the Norwegian construction industry from a supply chain perspective. Current practices may not be applicable in the future as legislation becomes stricter and the geopolitical landscape changes. Further, global sourcing may be a less attractive option in the future, and we see a trend toward shorter construction supply chains as companies need a reliable source of supply. The Norwegian construction industry must find ways to increase the supply of green construction materials. Further, we believe that a simple framework for green sourcing and material selection that minimizes the environmental impact through the life cycle of a building should be developed.

Moreover, our findings have practical implications with respect to our second research question as they shed light on the importance of EPD documentation in construction projects. By addressing the current barriers and enablers, our thesis may act as a troubleshooter to solve the shortcoming of EPDs in the market. Furthermore, the implementation of new regulations applies a higher pressure on companies to provide data that can be used to calculate the environmental impact of the production of materials and transportation. Our findings may help companies to adapt to the new and future changes in legislation.

6.3 Limitations and recommendations for further research

There are several limitations to our study we want to address. First, we want to address the sample size and scope of our data collection. As construction projects involve many actors, we limited our upstream sample to mainly involve actors in the HVAC segment. However, our findings suggest that several suppliers and manufacturers in the HVAC segment also supply other category segments of the main contractor. As we also found that our results were consistent with the literature, we believe that our findings apply to other categories of the construction supply chain. Second, our sample size only consists of 11 actors in a construction supply chain. As many of our interviewees have managerial positions and work for companies that supply the biggest contractors in the Norwegian construction industry, our data quality may compensate for the sample size. Our third limitation is that our literature review mostly relies on international studies related to green procurement in the construction industry, which in our opinion, also is an opportunity for comparison. Lastly, a case study design may be a limitation as we are not directly comparing different contractors in the Norwegian construction industry.

Future research should investigate and clarify green procurement's role in the circular economy and how to utilize the information found in EPDs. Our master thesis has merely described the importance of EPD and its enablers and barriers. Moreover, Norwegian construction projects rely heavily on imports from undeveloped countries, and future research should investigate how local sourcing can become affordable and economically sustainable in the future. Lastly, more research should address how to optimize legislation, laws, and incentives from the government that transitions the industry to become greener and more circular.

References

Ageron, B., Gunasekaran, A., & Spalanzani, A. (2012). Sustainable supply management: An empirical study. *International Journal of Production Economics*, *140*(1), 168–182. https://doi.org/10.1016/j.ijpe.2011.04.007

Akadiri, P. O. (2015). Understanding barriers affecting the selection of sustainable materials in building projects. *Journal of Building Engineering*, *4*, 86–93. https://doi.org/10.1016/j.jobe.2015.08.006

Alqadami, A. T., Zawawi, N. A. W. A., Rahmawati, Y., Alaloul, W., & Alshalif, A. F. (2020). Key Success Factors of Implementing Green Procurement in Public Construction Projects in Malaysia. *IOP Conference Series. Earth and Environmental Science*, *498*(1). https://doi-org.ezproxy.library.bi.no/10.1088/1755-1315/498/1/012098

Alwan, Z., & Gledson, B. J. (2015). Towards green building performance evaluation using asset information modelling. *Built Environment Project and Asset Management*, *5*(3), 290–303. https://doi-org.ezproxy.library.bi.no/10.1108/BEPAM-03-2014-0020

Andersen, S. C., Larsen, H. F., Raffnsøe, L., & Melvang, C. (2019). Environmental Product Declarations (EPDs) as a competitive parameter within sustainable buildings and building materials. *IOP Conference Series: Earth and Environmental Science*, *323*(1), 012145. https://doi.org/10.1088/1755-1315/323/1/012145

Anuar, M. H. K., Khalil, N., & Bohari, A. A. M. (2021). Analysis of key criteria and requirements in implementing green procurement for green construction projects in Malaysia. *IOP Conference Series. Earth and Environmental Science*, *881*(1). http://dx.doi.org/10.1088/1755-1315/881/1/012002

AS Backe. (2022). *AS Backe—Bærekraft*. AS Backe. https://backe.no/slik-jobber-vi/baerekraft

Asplan Viak. (2019). *Bygg- og anleggssektorens klimagassutslipp*. https://www.bnl.no/siteassets/dokumenter/rapporter/klimautslipp_bae_2019.pdf

Barrese, J., Phillips, C., & Shoaf, V. (2020). Why do U.S. public companies continue to join the UN global compact: Ethics or economics? *International Studies of Management & Organization*, *50*(3), 209–231. https://doi.org/10.1080/00208825.2020.1811525

Bartunek, J. M., & Seo, M.-G. (2002). Qualitative Research Can Add New Meanings to Quantitative Research. *Journal of Organizational Behavior*, *23*(2), 237–242.

Bell, E., Bryman, A., & Harley, B. (2019). *Business Research Methods* (5th ed.). Oxford University Press.

Benachio, G. L. F., Freitas, M. do C. D., & Tavares, S. F. (2020). Circular economy in the construction industry: A systematic literature review. *Journal of Cleaner Production*, *260*, 121046. https://doi.org/10.1016/j.jclepro.2020.121046

Bilal, M., Khan, K. I. A., Thaheem, M. J., & Nasir, A. R. (2020). Current state and barriers to the circular economy in the building sector: Towards a mitigation framework. *Journal of Cleaner Production, 276*, 123250. https://doi.org/10.1016/j.jclepro.2020.123250

Blaikie, N. (2007). *Approaches to Social Enquiry: Advancing Knowledge*. Polity.

Bohari, A. A. M., Bidin, Z. A., Rais, S. L. A., & Saferi, M. M. (2019). Exploratory Research as the way forward towards a green procurement practices for the construction industry; Research Methodology. *IOP Conference Series. Earth and Environmental Science*, *385*(1). http://dx.doi.org/10.1088/1755-1315/385/1/012054

Bohari, A. A. M., Skitmore, M., Xia, B., & Teo, M. (2017). Green oriented procurement for building projects: Preliminary findings from Malaysia. *Journal of Cleaner Production*, *148*, 690–700. https://doi.org/10.1016/j.jclepro.2017.01.141

Boyne, G. A. (2002). Public and Private Management: What's the Difference? *Journal of Management Studies*, *39*(1), 97–122. https://doi.org/10.1111/1467-6486.00284

BRE Group. (2016, September 16). *About us*. https://bregroup.com/about-us/

BREEAM. (2016a, August 24). *What is BREEAM*. https://www.breeam.com/

BREEAM. (2016b, November 14). *Why Choose BREEAM? | BREEAM - Sustainability Assessment Method*. https://www.breeam.com/discover/why-choose-breeam/

Bryman, A., & Bell, E. (2015). *Business Research Methods* (4th ed.). Oxford University Press.

Bygballe, L. E., Grimsby, G., Engebretsen, B. E., & Reve, T. (2019). *En verdiskapende bygg-, anlegg- og eiendomsnæring (BAE): Oppdatering 2019* (Forskningsrapport No. 2). Handelshøyskolen BI. https://biopen.bi.no/bi-xmlui/bitstream/handle/11250/2629396/Forskningsrapport%202-2019.pdf?sequence=1&isAllowed=y

Bygballe, L. E., Jahre, M., & Swärd, A. (2010). Partnering relationships in construction: A literature review. *Journal of Purchasing and Supply Management*, *16*(4), 239–253. https://doi.org/10.1016/j.pursup.2010.08.002

Byggevare Industrien. (n.d.). *Veileder om materialvalg i BREEAM-prosjekter*. Retrieved May 2, 2022, from https://www.byggevareindustrien.no/nyheter-2018/veileder-om-materialvalg-i-breeam-prosjekter/

Chan, A. P. C., & Chan, A. P. L. (2004). Key performance indicators for measuring construction success. *Benchmarking: An International Journal*, *11*(2), 203–221. https://doi.org/10.1108/14635770410532624

Chen, P.-H., & Nguyen, T. C. (2019). A BIM-WMS integrated decision support tool for supply chain management in construction. *Automation in Construction*, *98*, 289–301. https://doi.org/10.1016/j.autcon.2018.11.019

Clarke, V., & Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology*, *12*(3), 297–298. https://doi.org/10.1080/17439760.2016.1262613

Clough, R. H., Sears, G. A., & Sears, S. K. (2000). *Construction Project Management*. John Wiley & Sons.

Curkovic, S., & Sroufe, R. (2011). Using ISO 14001 to promote a sustainable supply chain strategy. *Business Strategy and the Environment*, *20*(2), 71–93. https://doi.org/10.1002/bse.671

D. Pettersen, T. (2016). *Nordic guide to sustainable materials*. The Norwegian Green Building Council. https://byggalliansen.no/wp-content/uploads/2018/07/Nordic-Guide-to-Sustainable-Materials_report_WP3_final.pdf

De Wolf, C., Pomponi, F., & Moncaster, A. (2017). Measuring embodied carbon dioxide equivalent of buildings: A review and critique of current industry practice. *Energy and Buildings*, *140*, 68–80. https://doi.org/10.1016/j.enbuild.2017.01.075

Delmonico, D., Jabbour, C. J. C., Pereira, S. C. F., de Sousa Jabbour, A. B. L., Renwick, D. W. S., & Thomé, A. M. T. (2018). Unveiling barriers to sustainable public procurement in emerging economies: Evidence from a leading sustainable supply chain initiative in Latin America. *Resources, Conservation and Recycling*, *134*, 70–79. https://doi.org/10.1016/j.resconrec.2018.02.033

Deloitte. (2020). *Kunnskapsgrunnlag for nasjonal strategi for sirkulær økonomi – Delutredning 2 Barrierer for å utløse potensial for sirkulær økonomi i Norge*.

Direktoratet for byggkvalitet. (2021, July 1). https://dibk.no/regelverk/horinger/hoyringar/klimabaserte-energikrav-til-bygg/

Dubois, A., & Araujo, L. (2007). Case research in purchasing and supply management: Opportunities and challenges. *Journal of Purchasing and Supply Management*, *13*(3), 170–181. https://doi.org/10.1016/j.pursup.2007.09.002

Dubois, A., & Gadde, L.-E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, *55*(7), 553–560. https://doi.org/10.1016/S0148-2963(00)00195-8

Durão, V., Silvestre, J. D., Mateus, R., & de Brito, J. (2020). Assessment and communication of the environmental performance of construction products in Europe: Comparison between PEF and EN 15804 compliant EPD schemes. *Resources, Conservation and Recycling*, *156*, 104703. https://doi.org/10.1016/j.resconrec.2020.104703

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory Building from Cases: Opportunities and Challenges. *Academy of Management Journal*, *50*(1), 25–32. https://doi.org/10.5465/AMJ.2007.24160888

Ekeskär, A., Havenvid, M. I., Karrbom Gustavsson, T., & Eriksson, P. E. (2022). Construction logistics in a multi-project context: Coopetition among main contractors and the role of third-party logistics providers. *Construction*

Management and Economics, *40*(1), 25–40. https://doi.org/10.1080/01446193.2021.2012815

Eriksson, P. E., Volker, L., Kadefors, A., & Larsson, J. (2020). Collaborative Infrastructure Procurement in Sweden and the Netherlands. *International Transport Forum Discussion Papers*, 1,3-4,9-110.

Eriksson, P. E., & Westerberg, M. (2011). R. *International Journal of Project Management*, *29*(2), 197–208. https://doi.org/10.1016/j.ijproman.2010.01.003

Ershadi, M., Jefferies, M., Davis, P., & Mojtahedi, M. (2021a). Achieving Sustainable Procurement in Construction Projects: The Pivotal Role of a Project Management Office. *Construction Economics and Building*, *21*(1). http://dx.doi.org.ezproxy.library.bi.no/10.5130/AJCEB.v21i1.7170

Ershadi, M., Jefferies, M., Davis, P., & Mojtahedi, M. (2021b). Barriers to achieving sustainable construction project procurement in the private sector. *Cleaner Engineering and Technology*, *3*, 100125. https://doi.org/10.1016/j.clet.2021.100125

European Parliament. (2022, June 7). *Deal on common charger: Reducing hassle for consumers and curbing e-waste | News | European Parliament*. European Parliament. https://www.europarl.europa.eu/news/en/press-room/20220603IPR32196/deal-on-common-charger-reducing-hassle-for-consumers-and-curbing-e-waste

Fallahpour, A., Yazdani, M., Mohammed, A., & Wong, K. Y. (2021). Green sourcing in the era of industry 4.0: Towards green and digitalized competitive advantages. *Industrial Management & Data Systems*, *121*(9), 1997–2025. https://doi.org/10.1108/IMDS-06-2020-0343

Garsten, C., & Jacobsson, K. (2011). Transparency and legibility in international institutions: The UN Global Compact and post-political global ethics. *Social Anthropology/Anthropologie Sociale*, *19*(4), 378–393. https://doi.org/10.1111/j.1469-8676.2011.00171.x

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

Ghauri, P. N., & Grønhaug, K. (2005). *Research methods in business studies: A practical guide*. Pearson Education.

GlobalABC. (2020). *GlobalABC Roadmap for Buildings and Construction 2020-2050 Towards a zero-emission, efficient, and resilient buildings and construction sector*. United Nations Environment programme. http://globalabc.org/our-work/forging-regional-pathways-global-and-regional-roadmap

Górecki, J., Núñez-Cacho, P., Corpas-Iglesias, F. A., & Molina, V. (2019). How to convince players in construction market? Strategies for effective implementation of circular economy in construction sector. *Cogent Engineering*, *6*(1), 1690760. https://doi.org/10.1080/23311916.2019.1690760

Green, K., Morton, B., & New, S. (1996). Purchasing and Environmental Management: Interactions, Policies and Opportunities. *Business Strategy*

and the Environment, *5*(3), 188–197. https://doi.org/10.1002/(SICI)1099-0836(199609)5:3<188::AID-BSE60>3.0.CO;2-P

Grønn byggalianse. (2018). *MATERIALVEILEDER - Hvordan jobbe godt med materialvalg i BREEAM-NOR prosjekter*. https://www.byggevareindustrien.no/siteassets/dokumenter/materialveileder-breeam-nor.pdf

Guerra, B. C., & Leite, F. (2021). Circular economy in the construction industry: An overview of United States stakeholders' awareness, major challenges, and enablers. *Resources, Conservation and Recycling*, *170*, 105617. https://doi.org/10.1016/j.resconrec.2021.105617

Guerra, B. C., Shahi, S., Mollaei, A., Skaf, N., Weber, O., Leite, F., & Haas, C. (2021). Circular economy applications in the construction industry: A global scan of trends and opportunities. *Journal of Cleaner Production*, *324*, 129125. https://doi.org/10.1016/j.jclepro.2021.129125

Han, Y., Skibniewski, M. J., & Wang, L. (2017). A Market Equilibrium Supply Chain Model for Supporting Self-Manufacturing or Outsourcing Decisions in Prefabricated Construction. *Sustainability*, *9*(11), 2069. https://doi.org/10.3390/su9112069

Hart, J., Adams, K., Giesekam, J., Tingley, D. D., & Pomponi, F. (2019). Barriers and drivers in a circular economy: The case of the built environment. *Procedia CIRP*, *80*, 619–624. https://doi.org/10.1016/j.procir.2018.12.015

Hawkins, T. G., Gravier, M. J., & Powley, E. H. (2011). Public Versus Private Sector Procurement Ethics and Strategy: What Each Sector can Learn from the Other. *Journal of Business Ethics*, *103*(4), 567–586. https://doi.org/10.1007/s10551-011-0881-2

Hodari, D. (2021, September 23). Electric-Car Shift Drains Fuel Taxes in Some Countries; Officials in places like Norway and the U.K. are rethinking EV incentives and studying road-pricing systems. *Wall Street Journal (Online)*. http://www.proquest.com/docview/2575421596/citation/5382880ACB184352PQ/1

Hodges, C. P. (2005). A facility manager's approach to sustainability. *Journal of Facilities Management*, *3*(4), 312–324. https://doi.org/10.1108/14725960510630498

Hwang, B.-G., & Tan, J. S. (2012). Green building project management: Obstacles and solutions for sustainable development. *Sustainable Development*, *20*(5), 335–349. https://doi.org/10.1002/sd.492

Ibáñez-Forés, V., Pacheco-Blanco, B., Capuz-Rizo, S. F., & Bovea, M. D. (2016). Environmental Product Declarations: Exploring their evolution and the factors affecting their demand in Europe. *Journal of Cleaner Production*, *116*, 157–169. https://doi.org/10.1016/j.jclepro.2015.12.078

Jiang, X., Link to external site, this link will open in a new window, & Guo, X. (2020). Evaluation of Performance and Technological Characteristics of Battery Electric Logistics Vehicles: China as a Case Study. *Energies*, *13*(10), 2455. https://doi-org.ezproxy.library.bi.no/10.3390/en13102455

Jónsdóttir, S. B., Marteinsson, B., & Helga Jóhanna, B. (2015). *Nordic guide to sustainable materials | WP 3: Survey results – Knowledge and demand of EPD*. IGBC. https://byggalliansen.no/wp-content/uploads/2018/07/Nordic-Guide-to-Sustainable-Materials_report_WP2_final.pdf

Kadefors, A. (1995). Institutions in building projects: Implications for flexibility and change. *Scandinavian Journal of Management*, *11*(4), 395–408. https://doi.org/10.1016/0956-5221(95)00017-P

Kadefors, A., Lingegård, S., Uppenberg, S., Alkan-Olsson, J., & Balian, D. (2021). Designing and implementing procurement requirements for carbon reduction in infrastructure construction – international overview and experiences. *Journal of Environmental Planning and Management*, *64*(4), 611–634. https://doi.org/10.1080/09640568.2020.1778453

Kalmykova, Y., Sadagopan, M., & Rosado, L. (2018). Circular economy – From review of theories and practices to development of implementation tools. *Resources, Conservation and Recycling*, *135*, 190–201. https://doi.org/10.1016/j.resconrec.2017.10.034

Kaur, A., & Lodhia, S. K. (2019). *Sustainability accounting, accountability and reporting in the public sector: An overview and suggestions for future research - ProQuest*. https://www.proquest.com/docview/2277888192?parentSessionId=Gy0j3aiagFUOOAFqp2M%2BLzoYcoDpofGYWlv5Gt8Gw3c%3D&pq-origsite=primo&accountid=142923

Khahro, S. H., Memon, A. H., Memon, N. A., Arsal, A., & Ali, T. H. (2021). Modeling the Factors Enhancing the Implementation of Green Procurement in the Pakistani Construction Industry. *Sustainability*, *13*(13), 7248. https://doi.org/10.3390/su13137248

Khan, M. W. A., Ng, H. T., Kuang, L. C., Darun, M. R., Mehfooz, U., & Khamidi, M. F. (2018). Green Procurement in Construction Industry: A Theoretical Perspective of Enablers and Barriers. *MATEC Web of Conferences*, *203*. http://dx.doi.org/10.1051/matecconf/201820302012

Khoso, A. R., Yusof, A. M., Chen, Z.-S., Skibniewski, M. J., Chin, K.-S., Khahro, S. H., & Sohu, S. (2022). Comprehensive analysis of state-of-the-art contractor selection models in construction environment-A critical review and future call. *Socio-Economic Planning Sciences*, *79*, 101137. https://doi.org/10.1016/j.seps.2021.101137

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular Economy: The Concept and its Limitations. *Ecological Economics*, *143*, 37–46. https://doi.org/10.1016/j.ecolecon.2017.06.041

Krause, D. R., Vachon, S., & Klassen, R. D. (2009). Special Topic Forum on Sustainable Supply Chain Management: Introduction and Reflections on the Role of Purchasing Management*. *Journal of Supply Chain Management*, *45*(4), 18–25. https://doi.org/10.1111/j.1745-493X.2009.03173.x

Lewis, K. V., Cassells, S., & Roxas, H. (2015). SMEs and the Potential for A Collaborative Path to Environmental Responsibility. *Business Strategy and the Environment*, *24*(8), 750–764. https://doi.org/10.1002/bse.1843

Lindblad, H., & Karrbom Gustavsson, T. (2021). Public clients ability to drive industry change: The case of implementing BIM. *Construction Management and Economics*, *39*(1), 21–35. https://doi.org/10.1080/01446193.2020.1807032

Lingegård, S., Havenvid, M. I., & Eriksson, P.-E. (2021). Circular Public Procurement through Integrated Contracts in the Infrastructure Sector. *Sustainability*, *13*(21), 11983. https://doi.org/10.3390/su132111983

Liu, L., Zhang, M., Hendry, L. C., Bu, M., & Wang, S. (2018). Supplier Development Practices for Sustainability: A Multi-Stakeholder Perspective. *Business Strategy and the Environment*, *27*(1), 100–116. https://doi.org/10.1002/bse.1987

Lovdata. (2022, June 1). *Forskrift om endring i forskrift om tekniske krav til byggverk (Byggteknisk forskrift)—Lovdata*. https://lovdata.no/dokument/LTI/forskrift/2022-05-29-945

Mantere, S., & Ketokivi, M. (2013). 'Reasoning in Organiza- tional Science.' *Academy of Management Review*, *38*(1), 70–89.

McKinsey. (2021, July 14). *Call for action: Seizing the decarbonization opportunity in construction*. https://www.mckinsey.com/industries/engineering-construction-and-building-materials/our-insights/call-for-action-seizing-the-decarbonization-opportunity-in-construction

McMurray, A. J., Islam, Md. M., Siwar, C., & Fien, J. (2014). Sustainable procurement in Malaysian organizations: Practices, barriers and opportunities. *Journal of Purchasing and Supply Management*, *20*(3), 195–207. https://doi.org/10.1016/j.pursup.2014.02.005

Meehan, J., & Bryde, D. (2011). Sustainable procurement practice. *Business Strategy and the Environment*, *20*(2), 94–106. https://doi.org/10.1002/bse.678

Miemczyk, J., Johnsen, T. E., & Macquet, M. (2012). Sustainable purchasing and supply management: A structured literature review of definitions and measures at the dyad, chain and network levels. *Supply Chain Management: An International Journal*, *17*(5), 478–496. https://doi.org/10.1108/13598541211258564

Miljøfyrtårn. (2019, May 29). *Avansert søk sertifiseringskriterier | Stiftelsen Miljøfyrtårn*. Miljøfyrtårn. https://www.miljofyrtarn.no/sok-sertifiseringskriterier/

Mokhlesian, S. (2014). How Do Contractors Select Suppliers for Greener Construction Projects? The Case of Three Swedish Companies. *Sustainability*, *6*(7), 4133–4151. https://doi.org/10.3390/su6074133

Morris, A. S. (2004). *ISO 14000 environmental management standards: Engineering and financial aspects*. John Wiley & Sons.

Nikolaisen, H. V. (2021, October 14). *Statsbygg: Energikravene til bygg bør være minst på passivhusnivå*. Tu.No. https://www.tu.no/artikler/statsbygg-gi-byggebransjen-strengere-klimakrav/514243

Norwegian Green Building Council. (n.d.). Nysgjerrig på BREEAM-NOR? *Grønn byggallianse*. Retrieved May 2, 2022, from https://byggalliansen.no/sertifisering/om-breeam/nysgjerrig-pa-breeam-nor/

NTB. (2022, June 5). *Firmaer kritiserer regjeringen – etterlyser strengere klimakrav til byggenæringen*. Www.Dn.No. https://www.dn.no/bygg-og-anlegg/eiendom/byggebransjen/firmaer-kritiserer-regjeringen-etterlyser-strengere-klimakrav-til-byggenaringen/2-1-1232187

Nußholz, J. L. K., Nygaard Rasmussen, F., & Milios, L. (2019). Circular building materials: Carbon saving potential and the role of business model innovation and public policy. *Resources, Conservation and Recycling*, *141*, 308–316. https://doi.org/10.1016/j.resconrec.2018.10.036

Orderud, G. I., & Naustdalslid, J. (2020). Climate change adaptation in Norway: Learning–knowledge processes and the demand for transformative adaptation. *International Journal of Sustainable Development & World Ecology*, *27*(1), 15–27. https://doi.org/10.1080/13504509.2019.1673500

Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., & Jaca, C. (2018). Circular Economy in Spanish SMEs: Challenges and opportunities. *Journal of Cleaner Production*, *185*, 157–167. https://doi.org/10.1016/j.jclepro.2018.03.031

Passer, A., Lasvaux, S., Allacker, K., De Lathauwer, D., Spirinckx, C., Wittstock, B., Kellenberger, D., Gschösser, F., Wall, J., & Wallbaum, H. (2015). Environmental product declarations entering the building sector: Critical reflections based on 5 to 10 years experience in different European countries. *The International Journal of Life Cycle Assessment*, *20*(9), 1199–1212. https://doi.org/10.1007/s11367-015-0926-3

Pesämaa, O., Eriksson, P. E., & Hair, J. F. (2009). Validating a model of cooperative procurement in the construction industry. *International Journal of Project Management*, *27*(6), 552–559. https://doi.org/10.1016/j.ijproman.2008.10.007

Purchase, C. K., Al Zulayq, D. M., O'Brien, B. T., Kowalewski, M. J., Berenjian, A., Tarighaleslami, A. H., & Seifan, M. (2022). Circular Economy of Construction and Demolition Waste: A Literature Review on Lessons, Challenges, and Benefits. *Materials*, *15*(1), 76. https://doi.org/10.3390/ma15010076

Rais, S. L. A., Bidin, Z. A., Bohari, A. A. M., & Saferi, M. M. (2018). The Possible Challenges of Green Procurement Implementation. *IOP Conference Series. Materials Science and Engineering*, *429*(1). http://dx.doi.org/10.1088/1757-899X/429/1/012023

Ramlee, N., Tammy, N. J., Raja Mohd Noor, R. N. H., Ainun Musir, A., Abdul Karim, N., Chan, H. B., & Mohd Nasir, S. R. (2016). *Critical success factors for construction project*. 030011. https://doi.org/10.1063/1.4965067

Roehrich, J. K., Hoejmose, S. U., & Overland, V. (2017). Driving green supply chain management performance through supplier selection and value internalisation: A self-determination theory perspective. *International Journal of Operations & Production Management*, *37*(4), 489–509. https://doi.org/10.1108/IJOPM-09-2015-0566

Sadri, H., Pourbagheri, P., & Yitmen, I. (2022). Towards the implications of Boverket's climate declaration act for sustainability indices in the Swedish construction industry. *Building and Environment*, *207*, 108446. https://doi.org/10.1016/j.buildenv.2021.108446

Saferi, M. M., Bohari, A. A. M., Bidin, Z. A., & Rais, S. L. A. (2018). Green Procurement for Construction Project: The Roles of Stakeholder Values. *IOP Conference Series. Materials Science and Engineering*, *429*(1). http://dx.doi.org/10.1088/1757-899X/429/1/012024

Samar, A. S., Link to external site, this link will open in a new window, Rajbir, K., Filiz, E., Bothinah, A., Arati, B., & Gerhard-Wilhelm, W. (2020). Measuring carbon performance for sustainable green supply chain practices: A developing country scenario. *Central European Journal of Operations Research: CEJOR*, *28*(4), 1389–1416. https://doi-org.ezproxy.library.bi.no/10.1007/s10100-020-00673-x

Samimi, A., Rahimi, E., Amini, H., & Jamshidi, H. (2019). FREIGHT MODAL POLICIES TOWARD A SUSTAINABLE SOCIETY. *Scientia Iranica*, *0*(0), 0–0. https://doi.org/10.24200/sci.2019.21386

Sanchez, A. X., Lehtiranta, L. M., & Hampson, K. D. (2015). Use of contract models to improve environmental outcomes in transport infrastructure construction. *Journal of Environmental Planning and Management*, *58*(11), 1923–1943. https://doi.org/10.1080/09640568.2014.969832

Santana, G. (1990). Classification of construction projects by scales of complexity. In *International Journal of Project Management* (Vol. 8, pp. 102–104). Butterworth & Co. (Publishers) Ltd.

Schneider, L., & Wallenburg, C. M. (2012). Implementing sustainable sourcing—Does purchasing need to change? *Journal of Purchasing and Supply Management*, *18*(4), 243–257. https://doi.org/10.1016/j.pursup.2012.03.002

Sears, S. K., Sears, G. A., Clough, R. H., Rounds, J. L., & Segner, R. O. (2015). *Construction Project Management*. John Wiley & Sons, Incorporated. http://ebookcentral.proquest.com/lib/bilibrary/detail.action?docID=1895571

Segerstedt, A., & Olofsson, T. (2010). Supply chains in the construction industry. *Supply Chain Management*, *15*(5), 347–353. https://doi-org.ezproxy.library.bi.no/10.1108/13598541011068260

Shen, L., Zhang, Z., & Long, Z. (2017). Significant barriers to green procurement in real estate development. *Resources, Conservation and Recycling*, *116*, 160–168. https://doi.org/10.1016/j.resconrec.2016.10.004

Simenergi. (2021). Ny TEK møter ikke fremtidens energikrav. *Ny TEK møter ikke fremtidens energikrav*. https://simenergi.no/ny-tek-moter-ikke-fremtidens-energikrav/

Simion, C.-P., Nicolescu, C., & Vrîncuț, M. (2019). Green Procurement in Romanian Construction Projects. A Cluster Analysis of the Barriers and Enablers to Green Procurement in Construction Projects from the Bucharest-Ilfov Region of Romania. *Sustainability*, *11*(22), 6231. https://doi.org/10.3390/su11226231

Sintef. (2020). *Framsikt 2015—Hvordan ser framtidens bygg- og anleggsnæring ut?* https://www.sintef.no/contentassets/ccf2bfe7339a4a75af3a5a8bfafdccff/framsikt-2050-rapport.pdf

Sparrevik, M., de Boer, L., Michelsen, O., Skaar, C., Knudson, H., & Fet, A. M. (2021). Circular economy in the construction sector: Advancing environmental performance through systemic and holistic thinking. *Environment Systems and Decisions*, *41*(3), 392–400. https://doi.org/10.1007/s10669-021-09803-5

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. https://doi.org/10.1111/j.1468-2370.2007.00202.x

SSB. (2021, April 10). *Innovasjon i næringslivet*. SSB. https://www.ssb.no/teknologi-og-innovasjon/forskning-og-innovasjon-i-naeringslivet/statistikk/innovasjon-i-naeringslivet

SSB. (2022a). *Backe Entreprenør Holding AS - 995422964—Lysaker—Se Regnskap, Roller og mer*. https://www.proff.no/selskap/backe-entrepren%C3%B8r-holding-as/lysaker/hovedkontortjenester/IGGND9W10NZ/

SSB. (2022b). *Næringenes økonomiske utvikling*. SSB. https://www.ssb.no/virksomheter-foretak-og-regnskap/virksomheter-og-foretak/statistikk/naeringenes-okonomiske-utvikling

Stentoft Arlbjørn, J., & Vagn Freytag, P. (2012). Public procurement vs private purchasing: Is there any foundation for comparing and learning across the sectors? *International Journal of Public Sector Management*, *25*(3), 203–220. https://doi.org/10.1108/09513551211226539

Sterner, E. (2002). 'Green procurement' of buildings: A study of Swedish clients' considerations. *Construction Management and Economics*, *20*(1), 21–30. https://doi.org/10.1080/01446190110093560

Tamannaei, M., Zarei, H., & Rasti-Barzoki, M. (2021). A game theoretic approach to sustainable freight transportation: Competition between road and intermodal road–rail systems with government intervention. *Transportation Research Part B: Methodological*, *153*, 272–295. https://doi.org/10.1016/j.trb.2021.09.002

Teddlie, C., & Yu, F. (2007). Mixed Methods Sampling: A Typology With Examples. *Journal of Mixed Methods Research*, *1*(1), 77–100. https://doi.org/10.1177/1558689806292430

Tserng, H. P., Yin, S. Y. L., & Li, S. (2006). Developing a Resource Supply Chain Planning System for Construction Projects. *Journal of Construction Engineering and Management*, *132*(4), 393–407. https://doi.org/10.1061/(ASCE)0733-9364(2006)132:4(393)

UN Global Compact Norge. (n.d.). *Om UN Global Compact Norge*. UN Global Compact Norway. Retrieved May 2, 2022, from https://globalcompact.no/om-oss/

Varnäs, A., Balfors, B., & Faith-Ell, C. (2009). Environmental consideration in procurement of construction contracts: Current practice, problems and opportunities in green procurement in the Swedish construction industry. *Journal of Cleaner Production*, *17*(13), 1214–1222. https://doi.org/10.1016/j.jclepro.2009.04.001

Vennström, A., & Eriksson, P. E. (2010). Client perceived barriers to change of the construction process. *Construction Innovation*, *10*(2), 126–137. https://doi-org.ezproxy.library.bi.no/10.1108/14714171011037156

Winch, G. M. (2009). *Managing Construction Projects*. John Wiley & Sons, Incorporated. http://ebookcentral.proquest.com/lib/bilibrary/detail.action?docID=698479

Wong, J. K. W., Chan, J. K. S., & Wadu, M. J. (2016). Facilitating effective green procurement in construction projects: An empirical study of the enablers. *Journal of Cleaner Production*, *135*, 859–871. https://doi.org/10.1016/j.jclepro.2016.07.001

Yin, R. K. (2014). *Case Study Research: Design and Methods* (5th ed.). SAGE Publications.

Zabalza Bribián, I., Valero Capilla, A., & Aranda Usón, A. (2011). Life cycle assessment of building materials: Comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential. *Building and Environment*, *46*(5), 1133–1140. https://doi.org/10.1016/j.buildenv.2010.12.002

Zhang, L., Long, R., Huang, Z., Li, W., & Wei, J. (2020). Evolutionary game analysis on the implementation of subsidy policy for sustainable transportation development. *Journal of Cleaner Production*, *267*, 122159. https://doi.org/10.1016/j.jclepro.2020.122159

Zhang, X., Platten, A., & Shen, L. (2011). Green property development practice in China: Costs and barriers. *Building and Environment*, *46*(11), 2153–2160. https://doi.org/10.1016/j.buildenv.2011.04.031

Zimmer, K., Fröhling, M., & Schultmann, F. (2015). Sustainable supplier management – a review of models supporting sustainable supplier selection, monitoring and development. *International Journal of Production Research*, *54*(5), 1412–1442. https://doi.org/10.1080/00207543.2015.1079340

Zou, P. X. W., Zhang, G., & Wang, J. (2007). Understanding the key risks in construction projects in China. *International Journal of Project Management*, *25*(6), 601–614. https://doi.org/10.1016/j.ijproman.2007.03.001

Zwikael, O. (2009). Critical planning processes in construction projects. *Construction Innovation*, *9*(4), 372–387. https://doi.org/10.1108/14714170910995921

Appendices

Appendix 1: Interview Guide – Purchasers and Sustainability Managers across the construction supply chain

Forskningsspørsmål: RQ1: *What barriers prevent green procurement in Norwegian construction projects, and what are the enablers to overcome these?* RQ2: *What are the current challenges with Environmental Product Declarations (EPDs), and how are they affecting green procurement?*
Innledning: Vi er to masterstudenter ved Handelshøyskolen BI som skriver en masteroppgave om barrierer og muliggjørere for grønne innkjøp ved norske byggeprosjekter som beskrives som komplekse og omfattende prosesser. Fokuset vårt er på hvordan innhenting av miljødata er i dag, hva som gjør det komplisert og hvordan samarbeidet på tvers av verdikjeden fungerer med tanke på bærekraftige innkjøp. Målet med oppgaven er å se på løsninger på hvordan man kan sikre at innkjøpene er bærekraftige, da litteraturen antyder at det ikke er fullstendig kontroll over disse prosessene. Vi har fokus på manglende miljødata (EPD) og hvordan dette påvirker grønne innkjøp.
Spørsmål
Hvordan bestiller dere varer idag? (mail, telefon, nett)
Hvilken produkt-informasjon får dere på miljø (Utslipp etc.) når dere bestiller varer?
Hvilke problemer er knyttet til innhenting av miljødata slik du ser det?
Hvilke kriterier legger dere til grunn når nye leverandører\produkter skal velges?
Hvilke utfordringer står denne miljøproblematikken ovenfor frem i tid?
Benytter dere standarder? Isåfall, hvilke standarder benytter dere for å sikre bærekraftige innkjøp?
Hvordan sikrer dere at leverandører og underleverandører følger samme miljøkriterier og standarder som dere selv?
Hvem bør etter deres mening etterspør bærekraftige produkter? Er det alltid byggherre, eller opplever dere også at Entreprenører etterspør?
Er byggherre villig til å betale mer for produkter som har EPD eller er bærekraftige? Er disse produktene dyrere i innkjøp?

Hvordan vurderer dere bærekraft opp mot kostnad og tilgjengelighet når dere bestiller varer?
Hvordan vurderer deres leverandører bærekraft opp mot kostnad og tilgjengelighet når de bestiller varer ?
Hvordan ser du for deg at den optimale løsningen på å sikre bærekraftige innkjøp vil være i fremtiden?

Appendix 2: Interview Guide – Representative for a software company within construction

Forskningsspørsmål: RQ1: *What barriers prevent green procurement in Norwegian construction projects and what are the enablers to overcome these?* RQ2: *What are the current challenges with Environmental Product Declarations (EPDs) and how are they affecting green procurement?*
Innledning: Vi er to masterstudenter ved Handelshøyskolen BI som skriver en masteroppgave om barrierer og muliggjørere for grønne innkjøp ved norske byggeprosjekter som beskrives som komplekse og omfattende prosesser. Fokuset vårt er på hvordan innhenting av miljødata er i dag, hva som gjør det komplisert og hvordan samarbeidet på tvers av verdikjeden fungerer med tanke på bærekraftige innkjøp. Målet med oppgaven er å se på løsninger på hvordan man kan sikre at innkjøpene er bærekraftige, da litteraturen antyder at det ikke er fullstendig kontroll over disse prosessene. Vi har fokus på manglende miljødata (EPD) og hvordan dette påvirker grønne innkjøp.
Spørsmål
Hvordan type dokumentasjon på miljødata på produktnivå mottar dere? (EPD, Svane-merket, etc)
Opplever dere store dokumentasjonsavvik på miljødata idag?
Er det noen utfordringer knyttet dokumentasjonsinnhenting på miljødata?
Opplever dere store dokumentasjonsavvik innenfor VVS sektoren?
Opplever dere at enkelte ikke klarer å oppdrive ønsket dokumentasjon?
Har du informasjon om hva som eventuelt blir gjort dersom miljødata ikke er mulig å oppdrive for et enkelt produkt?

Appendix 3: Interview Guide – Recycling Managers

Forskningsspørsmål: RQ1: *What barriers prevent green procurement in Norwegian construction projects and what are the enablers to overcome these?* RQ2: *What are the current challenges with Environmental Product Declarations (EPDs) and how are they affecting green procurement?*
Innledning: Vi er to masterstudenter ved Handelshøyskolen BI som skriver en masteroppgave om barrierer og muliggjørere for grønne innkjøp ved norske byggeprosjekter som beskrives som komplekse og omfattende prosesser. Fokuset vårt er på hvordan innhenting av miljødata er i dag, hva som gjør det komplisert og hvordan samarbeidet på tvers av verdikjeden fungerer med tanke på bærekraftige innkjøp. Målet med oppgaven er å se på løsninger på hvordan man kan sikre at innkjøpene er bærekraftige, da litteraturen antyder at det ikke er fullstendig kontroll over disse prosessene. Vi har fokus på manglende miljødata (EPD) og hvordan dette påvirker grønne innkjøp.
Spørsmål
Er EPD eller annen produktdata viktig for at byggebransjen skal bli mer sirkulær? Kan du utdype hvordan?
Opplever dere at det mangler dokumentasjon på byggematerialer som vanskeliggjør gjenvinning?
Hvordan resirkulerer dere eventuelle materialer som mangler miljødata og som ikke regnes som standard produkt?
Tror dere et samarbeid mellom innkjøpsavdelingen i byggeprosjekter og selskaper med kompetanse innenfor gjenbruk, reparasjon, reproduksjon og resirkulering kan øke bærekraften i byggeprosjekter?
Hva er deres mening den største barrieren knyttet sirkulær økonomi i norsk byggenæring?

Appendix 4: Formulated codes in NVivo that we used to form themes.

Codes	Description
Availability	Availability of materials and products
BREEAM	Related to BREEAM certified projects
Communication	Emphasizing communication
Contract speficiations	In relation to requirements and specifications in contracting
Customer Demand	Emphasizing demand from customer
Demand for green procurement	In relation to demand for green procurement
EPD generator	Mentioning development or use of a tool for creating EPDs
Evaluation	Evaluation practices
Focus on green procurement	Organizations focus on green procurement
Suppliers' focus	Suppliers focus on green procurement
Generic vs Specific Data	Mention use of generic or specific data
Information flow	How information in the organization flows
Legislation and law enforcement	How the organization regard legalisation and law enforcement
Measurebility	How easy it is to measure something , in relation to KPI
Procurement compliance	Procurement compliance in the organization
Price vs quality availability sustainability	How a procurement professional emphasizes price vs availability vs sustainability
Suppliers focus on price vs	How their supplier focus on price vs availability vs sustainability
Supplier selection	Supplier selection processes
Procurement method	Most utilized communication platform in procurement
Contract	Communication through contracts
E-mail	Communication through email
Internet & ERP	Communication through internet and ERP
Phone	Communication through phone
Subcontracting	Communication through subcontracting
Product Data	In what degree they receive product data
Enforcement	In relation to missing environmental product data
Environmental product Data	In relation to missing environmental product data
Barrier	
EPD	Mentioned barrier
Importance of documentation	
Lack of documentation	Barrier
Problems collecting data	Barrier
Requested	Barrier
Solutions	Enablers
Product function, quality	What type of information they receive
Product Legal requirement	Information related to products legal requirement
Product Quality compliance	Information related to product quality compliance

Profitability	Information related profitability
Recycling reuse and circular economy	Information related to reuse and circular economy
SC visibility	Supply chain visibility
Assortment, SKU	How big their assortment is
Environmental certification schemes	Use of
Enforcement supplier	How they assure that their suppliers has the same standards
Sustainable procurement	Sustainable procurement
Solutions	Enablers
Time and money	Green Procurement is time and money
Transportation EPD data	EPD data from transportation
Willingness to change	Willingness to change
Willingness to pay sustainability	Willingness to pay sustainability
Price level	Price level

Appendix 5: Secondary information (Reports, websites, etc)

BREEAM

BREEAM is an international scheme that provides independent third-party certification for assessing the sustainability performance of individual buildings, communities, and infrastructure projects .

Throughout the built environment lifecycle, from new construction to in-use and refurbishment, BREEAM recognizes and reflects the benefits of higher-performing assets. REEAM certifies the environmental, social, and economic sustainability performance of an asset using standards developed by BRE, an innovative group of scientists, engineers, researchers, and technicians (BRE Group, 2016).

BREEAM-rated developments enhance the well-being of people who live and work in them, protect natural resources and make investment properties more attractive (BREEAM, 2016a).

By demonstrating sustainable performances during planning, design, construction, operation, or renovation, BREEAM contributes to managing risk for clients, lowering running costs, maximizing market value, and attracting and retaining tenants with desirable spaces (BREEAM, 2016b).

In a BREEAM-certified assessment, the rating is the main output. Based on the standard and its benchmarks, a certified rating measures the performance of a project and its stakeholders. The ratings range from pass to good, very good, excellent, and outstanding (D. Pettersen, 2016). For every level, the building´s sustainability rating increases. BREEAM-NOR, the Norwegian version of BREEAM, ensures that the nine most important aspects of sustainability are taken into account: management, health, and indoor environment, energy, transportation, water, materials, waste, land use, and ecology and pollution. In each category, there are topics with criteria or measures one can take to reduce the environmental impact of the building. The more measures you take, the more points you get and the higher certification level the building achieves (Norwegian Green Building Council, n.d.).

Materials involve the purchase, selection, and documentation of materials. To get a BREEAM certification for a project, there are two minimum criteria that must be satisfied by the supplier and manufacturer:

1. Check whether the product is covered by the requirements in the BREEAM-NOR courses HEA 02 Indoor air quality, MAT 01 Sustainable material selection, and MAT 03 Responsible procurement of materials (Byggevare Industrien, n.d.).

2. If the product is covered by the requirements, it must be possible to submit documentation showing that the product satisfies these (Byggevare Industrien, n.d.). The documentation can, for example, be Nordic ecolabel, ECO product, EPD, or a datasheet telling that the product does not contain environmental toxins (Grønn byggalianse, 2018).

ISO 14000

ISO 14000 is a global term for a set of standards made to help organizations reduce their environmental impact. Within ISO 14000, ISO 14001 represents the fundamental standard for good practice in environmental management. ISO 14001 describes the numerous requirements that must be met to establish a successful EMS that reduces the risk of pollution events and other forms of environmental damage caused by a company´s operations and activities (Morris, 2004).

Because the clauses are written in a general manner, ISO 14001 can be used in a variety of industries and under a variety of geographical and social conditions. Therefore, ISO 14001 is not a recipe for implementing procedures in specific scenarios, and environmental emission targets are only set to the minimum defined in legislation. Common environmental minimum targets set by legislation are often about air and water pollution, waste management, and waste reduction. ISO 14001 recognizes that achieving specific environmental goals must be balanced against the cost of achieving those goals and the company's financial well-being. Therefore, ISO 14001 advises companies to set reasonably achievable goals (Morris, 2004). There are several reasons speaking for the implementation of ISO 14001; Improved environmental performance, improved stakeholder satisfaction, improved internal management methods, competitive improvements in certain markets, avoiding a potential non-tariff trade barrier, fewer regulatory inspections, reduced overhead costs, probable reduction in regulatory noncompliance and associated image (Curkovic & Sroufe, 2011). In the face of these benefits, ISO 14001 is associated with uncertainty and controversy. A common criticism is that the ISO 14001 standard is not connected directly enough with environmental performance and has a limited focus on continuous improvement. ISO 14001 cannot assess how well a company is integrating environmental requirements into the company's overall business planning. Further, to register for ISO 14001, it is not required that companies demonstrate compliance and that stakeholders are satisfied. Therefore, a registered company can produce a substantial amount of waste and pollution. The registration process is also costly for companies, and a strong positive relationship between improved environmental performance and strong corporate performance has not been shown (Curkovic & Sroufe, 2011). The main reason companies are registering for ISO 14001 is because their industrial customers are demanding it. The largest industrial actors require suppliers to be ISO 14001 registered and are not trading with companies that are not (Curkovic & Sroufe, 2011).

Miljøfyrtårn

Miljøfyrtårn (Eco-Lighthouse) is a Norwegian certification scheme as well as Norway´s most widely used environmental management system with almost 6700 valid certificates (Miljøfyrtårn, 2019). Miljøfyrtårn is recognized by the European Commission, implying the certification scheme is a standardization equivalent to ISO 14001 and EMAS.

To become certified by Miljøfyrtårn, a company must satisfy the general industry criterion, landlord and tenant criterion as well as the specific industry criteria (Miljøfyrtårn, 2019). The general criterion is divided into 7 categories: System, work environment, procurement, transport, waste, aesthetics, and additional environmental aspects. For the scope of this thesis, the procurement criterion is of high relevance. For the HVAC industry, there are 3 criteria specified for procurement, where two are required by legislation. Miljøfyrtårn ID 416 states that a company must influence its supplier´s solutions that optimize temperature control and energy usage (Miljøfyrtårn, 2019).

UN Global Compact

UN Global Compact is an organization within the UN for sustainable business and is the world´s biggest business initiative for sustainability with over 12 354 business members within 160 countries. To become a member, the organization must follow 10 principles stated by UN Global Compact and deliver a report each year. The 10 principles are within human rights, working environment, anti-corruption, and environment (UN Global Compact Norge, n.d.).

UN Global Compact has received critics for the low barriers to joining, and no enforcement of compliance. Some critics are even suggesting companies are joining because of economic incentives instead of ethics. Barrese et al. (2020) found a positive significant increase in sales outside the US for companies joining UN Global Compact. They also found a subsequent increase in environmental strengths and social strengths, and concluded that organizational learning in the sustainability area is improved by joining UN Global Compact (Barrese et al., 2020). Despite its critics of low level of enforcement and "soft rules for hard issues," UN Global Compact membership requires that the company delivers a COP report, communication of progress, that is available for the public. Members that fail to deliver this report result in a change in participant status and possible expulsion. Companies risk public shaming and serious reputational losses if they fail to meet high ethical standards (Garsten & Jacobsson, 2011). Today, transparency tools act as an accountability tool, allowing companies to get their corporate social responsibility rubberstamped, reducing the complex social reality and ethical challenges into a manageable format. More complex supply chain issues may not

receive the proper attention and risk being pushed aside. Today´s CSR practices risk “giving an impression” rather than actual performance when the performance of ethics is tied with market value, brand reputation, and corporate positioning (Garsten & Jacobsson, 2011).

Appendix 6: Example of an EPD

ver1 2015

epd-norge.no
The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Hydro Aluminium AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-2265-1034-EN
Registration number:	NEPD-2265-1034-EN
ECO Platform reference number:	-
Issue date:	18.06.2020
Valid to:	18.06.2025

Hydro Aluminium Primary Foundry Alloys Europe Si content > 8%

Hydro Aluminium AS

www.epd-norge.no

General information

Product:
Hydro Aluminium Primary Foundry Alloys Europe, Si content >8%

Owner of the declaration:
Hydro Aluminium AS
Contact person: Leonhard Heusler
Phone: +49 2285522217
e-mail: Leonhard.heusler@hydro.com

Program operator:
The Norwegian EPD Foundation
Pb. 5250 Majorstuen, 0303 Oslo
Phone: +47 97722020
e-mail: post@epd-norge.no

Manufacturer:
Hydro Alumium AS
Drammensveien 263, N-0240 Oslo
Phone: +47 22538100
e-mail: greener@hydro.com

Declaration number:
NEPD-2265-1034-EN

Place of production:
Hydro Aluminium Sunndal
Hydro Aluminium Årdal
Slovalco

ECO Platform reference number:

Management system:
IATF 16949, ISO 9001:2016, ISO 14001, ISO 45001, ISO 50001

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR 013, "Version 3.0 Part B for steel and aluminium construction products"

Organisation no:
917 537 534

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturerinformation, life cycle assessment data and evidences.

Issue date:
18.06.2020

Valid to:
18.06.2025

Declared unit:
1 kg Hydro Aluminium Primaru Foundry Alloy Europe, Si content >8%

Year of study:
2020

Declared unit with option:
1 kg Hydro Aluminium Primary Foundry Alloy Europe, Si content >8% , including waste handling and possible environmental benefits after end of life.

Comparability:
EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

Functional unit:
The product is an input to automotive parts and to different building and construction products. No use scenarios are defined, hence no functional unit.

The EPD has been worked out by:
Irmeline de Sadeleer, Andreas Brekke, Kari-Anne Lyng

Østfoldforskning

Verification:
The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:
Jane Anderson, ConstructionLCA Limited
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:

This EPD covers production of Primary Foundry Alloys from Hydro Aluminium's European Smelters with alloy content > 8% Consistent high metal quality is ensured by using top-grade raw materials, standardized production processes and continuous quality control.

Product specification:

Materials	kg	%
Primary Liquid Al from own Electrolysis	0.85-0.9	85-90%
Primary Metal from external sources	0.01-0.03	1-3%
Alloying Elements	0.08-0.12	8-12%

Examples of Industry we serve:

Automotive (Wheels, Chassis & Engine parts), Electrical applications, decorative / anodized applications

Market:

European Automotive & non automotive market for cast parts

Technical data:

All alloys meet specifications in accordance with relevant ISO, EN and JIS standards.

Alloys are produced as continuous cast or mold cast ingots. The products are stacked and strapped into bundles of various sizes. Depending on the particular production source, our foundry alloy ingots are supplied in weights of 7-22 kg, and bundle weights can range from 700-1200 kg.

For more detailed information on our products: https://www.hydro.com/en-NO/products-and-services/casthouse-products/foundry-alloys/

Reference service life, product:

Dependent on product application, but the material itself has an infinite life time.

Reference service life, building:

Dependent on product application, but the material itself has an infinite life time.

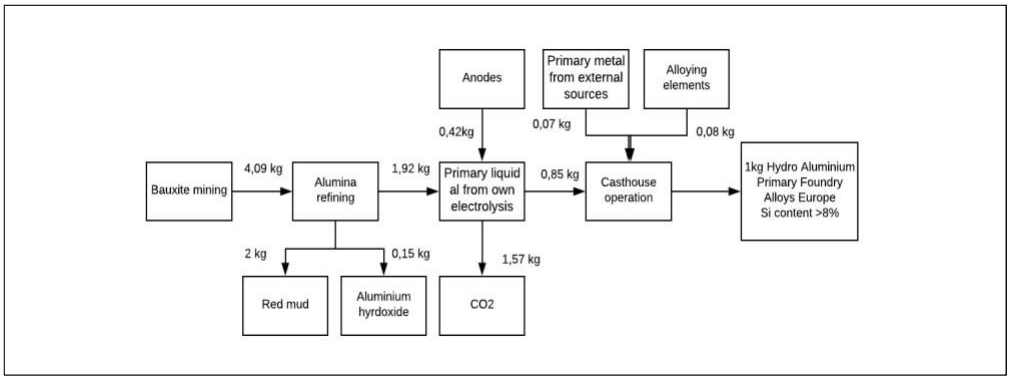
LCA: Calculation rules

Declared unit:
1 kg Hydro Aluminium Primary Foundry Alloys Europe Si content >8%. The EPD also covers modules C2-C4 and D.

The foundry alloys are produced in three smelters: Sunndal and Årdal in Norway, and Slovalco in Slovakia. The presented results is a weighed average of production volumes in 2017.

System boundary:
Cradle to gate with options. The following stages have been declared: A1-A4, C2-C4 and D. Further specified in flow sheet below.

Module D covers the potential benefits from recycling of Hydro Aluminium Foundry Alloy after end of useful life. Module D covers all necessary stages from C3 until the aluminium is back on the market and compares to the environmental performance of an average market foundry alloy. The module is further specified under scenarios.



Data quality:
Specific data are used for all of Hydro's processes, based on the production year 2017, and are collected the first months of 2019. As Hydro has ownership in a total value chain from mining of bauxite to production of aluminium extrusion ingots, all stages from A1 to A4 are covered by specific data. Background data on for instance transport and electricity production are from ecoinvent 3.4 (April 2018).

Cut-off criteria:
All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances, and mostly apply for alloying elements that are added in less than per thousandth.

Allocation:
The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production inhouse is allocated equally among all products through mass allocation. For almost all processes, detailed data are provided for each process step, and the main allocation is between aluminium hydroxide and aluminium oxide in the production of alumina. Effects of primary production of recycled materials are allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

The transport from production sites to market is assumed to be the weighted distance from the two smelters in Norway and the one in Slovakia to a location in central Europe.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption
Truck	50	Lorry, >32 metric tons, Euro V	611	2.46 E-02 l/tkm
Boat	80	Cargo ship, 5000 tons	1019	1.56 E-02 l/tkm

Most of the aluminium used for construction purposes is collected (approximately 96%) and recycled (approximately 97% of the collected aluminium), giving a total of 93% recycled. The aluminium is transported to a material processing site where different materials, including metals are shredded and sorted. Most of the aluminium used in the automotive industry is collected (approximately 95%) and recycled (approximately 97% of the collected aluminium), giving a total of 92% recycled. The rest is assumed landfilled.

End of Life (C2, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	-
Collected	kg	0.951
Reuse	kg	-
Recycling	kg	0.924
Energy recovery	kg	0.027*
To landfill	kg	0.049**

* 27 grams of the original 1 kg of aluminium is going to incineration. No loads or beneifts are attribuded to this flow.

**There will be a small portion of aluminium ending as uncollected. This is included under "To landfill" where no loads or benefits are included.

Transport to waste processing (C2)

Type	Capacity utilisation	Type of vehicle	Distance km	Fuel/Energy
Truck	40	Lorry, >32 metric tons, Euro V	50	2.85 E-02 l/tkm

Aluminium from construction site to waste handling site is assumed to be transported in an older medium-sized lorry with smaller capacity utilization than in the production system

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Aluminium foundry alloy to recycling	g	924

Aluminium collected and recycled is assumed to replace an average extrusion ingot in Europe consisting of 40% recycled and 60% primary aluminium. This is a conservative approach.

LCA: Results

All results are calculated with the use of SimaPro v.9 (2019) and impact methods according to ISO 15804. Results are based on a weighted average between three production sites.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assemby stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
x	x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	x	x	x	x

Environmental impact

Parameter	Unit	A1-A3	A4	C2	C3	C4		D	
GWP	kg CO_2-eqv	4.95E+00	6.99E-02	7.78E-03	2.48E-01	0.00E+00		-4.87E+00	
ODP	kg CFC11-eqv	4.21E-07	1.92E-08	1.44E-09	9.63E-09	0.00E+00		-2.98E-07	
POCP	kg C_2H_4-eqv	1.33E-03	1.97E-05	1.29E-06	3.04E-05	0.00E+00		-2.61E-03	
AP	kg SO_2-eqv	2.75E-02	4.72E-04	3.05E-05	6.97E-04	0.00E+00		-3.10E-02	
EP	kg PO_4^{3-}-eqv	8.73E-03	7.15E-05	5.47E-06	1.59E-04	0.00E+00		-1.62E-03	
ADPM	kg Sb-eqv	9.95E-06	1.07E-07	2.35E-08	1.64E-06	0.00E+00		-1.22E-05	
ADPE	MJ	4.56E+01	1.63E+00	1.25E-01	1.35E+00	0.00E+00		-4.71E+01	

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

Resource use

Parameter	Unit	A1-A3	A4	C2	C3	C4		D	
RPEE	MJ	5.11E+01	1.25E-02	1.19E-03	1.72E-01	0.00E+00		-2.29E+01	
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
TPE	MJ	5.11E+01	1.25E-02	1.19E-03	1.72E-01	0.00E+00		-2.29E+01	
NRPE	MJ	5.38E+01	1.57E+00	1.20E-01	1.52E+00	0.00E+00		-5.72E+01	
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
TRPE	MJ	5.38E+01	1.57E+00	1.20E-01	1.52E+00	0.00E+00		-5.72E+01	
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
W	m^3	6.08E-02	2.69E-04	2.25E-05	7.37E-04	0.00E+00		-4.36E-02	

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life - Waste									
Parameter	**Unit**	**A1-A3**	**A4**	**C2**	**C3**	**C4**		**D**	
HW	kg	2.05E-02	7.34E-07	7.61E-08	6.11E-03	0.00E+00		4.91E-03	
NHW	kg	3.36E+00	8.13E-02	6.36E-03	1.15E+00	9.80E-02		-2.49E+00	
RW	kg	2.71E-04	1.08E-05	8.12E-07	4.81E-06	0.00E+00		-2.26E-04	

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life - Output flow									
Parameter	**Unit**	**A1-A3**	**A4**	**C2**	**C3**	**C4**		**D**	
CR	kg	-	-	-	-	-		-	
MR	kg	-	-	-	9.25E-01	-		-	
MER	kg	-	-	-	2.57E-02	-		-	
EEE	MJ	-	-	-	-	-		-	
ETE	MJ	-	-	-	-	-		-	

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9.0 E-03 = $9.0*10^{-3}$ = 0.009

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase
National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

Data source	Amount	Unit
ecoinvent v3.4 (April 2018)	4	g CO_2-eqv/kWh

Dangerous substances

☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list

☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0.1 % by weight.

☐ The product contain dangerous substances, more than 0.1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.

☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Name	CAS no.	Amount

Indoor environment
Not relevant

Carbon footprint

Calculations connected to climate change and global warming potential (GWP) include greenhouse gas emissions from fossil sources and land use change connected to extraction of bauxite, but does not include calculations of biogenic emissions of CO_2.

Bibliography

ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
NPCR 013	*NPCR 013 version 3.0 Part B for steel and aluminium construction products.*
Sadeleer, I., Brekke, A. and Lyng, Kari-Anne (2020)	*Background report for the Environmental Product Declarations for Hydro Aluminium Wire Rod, Hydro Aluminium Sheet Ingot and Hydro Aluminium Foundry Alloy*

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Appendix 7: Information letter and consent form to interviewees

Vil du delta i forskningsprosjektet

" Bærekraftige innkjøp i byggeprosjekter"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke hvordan man kan sikre bærekraftige innkjøp gjennom hele forsyningskjeden i bygg og anleggsbransjen. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Formålet med prosjektet er å undersøke hvordan en organisasjon kan sikre bærekraftige innkjøp gjennom hele forsyningskjeden, hvor hovedfokuset innenfor bærekraft er miljørelatert. Sosiale aspekter ved bærekraft ligger utenfor omfanget av studien.

Hvem er ansvarlig for forskningsprosjektet?
Institutt for regnskap, revisjon og foretaksøkonomi ved Handelshøyskolen BI er ansvarlig for prosjektet.

- Lena Bygballe er veileder og har overordnet ansvar.
- Masterstudenten [redacted] og [redacted] ansvarlige for gjennomføringen av intervjuene.

Hvorfor får du spørsmål om å delta?

Utvalget av personer i denne studien er direkte knyttet til det kategoriutvalget i organisasjonen vi undersøker, og personene er utvalgt på grunnlag av deres stilling i organisasjonen og ansvarsområde. Hvor mange som blir intervjuet avhenger av hvor mange nøkkelpersoner hos leverandører og produsenter som ønsker å delta i studien.

Hva innebærer det for deg å delta?

Hvis du velger å delta i prosjektet innebærer det at du deltar på et intervju der opplysningene registreres via notater, lyd og video-opptak. Det vil bli satt av 1 time til intervjuet.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Personene som vil ha tilgang ved behandlingsansvarlig institusjon er veileder og masterstudentene som skriver oppgaven.
For at ingen uvedkommende får tilgang til opplysningene vil navnet og kontaktopplysningene bli erstattet med en kode som lagres på egen navneliste adskilt fra øvrige data, og fortløpende bli anonymisert.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er 01.07.2022. Videopptak, lydopptak vil bli slettet.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene,
- å få rettet personopplysninger om deg,
- å få slettet personopplysninger om deg, og
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra *Institutt for regnskap, revisjon og foretaksøkonomi ved Handelshøyskolen BI* har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
Lena Bygballe ved *Institutt for regnskap, revisjon og foretaksøkonomi ved Handelshøyskolen BI* [redacted] eller epost [redacted]

- Student [redacted]
- Student [redacted]
- Vårt personvernombud: [redacted]

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:

- NSD – Norsk senter for forskningsdata AS på epost (personverntjenester@nsd.no) eller på telefon: 55 58 21 17.

Med vennlig hilsen

Lena Bygballe	[redacted]	[redacted]
(Forsker/veileder)	(Student)	(Student)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *[sett inn tittel]*, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i intervju
- ☐ at [Studentene] kan gi opplysninger om meg til prosjektet

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)