IMPLEMENTING THE CORPORATE SUSTAINABILITY REPORTING DIRECTIVE (CSRD) INTO SUPPLY CHAIN MANAGEMENT

Case Multinational Company in Maritime Industry

Lappeenranta–Lahti University of Technology LUT

Master's programme in Supply Management

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ABSTRACT

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Implementing the corporate sustainability reporting directive (CSRD) into supply chain management

Case multinational company in maritime industry

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Keywords: Corporate sustainability reporting directive (CSRD), Sustainable supply chain management, Supplier management, Double Materiality Assessment

This master’s thesis focuses on understanding how a case company should develop and prepare its supply chain management to meet the requirements of corporate sustainability reporting directive (CSRD). The aim of the study is to examine what capabilities the company's current sustainability reporting includes and what kind of capabilities should be developed for future sustainability reporting change. The study also aims to increase a comprehensive understanding of what measures company should take to ensure full compliance with the directive.

The thesis has been carried out as a qualitative case study and the research material mainly consists of the internal Double Materiality Assessment results of the project as well as secondary material consisting of the company's public sustainability reports and annual report. The aim was to increase the reliability and validity of research results by finding links between previous literature and research findings and by identifying needs for deeper research.

The findings show that companies need to integrate sustainability issues more comprehensively into supply chain management and deepen the business strategy and business model to consider the double materiality assessment perspective. This involves identifying impacts, risks and opportunities and gathering data across the value chain to create a reporting system that meets sustainability reporting requirements. Alongside the necessary measures, the thesis emphasizes the need for increased transparency and cooperation throughout the value chain, especially with external stakeholders.

TIIVISTELMÄ

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Yritysten kestävyysraportointidirektiivin (CSRD) täytäntöönpano toimitusketjun hallinnassa:

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Tämä pro gradu -tutkielma keskittyy ymmärtämään, miten case-yrityksen tulee kehittää ja valmistella toimitusketjunsa hallintaa vastatakseen yritysten kestävyysraportoinnin (CSRD-direktiivin) vaatimuksiin. Tutkimuksen tavoitteena on tutkia, mitä valmiuksia yrityksen nykyinen vastuullisuusraportointi sisältää sekä millaisia valmiuksia tulisi kehittää tulevaa kestävyysraportoinnin muutosta varten. Tutkimus pyrkii lisäksi lisäämään kokonaisvaltaista ymmärrystä, mitä tarvittavia toimenpiteitä yrityksen tulisi tehdä varmistaakseen direktiivin täysimääräisen noudattamisen.

Tutkielma on toteutettu laadullisena tapaustutkimuksena ja tutkimusaineisto koostuu pääasiallisesti toimeksiantaja yrityksen sisäisestä Double Materiality Assessment – projektin tuloksista sekä sekundääriaineistosta, joka koostuu yrityksen julkisista vastuullisuusraporteista sekä vuosikertomuksesta. Tutkimustulosten luotettavuutta pyrittiin lisäämään löytämällä yhteyksiä aiemman kirjallisuuden ja tutkimustulosten sekä havaitsemalla tarpeita syvemmälle tutkimukselle.

Tutkimustulokset osoittavat, että yritysten tulee sisällyttää vastuullisuusseikat kokonaisvaltaisemmin osaksi toimitusketjun hallintaa ja syventää liiketoimintastrategia ja yritysmalli ottamaan huomioon kaksoisolennaisuus näkökulma, ja keskittyä sen vaikutusten tunnistamiseen sekä tietojen keräämiseen koko arvoketjussa luodakseen kokonaisvaltaisen raportointijärjestelmän, joka kattaa kaikki kestävyysraportoinnin vaatimukset. Pro gradu -tutkielma korostaa tarvittavien toimenpiteiden rinnalla tarvetta arvoketjun läpinäkyvyyden ja yhteistyön lisäämiselle koko arvoketjussa, etenkin ulkoisten sidosryhmien kanssa.

ABBREVIATIONS

CSRD	Corporate Sustainability Reporting Directive
CSR	Corporate Social Responsibility
EFRAG	European Financial Reporting Advisory Group
EC	European Commission
ESG	Environment, Social and Governance
ESRS	European Sustainability Reporting Standard
EU	European Union
GRI	Global Reporting Initiative
NFRD	Non-Financial Reporting Directive
PIE	Public interest entities
TBL	Triple Bottom Line
VC	Value Chain

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1 Introduction

Sustainability has become crucial issue for both organizations and society, driven by the rapid growth of third-world economies and globalization, which has increased pressure on natural resources. Additionally, greater transparency and improved information flow have heightened global awareness of business practices and their environmental impact. Consequently, companies are now obligated to consider not only the economic impacts of their activities but also social and environmental effects. (Jesus Saenz, Koufteros, Meixell & Luoma 2015.) This shift has forced organizations to disclose more than just financial information to both internal and external stakeholders.

Increasing external pressure requires businesses to address environmental and social concerns alongside their economic performance, aligning with principles such as the triple bottom line (TBL) or corporate social responsibility (CSR). (Jesus Saenz et al. 2015) Here is where both governments and corporations play a crucial role in shaping a sustainable economy by ensuring the responsible management of resources for future generations. In response to this global shift, there is a growing need for comprehensive guidelines that help integrate sustainability issues with corporate governance practices (Hristov & Searcy 2024; Kosi & Relard 2024). This alignment ensures that sustainability becomes a core component of business strategy and decision-making processes, further advancing the transition to a sustainable global economy.

The concept of sustainability is continually evolving, with initiatives expanding on a global scale. As energy and commodity prices rise and raw materials become scarcer, sustainable development is crucial for the future viability of organizations. Additionally, growing consumer demand and regulatory initiatives make sustainable development increasingly appealing from a financial perspective. (Brockett & Rezaee 2012, 8.) Nowadays, sustainability is no longer seen as voluntary action but has become mandatory in several countries and businesses of diverse sizes and industries.

The European Union (EU) has been a leader of this movement, implementing various directives to ensure that businesses operating within its jurisdiction are held to high standards of sustainability reporting and to address corporate sustainability issues (Krasodomska, Zarzycka & Zieniuk 2024b). The European Union's Corporate Sustainability Reporting

Directive (CSRD) stands as one of the most impactful mandatory sustainability initiatives worldwide. This new directive emphasizes a disclosure of sustainability information related to company's business model, strategy, policies, governance, time-bound targets, performance indicators, and due diligence processes. (European Commission 2024a; Hristov & Searcy 2024.) It ensures that external as well as internal stakeholders have access to comprehensive information regarding a company's negative and positive impacts on people and the environment, as well as the financial risks and opportunities stemming from climate change and other sustainability challenges.

While CSRD is relatively new, studies have already begun exploring how it differs from other directives and how it might influence company operations (Kosi & Relard 2024). However, the critique that there is a lack of in-depth research on how companies should integrate CSRD requirements into their business models and supply chains, and therefore further research how to implement CSRD requirements into supply chain is needed. The framework provided by Hristov and Searcy (2024) through a balanced scorecard offers a strong starting point, but the application of CSRD in specific industries—such as the case company requires further exploration. Understanding the nuances of how CSRD affects particular sectors can provide clearer guidance on the practical actions needed to meet its requirements. This insight can be especially valuable in shaping industry-specific strategies for compliance and sustainability integration.

Within this research context, the CSRD's mandatory sustainability reporting requirements provide a chance to improve the incorporation of sustainability into corporate governance and enhance stakeholder collaboration to meet these standards. It establishes the foundation for future sustainability reporting, making it essential to evaluate how effectively the ESRS fulfils the CSRD's goals of increasing transparency, comparability, and accountability in ESG performance among companies.

1.1 Research background

In today’s business environment, the concept of sustainability has transferred from minor concern to a critical pillar of corporate strategy and governance (Nguyen & Kanbach 2024). The rising significance of sustainability reporting highlights a global shift in business practices, acknowledging that long-term success relies not only on financial performance but also on the social and environmental impact of business operations (KPMG 2024; Fornasari & Traversi 2024). As supply chains become more globalized, sourcing products from developing countries has become more generalized and companies are facing growing pressure from NGOs, governments, regulators, consumers, and investors to ensure that their products meet acceptable social and environmental standards (Okongwu, Morimoto & Lauras 2013). According to Brockett and Rezaee (2012, 6-7) the transformation towards voluntary reporting instead of mandatory regulations has become a trend due the expectations of external stakeholders, also raising bar of quality of sustainability reporting and risks for companies whose disclosure and transparency cannot take the criticism and examination.

In 2015, sustainability gained significant global attention when the United Nations established the seventeen (17) Sustainable Development Goals (SDGs) as part of the 2030 Agenda to guide companies' efforts and actions towards a more sustainable future for all (Chen & Marquis 2021; Kosi & Relard 2024; Jesus Saenz et al. 2015). This agenda was non-obligatory agreements that demand countries to identify and define their national priorities and targets to align with requirements of SDGs (Rashed & Shah 2021). This shift toward sustainable development increased the importance of sustainability, as stakeholders began pressuring supply chain organizations to include environmental, social, and governance (ESG) considerations into their operations.

According to Attanasio, Preghenella, De Toni and Battistella (2022) states that even though sustainability activities are voluntary for some companies, sustainable development in the world requires integration of environmental and social issues into decision-making, for both public and private sectors. In corporate sustainability movement, the private sector can be seen as a key player in achieving SDGs (Rashed & Shah 2021), and corporate leaders are continuously seeking of ways to address societal issues while ensuring long-term sustainability and resilience. While firms previously disclosed sustainability information voluntarily many countries are now introducing mandatory reporting requirements.

Consistent with the developments also the sustainability disclosure legislation has been ever-volving, as the starting point of the transformation was EU's the Non-Financial Reporting Directive, known as the NFRD. Non-Financial Reporting Directive (NFRD) began in 2014, requiring large public-interest companies to disclose non-financial information, including diversity data, starting from the 2017 fiscal year. (Hummel & Jobst 2024; EUR-lex 2019) According to research by Krasodomska, Zarzycka and Zieniuk (2024a) even though NFRD was real game changer in EU, its effect was not as satisfying as wanted, although it increased relevance, consistency, and comparability of disclosed information across EU.

In December 2019, European Commission introduced the "European Green Deal" which aims to tackle critical challenges such climate change and environmental degradation, which poses existential threats to Europe and the world. (European Commission 2024b; Hummel & Jobst 2024) The objectives are to transform the EU into a resource-efficient and modern competitive economy by ensuring that following objectives are achieved:

- Net-zero emissions of greenhouse gas (GHG) by 2050
- Economic growth separated from resource consumption
- No one and no region are left behind (European Commission 2024b.)

In November 2022, the EU adopted the Corporate Sustainability Reporting Directive (CSRD), which will replace the NFRD from the 2024 fiscal year aiming to end the criticism about NFRD being too general about the reporting requirements and to move towards a new direction of reporting which is based on predefined and clear metrics (Bataleblu, Rauch, Cochran & Matt 2024, 240). The CSRD broadens the scope to encompass wider range of companies and imposes detailed reporting requirements, including compliance with European Sustainability Reporting Standards (ESRS), incorporation of sustainability information into management reports, external assurance, and digital tagging of reports. The first ESRS were adopted by the European Commission in July 2023. (Hummel & Jobst 2024; EU Finance Podcast 2023; European Commission 2024a.)

This research on the CSRD focuses on understanding its potential to enhance corporate governance by aligning sustainability practices with long-term business resilience, improving corporate transparency, and facilitating collaboration with stakeholders. The directive's integration marks fundamental transformation from voluntary sustainability practises and reporting to mandatory compliance, reflecting a broader global trend towards stricter regulatory framework for sustainability reporting.

1.2 Key concepts

Corporate sustainability reporting is a sustainability practice where companies disclose Environmental, Social and Governance (ESG) topics, activities, risks, and policies publicly to improve the transparency, comparability, trust of stakeholders and reputation in general. (Christensen, Hail & Leuz 2021).

The **Corporate Sustainability Reporting Directive (CSRD)** is a significant piece of legislation introduced by the European Union (EU) to enhance and standardize sustainability reporting by companies operating within its jurisdiction. This directive marks a critical shift towards greater corporate accountability and transparency regarding environmental, social, and governance (ESG) impacts. (Directive 2022/2464/EU (2022); European Commission 2024a.)

Sustainable Supply Chain Management (SSCM can be defined based on Seuring and Müller (2008) as "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements".

European Sustainability Reporting Standards (ESRS): A set of guidelines specifying the sustainability information that companies must disclose in accordance with Directive 2013/34/EU, as amended by Directive (EU) 2022/2464. These standards emphasize material impacts, risks, and opportunities associated with environmental, social, and governance (ESG) issues. the ESRSs are designed to provide stakeholders all the information to understand a company's significant impacts on people and the environment, as well as the effects of sustainability matters on the company's development, performance, and position. (Commission Delegated Regulation (EU) 2023/2772.)

Double Materiality Assessment is a mandatory practise for companies to identify which sustainability matters are most significant for the company and its stakeholders by evaluating their impact on environmental and social aspects, while also including evaluation how they impact on the organization (PwC 2024a).

Value chain in the context of this study is defined as “the full range of activities, resources and relationships related to the undertaking’s business model and the external environment in which it operates.” (Directive (EU) 2023/2772 (2023)). A value chain includes all activities, resources, and relationships involved in creating, delivering, and managing a product or service throughout its lifecycle, encompassing the undertaking's operations, supply and distribution channels, and the broader financial, geographical, geopolitical, and regulatory environments, involving both upstream actors (e.g. suppliers) and downstream entities (e.g. distributors and customers). (Directive (EU) 2023/2772 (2023))

1.3 Research questions and objectives

The aim of this master’s thesis is to provide a comprehensive analysis of how the case company can effectively prepare its supply chain management for the requirements of the Corporate Sustainability Reporting Directive (CSRD). This includes identifying how the company can leverage its existing capabilities, develop new competencies, and implement necessary actions to ensure full compliance with the directive.

First, we analyze the current state of the reporting to fully understand the need for changes that are in line with the CSRD's requirements, then we investigate the specific actions that supply chain management must undertake to align with the CSRD. Based on the current state analysis, one objective is to identify the capabilities needed to meet the CSRD requirements and use risk mapping to assess the sustainability impacts, risks, and opportunities offered by suppliers.

The research focuses on the upstream side of the value chain and is limited to narrowing stakeholder engagement to suppliers in the supply chain, and how they affect the ability to meet the requirements of CSRD in this research. The main emphasis will be placed on Scope 3 emissions, which include all indirect emissions that occur in the company’s value chain but also focusing on the other emissions within the supply chain.

The main research question:

> *Q1: What actions are required of company’s supply chain management to prepare for the Corporate Sustainability Reporting Directive (CSRD)?*

With sub-research questions the main research question can be answered, and the sub-research questions are following:

> *Q2: What capabilities need to be built and develop to achieve the requirements of CSRD?*
>
> *Q3: What impacts, risks and opportunities suppliers offer in the point of sustainability matters?*
>
> *Q4: What are the reporting requirements considering methodology and level of detail of the underlying data?*

Previously set objectives guide the research and address the main and sub-research questions, providing a comprehensive understanding of how case company should prepare their supply chain management to comply with CSRD, the capabilities they need to develop and build, and what sustainability impacts, risks and opportunities associated with their suppliers as well as what are the reporting requirements of CSRD in terms of methodology and level of detail of the underlying data.

1.4 Research methodology and limitations

This empirical study explores the impact of the CSRD on the supply chain management of a multinational company, Case company X. The focus is on enhancing and developing capabilities to meet CSRD requirements and improve business performance to address sustainability matters that arise in the value chain. The phenomenon studied in this study is the current state of the company's corporate sustainability reporting and what actions are required to achieve CSRD requirements in the terms of supply chain management. This study is limited to address only upstream of supply chain, leaving downstream out of consideration, due to their complexity and diversity.

The empirical study is conducted as a qualitative case study, aiming to understand the subject as comprehensively as possible (Hirsjärvi, Remes & Sajavaara 2009, 161). The empirical part of the study has been conducted as utilizing internal material obtained from the company and comparing it with existing literature. The research material consists of Double Materiality Assessment (DMA) projects results which was carried out between June and September 2024. Double materiality assessment results are analysed using a thematic analysis of the content, where the relevant points that emerged from the material were first picked up as so-called codes and then grouped under themes and their sub-themes. Sorting to codes and themes helps to qualitive case study to achieve the objective by increasing the understanding of the research subject (Liu, Sellgren, Kaila & Koskela 2021).

Secondary data such as annual reviews and sustainability reports of the company are used to improve reliability of the findings and to gain comprehensive understanding of the current state of sustainability reporting and its challenges related to upcoming regulatory changes, in this case the corporate sustainability reporting directive. The secondary data from the available reports for the years 2021-2023 and was used to utilize the current state of sustainability reporting.

1.5 Thesis structure

The aim of this thesis outlined is to provide a comprehensive framework for addressing the research objectives and questions, ensuring a thorough analysis of how companies can adapt their supply chain management to comply with the CSRD, the necessary capabilities, and the sustainability impacts, risks, and opportunities associated with suppliers.

The thesis is structured into six main chapters to support the objectives of the research. It begins with an introduction chapter, providing an overview of the research background and key concepts, and outlining the objectives, research questions, methodology, and limitations. summarizes the key theoretical foundations of the study, offering a comprehensive view of the relevant theories and the research topic. The conceptual framework is to conduct based on the literature review of the research and Figure 1 illustrates the conceptual framework and the relationships between crucial elements of the research phenomenon. The framework points out that aspect of supply chain management and effect of new regulations is not simple but instead it has multiple factors guiding the process.

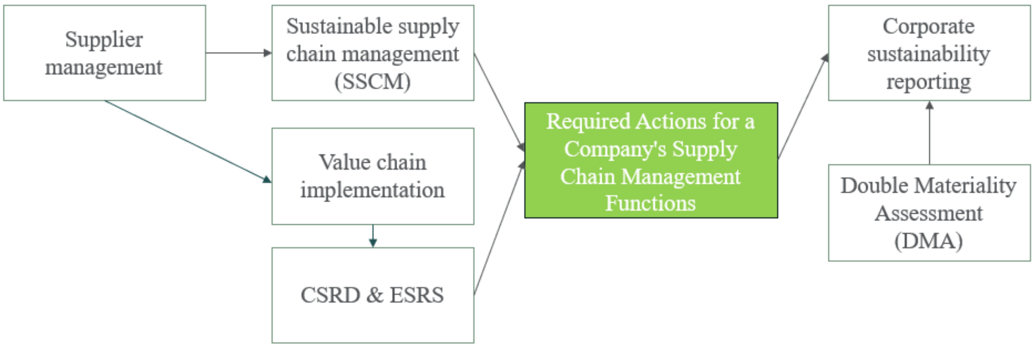

Figure 1. The Conceptual Framework

The framework visualizes the research basis, as multiple factors are forming the need for the required actions of a supply chain organization to achieve upcoming CSRD requirements. From the point of view of the study, the current state and importance of existing sustainable supply chain management is worth highlighting as it forms the basis of the thesis and its objectives. Nevertheless, the idea of this framework is to illustrate how all the elements have effect on both internal and external communication within the company in the point of corporate sustainability reporting and how double materiality assessment (DMA) specifies which sustainability matters are most important to evaluate and include in the corporate sustainability reporting.

The third chapter deals with the presentation of the research methodology and data collection. Based on the research data, a thematic analysis is formed, which aims to answer research questions. The fourth chapter of the study presents target company and analysis of the current state of sustainability reporting and maturity. Fifth chapter includes the key findings of the thematic analysis and concludes the needed measures based on the theory and empirical findings of the study. The final chapter answers the research questions and draws conclusions, as well as an assess the validity and reliability of the results and presents the proposals for further research.

2 Literature review

In this chapter, we outline overview of sustainability reporting in sustainable supply chain management and its aspect such as supplier management and engagement. After that, we delve deepen to European Union's (EU) Corporate Sustainability Reporting Directive (CSRD) and detailed examine the CSRD, its objectives, and requirements and comparison with previous directive the Non-Financial Reporting Directive (NFRD). Then we evaluate European Sustainability Reporting Standards (ESRSs) and how value chain can be implemented to ESRS, and finally present the concept of double materiality.

2.1 Corporate sustainability reporting in sustainable supply chain management

Supply chains are increasingly exposed to growing risks driven by the complexity of products and services, fluctuation of energy prices and volatile financial markets in today's dynamic business environment. While the risks vary, companies aim to reduce the costs, improve customer service, enhance reliability and efficiency of activities, and fasten the delivery of products. (Okongwu, Morimoto & Lauras 2013.) Corporate sustainability requires companies to engage with broader range of stakeholders, including customers, employees, suppliers, governments, and other stakeholders.

Over the past two decades, stakeholders' interest in the environmental and social aspects of business activities has grown increasingly (Yu & Rowe 2017; Kumar 2022). Each group holds different ecological, social, ethical, and economic expectations, pushing companies to communicate their performance more transparently. In response, many businesses have adopted sustainability reporting to report their environmental and social impacts, demonstrating accountability and commitment to sustainable practices. (Kumar 2022.)

Before delving into sustainable reporting in the supply chain, it is important to define the supply chain itself. A supply chain can be described as:

> "All the activities associated with the flow and transformation of goods from raw materials to end users, as well as the information flows" (Seuring & Müller 2008).

Sustainable supply chain management (SSCM) involves managing material and information flows within the supply chain while promoting collaboration across companies, all within the context of sustainability's three dimensions—economic, social, and environmental to improve sustainable outcomes in their supply chains (Tidy, Wang & Hall 2016; Koberg & Longoni 2019). SSCM not only considers traditional business factors but also emphasizes the ecological and social impacts, focusing on improving overall performance.

This study uses the Triple Bottom Line (TBL) theory by Elkington (1998) to frame the concept of sustainability in supply chains. Based on the theory, sustainability performance can be achieved as the sum of three dimensions: economic, social, and environmental (Elkington 1998). While the concept of sustainability has evolved, the TBL framework remains relevant for understanding corporate sustainability reporting.

Social sustainability refers to the company's capabilities to ensure and increase the wellbeing of society and individuals. The problem of implementing social sustainability is that companies usually fail to understand the social dimension of TBL, and their impact on society and determine accountability. Environmental sustainability is about a firm's ability to protect and cherish the environment and establish the continuity of productivity and functionality of ecosystems, as well as protection of resources and conservation of biodiversity. Even though environmental awareness has increased, firms often view environmental efforts as cost-cutting opportunities rather than long-term investments. Economic sustainability extends beyond traditional financial performance to include survival, profitability, and economic contributions, all without sacrificing social or environmental responsibilities. (Singh & Rahman 2021; Purvis, Mao & Robinson 2019.)

Corporate sustainability reporting helps organizations disclose the sustainability performance of their supply chains, allowing stakeholders to assess the broader impact of the company's operations. Sustainability reports are now recognized as a critical component of corporate sustainability, reflecting a company's dedication to responsible performance and stakeholder engagement. (Kumar 2022.) Company's contribution and actions towards sustainability can be also monitored through sustainability reporting, which is a great tool for holding the companies responsible for their impacts on the environment and society (Kosi & Relard 2024).

Christensen et al. (2021) define corporate sustainability reporting as measuring, disclosing and communicating information on CSR and sustainability topics, including the company's ESG functions, risks and policies. Another definition for sustainability reporting is the following provided by GRI:

> “Sustainability reporting helps organizations to set goals, measure performance, and manage change in order to make their operations more sustainable. A sustainability report conveys disclosures on an organization’s impacts – be they positive or negative – on the environment, society, and the economy.” (Global Reporting Initiative 2013, 3.)

Sustainability reporting can be conducted through various channels, including corporate websites, integration with annual financial reports, or dedicated standalone sustainability reports. (Kozlowski, Searcy & Bardecki 2014) Sustainability reporting can be seen as tool to improve transparency, reputation, brand value and gain sustainable competitive advantage (Kumar 2022; Russo-Spena, Tregua & De Chiara 2018).

Corporate sustainability reporting in supply chain management is also crucial for promoting transparency, managing risks, improving performance and innovation and ensuring regulatory compliance (Horváth & Pütter 2017). To promote sustainable practices among suppliers, companies must invest in activities that include identifying and assessing sustainability-related risks associated with suppliers and focus on enhancing suppliers’ capabilities in adopting sustainability-related practices (Gouda & Saranga 2018). The collaboration with stakeholders should not only focus on the input of the assessment but should also allow to discussed strategies, policies, and action plans for the ESG topics (PwC 2024b). These activities overall enhance awareness and improve quality of sustainability practices among suppliers, ultimately enabling them to achieve regulatory requirements on time of this new directive.

In order to fully comply with different frameworks of corporate sustainability reporting, Companies must implement its supply chain into a part of the disclosure of the information. Next, we examine the role of supplier management in corporate sustainability reporting and as an enabler for full compliance to upcoming regulatory changes.

2.2 Supplier management

Due to the increased competition in the markets, it has put pressure on the firms to improve their quality, delivery performance and responsiveness while decreasing the costs of business operations. In the respond to this challenge, firms have started to leverage the supply chain and systematically evaluating the role of suppliers in their own operations and have recognize the significance of engaging both supplier and buyers into their corporate social responsibility (CSR) actions in addition to their own actions towards more sustainable efforts. (Kannan & Choon Tan 2006; Peng, Zhang, van Donk & Wang 2022.) Supplier relationship management plays a pivotal role of achieving high business performance and mitigate the risks related to supply chain, especially within upstream side of value chain.

The one solution for the constantly changing demand in the market has been the outsourcing, resulting better utilization of the internal resources and adding value to them. Furthermore, it enhances flexibility and responsiveness within the supply chain while enabling companies to leverage the capabilities, expertise, technologies, and efficiencies of their suppliers. (Kannan & Choon Tan 2006.) This poses a challenge in the terms of sustainability reporting and how to manage sustainability performance throughout suppliers and they activities that are directly related to the company's own sustainability performance.

In supplier management, managing risk and performance within the supply chain requires understanding both barriers and enablers to development. According to Seuring and Müller (2008), there are three key barriers to implementing sustainable supply chains: (1) high costs, (2) complexity and coordination efforts, and (3) poor communication across the supply chain. These challenges, however, can be mitigated through strong collaboration and partnerships within the supply chain, ultimately enabling the realization of sustainability benefits. (Seuring & Müller 2008.)

Supplier management systems are critical for managing risks, as they enable the monitoring, evaluation, and reporting of supplier activities. There are also supporting factors of sustainable supply chain management presented based on the literature review of Seuring and Müller (2008): "Company-overlapping communication; Management systems, Monitoring, evaluation, reporting, sanctions; training of purchasing staff and suppliers; and integration to corporate policy". Environmental management systems, such as ISO 14001, focus on sustainability and environmental standards, while social aspects are addressed through frameworks like SA 8000 or supplier codes of conduct (Seuring & Müller 2008). These systems help ensure that suppliers align with both environmental and social sustainability goals but can be costly to adopt. Company-overlapping communication and education of purchasing staff and suppliers of sustainability matters are proactive measures that allows an improvement in supply chain relations as well as overall performance for both social and environmental aspects. (Seuring & Müller 2008.)

In today's business environment firms seek to improve supply chain transparency through collaboration and communication across the supply chain, to address the barriers in the implementation of sustainability to supply chains. (Zhu, Song, Hazen, Lee & Cegielski 2018). Collaborating with suppliers is a critical step to gain more visibility about supply chain operations regarding sustainability matters and further improve visibility of sustainability performance within whole supply chain (Sodhi & Tang 2019).

Supply chain transparency can be defined as disclosure of information, in the terms of access to supply chain information for its end-users and other companies within supply chain (Awaysheh & Klassen 2010; Abhi Santharm & Ramanathan 2022). A transparent supply chain depends significantly on the availability of information about products as they progress through the supply chain. Operational supply chain transparency refers to a firm's ability to proactively engage with stakeholders to gain visibility and traceability of its upstream and downstream value chain activities. (Zu et al. 2018.) In the previous literature there are multiple ways to improve supply chain transparency, such as supply chain relationships and leveraging technologies for supply chain transparency (Morgan, Richey & Ellinger 2018).

2.2.1 Supplier engagement

Stakeholder engagement has become a critical component of sustainability reporting (SR), as it not only enhances the legitimacy of the report but also demonstrates how an organization addresses stakeholder concerns (Ferrero-Ferrero, Fernández-Izquierdo, Muñoz-Torres & Bellés-Colomer 2018). Supply chain engagement involves the collaboration and information exchange between a focal firm and key stakeholders to address sustainability and social issues (Tidy, Wang & Hall 2016; Dahlmann & Roehrich 2019), and it is driven by intrinsic or extrinsic motivations. Sustainable supply chain management (SSCM) approaches primarily focus on the extrinsic motivations that involve gaining financial benefits, whereas intrinsic motivations are focusing on ethical considerations and values in decision-making process (Dahlmann & Roehrich 2019).

While the importance of engaging suppliers in supply chain activities is widely recognized, effectively sharing information and best practices between supply chain partners remains a significant challenge (Dahlmann & Roehrich 2019). The significance of supplier engagement lies in the fact that suppliers' actions inevitably impact the company, and it have been studied that engaging with the supplier can have significant impact on the sustainability performance of the company (Lintukangas, Arminen, Kähkönen & Karttunen 2023). The companies' both need to and must build supply chain that supports their sustainable operations and increase transparency, and this requires that companies ensure that their suppliers follow the sustainability requirements and push their lower supply chain tiers also contribute with them. (Marttinen & Kähkönen 2022). As nowadays supply chain are increasingly complex, this poses a challenge but with tight collaboration, information exchange and supplier development this can be managed.

The use of sustainable supply chain management practices can help companies to influence and engage suppliers, and by building collaborative relationship practices can led to gaining competitive advantage. (Lintukangas et al. 2023) Also supplier engagement can help generate sustainability-related ideas and solutions that couldn't be solved alone without help of suppliers (Awan, Sroufe & Kraslawski 2019). Where increasing need to report for example corporate scope 3 emissions, which are all the indirect emissions that occur in the company's value chain, engagement with supplier has become increasingly collaborative, particularly driven by the need to exchange increasing volumes of data. (Hettler & Graf-Vlachy 2024)

After gaining understanding on the corporate sustainability reporting and the importance of supplier management and engagement to fully comply with requirements of external stakeholders, we delve into new corporate sustainability reporting directive and how it will change the sustainability reporting for the companies under the influence of CSRD.

2.3 Corporate Sustainability Reporting Directive (CSRD)

Where previously mentioned, The European Union (EU) can be seen as driver of the sustainable reporting movement. In 2014, EU required large public interest entities (PIEs) (with more than 500 employees) to publish non-financial information throughout Non-Financial Reporting Directive (NFRD), where this regulation has been applicable since 2017. The NFRD set broad reporting requirements for large companies across EU markets, aiming to provide investors and stakeholders with a fuller picture of corporate development, performance, and impact. However, criticisms arose over the quality, comparability, reliability, and relevance of the non-financial information disclosed, as well as inconsistencies in reporting frameworks and standards. (Krasodomska, Zarzycka & Zieniuk 2024; European Finance podcast 2023; European Parliament 2021.)

Despite the constraints and criticism, the introduction of the NFRD can be marked as the EU's first major step toward mandating sustainability disclosures for large companies. However, its limitations—such as inconsistencies in reporting standards, insufficient enforcement, and a limited scope of companies—highlighted the need for more comprehensive legislation. In respond, On January 5th of 2023 European Union's Corporate Sustainability Reporting Directive (CSRD) entered into a force, modernizing, and strengthening the requirements related to reporting the social and environmental aspect of business activities. (PwC 2024a; European Commission 2024a.) The CSRD now applies to a broader range of companies, including listed SMEs and large entities, and mandates non-EU companies with over EUR 150 million in EU revenue to comply (European Commission 2024a). In the Figure 2. Timeline of scope of the companies influencing CSRD.

Figure 2. Timeline of the scope of the CSRD. (Kosi & Pelard 2024)

In EU Finance Podcast, Thomas Dodd (2023) states that the biggest changes compared to NFRD are the three following:

- Larger scope of companies involved in the directive.
- Required reporting will be subject to assurance audit.
- Companies will now have to report according to mandatory common European Sustainability Reporting Standards (ESRS).

The CSRD significantly expands the scope of reporting, both in terms of the number of companies affected and the depth of disclosure requirements. It aims to bring sustainability reporting on a line with financial reporting by implementing common standards and requiring independent assurance of the information provided. The new directive is designed to address key criticisms of the NFRD and improve the quality, comparability, and reliability of sustainability data, as a part of the European Green Deal. (European Commission 2024a.)

Implementing the Corporate Sustainability Reporting Directive (CSRD) into supply chain management requires integrating sustainability practices and reporting across all levels of the supply chain. The transformation towards CSRD compliance is different and unique path to every organization due the diversity of their businesses, timeline of the adaptation and its current status of sustainability reporting (Grant Thornton 2023). According to Grant Thornton (2023) the process involves determining the entities subject to CSRD, conducting a double materiality assessment, identifying gaps in existing information, collecting relevant data, and preparing for independent assurance. Sustainability information of the company will be reported as separately in the company's annual report, and the quality and reliability of the published data must be verified by an external, independent certifier which has become a mandatory requirement for CSRD. (Niskala & Palmuaro 2023, 39-45.) Additionally, the CSRD mandates companies to provide assurance and use a digital taxonomy for sustainability information, The Taxonomy Regulation is an existing piece of legislation and applies to public-interest entities employing more than 500 people. The Sustainability Reporting Directive extends the duty of taxonomy reporting to all companies covered by the CSRD. (Niskala & Palmuaro 2023, 26.) The Taxonomy regulation defines the criteria for the actions that are seen to significantly promoting EU's long-term environmental and climate adaption or mitigation objectives. (European Commission 2023; Niskala & Palmuaro 2023, 26.) The CSRD requires companies to disclose information based on

European Sustainability Reporting Standards (ESRS), next we delve deeper into what disclosure requirements they include and how companies can comply with the new standards.

2.4 European Sustainability Reporting Standards

The European Commission has also introduced a delegated regulation alongside the CSRD, detailing the framework and rules companies must follow to comply with the directive's sustainability reporting requirements. These guidelines, known as the European Sustainability Reporting Standards (ESRS), form the foundation of sustainability disclosures in the EU. (European Commission 2024a.) European Financial Reporting Advisory Group, known as EFRAG developed total 12 ESRSs (Figure 3), which challenges companies not only to meet mandatory legislative requirements but also to integrate more sustainable business practices. The ESRS provide a comprehensive framework for sustainability reporting that enables businesses to align their strategies with sustainable development goals. (European Commission 2024a.)

The structure of ESRS is that it contains three categories of ESRS including (a) cross-cutting standards; (b) topical standards (Environmental, Social and Governance standards); and (c) sector-specific standards.

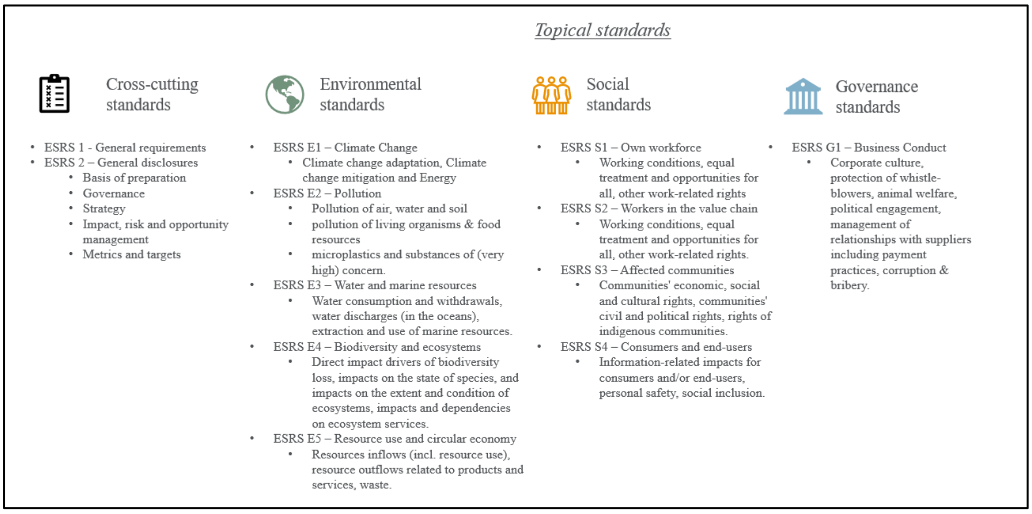

Figure 3. An overview of the ESRS.

The cross-cutting and topical standards are sector-agnostic, meaning they apply to all companies, regardless of the industry in which they operate. Sector-specific standards provide more detailed requirements for companies within particular sectors, ensuring that disclosures reflect the unique sustainability challenges of different industries which are not yet published and therefore not presented in the figure above. The ESRS will also require companies to disclose sector-specific impacts, risks and opportunities, and EFRAG is currently developing the standards for this but haven't yet been published at the time of this study and these are expected to be released by June 2026. (Grant Thornton 2023)

Cross-cutting standards in the ESRS encompass general requirements and disclosures that apply across all sustainability topics and sector-specific standards. ESRS 1 – General Requirements provides an overview of the ESRS architecture, explains key principles and foundational concepts, and establishes the general requirements for preparing and presenting sustainability-related information. ESRS 2 – General Disclosures specifies the comprehensive disclosure obligations companies must meet, covering all significant sustainability matters. These include reporting on governance, strategy, impacts, risks, opportunities (IRO), as well as relevant metrics and targets. (Commission Delegated Regulation (EU) 2023/2772; European Commission 2023.)

The environmental standards encompass various aspects of a company's environmental impacts, both potential and actual, as well as positive and negative. They address strategies, policies, and plans, along with the company's ability to adapt its strategies and business models to support environmental sustainability. These standards also require the disclosure of expected financial effects over short, medium, and long-term periods, as well as targets related to management of environmental issues, such as climate change or circular economy. (Commission Delegated Regulation (EU) 2023/2772; European Commission 2023.)

ESRS E1 – climate change address actions related to climate change and energy-related matters, aiming to transform towards zero net emissions and ensuring compliance with Paris Agreement. This standard includes calculation of energy consumption and gross scope 1, 2 and 3 emissions as well as total GHG emissions. (European Commission 2023; Commission Delegated Regulation (EU) 2023/2772.) E2 – Pollution, the objective of this Standard is to define Disclosure Requirements that help users understand how an organization affects pollution (air, water, and soil) through material impacts, both positive and negative. It covers actions taken to prevent or mitigate negative impacts, the organization's ability to adapt its strategy in line with a sustainable economy, and efforts toward achieving zero pollution. (Commission Delegated Regulation (EU) 2023/2772) E3 – Water and marine resources focuses on companies’ water management related sustainability matters such as water consumption and withdrawals, marine resources extraction and use of the marine resources. And E4 – biodiversity and ecosystems address the impacts undertaking has on biodiversity and ecosystems such as direct drivers of biodiversity loss throughout land-use or climate change. (European Commission 2023.) E5 - Resource use and circular economy focuses on companies' resource use and transition to a circular economy. It emphasizes efficient management of products, materials, and resources while aiming to minimize waste. Key themes included are resource efficiency, product durability, waste management, material flow tracking, and the adoption of renewable resources. (European Commission 2023.)

The basis of these standards are the capabilities for the company to adapt its business strategy and model to comply with sustainability matters of environmental aspects. Also, these standards require companies to disclosure what actions company is taking to mitigate, prevent and remediate the potential or actual negative impacts of environmental aspects of business activities. (Niskala & Palmuaro 2023, 102- 200; European Commission.)

Social standards on the other hand outline the social disclosure requirements for the organizations to report on their risks and opportunities as well as positive and negative, actual and potential impacts related to value chain employees and workers, affected communities, consumers, and end-users. S1 – Own workforce addresses an organization's workforce, including both employees directly employed by the company and non-employees. It covers themes related to working conditions such as working time or secure employment, equal treatment and opportunities which covers gender equality and equal pay and other work-related rights, including child labour, forces labour and others. (European Commission 2023.) S2 – workers in the value chain on the other hand requires company to address same themes that was covered in the S1, in the point of view of the value chain workers, including workers in upstream and downstream value chain. S3 – Affected communities aim to disclose information about how the undertaking identifies and manages material actual and potential impacts on affected communities regarding their economic, social, and cultural rights (such as adequate housing, food, water, sanitation, and security), civil and political rights (including freedom of expression and assembly), and the specific rights of indigenous peoples (like free, prior, and informed consent and self-determination).

S4 – Consumers and end-users covers information on how undertaking is identifying and managing risk and impact on consumers and/or end-users related to its products and services, including information related impacts, personal safety of customers and/or end-users and social inclusion of consumers and/or end-users. (European Commission 2023.)

The governance requirements consist of a single standard, ESRS-G1 Business Conduct, which aims to outline disclosure requirements that enable users of the company's sustainability statements to gain a clear understanding of its strategy, approach, processes, procedures, and performance related to business conduct. (European Commission 2023.) This standard addresses the following areas of business conduct matters;

(a) business ethics and corporate culture, covering aspects like anti-corruption and anti-bribery measures, whistleblower protection and animal welfare;

(b) Management of supplier relationships, with a focus on payment practices, particularly regarding late payments to small and medium-sized enterprises;

(c) The company's activities and commitments related to political influence, including lobbying efforts. (European Commission 2023.)

A particularly significant aspect of this standard is the ESRS G1-2, which focuses on the management of relationships with suppliers. Companies are required to disclose how they manage these relationships and the impact of suppliers on their value chain. (European Commission 2023.) This is crucial for effective supply chain management, as suppliers play a vital role in upstream operations, and their influence on overall performance is substantial.

The purpose of this disclosure is to clarify how companies conduct their procurement processes, ensuring fair treatment of suppliers. This includes detailing how they manage supplier relationships while considering associated risks, impacts, and opportunities related to sustainability. Companies must also address whether environmental and social criteria are incorporated into their supplier selection processes. (Niskala & Palmuaro 2023, 265.)

Companies that are affected by CSRD shall identify, document, plan, and eventually report their sustainability performance in accordance with the sustainability reporting standards. Commission Delegated Regulation (EU) 2023/2772 outlines the objective of the ESRS as follows:

> "Specifically, ESRS specify the information that an undertaking shall disclose about its material impacts, risks, and opportunities in relation to environmental, social, and governance sustainability matters. The information disclosed in accordance with ESRS enables users of the sustainability statement to understand the undertaking's material impacts on people and environment and the material effects of sustainability matters on the undertaking's development, performance, and position."

The ESRS are also informed by the Accounting Directive (2013/34/EU), as amended by the CSRD. This directive mandates that sustainability reports include information related to three-time horizons:

- Short-term: The reporting period aligned with financial statements
- Medium-term: A period extending from the end of the short-term reporting period up to five years.
- Long-term: The reporting period more than five years.

Under the European Sustainability Reporting Standards (ESRS), companies are required to provide comprehensive sustainability-related disclosures. Here's a structured outline of the required information:

Table 1. Structure of the required information (Bataleblu et al. 2024, 241-242; Hummel & Jobst 2024.)

Business Model and Strategy:
· A summary of the company's core business model.
· An overview of how sustainability is integrated into the company's strategy.
· Detailed information on the sustainability goals with specified timelines.
Sustainability Goals, targets and relevant indicators:
· Specific time-bound sustainability-related targets, including potential greenhouse gas (GHG) emission reductions.
· A description of the progress made towards achieving these targets.
· Information on whether the targets are based on scientific evidence.
· Indicators relevant to the mandatory disclosures of these sustainability issues.
Roles and Responsibilities in Sustainability:
· Description of the roles of administrative, management, and supervisory bodies in sustainability matters.
· Information on their expertise, skills, or access to relevant resources to fulfill these roles.
Sustainability Policies:
· A summary of the company's policies related to sustainability matters.
Incentive Programs:
· Information on existing sustainability-linked incentive schemes for members of the administrative, management, and supervisory bodies.
Due Diligence Processes:
· Description of the due diligence processes in place to address sustainability concerns.
· Identification of principal actual or potential adverse impacts in the company's operations and value chain.
· Actions taken to identify, track, and mitigate these adverse impacts.
Address impacts and risks:
· Key actual or potential positive or negative impacts linked to the company's internal operations and value chain and actions taken by the company to address real or potential impacts and the results of those efforts.
· An outline of sustainability-related risks that the company is facing and how these risks are managed.

Additionally, the CSRD mandates companies to provide assurance and use a digital taxonomy for sustainability information, aligning sustainability reporting with financial reporting practices (Krasodomska et al. 2024a; European Commission 2024a). This boosts the confidence of external stakeholders in the reported data, making it a potential source of competitive advantage for companies that can achieve these requirements.

2.5 Value chain implementation

CSRD specifies that under Articles 19(a)3 and 29(a)3, undertaking is required to report information that covers an undertaking's own operations but also its upstream and downstream value chain (VC), including its products and services, business relationships, and supply chain. While the CSRD does not provide additional definitions or guidance on VC, it refers to international sustainability due diligence frameworks that outline how companies should identify, address, and report on impacts throughout their value chains. (EFRAG IG 2024; Directive (EU) 2022/2464).

The European Financial Reporting Advisory Group (EFRAG) provides further clarity through its Value Chain Implementation Guidance, which details what organizations should disclose under the European Sustainability Reporting Standards (ESRS) related to both upstream and downstream value chain information, which is illustrated in the table 2.

Companies are required to disclose information about impacts, risks and opportunities associated with assessed materials across its value chain, and which part of value chain they arise, upstream, downstream or own operations and provide description of its value chain and key actors of it. Value chain implementation also extent the sustainability statement to cover information how policies, actions or targets (PAT) are associated with value chain, for example policies to prevent and control pollution by its suppliers and/ or actions and resources related to pollution and targets to reduce pollution generated by suppliers. (European Commission 2023 E2 – Pollution AR 13 and 19.)

All ESRS disclosure requirements related to quantitative datapoints apply only to the undertaking's own operations, with the following exceptions: ESRS E1 – 6: gross scope 1, 2 and 3 GHG emissions, and total GHG emissions; and ESRS E1 – 7 GHG removals and GHG mitigations projects financed though carbon credits. Addition to these two, undertaking shall disclose Entity-specific disclosures, where undertaking decides if and what information from value chain is needed. (EFRAG IG 2024.)

It is also required to use qualitative disclosure under ESRS, for example E1-1 Transition plan for climate change mitigation paragraph 16 (b) shall include explanation of decarbonisation levers identified and key action plans, which should cover changes in the undertaking's product and service portfolio and adaptation of new technologies in its own operations, or the upstream and/or downstream value chain. Qualitative characteristics of information includes the relevance, faithful presentation, comparability, verifiability and understandability, which make the disclosed information more accurate, complete and neutral as required under CSRD.

Table 2. Value chain coverage map of ESRSs (EFRAG IG 2024).

Level of VC coverage	Disclosure Requirements with this level of VC coverage	Comments	
1. The undertaking shall assess its material IROs across its VC	IRO-1		
2. The undertaking shall describe its VC.	SBM-1	Requires that value chain be covered but is not expected to trigger data requests for actors in the value chain – i.e., can be covered by internal or public information	
3. The undertaking shall describe its material IROs and report where in the VC they arise	SBM-3	For each material IRO identified in the materiality assessment, the undertaking shall report whether the undertaking is involved with the negative or positive impacts through its activities or because of its business relationships.	
4. The undertaking shall reflect whether and how policies, actions or targets (PAT) cover VC.	BP-1/2, SBM-2, GOV-4/5 E1-2 to E1-4 E2-1 to E2-3, E3-1 to E3-3, E4-1 to E4-4, E5-1 to E5-3, S1-1 to S1-5 S2-1 to S2-5 S3-1 to S3-5 S4-1 to S4-5 G1-1, G1-2, G1-3	BP-1: To what extent the sustainability statement covers the undertaking's upstream and downstream VC.	BP-2 :When metrics include VC data estimated using indirect sources, such as sector average data or other proxies, the undertaking shall: i.) identify the metrics; ii.) describe the basis for preparation, per E4-1 paragraph 13; iii.) describe the resulting level of accuracy; and, iv.) where applicable, describe the planned actions to improve the accuracy in the future.
5. The standard covers PAT for IROs that are linked to people in the VC. The undertaking shall disclose whether and how PAT cover VC.	S2 , S3 & S4		
6. The disclosure only reflects own operations, as no coverage of VC is required.	GOV-1/3, IRO-2, E1-5 E1-8 -E1-9, E2-4 , E2-6, E3-4/5 E4-5/6 E5-4 par. 31 E5-6 S1-1 to S1- 17 G1-4 to G1-6	E2-4 AR 20 refers to procurement of microplastics.	
7. Disclosure of procured materials.	E2-5 & E5-5	E2-5 Relates to the products/materials and/or substances procured which ends up in products/manufacturing.	E5-5 Includes supplied material but does not expand to suppliers and waste treatment; it may sometimes require information from supplier who treats waste.
8. There are specific quantitative datapoints in this DR that require VC coverage	E1-6 & E1-7		
9. There are specific qualitative datapoints in this DR that require VC coverage	E1-1 E4-1 par. 13 E4 IRO 1 par 17(a) E4-4 par. 32(c) E5-4 par. 30		
10. SFDR indicators12 listed in ESRS 2 Appendix B.	VC to be covered to the extent contemplated in the relevant technical standards		
11. Other EU law (excluding SFDR) in ESRS 2 Appendix B.	VC covered when required by relevant regulation.		

In conclusion, companies are required to provide information about its value chain, and reflect whether and how policies, actions and targets cover its value chain. This helps stakeholders understand the impacts of value chain to companies' actions, and how they are planning to mitigate the negative impacts and risks, and address the opportunities associated with upstream and downstream value chain.

2.5.1 Data collection

Effective supply chain management depends significantly on the accuracy and quality of supplier data. As business processes increasingly depend on accurate information, the role of master data in the supply chain has expanded from a single company focus to a global perspective. Data quality is assessed by criteria such as accuracy, completeness, consistency, and timeliness, with the first three being the most relevant for measuring data quality (Knapp & Hasibether 2011). In line with new regulations like the CSRD, information must be complete, neutral, and accurate to meet transparency and comparability of ESRS standards.

For CSRD and ESRS, companies must gather comprehensive information across environmental, social, and governance (ESG) data throughout their value chain to ensure transparent and reliable sustainability reporting, as data needs to be detailed, transparent, and traceable to meet the reporting and disclosure requirements. ESRS also requires companies to identify entity-specific metrics for evaluating impacts in the value chain, particularly when a company’s activities significantly depend on its upstream value chain partners, such as measuring the environmental and social impacts of upstream actors, including scope 3 GHG emissions. (EFRAG IG 2024.)

Data collection is divided into primary and secondary categories. Primary data is collected directly from specific activities within the company's value chain, while secondary data, like industry averages, is obtained from external sources. (Mazhar, Anjum, Anwar & Khan 2021; GHG Protocol 2011) Under the CSRD, companies are expected to prioritize collecting primary data from upstream and downstream actors, making reasonable efforts to do so. If primary data is not available, companies may estimate this information using sector averages or other proxies. (Commission Delegated Regulation (EU) 2023/2772) After gaining insight on data collection in the terms of CSRD and ESRSs, we focus on how to disclosure and collect needed data to achieve requirements of value chain information.

2.5.2 Scope 3 upstream emissions

Global value chains are complex, involving multiple supplier tiers across different regions. To calculate Scope 3 emissions accurately using primary data, companies need access to information from suppliers, which are often beyond their control. This requires collaboration across all tiers, but many suppliers lack the expertise and resources for proper data collection, creating significant challenges, often requiring substantial upfront investment to address these gaps. (Stenzel & Waichman 2023.)

GHG Protocol Corporate Value Chain Accounting and Reporting Standards (2011) identified 4 steps process of collecting and evaluating Scope 3 emissions, as illustrated in the Figure 4. The process involves prioritizing the data collection efforts based on the business goals, selection of relevant data, gathering data and addressing any data gaps if identified, and continuously improving quality to data over time.

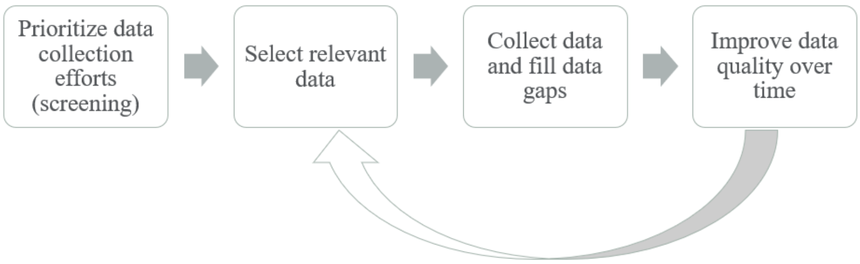

Figure 4. interactive process of data collection

Companies may use different methods to collect and calculate scope 3 emissions across the value chain, such as supplier specific and hybrid methods – include collecting data straight from suppliers or value chain partners, or approaches like – average-data and spend-based methods – use secondary data, for example industry average data. In the ESRS, Application requirement (AR) 46. defines that when measuring Scope 3 emissions using inputs from specific activities within entity's upstream and downstream value chain, the data used in calculations should be collected primarily from suppliers or other value chain partners. (Commission Delegated Regulation (EU) 2023/2772) Due to this requirement, we will focus on examining only the first two methods in this context.

When selecting the most appropriate calculation method, company should first carry out the screening, as not all data have same prioritization in the data collection and calculation process. This also applies to significance of different suppliers and data obtained from them, as not all suppliers are as important and severe for example based on magnitude of GHG emissions or revenue. Primary activity data can be gathered through meter readings, purchase records, direct monitoring, or other methods used to collect data from specific activities within the company's value chain. If available, emission and/or energy data from suppliers or other value chain partners should be used to obtain site-specific data for priority Scope 3 categories. Activity and emission data can be collected at varying levels of detail and granularity, with the company aiming to obtain the most product-specific data available, as shown in figure 5.

Data Type	*Description*
Product-level data	Cradle-to-gate GHG emissions for the product of interest
Activity-, process-, or production line-level data	GHG emissions and/or activity data for the activities, processes, or production lines that produce the product of interest
Facility-level data	GHG emissions and/or activity data for the facilities or operations that produce the product of interest
Business-unit-level data	GHG emissions and/or activity data for the business units that produce the product of interest
Corporate-level data	GHG emissions and/or activity data for the entire corporation

Figure 5. Level of data. (GHG Protocol 2011)

When primary data is unavailable or requires unreasonable effort to obtain, the company should use secondary data to fill the gaps. In selecting secondary data, preference should be given to internationally recognized databases, those provided by national governments, or peer-reviewed sources. Utilizing data quality indicators, such as completeness and reliability, can help identify secondary data sources that are the most accurate, reliable, and representative of the company's activities in terms of technology, time, and geography (GHG Protocol, 2013). When combining secondary data with primary data from suppliers or other value chain partners, the company must understand the boundaries of the data to minimize the risk of double counting.

2.6 Double Materiality Assessment

Sustainability reporting is challenging due to various aspects of its topic and this has led to challenges of what sustainability information company should disclosure. However, in corporate financial reporting, companies have traditionally used the materiality principle to determine which information should be included or excluded from their financial statements. Unlike financial reporting where information is considered material if its omission or misstatement could reasonably impact the decisions made by users based on the company's financial statements, corporate sustainability reporting has developed its own approach to materiality. (Mezzanotte 2023.)

Double materiality assessment, introduced by the European Parliament, is a key concept for both companies and stakeholders and at a heart of the CSRD. It sets a threshold for the disclosure of all aspects of corporate sustainability, ensuring that businesses evaluate both how their activities impact the environment and society, and how sustainability issues affect their financial performance. (Dragomir, Dumitru, Chersan, Gorgan & Păunescu 2024; Abhayawansa 2022) Double materiality reflects a broader understanding of corporate responsibility and risk management, aligning financial performance with sustainable practices and stakeholder interests. Double Materiality Assessment process can be an effective tool to establish issues that have impact on the company and its stakeholders (Hristov & Searcy 2024; Fiandrino, Tonnelli & Devalle 2022).

According to Mezzanotte (2023) double materiality has two dimensions: impact materiality and financial materiality, which are closely related to each other's and therefore interdependencies between these two dimensions should be considered when doing double materiality assessment. The reporting company employs specific criteria to identify information that is financially material and information that is identified as material in the impact perspective. This approach enables the company to identify "material sustainability matters" and subsequently prepare the necessary disclosures – including application requirements (AR) and datapoints applicable to such sustainability matters. (Mezzanotte 2023; European Commission 2023.)

Under the CSRD (Directive (EU) 2022/2464), companies are required to report the sustainability matters under double materiality assessment perspective. This means that undertaking must consider both their impact on people and environment, as well as financial materiality – how the sustainability issues effects on the company's financial position. In the Figure 6, double materiality as a concept and the interdependencies between financial materiality and impact materiality is illustrated.

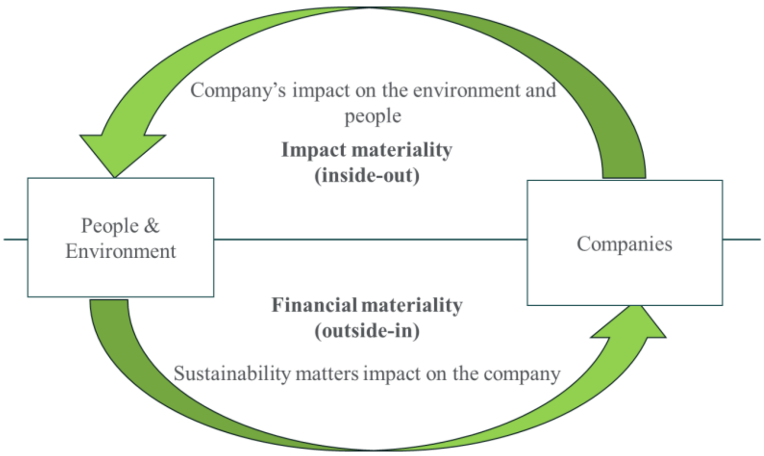

Figure 6. Double Materiality

Impact materiality refers to material issues from an "inside-out" perspective. It captures the actual or potential positive or negative effects of a company's activities on people and the environment, including environmental, social, and governance (ESG) matters, over the short, medium, or long term. These impacts arise from both the company's direct own operations and its value chain (upstream and downstream), covering its products, services, and business relationships, beyond direct contractual ties. (European Commission 2023.) For actual negative impacts, materiality depends on the severity of the impact, which is assessed based on scale, scope, and irreversibility. For potential negative impacts, both severity and likelihood are considered, with severity taking precedence for potential human rights impacts. In the case of positive impacts, materiality is determined by the scale and scope for actual impacts, and by scale, scope, and likelihood for potential impacts. (European Commission; Dragomir et al. 2024.)

Financial materiality on the other hand, focuses on the "outside-in" perspective, assessing how sustainability issues impact a company's financial performance, such as cash flows, development, performance, cost of capital, and access to finance. This goes beyond traditional financial materiality used in financial statements, encompassing risks that influence value creation even if they are not classified as assets or liabilities. The materiality of these risks is assessed based on both the likelihood of their occurrence and the potential fiscal impact. (European Commission 2023; Grant Thornton 2023.)

In double materiality assessment sustainability matters can be identified as material from either point of view or based on both financial and impact materiality perspective. The corporate sustainability directive requires a company to report information that is relevant from either point of view or only from one point of view. The impact can also expand from the influence essential to financial materiality and vice versa, so it is important to consider both as individual perspective as well as their interdependencies. (Niskala & Palmuaro 2023, 48; Mezzanotte 2023.)

According to ESRS company may exclude all disclosure requirements in a topical standard if assessment shows that topic in question isn't material. However, if E1 – climate change is defined as non-material, company shall disclose a detailed explanation of why climate change is not defined as material and may disclose brief explanations of other topics as well. In the figure 7. is illustrated the flowchart of determining disclosures under ESRS. (European Commission 2023.)

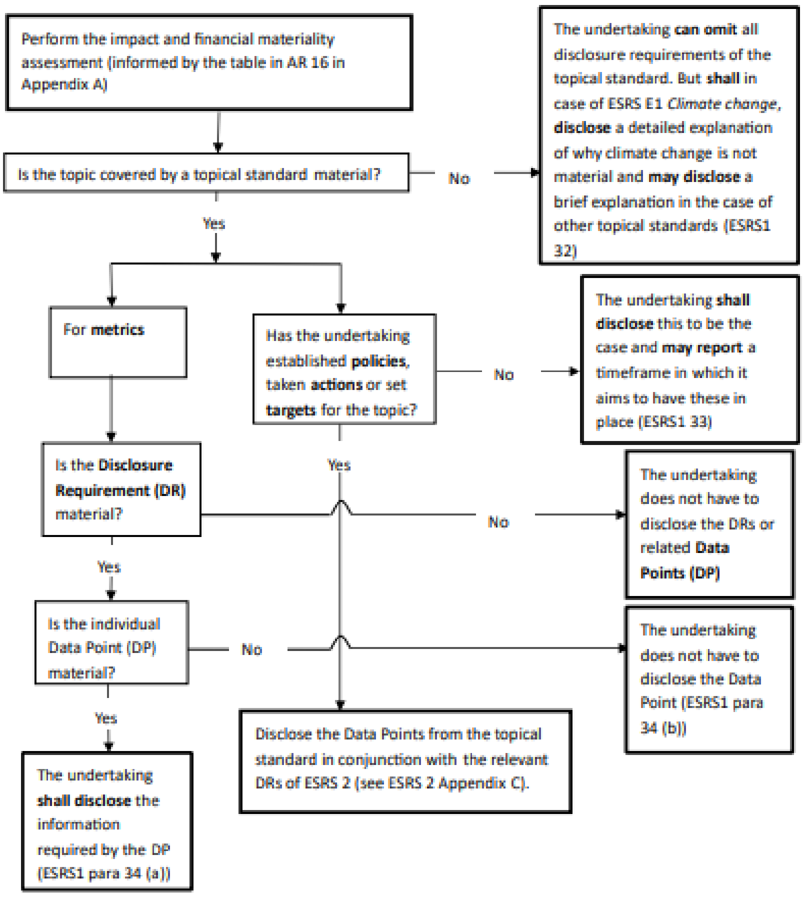

Figure 7. Flowchart for determining disclosures under ESRS. (European Commission (2023) Annex 1, 33)

In conclusion, the double materiality assessment is a great framework in corporate sustainability reporting, as it provides comprehensive approach to determine which sustainability matters company should disclose. By integrating both impact perspective and financial perspective, the double materiality principles ensure evaluation of corporate sustainability for the stakeholders. As required by the CSRD, companies must assess and report on both dimensions if topic is material, ensuring that all relevant information is disclosed, promoting transparency, and enhancing accountability in corporate sustainability practices. This approach helps companies and stakeholders to make more informed decisions based on the sustainability reporting, considering both internal and external impacts, risks and opportunities.

3 Research methodology and data collection

This chapter focuses on deepening research methodology and data collection. It begins by explaining and justifying the research methods employed, followed by an overview of the various data collection techniques utilized. Research methodology consist of various qualitative data collection approaches, including the results of a double materiality assessment and secondary analysis of data from annual and sustainability reports to provide comprehensive insights into the case company.

The study was conducted as a qualitative case study. The aim of a qualitative case study is to gain a comprehensive understanding of the phenomenon being examined. This method is well-suited for this research, as it focuses on a single company's corporate sustainability reporting requirements, providing an in-depth picture of the situation. (Hirsjärvi, Remes & Sajavaara 2009, 161; Metsämuuronen 2006, 90–91.)

The case study is a qualitative method to carry out research and can be defined from its unit of analysis as a "research method that involves investigating one or a small number of social entities or situations about which data are collected using multiple sources of data and developing a holistic description through an iterative research process" (Runfola, Perna, Baraldi & Gregori 2017). The thematic analysis was chosen to use for the primary data of the thesis. Where thematic analysis can be defined as:

> "Thematic analysis is a method to analyze qualitative data. It involves the identification and reporting of patterns in a data set, which are then interpreted for their inherent meaning." (Naeem, Ozuem, Howell & Ranfagni 2023.)

Thematic analysis in a double materiality assessment involves identifying key themes across both financial materiality (how sustainability factors impact the company) and impact materiality (how the company affects environmental, social, and governance issues). By categorizing these themes, organizations can better understand and address risks, opportunities, and the wider impacts of their activities.

In this study we follow phases of thematic analysis provided by Braun and Clarke (2006) which is illustrated in the figure below:

Figure 8. Phases of thematic analysis

The thematic analysis process begins with repeatedly reviewing the data to gain a clear understanding and form a broader perspective, using notes and initial observations based on prior research. After this, the formal coding process starts by creating initial codes, which represent meaningful data elements relevant to the research. These codes help organize the data into groups for easier interpretation. (Braun & Clarke 2006.) After all initial codes have been generated and collated, the next step is to re-focus the analysis at the broader level of themes, involving sorting the codes into potential themes and collate all the relevant codes extracts within identified themes. (Braun & Clarke 2006.) These themes are then reviewed to ensure they align with the research objectives.

Before defining and naming the themes, the underlying or guiding ideas should form the basis of a thematic map. This map visually represents the process of defining themes, ensuring they are distinct yet coherent, highlighting their consistency while keeping them separate from one another (Tuomi & Sarajärvi 2018; Braun & Clarke 2006). Phase 5 begins when you have a satisfactory thematic map of your data. At this stage, the themes are refined, focusing on their essence and how they contribute to the overall research narrative. Sub-themes may also be created to provide additional structure. Ultimately, each theme is clearly defined and analysed in relation to the research question. (Braun & Clarke 2006.) Final stage, includes the final analysis and written report of the findings.

In this research thematic analysis was conducted using five identified themes of the double materiality assessment data provided by the case company, the following themes are presented in the figure 9.

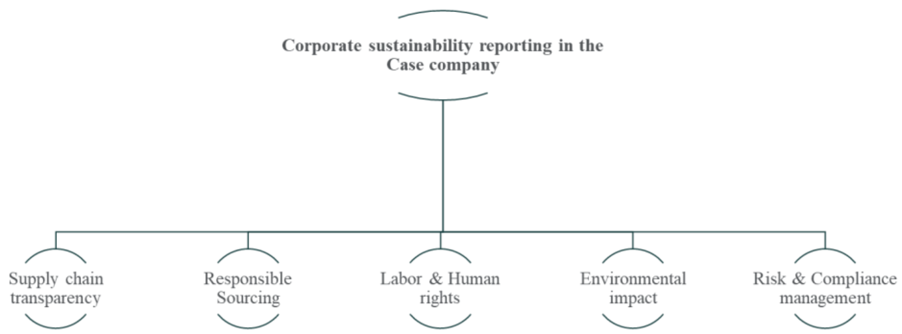

Figure 9. Thematic analysis

In this qualitative case study, the primary data was analysed using thematic analysis, the empirical part of the study has been conducted utilizing internal material obtained from the company and comparing it with existing literature. The research material consists of Double Materiality Assessment (DMA) projects results which was carried out between June and September 2024. Double materiality assessment results are analysed using a thematic analysis of the content, where the relevant points that emerged from the material were first picked up as so-called codes and then grouped under themes and their sub-themes. Sorting to codes and themes helps to qualitive case study to achieve the objective by increasing the understanding of the research subject. (Liu, Sellgren, Kaila & Koskela 2021.) Double materiality assessment was conducted using existing sustainability related information, analyses, reports and plans, previous materiality assessment, engagement with case company's key stakeholders and external insights of typical material topics in the industry.

Secondary data was used to utilize the current state of sustainability reporting and to fully understand the actions required to achieve full compliance with the new corporate sustainability reporting directive and its requirements. Secondary data collection included annual review and sustainability reports from the company website including sustainability reports from years 2021-2023 and one annual review from year 2023.

4 Current state of Sustainability Reporting

This chapter presents the empirical analysis and findings on the current state of sustainability reporting in the case company. It begins with an introduction to the case company, followed by an evaluation of its current sustainability reporting practices, as understanding the current situation is crucial for the implementation of CSRD requirements into corporate sustainability reporting. After gaining a comprehensive picture of the current state, the chapter evaluates the company's maturity to identify the need for concrete actions in the terms of continuous improvement.

4.1 Introduction of the case company

In this research, the case company is a multinational organization which is offering several types of services, products, and solutions to its customers across commercial, naval, and offshore segments in maritime industry. The case company aims to provide solutions, services, and products to help its international customers to reduce their environmental footprint both on land and at sea. Company employs approximately 500 people in 14 different countries. Due to its size, the company is organized into different business areas, and at this study we focus on one business line that focuses on providing water and waste management technologies across the maritime industry, excluding other business lines out of the examination due to their diversity. Case company has grown into a global leader in its field, serving customers in various industries, so the importance of transparency and accountability for its stakeholders has become more significant part of the corporate governance and its business activities.

In the mentioned business area, the selling of the goods happens directly to organizational customers as well as throughout its global distribution network with multiple different actors. Also, the end customers vary a lot from each other's, with the demand, needs and capabilities taken into account, which makes it more difficult to answers constantly changing customer requirements and this issue emphasizes the need to also answer sustainability questions related to customer needs. Unlike the conventional, Case company does not have its own manufacturing operations, except basic assembly, and the manufacturing is done using external manufacturing partners. This emphasizes the need for collaboration within supply chain partners to assure prominent level of sustainability within whole supply chain.

Supplier management within company aims to create industry's best supply network by working together the most effective parties to increase sustainability within supply chain. Case company has up to 800 different active suppliers, and around 200 are key suppliers which cover most of the demand. The supplier base is segmented into strategic, preferred and approved suppliers, and each segment is driving defined principles and requirements, and the performance is monitored in several levels, and development of collaboration with them is one of the key areas. Most of the first-tier suppliers are based in Europe and United States, with few in Asia. Suppliers are categorized to direct and in-direct suppliers, and they have multiple sub-categories in both groups. Each category has their own supplier management strategy which is created and managed cross-functional matters, including solid supplier selection process and practices as well as in supplier relationship management. The supplier relationship management ais to collaborate with best-performing supplier that supports case company's vision, mission, and values.

In the case of case company, the new corporate sustainability reporting directive will enter into force in 2025, and for the report to be published in 2026 from 2025 fiscal year. So, the based on this research, company can gain significant insight about needed actions and capabilities to address the challenges that came up in the double materiality assessment.

4.2 Case company's current state of sustainability reporting

The sustainability reporting in the case company isn't a new phenomenon; it has been an integral part of its annual reporting. Available to all in company's website, the sustainability reports under review in this study are from year 2021-2023. Sustainability reporting takes place on annual basis and covering all the operations globally within 14 different countries. These reports are prepared annually in accordance with the GRI 2021 standards, ensuring consistency and transparency in sustainability practices throughout the review period.

The sustainability within the company, is seen as cornerstone of all the activities and sustainability is strategically aligned with the material topics identified. They use materiality analysis as a basis of sustainability reporting which was conducted already in 2021. Now step forward is taken as the double materiality assessment project is kick-started that also takes place as basis to prepare for the upcoming CSRD. The double materiality assessment was carried out between June and September 2024 and provided significant insight about the current state of sustainability in the terms of CSRD requirements.

In 2022, case company stated to emphasize the collaboration with its supplier network, aiming to align and fully understand their sustainability approaches and define shared focus areas and targets. This enhancement of collaboration continued in 2023, by building effort to strive for responsible sourcing as part of broader sustainability program. This included deepening the collaboration with selected partners and strategic suppliers by arranging workshops and meetings which focused on sustainability. One of the targets defined together with partners and suppliers within value chain, is to decrease environmental impacts of the long-distance transportation, which also lead to decreasing amount of GHG emissions in the value chain.

In year 2023, total of 21 supplier audits were conducted and the number of audits is going to increase up to 35 in 2024, which is a great transformation in the terms of upcoming CSRD and its requirements, as supplier engagement and monitoring plays a pivotal role of reporting under new European sustainability reporting standards. Case company notes that audits will cover sustainability factors in production processes, environmental management, quality and management systems. Moreover, in 2023 case company required up to 23 corrective actions from suppliers and proposed 35 improvement ideas, emphasizing the commitment to continuous improvement.

Sustainability in supplier management and especially in supplier qualification process has grown to significantly as a determination criterion, which takes place the basis of new supplier selection process and evaluation throughout integrated questions into the qualification process and studying sustainability practices of top 20 suppliers by arranging comprehensive questionnaire. All these actions aim to maintain continuous sustainability dialogue with suppliers and encourage them to take proactive measures within their supply chain to mitigate the negative impact to environment and people and achieve high overall performance that can be achieve throughout sustainability.

Case company uses Supplier Code of Conduct (SCoC) as part of supplier management, and it outlines the company values and requirements for suppliers, as well as terms and conditions of each purchase orders. Within the company, they expect that suppliers have systematic process to manage their environmental impacts and follow internationally recognized human right standards, forbiting forced or child labour under any circumstances.

The continuous development can be seen in the years of review, as each year corrective actions from suppliers has been required and aim to supplier improvement is also centre of attention as well as overall improvement within company. Integration of sustainability into key suppliers' management process - qualification, evaluation, audits, and business reviews – happens by regularly monitoring agreed-upon actions and swiftly addressing any violations. If breaches are not adequately resolved, company reserves the right to suspend or terminate the supplier agreement. This gives case company a power to negotiate with suppliers and maintain high-level performance of suppliers in the terms of sustainability.

Due to increasing pressure on supply chain, in 2024, the selection of strategic partners focuses on improving overall sustainability of the supply chain to enable the most significant positive impact and prevent the negative impacts as well. To measure the progress within supply chain, case company has integrated sustainability as part of regular supplier monitoring process, and at the same time improving internal knowledge about sustainability throughout sustainability trainings. In conclusion, the commitment to fostering collaboration, enhancing supplier qualifications, and continually refining evaluation processes is key to promoting sustainability across supply chain. These efforts not only align with business mission but also empower suppliers to meet their own sustainability goals. Altogether, the desired outcome is positive impact on both the environment and society, driving meaningful change throughout global operations.

In conclusion, there can be seen continuous development of sustainability disclosure over the years, and they offer a great basis of transformation to disclosing sustainability matters under CSRD and ESRSs. Next, we evaluate the maturity of sustainability reporting in the terms of CSRD in order to identify the needs for improvement.

4.3 Maturity analysis of current state of sustainability reporting

In this Thesis, we used maturity analysis principles of research provided by Okongwu, Morimoto and Lauras (2013), we maturity of supply chain sustainability disclosure is evaluated from a continuous improvement perspective and therefore suits well for this maturity analysis of current state of sustainability reporting in the case company. In the research provided by Okongwu et al. (2013), the maturity has three levels; level 1 – define, level 2 – measure and manage and level 3 – improve and change. In the first level, company should check whether they as an organisation defines and reports, both societal development sustainability (SDS) and supply chain sustainability (SCS), key stakeholders and their needs, sustainability strategies and policies, and major sustainability attributes that enable to measure performance. At level 2, they should report information about how they measure and manage sustainability issues and a process that is confirmed by self-assessment and audits. At the final level, this reporting should extent the reporting on how performance measures are used to change and improve performance for identified stakeholders to how engagement of services of an independent auditing body is used to add reliability of reported information as well as continuous improvement. (Okongwu et al. 2013.)

In this maturity analysis, the proposed framework for improving the maturity of firms in sustainability disclosure is modified to suit best for the evaluation of the case company's current state of sustainability reporting and identify the needs for improvement. In the table below, the colour indicates the current state of sustainability disclosure and level of maturity and next steps for continuous improvement perspective.

Table 3. Proposed framework to improve maturity of the case company.

Sustainability criteria	Level 1: initial	Level 2: intermediate	Level 3: advanced	Level 4: world clas
Organisation (governance)	the governing body is clearly defined	The governing body plays a major role in the implementation of sustainability initiatives	The governing body adopts a proactive approach in the development and management of sustainability initiatives	"Sustainability data are certified by an independent body (external assurance) Evidence of how the defined sustainability attributes and initiatives contribute to satisfying stakeholders."
Strategy and policies	Organisation's sustainability-related strategy and policies are clearly defined	There is evidence of how sustainability strategy and policies are implemented	New sustainable technologies and initiatives are continuously integrated into corporate strategy and policies	
Stakeholders	Stakeholders and their needs are clearly identified	Key stakeholders are engaged in decision making	Stakeholders are involved in improvement initiatives	
Performance measurement	Key sustainability performance indicators are clearly defined	The performance of sustainability initiatives are measured	Sustainability performance measures are updated and improved and self-audit performed	
Sustainability standards	Sustainability standards (ISO 14001, ISO 26000 & ISO 9000) and compliance policies are clearly mentioned	Sustainability standards are implemented and managed in at least two of the three sustainability dimensions	Sustainability standards are improved	
Supply chain design	Supply chain (SC) processes and activities are clearly defined	Sustainability initiatives are implemented in upstream or downstream linkages	A life cycle approach is adopted in implementing sustainability initiatives	
Employee management	Policies related to personnel management (wages, work conditions, health and safety, [y]) are clearly defined	Social initiatives concerning employees are implemented and managed, and performance measured	Social measures concerning employees are improved over time	
Supplier relationship management	Policies concerning the management of suppliers are clearly identified	Suppliers are involved in implementing and managing sustainability initiatives	Suppliers are involved in sustainability improvement measures and problem solving	
Environment	Environmental issues and management policies are clearly defined as they apply to the life cycle SC	Environmental initiatives are implemented and performance measured	Environmental measures are improved over time and changes made in the supply chain	

In conclusion, case company has good level of sustainability disclosure of the supply chain management, but there is need for improvement to address the challenges coming from upcoming corporate sustainability reporting directive. Based on the maturity analysis of current state of sustainability reporting, there is clearly need for deeper level of reporting and especially disclose information about how the performance is measured and monitored in terms of continuous improvement, and implementation of identified key stakeholders such as upstream value chain partners to decision-making and problem-solving process to fully achieve the high sustainability performance within the company.

5 Thematic analysis and findings

Double materiality assessment is a central part of CSRD, as it defines the scope of related reporting requirements, and in the terms of case company the aim was to identify the key sustainability topics across the entire value chain. This highlights Case company's most significant positive and negative impacts on both people and the environment, while also pinpointing the critical business risks and opportunities related to sustainability. In this chapter, first we present the key finding of the thematic analysis and based on the findings present the needed measures of the supply chain management in the case company to comply with the CSRD. Thematic analysis principles and main step are explained in chapter 3 more deeply.

In the double materiality assessment, there were total 8 topical material groups for Case company's CSRD reporting discovered, and not material topics were S3 – affected communities and S4 – Consumers & end-users. In this research we focus on the upstream side of this double materiality assessment results, and evaluate what kind of risks, impacts and opportunities upstream value chain especially suppliers offer in the terms of upcoming CSRD requirements. In this research we narrow down the examination of results for the identified topical standards, and their sub-topics as well as sub-sub-topics (Figure 10).

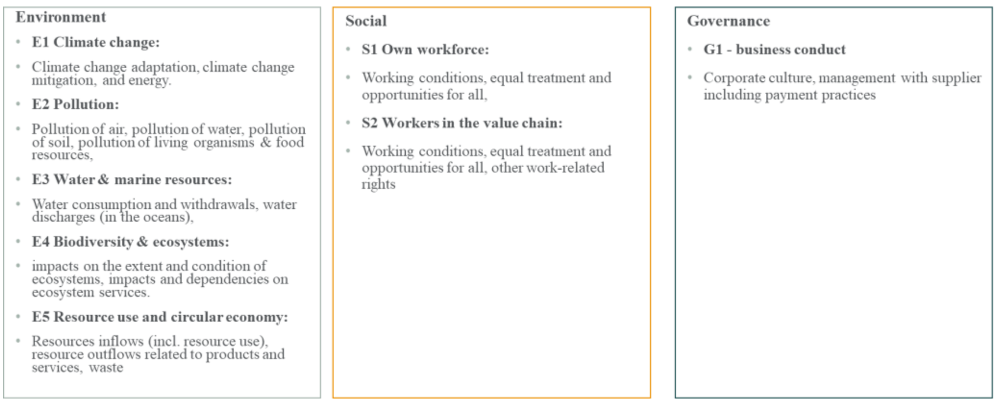

Figure 10. Identified material topical standards of the ESRSs and their sub-topics.

Based on the assessment, the highest impacts both positive and negative were associate with environmental topics. As impact materiality assessment identifies that Case company's impacts both positive and negative impacts rely on the environmental aspects, the role of suppliers is increasing to address and prevent the negative impacts. The highest opportunities are tied to positive impacts such as ability to reduce emissions, energy efficiency and circularity within supply chain with the help of stakeholders. Furthermore, an analysis of the findings from the double materiality assessment reveals that the majority of risks and negative impacts are associated with the upstream value chain. Key material impacts identified include material issues related to pollution, water consumption, resource use, and biodiversity.

After conducting the thematic analysis of double materiality assessment results, we identified total five main themes and sub-themes was created to provide additional structure to this analysis. The primary themes and their sub-themes are illustrated in the table 4.

Table 4. Themes of the thematic analysis

Primary theme	Sub-themes
Supply chain transparency	limited knowledge, traceability, data collection
Responsible sourcing	Supplier assessment, sustainability agenda and targets, supplier development, supplier audits, sustainability dialogue
Environmental impacts	Climate change, emissions and energy efficiency, Environmental Impacts of the Value Chain, Emission management in value chain, Pollution, Non-Renewable Materials, Reporting and Compliance
Labor & Human rights	Health & Safety, geographical risk, Supplier Code of Conduct
Risk & Compliance management	Sanction compliance, risk assessment, risk monitoring, natural disruptions, Supplier Code of Conduct

5.1 Supply chain transparency

One of the main themes in the thematic analysis was identified supply chain transparency, as in the analysis it was noticed that lack of visibility and transparency within value chain is significant challenge and yet haven’t been able to be solved. For example, lack of visibility to monitor and assess working conditions of the workers in the value chain, is one of the reasons that in the double materiality assessment the risk of various human rights violations have being identified as negative impact in the upstream value chain.

The Corporate Sustainability Reporting Directive (CSRD) emphasizes the need for transparency and accountability in supply chains, requiring organizations to collect detailed sustainability-related data across various levels of their operations, including supplier data for example of GHG emission. To meet the objectives of CSRD, case company must ensure the whole value chain is aligned with topical standards, and to monitor that suppliers comply with common regulations.

In the double materiality assessment, one reason of the negative impact and financial risks was that case company has limited knowledge on the ESG aspects within upstream value chain. Under environmental standards multiple negative impacts under impact materiality and risks under financial materiality has been identified and one major key issue is stated as following:

> "Without comprehensive data from suppliers, it is challenging to manage and reduce these emissions effectively, which can lead to regulatory and reputational risks."

Therefore, systematic risk management process should be developed to support supplier assessment and monitoring to increase supply chain transparency. Supply chain transparency should be included to whole value chain, and especially traceability of suppliers and external manufacturers actions should be prioritized in data collection process to achieve reporting requirements of CSRD.

5.2 Responsible sourcing

Responsible sourcing within case company has been one of the aspects of sustainability reporting annually. The most significant potential environmental impacts arise from different parts of the supply chain, and within the company the importance of responsible sourcing and supply chain management practices have been acknowledged. Company addresses the sustainability matters annually throughout supplier audits, which can be seen as effective way to monitor suppliers' sustainability activities and performance. The challenge in the responsible sourcing is that there is significant number of environmental and social impacts associated with value chain, especially within upstream value chain. As already stated, this becomes more complex to address due to limited visibility and knowledge of supply chain activities.

The challenge of CSRD and ESRSs is the shared responsibility of various environmental issues and resources. Considering for example water and marine resources, it is seen as shared resources and therefore may require collective actions together with other stakeholders (e.g. suppliers, manufacturers). This could include actions to decrease substantial water withdrawals for raw material production and components manufacturing of upstream value chain which have been identified as negative impact. The problem associated with water and marine resources relies on the limited knowledge of the value chain impacts of water, and therefore the comprehensive assessment of suppliers and monitoring should be expanded also to water related sustainability matters to increase the visibility of value chain.

One of the sustainability targets in the case company is to decrease the environmental impact of long-distance transportation, particularly in Asia, this has significant impact to almost all environmental topical standards. Especially, it has been identified that transportation has significant influence on the scope 3 emissions in both downstream and upstream value chain.

In resource inflows, including resource use sub-topic had negative impact on the upstream side in value chain. Case company has high dependency on the non-renewable materials (such as metals) and the business model is structured on the dependency on these, which poses the challenge on how to reduce the negative impact on the consumption of these and increase the possibility to transform the business model towards circular economy and use of renewable materials. In assessment, it is identified that there is a need for actions in the terms of continuous improvement, and this poses an opportunity together with suppliers to drive towards resource efficiency, use of recycled materials and material substitution where possible.

The disclosure required by paragraph 28 shall include a description of its resource inflows where material: products (including packaging) and materials (specifying critical raw materials and rare earths), water and property, plant and equipment used in the undertaking's own operations and along its upstream value chain. (Commission Delegated Regulation (EU) 2023/2772.) This may require data collection from upstream value chain and manufacturing partners, as under the standard *E5-4 – Resource inflows* undertaking shall include information about materials are used to manufacture products and services during the reporting period.

5.3 Labor & Human rights

In the Double materiality assessment only S1 – Own workforce and S2 – Workers in the value chain were identified as material, and in this study, we focus on the S2 which includes workers working within supplier's premises as well as in the external manufacturing partners facilities. In the analysis, we highlighted the importance of the S2- workers in the value chain due to their nature and impact on the potential workers' rights and human rights violations in the upstream value chain. The risk of various labour rights violations and human rights violations, such as health and safety risks of workers in the value chain and external manufacturing partners has been identified as a negative impact associated with upstream value chain.

One of the aspects that increases the risk of human right violations is the geographical destination of the supplier in the value chain and their premises. Even though main of the external manufacturing partners are in Europe, some of them is in China which increases the risk of violations and in Europe the risk remains for example due use of migrant workers in some countries. The lack of visibility into the supply chain poses challenge to assess and monitor working conditions within value chain and therefore leave room for violations like child labour and safety and health violations. Also, insufficient assessment and monitoring of human & labour rights have been identified as challenge, and this highlight the need for comprehensive risk management process.

S2 – Workers in value chain topical standard was also assessed in the financial materiality perspective but none of the risk were indicated as material and therefore is left out of examination. Although there are not seen as priority of the reporting, there should be taken into account for the future reporting, as even though possibility of occurring is seen unlikely, the case company can't completely ignore it and assume it won't happen.

Case company shall disclosure information whether and how policies, actions and/or targets cover workers in value chain (S2-1 to S2-5). Even though, ESRS and CSRD doesn't define specific methods to disclosure information of the own value chain workers working conditions, it requires information of how company ensures that within its value chain have fair and safe working conditions. The disclosure requirements *S2-4 Taking action on material impacts on value chain workers, and approaches to managing material risks and pursuing material opportunities related to value chain workers, and effectiveness of those actions,* aims to prevent, mitigate and remediate the negative impacts on value chain workers and/or achieve positive impacts for them. This includes describing actions taken, processes to identify needed actions and related to material risk and opportunities, what actions are planned and how to track the effectiveness in practise. Also, company needs to disclose information whether severe human right issues and incidents are connected to in this case its upstream value chain that have been reported and disclose this information. ERSR S2-4 also requires that the risk management process(es) are also integrated to cover value chain workers and include description of how and whether its process(es) to manage material risks are related to value chain workers.

Under *Disclosure Requirement S2-5 – Targets related to managing material negative impacts, advancing positive impacts, and managing material risks and opportunities* company shall disclose the time-bound and outcome-oriented targets which shall contain information requirements defined in ESRS 2 MDR-T.

In the Supplier Code of Conduct (SCOC) of the case company, is one of the ways and actions to address the social sustainability matters, such as labour and human rights. In the SCOC, there is separately listed a requirement for human and labour rights, which address for example issue of child labour as it is defined that "*The Supplier shall not use workers under the age of 15 or under the local legal minimum age for work and or mandatory schooling age."* Health and safety issues are also aligned in SCOC, where suppliers are required to comply with all applicable laws and regulations, and suppliers are encouraged to have systematic approach to manage its health and safety responsibilities and if applicable to use management system such as IS0 45001.

Also, case company has conducted supplier audits regularly to address sustainability issues related to production processes, environmental management, quality and management systems but more deeply integration of social matters should be next step to increase visibility to value chain in the terms of labour and human rights.

5.4 Environmental impacts

Based on the double materiality assessment, Case company has significant environmental impacts, both positive and negative, especially in sustainability matters related climate change and energy efficiency. Additionally, material impacts have been identified in the upstream value chain, including pollution, water consumption, resource use, and associated biodiversity effects.

Double materiality assessment identified 9 negative impacts associated with upstream value chain, and that are seen as material where none of positive impacts were identified. The highest scoring is for the emissions in the upstream value chain, energy consumption and dependence on aluminium, copper, steel, ceramics and oil-related materials (e.g. plastics), based on the value chain implementation guidance provided by EFRAG (2024) these should be integrated to reporting by using impact data from upstream actors, as case company has high dependency on these value chain actors which on the other hand have high impact on the environment.

Analysis of the current state of sustainability emphasizes that GHG emissions are high prioritize on the case company's sustainability actions and reporting, and they have acknowledged the significance of the need for GHG emission reduction, where Scope 3 emissions which include all indirect emissions of their value chain (approximately 99,5% of total carbon footprint). They also identify the importance of collaboration with suppliers to reduce negative impacts across the value chain and leverage on the opportunities that suppliers offer in the terms of sustainability. The current challenge relies on the data collection of GHG emissions and other data needed to gather across the value chain, required in the ESRSs and CSRD. Now, Current state of scope 3 emissions in the case company, is that they have limited spend-based understanding of its scope 3 emissions within value chain, and it have been identified that highest intensity of carbon in primary materials, energy-intensive processes for external manufacturers such as welding and upstream and downstream transportation.

High environmental impact relies also on the air, water and soil pollution in the value chain from steel, copper, aluminium, plastics and ceramics manufacturing and related raw material extraction processes and high energy consumption, particularly in mining and metal production as well as industrial machinery manufacturing. Under ESRS company should disclosure information under E2 – Pollution (see appendix 1.) and one of the application requirements is to if these actions under E2 extend to upstream value chain engagements, company shall provide information on what types of actions are done together with upstream value chain.

Also, additional information should be provided from how to address negative impacts associated to use of non-renewable materials and aluminium, copper and steel as well as ceramics and oil-related materials (e.g. plastics) which case company has high dependency where business model currently rely on these materials. This poses the opportunity to considered possibilities outside of these resources, and together with upstream value chain aim to use more renewable materials and develop more sustainable using circular economy principles and resource use, such as recycling. In the table below, the summary of the identified themes under each topical standard are illustrated to conclude the observations and practises related to environmental impacts.

Table 5. Summary of environmental impacts

Theme	Practices and Observations
Climate change, emissions and energy efficiency	Prioritization of high GHG emissions in sustainability policies, actions and targets for reporting under CSRD.
	There is a need for comprehensive data collection from suppliers to manage and reduce Scope 3 emissions effectively.
	High energy consumption related to mining, metal production and industrial manufacturing,
	Need to improve energy efficiency and reduce Scope 3 emissions through collaboration with suppliers.
Environmental Impacts of the Value Chain	Most significant impacts: emissions, energy consumption, and dependence on aluminum, copper, steel, ceramics, and oil-based materials.
	Other key environmental impacts: pollution, water consumption, resource utilization, and effects on biodiversity.
Emission Management in the Value Chain	Need to collect data from value chain actors for impact reporting (based on EFRAG 2024 and ESRS guidance).
	Focus areas of data collection: carbon-intensive materials and energy-intensive manufacturing processes (e.g., welding) and upstream transportation
Pollution in the Value Chain	Significant pollutants may be generated during the extraction and production of sourced materials, including steel, copper, aluminum eg.
	Negative Impacts are primarily driven by metal mining, smelting and refinement processes.
Non-Renewable Materials	Need to transition to renewable materials and adopt circular economy principles to business model
	Opportunity for collaboration with upstream value chain to adopt ainable resource use practices and use more renewable materials.
Reporting and Compliance	Disclosure Policies, actions and targets related to environmetal impacts, under ESRSs.
	Additional information should be provided from how to address negative impacts associated to use of non-renewable materials.
	E2 - Pollution: disolsure of how actions extend to upstream value chain enegagements.

In conclusion, case company has significant environmental impacts that need to be addressed to avoid negative impacts from occurring, and this requires providing information about policies, actions and targets of each topical standards identified as material. This poses a challenge to collect value chain information, as EFRAG IG 2 defines that impact data from suppliers should be incorporated into reported metrics use to determine targets when company's actions rely highly on upstream value chain activities or value chain has significant impact on people or environment.

5.5 Risk & Compliance management

In the double materiality assessment, the most significant business risks are associated to direct or indirect breaches of sanctions and inability to innovate and therefore risking the ability to stay competitive in ever-volving business environment. Other significant risks are related to environmental risks in the value chain, such as natural disruptions and correspondingly to data collection problem already mentioned, the lack of data to monitor suppliers and mitigate the environmental risks associated to their activities that may influence financially negative to case company's business operations.

At the same time, being prepared for upcoming regulatory requirements and more stringent future regulations poses a significant opportunity to achieve competitive advantage and other benefits related to integration of regulations into supply chain management. In Business conduct standards sub-topics corporate culture and management of relationships with suppliers including payment practices has been identified as material and other sub-topics are non-material and therefore doesn't require disclosure.

Based on the analysis, we can see that especially management of relationships with suppliers includes significant number of risks associated with supplier and one opportunity that can help mitigate or prevent the risk occurring. Risks are associated with supplier relationship management, and as suppliers have been identified as crucial part of business resilience, this should be considered comprehensively to address the risks proactively. *G1-2 Management of relationships with suppliers* includes several risks but only suppliers breaching sanctions directly or indirectly were identified as financial material issue.

The potential ethical and legal breaches are mitigated already by centralized compliance policies and practises within value chain, as well as comprehensive employee trainings to track awareness as a key performance indicator. The company also performs thorough screening and due diligence, consistently reviewing transactions to ensure compliance. In 2023, it rejected several quotations following sanction screenings.

Additional information about management relationships with suppliers may be disclosed, with a focus on the accuracy, completeness, and transparency of the disclosed data. According to Disclosure Requirement G1-2, the following aspects should be considered:

(a) *Supply Chain Risk Management*: How the company's practices, including efforts to avoid or minimize the impacts of disruptions to its supply chain, support its overall strategy and risk management approach.

(b) *Training and Incentives:* The training provided to the company's procurement/supply chain workforce on engaging and communicating with suppliers, as well as the incentives offered to procurement staff, including whether these incentives focus on price, quality, or sustainability factors.

(c) *Supplier Evaluation*: The processes used for screening and evaluating the social and environmental performance of suppliers.

(d) *Local and Certified Suppliers:* The inclusion of locally based suppliers and/or suppliers with relevant certifications in the company's supply chain.

(e) *Supporting Vulnerable Suppliers:* How the company's practices address the needs of vulnerable suppliers.

(f) *Targets and actions of supplier relationships:* the company's targets and actions concerning communication and management of relationships with suppliers.

(g) *Evaluation of Practices:* How the outcomes of these practices are assessed, including through supplier visits, audits, or surveys.

As stated before, it is important to get clear understanding of how the practices to address sustainability matters and risks associated with upstream value chain are implemented through business.

5.6 Necessary Measures for Supply Chain Management in Case Company

The objective of this chapter is to understand what the required measures of supply chain management in the case company are, and what capabilities and actions are needed to achieve the requirements of both CSRD and ESRSs. The double materiality assessment served as a basis for research, but secondary data enabled us to evaluate already existing capabilities and how they can be developed to meet the requirements of new directive and standards.

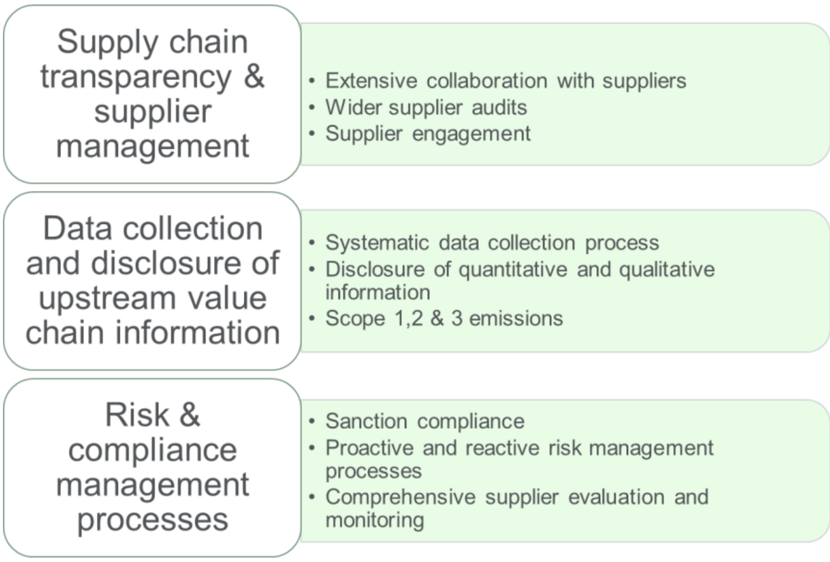

Figure 11. Necessary Measures for Supply Chain Management

In the figure 11, the needed measures are illustrated to conclude the findings and needed measures to address impacts, risks and opportunities associated with sustainability matters identified.

5.6.1 Supply chain transparency & supplier management

Based on the analysis of case company's double materiality assessment one of the main challenges emphasized in the various aspects of sustainability was the lack of transparency within supply chain. Transparency is recognized to be associated with the collection of accurate and credible data, and transparency emphasizes the measurement of data from various sources, but the challenge relies on the fact that companies still widely withhold their information of their business activities (Yang & Lu 2024). In the thematic analysis under the theme supply chain transparency, was also identified sub-themes such as traceability and limited knowledge.

In the previous literature there are multiple ways to improve supply chain transparency, but in this study, we focus on supply chain relationships, and particularly supplier engagement and collaboration to improve transparency and visibility in supply chain. Brun, Karaosman and Barresi (2020) identified two practises to enhance suppliers' sustainability performance which are collaboration and assessment. In the case company, the wide collaboration with suppliers is seen essential to understanding of their sustainability approaches and defining shared targets and focus areas. The current state of collaboration is at good level as there have been frequent meetings and workshops focusing on sustainability, which emphasized a high commitment to continuous improvement of whole value chain.

It can be challenging to obtain information ad influence on low-tier suppliers (Brun et al. 2020), so Yang and Lu (2024) recommend that the first step to improve would be to focus on the first-tier suppliers. In this case study, it would also be recommended to start increasing supply chain transparency within upstream value chain and addressing negative impacts and risk associated to lack of transparency on direct suppliers, and therefore also starting to gain insight on multi-tier suppliers.

In this study, the limited transparency in the supply chain was seen one of the major challenges achieving full compliance with upcoming CSRD. Supply chain transparency have been assessed already though supplier monitoring and evaluation as well as integrating sustainability dimensions to supplier selection processes and audits. An impact materiality analysis revealed significant negative impact on upstream emissions and energy consumption. However, these challenges can be effectively addressed through proactive supplier engagement and relationship management. Implementing robust engagement systems can significantly reduce emissions, alongside collaborative efforts between companies and their suppliers can lead to increased revenues, enhanced brand reputation, cost savings, and reduced risks. (Tidy, Wang & Hall 2016.)

In conclusion, supplier management and engagement also play pivotal role of managing supplier sustainability performance and therefore address risks and negative impacts associated to suppliers' supply chain activities. Ultimately, advancing supply chain transparency is essential for improving the company's overall sustainability performance and ensuring compliance with emerging sustainability standards.

5.6.2 Data collection and disclosure of upstream value chain information

As stated before, according to Brun et al. (2020) enhancement of suppliers' sustainability performance can be done through out supplier assessment (monitoring and evaluation), which typically aims to control suppliers' outputs against specific performance criteria using tools to measure them, such as questionnaires, voluntary standards and/or audits. To enhance sustainability of suppliers, it is also important to obtain information about their performance and track the effectiveness of process.

Even though CSRD and ESRS doesn't require any specific level of detail of the underlying data or methodology used in the reporting, it proposes that the primary data is collected from its upstream and downstream value chain, and only in the case of company isn't able to collect the information, undertaking company shall estimate the impact of its value chain by using sector average data and other proxies. (European Commission 2023.) Also, how to collect data from upstream value chain isn't specified but in the value chain implementation guidance (EFRAG 1G 2024) proposed that data collection in the cases, when data needs to be obtained straight from direct suppliers the data can be collected using questionnaires, surveys and audits to gain needed information.

Under ESRS the undertaking must disclose both quantitative and qualitative information about its value chain, for example under E1 – Climate change, undertaking company is required to disclose information about Scope 1, 2 and 3 GHG emissions of whole supply chain, including upstream and downstream across the value chain. To achieve this disclosure requirement company needs to systematically generate the process how together with suppliers obtain the needed data and calculate the emissions. Where there is specific guidance to calculate the emissions proposed in the ESRS, there isn't guidance how to implement the upstream and downstream value chain.

The CSRD doesn't provide a specific method for data collection, but it requires accuracy, transparency and completeness of the data obtained and it encourages companies to follow internationally accepted frameworks such as GHG protocol Corporate Standard (version 2004) or/and ISO 14064-1:2018. (Commission delegated regulation (EU) 2023/2772.) In this study, we focus on the scope 3 emissions and how to collect relevant data to achieve GHG calculation requirements regarding Scope 3 emissions.

The screening to prioritize the data collection within supply chain should be done, to identify which scope 3 emissions on the upstream side of value chain are the most significant in the terms of risks, opportunities and impacts on the business goals. As a result of the screening process, company might allocate the resources of the precise data collection to the critical activities to gain high quality data, and moreover can rely on the relatively less accurate data for the activities that have less significant emissions or where the data is difficult and time consuming to obtain (GHG protocol 2013). Based on the current state of scope 3 emissions which is spend-based understanding of the most significant emissions come from purchased goods and services, upstream transportation and distribution and fuel and energy related activities, such as welding so it is suggested to prioritize the data collection of these categories from suppliers and use secondary data on those categories less significant to total emissions.

As the most severe emissions come from upstream and downstream transportation, manufacturing processes and use of materials in production, such as steel and plastics, we proposed that in the data collection the primary focus should on hybrid method from data collection and calculations. As company already has spend-based understanding of scope 3 emissions, this helps the screening process. In the hybrid method, the main focus should be on the collection of data from suppliers or other value chain partners and only fill the gaps with secondary data, such as industry averages.

Hybrid method include collecting allocated scope 1 and 2 emission data directly from supplier or value chain partner, calculating upstream emissions from suppliers involves using activity data such as the quantity of materials, fuel, and electricity consumed, the distance goods are transported, and the amount of waste generated and applying appropriate emission factors and using secondary data to fill the gaps if primary data isn't available. (GHG Protocol 2013). Not to all upstream emission categories the hybrid method is appliable, but the idea behind the hybrid approach in this study is to collect supplier-specific data when available and use other methods or combination when primary data cannot be obtained.

It is recommended to adopt an international framework, such as the Greenhouse Gas (GHG) Protocol, for the systematic collection and monitoring of GHG emissions on an annual basis. The use of digital tool can significantly streamline the data collection process, making it more efficient and accurate (Gustafsson-Wright, Osborne & Aggarwal 2022). These tools can help track emissions data in real-time and across multiple sources, ensuring compliance with reporting standards like the Corporate Sustainability Reporting Directive (CSRD). Engagement with suppliers is equally important, and it is studied to improve sustainability performance of a company. (Lintukangas et al. 2022). The first-tier supplier should be the priority in scope 3 emissions process including data management, as they pass the sustainable requirements to second-tier suppliers and therefore engagement with them is essential in transferring sustainability further upstream in the supply chain (Lintukangas et al. 2022; GHG Protocol 2011).

In addition, companies must disclose the elements of its strategy that are related to or affect sustainability matters, and its business model and value chain. This means that case company needs to include description of its business model and value chain, including main features of its upstream value chain and company's position in its value chain and description of its main business actors, such as key suppliers or/and distributors. Additionally, companies should explain how stakeholder interests and perspectives are integrated into their strategy and business model. Finally, they should report on their material impacts, risks, and opportunities, highlighting how these factors align with and influence the company's strategy and operations. (Commission delegated regulation (EU) (2023).)

In conclusion, when gathering data from upstream value chain and disclosing information, case company should integrate comprehensive reporting system into sustainability reporting that includes strategy, business model and value chain, and how the value chain partners effect on the overall performance of sustainability. This includes identifying key stakeholders, such as key suppliers and integrate them to the overall corporate strategy and business model, to fully comply with upcoming CSRD. When collecting data about upstream value chain, case company should consider its resources and select the data collection process that best suits its situation, and it is suggested to collect data primary to its suppliers and fill the gaps using sector averages and other proxies to meet the requirements of CSRD.

5.6.3 Risk & compliance management processes

In the European Commission (2023) Annex I is states that the undertaking shall disclose the main features of its risk management and internal control system related to sustainability reporting, including the scope, components, risk assessment approach, identified risks and mitigation strategies, integration of risk assessment findings into internal processes, and periodic reporting of these findings to its administrative, management, and supervisory bodies. It aims to provide comprehensive understanding on company's risk management and internal processes related to sustainability reporting (European Commission 2023). Even though reporting of risk management processes focuses on the internal control processes, case company may consider risks associated with availability of upstream value chain data and other aspects of upstream value chain management.

Aim of the reporting of risk management process is to be effectively and proactively able to manage the risk occurring on the sustainability matters. To be able to manage the risk and negative impacts identified and assessed in double materiality, case company must adopt risk mitigation strategies to both non-material and material issues. Risk can be mitigated either proactively or reactively, where reactive approaches cover responding to incidents after they have occurred and proactive measures such as predefined actions plan, address incidents before them occurring which aims to facilitate a more effective and prompt crisis response. (Dohale, Ambilkar, Gunasekaran & Verma 2023) Although reactive strategies include some proactive elements, they fall short of reaching their full potential by concentrating mainly on mitigating the consequences of risks, rather than reducing the likelihood of those risks occurring in the first place (Kilubi 2016; Dohale et al. 2023). The distinction between these two approaches lies in their focus: proactive strategies emphasize managing the supply chain itself, while reactive strategies are aimed at mitigating outsourcing risks, which tend to be more challenging to control (Can Saglam, Yildiz Çankaya & Sezen 2021).

In the risk mitigation strategy perspective case company should apply proactive measures to the risks that cause widespread harm if they occur, and reactive measures to those that aren’t so severe for the company. The highest severity or financial effect of the risk or negative impact relies on the environmental topics, such as climate change, pollution and biodiversity. Even though priority should be in the material topics identified, the reactive risk management processes should be implemented to non-material issues identified, as they might come into effect in the future.

Sustainability should be integrated into comprehensive risk management process(es) to mitigate the risk and negative impact of company’s value chain. For example, company must consider whether and how its material risks related to S2 – value chain workers are integrated to overall risk management processes. It is proven that adopting sustainable practices as part of risk management process helps mitigate wide range of risks, making companies more resilient to economic fluctuations, natural disasters and regulatory changes (Fornasari & Traversi 2024).

Under ESRS company shall disclose the main features of risks management and internal controls over sustainability reporting, which aims to provide understanding about the risk management and internal controls of sustainability matters.

6 Discussion & Conclusions

The aim of this master's thesis was to find out, how case company can efficiently prepare its supply chain management for the upcoming requirements of Corporate Sustainability Reporting Directive (CSRD). In this chapter we answer the main research question with three sub-research questions then we draw conclusions and identify the limitations. Lastly, we evaluate reliability and validity of the study and consider future research proposals.

6.1 Research questions

With sub-research questions the main research question can be answered, and the sub-research questions are following:

Q2: What capabilities need to be built and develop to achieve the requirements of CSRD?

To meet the requirements of the Corporate Sustainability Reporting Directive (CSRD), organizations must strengthen their capabilities in governance, data management, sustainability strategy, and reporting. To align with the directive, the case company must develop robust systems and approaches to effectively monitor, manage, and report on sustainability impacts, risks, and opportunities across the entire value chain.

Based on the analysis of current state of sustainability reporting and maturity analysis, we can say that case company has good level of sustainability reporting and good maturity in the terms of upcoming CSRD. Sustainability is seen as counter stone of business operations, and it is implemented as part of corporate strategy, but under ESRSs company is required to disclose more specific information about:

(a) The aspects of the undertaking's strategy that address or influence sustainability matters, including its business model and value chain.

(b) How the interests and perspectives of stakeholders are incorporated into the undertaking's strategy and business model.

(c) The results of the undertaking's assessment of material impacts, risks, and opportunities, and how these findings shape its strategy and business model. (Commission delegated regulation (EU) (2023))

Therefore, the more deeply consideration of sustainable strategy of the case company is needed and how they are implemented into supply chain management and how case company is planning to improve the sustainability performance to improve the sustainability performance of the company over the years and how they are integrated as part of corporate strategy and policies. Also based on the maturity analysis for continuous improvement it is suggested that the new sustainable technologies and initiatives are continuously integrated as part of company’s corporate strategy and policies. Interest and views of stakeholders is also one part of strategy, and case company has already engaged the stakeholders as part of sustainability reporting through stakeholder dialogue and identified the key stakeholders, so next step should be how to improve sustainability in the value chain together with them, and disclose information about policies, actions and targets of this process.

The one of the key elements of new directive and standard is the disclosure of targets and metrics to track effectiveness of actions and policies. The current status of targets and metrics is that case company uses key performance indicators (KPIs) to track the progress of its actions towards more sustainable transition. The challenge relies on the fact that KPIs and other sustainability matters they are now quite limited to own operation within company, not extent to upstream value chain. To achieve full compliance with CSRD and ERSRs, company shall identify and measure their policies, actions and targets through entire value chain, and use of metrics this can be fully acknowledged, and progress can be tracked of the chosen sustainability matter. Therefore, the use of KPIs should be extended to cover upstream value chain on the issues, where upstream value chain actions have high impact on the people and environment, and company has high dependency on these actors in the value chain. For example, upstream high emissions and pollution should be integrated to policies, actions and targets taken to address negative impacts, and these actions should be measured to achieve high sustainability performance through entire value chain.

Data collection from case company’s value chain is one of the key aspects of the upcoming directive, and therefore case company should generate a systematic data collection process to obtain needed information from its supply chain. Although, CSRD and ESRSs doesn’t define the methods for the data collection process, it requires the data to be obtain primarily from upstream value chain and its actors and proposed use of internationally acknowledged guidance, such as GHG Protocol to calculate GHG emissions and/or Science-Based Targets Initiative for Nature (SBTN) to set targets. Also, related to climate change, the is a need to create comprehensive plan for emissions inventory and reduction, including setting up science-based targets for emissions reduction and conducting climate transition plan.

Supply chain transparency is one of the main issues that stood out on the analysis, due to the complexity of supply chain the limited visibility and knowledge of the value chain activities stays challenging. Through even wider collaboration with suppliers, the supply chain transparency can be gained, as well as strengthen supplier assessments and monitoring. Also, wider supplier audits for example in the social standards aspect could be beneficial to gain insight of the labour and human rights in the upstream value chain, and this also would increase the visibility of the supply chain activities across different geographical areas.

Integrating sustainability matters into corporate business model, strategy and risk management processes is essential to fully comply with CSRD and achieve the positive impacts of addressing the impacts, opportunities and risks that company has identified in the double materiality assessment. Based on the current state of sustainability reporting, sustainability needs to be fully implemented to risks management processes and then provide requested information about risk management and internal controls over sustainability reporting, such as risk prioritization methodologies and mitigation strategies including related controls.

Q3: What impacts, risks and opportunities suppliers offer in the point of sustainability matters?

Upstream value chain and especially suppliers offer various risks, opportunities and impacts for the case company in the terms of sustainability. Suppliers has a significant impact on the company’s value chain sustainability, so therefore this study provides important insight on how suppliers affect the company’s performance in the terms of sustainability.

Both negative impacts and risks associated with upstream value chain has been comprehensively assess, but the identification of positive impacts and opportunities related to it haven’t yet been addressed as material. Although positive impacts or opportunities haven’t been yet addressed as material and limited acknowledgement of the positive impacts and opportunities, point out that the role of upstream value chain partners as enablers of higher level of sustainability and key partners to improve sustainability actions within company haven't been fully acknowledged which poses a challenge for the future development. Supplier sustainability performance reflects straight to buyer company, and there are two choices seen to improve performance related to supplier sustainability performance by replacing the supplier or collaborating with them to improve their skills. (Gualandris & Kalchschmidt 2016). Therefore, as previously discussed, the high level of collaboration with suppliers assists the aim to improve suppliers' sustainability performance and therefore, achieve high sustainability performance within company. Also, according to Awan et al. (2019) supplier engagement can help foster the generation of sustainability-related ideas and solutions that would be challenging to achieve independently without the collaboration and input of suppliers, so high level of collaboration and engagement of upstream value chain and especially suppliers is highly recommended as well as more deeply consideration of the opportunities that supplier offer.

Most of the material impacts of upstream value chain were related to environmental topics, such as pollution, water consumption, resource use and related biodiversity impacts, and it have been addressed that responsible sourcing and supply chain management practices are important for the company to address these in the value chain. Prioritization of negative impacts and risks should be on the ones that have highest impact on people and environment and therefore, it would be suggested to emphasize the material issues that have highest scoring in the double materiality assessment, so especially focus on environmental issues, impacts on the human and labour rights issues and management of relationships with suppliers. Also, negative impacts and risk are associated with workers in value chain due to the potential workers' rights and human rights violations in the upstream value chain, mainly due the geographical challenges.

Addition to these negative impacts and risks, together with upstream value chain there is seen need for continuous improvement in resource efficiency, and this can be managed together with suppliers as buyer company can use the negotiation power to encourage suppliers towards innovation related to use of other that non-renewable materials and, also throughout collaboration transition toward circular economy and resource use can faster the development and make it beneficial to both parties.

Although upstream value chain includes several different negative impacts and risks, comprehensive risk management process can mitigate them from occurring and increased collaboration and enhanced transparency can help benefit from the external stakeholders. The findings of this thesis also contribute that case company must align its values and implement concrete cooperative actions to address adverse impacts throughout its whole value chain, ensuring full compliance with the upcoming sustainability reporting directive and its requirements.

Q4: What are the reporting requirements considering methodology and level of detail of the underlying data?

Under the Corporate Sustainability Reporting Directive (CSRD), companies must comply with detailed and standardized reporting requirements related to sustainability. Articles 19a (1) and 29a (1) of Directive 2013/34/EU mandate that undertakings disclose information across five key reporting areas: the business model, implemented policies (including due diligence processes), the outcomes of these policies, risks and risk management process, and key performance indicators relevant to the business activities. (Directive (EU) (2022)) The directive expands the scope and depth of the disclosure requirements, making the methodology and level of detail in underlying data critical part to meet the compliance. Reporting requirements for the upstream value chain involve detailed data collection and methodologies that align with specific standards, such as GHG protocol and use of science-based targets.

As stated, CSRD revolves around double materiality concept and one of the main disclosure requirements is the description of the process on identifying and assessing material impacts, risks and opportunities of the company. This includes description of the methodologies and assumptions applied in the process; impact assessment; risk and opportunity assessment; decision-making and integration to supply chain management and overall business model and disclosure of used data sources, scope and assumptions used in the assessment. Using detailed explanation ensures comprehensive transparency in the sustainability matters, and help stakeholders gain clear overview of the process.

When disclosing metrics of sustainability matters, the undertaking isn't required to disclose value chain information except in the E1-6 and E1-7, where the primary data should be collected from the suppliers and disclose the percentage of emissions calculated using primary data. In this study, as one of the challenges was the limited knowledge and visibility of upstream of the scope 3 emissions, which have high impacts on company's total emissions. Based on the GHG Protocol (2013) it would be suggested to use hybrid approach to data collection and calculations, as in that case the primary data is obtained from straight from suppliers or other upstream value chain partners and secondary data such as industry averages, is used to fill the gaps. Level of detail in scope 3 emission data calculation and collection methods depends both on the company's resources as well as minimum boundaries of each scope 3 category, see appendix 2.

Addition to these quantitative datapoints, company shall disclose qualitative information from their upstream value chain, and level of detail should include fundamental qualitative characteristics of information, such as relevance and faithful presentation; and enhance comparability, verifiability and understandability of disclosed information. Relevance can be defined as sustainability information is relevant when it influences sustainability statement's user, following double materiality approach. Relevance should ensure that sustainability information supports decision-making by providing valuable information about future outcomes (predictive value) and past evaluation (confirmatory value). Faithful presentation on the other hand should ensure that information provided is neutral, complete and accurate. Comparability includes that the sustainability information should be comparable to previous periods and other information provided by other undertakings that has similar activities or operates within same industry. A point of reference for comparison can include a target, a baseline, an industry benchmark, or comparable data from other undertakings or internationally recognized organization. (Commission delegated regulation (EU) (2023).) Verification provided by external assurance audit increase the reliability of sustainability and helps users of sustainability statement gain confidence that the information is complete, neutral and accurate. Understandability means that sustainability information must be clear, concise and easily comprehensible to reasonably knowledgeable users, and undertaking shall avoid generic statements, unnecessary duplication and include only material information. (Commission delegated regulation (EU) (2023).)

Mandatory quantitative disclosure datapoints that require value chain coverage are E1-1 Transition plan for climate change mitigation; E4-1 paragraph 13 – disclosure of "the scope of the resilience analysis in relation to the undertaking's own operations and its upstream and downstream value chain and in relation to the risks considered in that analysis"; E4 IRO 1 par 17(a) – A description of the process for identifying and assessing actual and potential impacts on biodiversity and ecosystems at the company's own site, as well as across the upstream value chain.; E4-4 paragraph 32 (c) description how the targets are in relation to its upstream and downstream value chain and lastly E5-4 par. 30 - a description of material resource inflows, such as products, materials, water and property, plants, and equipment used in the undertaking's operations and upstream value chain. These datapoints requires collection of information about upstream value chain and provide actions, policies and targets to address sustainability issues arising from upstream value chain especially related to these topical standards but also disclose information about other sustainability matters that have significant impact on environment and people.

Despite the challenge of collecting data that fits of the requirements of CSRD, it will enhance the quality of both quantitative and qualitative aspects of sustainability reporting by companies currently reporting under the NFRD (Ottenstein, Erben, Jost, Weuster & Zülch 2022). The data and assumptions used should be aligned and consistent with financial data and assumptions, meaning that sustainability statement needs to be as credible and reliable as financial statement (Commission delegated regulation (EU) (2023)). This may require investments in technology to obtain needed tools for data collection and reporting.

After answering the sub-research questions, the main research question *What actions are required of company's supply chain management to prepare for the Corporate Sustainability Reporting Directive (CSRD)?* can be answered based on the findings of this research. Based on previous literature and this research emphasize that various factors need to be considered due the complexity of the CSRD, when preparing supply chain management of the company.

The companies under CSRD need to make significant changes in their business governance, strategy and impact, risk and opportunities management processes to be able to comply with upcoming sustainability directive and its objectives. The findings of this thesis emphasize the need for company to develop comprehensive approaches to manage sustainability as part of business planning, resourcing and target setting. As case company might have limited resources and all material impacts, risk and opportunities that needs to be disclosed may require information from the value chain, company should allocate the resources for data collection of the sustainability matters that have the most significant impact on the environment and people.

Case company should consider deeply about opportunities and risks associated with sustainability development and continuous improvement, and first disclose information about its strategy, business model and value chain. Value chain information shall include information about the key stakeholders and how they are taken into account by case company's strategy, business model and risks management process, and also disclose where material impacts, risks and opportunities arise in the value chain. Second, case company shall disclose how and whether the policies, actions and targets are implemented to address the impacts, risks and opportunities in the value chain. Lastly, sustainability should be comprehensively integrated as part of the supply chain management process, including risk management and into corporate business strategy and business model.

As mentioned, discussions and collaboration with key stakeholders have become crucial for a company's success under the CSRD. Therefore, the CSRD presents a significant opportunity for the company to legitimize its business by adopting CSR practices and also effectively communicating relevant information to key stakeholders (Ananzeh, Al Shbail, Al Amosh, Khatib & Abualoush 2023). Under the new directive, case company is empowered to take actions to prevent, mitigate and address the impacts, risks and opportunities on both environment and people. To fully comply with the CSRD, it requires to collaborate with various stakeholders throughout the value chain. Additionally, to operate and report efficiently as required in CSRD, companies need to leverage and develop competencies of the company, and together with upstream value chain utilize the continuous development within whole value chain. Throughout extensive collaboration and supplier management company could address the challenges related to limited transparency in the value chain.

In this thesis, we address the challenges of transparency through supply chain relationships, and especially supplier engagement and collaboration. Previous studies shows that two main practises to enhance suppliers' sustainability performance and gain visibility to suppliers' sustainability operations are collaboration and assessment (Brun et al. 2020). The findings of this study shows that current state of supplier management is at the good level due the regular monitoring and assessment of the supplier via supplier audits and collaboration but upcoming regulatory changes pressure case company to expand supplier audits to cover more sustainability matters identified to address negative impacts and risks and moreover to gain visibility of value chain.

Based on the current state of sustainability reporting, one of the key findings and need for improvement was the implementation of upstream value chain to comprehensively as part of sustainability initiatives and supply chain management as they include significant number of impacts, risks and opportunities and therefore plays pivotal role to case company sustainability performance within value chain.

6.2 Conclusions

This master's thesis aimed to understand how case company can effectively prepare its supply chain management for the upcoming requirements of Corporate Sustainability Reporting Directive (CSRD). The findings indicate that there is a need for comprehensive implementation of CSRD and ESRSs to supply chain management of the case company, and sustainability matters identified as material topics in double materiality assessment needs to be fully addressed in order to achieve the reporting requirements of CSRD. To effectively address sustainability challenges, the company must establish a systematic process for collecting data from its upstream value chain partners, including suppliers and external manufacturers, and utilize the data to provide quantitative and qualitative information of the upstream value chain. Achieving this may require the company's supply chain management functions to allocate additional resources and consider investing in technologies that facilitate efficient data collection and management across the value chain. Overall, sustainability needs to be integrated more deeply into supply chain management and business model, and moreover to risk management process as upstream value chain expose company to significant number of negative impacts and risks.

Sustainability reporting in the case company isn't a new phenomenon, and due to the continuous development, the current state of sustainability reporting in the case company serves a great basis to achieve requirements of CSRD and corresponding ESRSs. Despite the development over the years, the findings indicate that there need for deeper integration of sustainability into supply chain management and disclosure of more information about stakeholders and their impact on the case company's sustainability operations and management. The key finding of this thesis supports the statement that new sustainability reporting directive will require companies to take various measures in their supply chain management, and companies need to not only disclosure metrics and targets to manage negative impacts and risks, but also implement policies and actions to achieve their sustainability initiatives. This study supports the findings that CSRD expands the sustainability thinking to long-term perspective and this is implemented to developing comprehensive corporate strategy.

To achieve the requirements of CSRD, the need for increased collaboration with upstream value chain cannot be understated as companies will need to foster collaboration within their organization - across various business units and stakeholders throughout the value chain. With the wider collaboration, company is able to leverage diverse external competencies and integrate them as part of company's business capabilities that are missing from its own core competencies.

This master thesis supports previous literature that argues that sustainability reporting has previously been highly selective as companies have been able to choose the sustainability matters, they report and how they disclose information. Findings of this thesis criticized that there isn't yet guidance how to implement CSRD as part of sustainability reporting, and how to collect information under double materiality assessment from the value chain but supports the previous literature on the fact that CSRD will improve the quality, comparability and reliability of sustainability data as ESRS provided detailed information what aspects of each topical standard needs to be disclosed.

This empirical study focuses on only one individual case company which is specialized to provide solutions across commercial, naval, and offshore segments in maritime industry. Due to this it is providing only a limited overview of the required actions when implementing CSRD into a corporate sustainability reporting and in the supply chain management and the findings of this study can only be generalized to the research phenomenon of this individual target company. On the contrary, it deepens the internal understanding within the company and offers good basis for the future development of corporate sustainability reporting and other relevant research.

Despite this study is conducted using one case company, this provides insight to other similar companies as they might have similar challenges and opportunities in the frame of ESRS and CSRD requirements. One of the limitations in this study is that the limited amount of supplier was interviewed in the double materiality assessment to gain insight about suppliers' risks, opportunities, and impacts to company's business, so as there are several suppliers influence the supply chain in addition to these, we get only a limited picture of their commitment and affects.

6.3 Evaluation of validity and reliability and future research proposals

In empirical research, the starting point should be minimizing errors, which makes reliability assessment a crucial part of the entire research process. Reliability involves a thorough critical review of the entire research period, evaluating how well empirical data is collected and analysed, and ensuring the use of the most appropriate methods to address the research question (Puusa, Juuti & Aaltio 2020; Saaranen-Kauppinen & Puusniekka 2006). Reliability is ensured by aligning the study's results with previous literature, allowing for the research questions to be effectively addressed through the integration of both empirical findings and theoretical insights.

In this study, data collection includes a comprehensive review of literature to support the primary empirical research. The use of secondary data enhances both the validity and reliability of the study. According to Ozuem, Willis and Howell (2022), drawing on literature to understand the phenomenon under investigation can strengthen the validity of the interpretation of primary qualitative data. This contributes to the overall validity of the study's findings.

In the terms of future research, as CSRD is a burning topic in today's business environment especially within EU, the first results of new corporate sustainability reporting can be seen from the fiscal year 2024, which will be published in 2025. Due to nature of development is still progress, future research about the successful and unsuccessful implementation of CSRD requirements into sustainability reporting should be studied, and what challenges companies' might have encountered during the process. Other topic that might offer significant insight of CSRD in practise, are the effects of the new directive on companies' activities and what benefits it has offered in the long-term to stakeholders and businesses themselves. Lastly, benchmarking different industries between each other would most likely provide significant insight of the sustainability matters addressed by the company's and how they vary between different industries, and this may help investors, civil society organizations and other stakeholders evaluate the sustainability performance of companies better.

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Appendix 1. Summary of disclosure requirements

ESRS 2 – General disclosures
DR 2-BP-1 – General basis for preparation of the sustainability statement
DR 2-BP-2 – Disclosures in relation to specific circumstances
DR 2-GOV-1 – The role of the administrative, management and supervisory bodies
DR 2-GOV-2 – Information provided to and sustainability matters addressed by the undertaking's administrative, management and supervisory bodies
DR 2-GOV-3 – Integration of sustainability-related performance in incentive schemes
DR 2-GOV-4 – Statement on due diligence
DR 2-GOV-5 – Risk management and internal controls over sustainability reporting
DR 2-SBM-1 – Strategy, business model and value chain
DR 2-SBM-2 – Interests and views of stakeholders
DR 2-SBM-3 – Material IROs and their interaction with strategy and business model
DR 2-IRO-1 – Description of the processes to identify and assess material IROs
DR 2-IRO-2 – Disclosure Requirements in ESRS covered by the undertaking's sustainability statement
Policies MDR-P – Policies adopted to manage material sustainability matters
Actions MDR-A – Actions and resources in relation to material sustainability matters
Metrics MDR-M – Metrics in relation to sustainability matters
Targets MDR-T – Tracking effectiveness of policies and actions through targets
ESRS E1- Climate change
DR E1-1 – Transition plan for climate change mitigation
DR E1-2 – Policies related to change mitigation and adaptation
DR E1-3 – Actions and resources in relation to climate change policies
DR E1-4 – Targets related to climate change mitigation and adaptation
DR E1-5 – Energy consumption and mix
DR E1-6 – Gross Scopes 1, 2, 3 and Total GHG emissions
DR E1-7 – GHG removals and GHG mitigation projects financed through carbon credits
DR E1-8 – Internal carbon pricing
DR E1-9 – Anticipated financial effects from material physical and transition risks and potential climate-related opportunities
ESRS E2 - Pollution
DR E2-1 – Policies related to pollution
DR E2-2 – Actions and resources related to pollution
DR E2-3 – Targets related to pollution
DR E2-4 – Pollution of air, water and soil
DR E2-5 – Substances of concern and substances of very high concern
DR E2-6 – Anticipated financial effects from pollution-related IROs
ESRS E3 - Water and marine resources
DR E3-1 – Policies related to water and marine resources
DR E3-2 – Actions and resources related to water and marine resources
DR E3-3 – Targets related to water and marine resources
DR E3-4 – Water consumption
DR E3-5 – Anticipated financial effects from water and marine resources-related IROs
ESRS E4 - Biodiversity and ecosystems
DR E4-1 –Transition plan and consideration of biodiversity and ecosystems in strategy and business model
DR E4-2 – Policies related to biodiversity and ecosystems
DR E4-3 – Actions and resources related to biodiversity and ecosystems
DR E4-4 – Targets related to biodiversity and ecosystems
DR E4-5 – Impact metrics related to biodiversity and ecosystems change
DR E4-6 – Anticipated financial effects from biodiversity and ecosystem-related IROs
ESRS E5 - Resource use and circular economy
DR E5-1 – Policies related to resource use and circular economy
DR E5-2 – Actions and resources related to resource use and circular economy
DR E5-3 – Targets related to resource use and circular economy
DR E5-4 – Resource inflows
DR E5-5 – Resource outflows
DR E5-6 – Anticipated financial effects from material resource use and circular economy-related IROs
ESRS S1 - Own workforce
DR S1-1 – Policies related to own workforce
DR S1-2 – Processes for engaging with own workforce and workers' representatives about impacts
DR S1-3 – Processes to remediate negative impacts and channels for own workforce to raise concerns
DR S1-4 – Taking action on material impacts on value chain workers, approaches to managing material risks and pursuing material opportunities related to own workforce, and effectiveness of those actions
DR S1-5 – Targets related to managing material negative impacts, advancing positive impacts and managing material risks and opportunities
DR S1-6 – Characteristics of the undertaking's employees
DR S1-7 – Characteristics of non-employee workers in the undertaking's own workforce
DR S1-8 – Collective bargaining coverage and social dialogue
DR S1-9 – Diversity metrics
DR S1-10 – Adequate wages
DR S1-11 – Social protection
DR S1-12 – Persons with disabilities
DR S1-13 – Training and skills development metrics
DR S1-14 – Health and safety metrics
DR S1-15 – Work-life balance metrics
DR S1-16 – Compensation metrics (pay gap and total compensation)
DR S1-17 – Incidents, complaints and severe human rights impacts
ESRS S2 - Workers in the value chain
DR S2-1 – Policies related to value chain workers
DR S2-2 – Processes for engaging with value chain workers about impacts
DR S2-3 – Processes to remediate negative impacts and channels for value chain workers to raise concerns
DR S2-4 – Taking action on material impacts on value chain workers, approaches to managing material risks and pursuing material opportunities related to value chain workers, and effectiveness of those actions
DR S2-5 – Targets related to managing material negative impacts, advancing positive impacts and managing material risks and opportunities
ESRS S3 - Affected communities
DR S3-1 – Policies related to affected communities
DR S3-2 – Processes for engaging with affected communities about impacts
DR S3-3 – Processes to remediate negative impacts and channels for affected communities to raise concerns
DR S3-4 – Taking action on material impacts on affected communities, approaches to managing material risks and pursuing material opportunities related to affected communities, and the effectiveness of those actions
DR S3-5 – Targets related to managing material negative impacts, advancing positive impacts and managing material risks and opportunities
ESRS S4 - Consumers and end users
DR S4-1 – Policies related to consumers and end users
DR S4-2 – Processes for engaging with consumers and end users about impacts
DR S4-3 – Processes to remediate negative impacts and channels for consumers and end users to raise concerns
DR S4-4 – Taking action on material impacts on affected communities, approaches to managing material risks and pursuing material opportunities related to affected consumers and end users, and the effectiveness of those actions
DR S4-5 – Targets related to managing material negative impacts, advancing positive impacts and managing material risks and opportunities
ESRS G1 - Business conduct
DR G1-1 – Business conduct policies and corporate culture
DR G1-2 – Management of relationships with suppliers
DR G1-3 – Procedures to address corruption or bribery
DR G1-4 – Incidents of corruption or bribery
DR G1-5 – Political influence and lobbying activities
DR G1-6 – Payment practices

Appendix 2. Description and boundaries of scope 3 emissions.

Upstream scope 3 emissions			
Category	**Category description**	**Minimun boundary**	**Time boundaries**
1. Purchased goods and services	the extraction, production, and transportation of goods and services purchased or acquired by the reporting company during the reporting year, which are not included in other Scope 3 categories (Categories 2 - 8)	All upstream (cradle-to-gate) emissions of purchased goods and services	Past year, reporting year
2. Capital goods	Extraction, production, and transport ation of capital goods purchased or acquired by the reporting company in the reporting year	All upstream (cradle-to-gate) emissions of purchased capital goods	Past year, reporting year
3. Fuel and energy-related activities (not included in Scope 1 or Scope 2)	Extraction, production, and transportation of fuels and energy purchased or acquired by the reporting company in the reporting year, not already accounted for in scope 1 or scope 2, including: (a) Upstream emissions of purchased fuels (extraction, production, and transportation of fuels consumed by the reporting company) (b) Upstream emissions of purchased electricity (extraction, production, and transportation of fuels consumed in the generation of electricity, steam, heating, and cooling consumed by the reporting company) (c) Transmission and distribution (T&D) losses (generation of electricity, steam, heating and cooling that is consumed (i.e., lost) in a T&D system) – reported by end user (d) Generation of purchased electricity that is sold to end users (generation of electricity, steam, heating, and cooling that is purchased by the reporting company and sold to end users) – reported by utility company or energy retailer only	(a) For upstream emissions of purchased fuels: All upstream (cradle-to-gate) emissions of purchased fuels (from raw material extraction up to the point of, but excluding combustion) . (b) For upstream emissions of purchased electricity: All upstream (cradle-to-gate) emissions of purchased fuels (from raw material extraction up to the point of, but excluding, combustion by a power generator) (c) For T&D losses: All upstream (cradle-to-gate) emissions of energy consumed in a T&D system, including emissions from combustion (d) For generation of purchased electricity that is sold to end users: Emissions from the generation of purchased energy	Past year, reporting year
4. Upstream transportation and distribution	Transportation and distribution of products purchased by the reporting company in the reporting year between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company) Transportation and distribution services purchased by the reporting company in the reporting year, including inbound logistics, outbound logistics (e.g., of sold products), and transportation and distribution between a company's own facilities (in vehicles and facilities not owned or controlled by the reporting company)	- The scope 1 and scope 2 emissions of transportation and distribution providers that occur during use of vehicles and facilities (e.g., from energy use) **Optional**: The life cycle emissions associated with manufacturing vehicles, facilities, or infrastructure	Past year, reporting year
5. Waste generated in operations	Disposal and treatment of waste generated in the reporting company's operations in the reporting year (in facilities not owned or controlled by the reporting company)	- The scope 1 and scope 2 emissions of waste management suppliers that occur during disposal or treatment **Optional:** Emissions from transportation of waste	Reporting year, future year
6. Business travel	Transportation of employees for business-related activities during the reporting year (in vehicles not owned or operated by the reporting company)	- The scope 1 and scope 2 emissions of transportation carriers that occur during use of vehicles (e.g., from energy use) **Optional:** The life cycle emissions associated with manufacturing vehicles or infrastructure	Reporting year
7. Employee commuting	Transportation of employees between their homes and their worksites during the reporting year (in vehicles not owned or operated by the reporting company)	- The scope 1 and scope 2 emissions of employees and transportation providers that occur during use of vehicles (e.g., from energy use) **Optional**: Emissions from employee teleworking	Reporting year
8. Upstream leased assets	Operation of assets leased by the reporting company (lessee) in the reporting year and not included in scope 1 and scope 2 – reported by lessee	- The scope 1 and scope 2 emissions of lessors that occur during the reporting company's operation of leased assets (e.g., from energy use) **Optional**: The life cycle emissions associated with manufacturing or constructing leased assets	Reporting year