Siiri Stenborg

Sustainability and supply chain resilience in corporate reporting

A study of Finnish forest industry companies

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Author: Siiri Stenborg
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ABSTRACT:

Sustainability and supply chain resilience have become increasingly important themes in corporate supply chain management. Companies are expected to operate more responsibly and report their activities more transparently, as stakeholders, regulations and changing operating environments require more information on supply chain responsibility and risk management. At the same time, complex supply chains and recent disruptions have increased the need to understand how companies communicate resilience in their supply chain reporting.

The study examines how Finnish forest industry companies communicate supply chain sustainability and resilience in their 2023 annual reports. The study focuses on three companies: Stora Enso, UPM and Metsä Group. The research data consist of the companies' published annual reports, which are analysed using qualitative document analysis. The purpose of the analysis is to identify the sustainability-related themes that appear in the reports, how resilience is described in relation to supply chains and what similarities and differences can be found between the companies.

The findings indicate that sustainability is an integrated part of supply chain management. This is reflected in governance mechanisms, such as codes of conduct and operational practices, including material efficiency and collaboration. The annual reports also highlight the growing importance of data, transparency and traceability. Supply chain resilience in not presented as separate concept. Instead, resilience is communicated indirectly through sustainability-related practices. Differences can be seen in how much emphasis the companies place on technological solutions, governance mechanisms and collaboration.

Overall, the research shows that sustainability and supply chain resilience are linked, although this is not always explicitly stated. Sustainability practices appear to support resilience, particularly through transparency, supplier collaboration, risk management and treacebility.

KEYWORDS: supply chain management, supply chain resilience, corporate reporting, forest industry, responsible sourcing

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TIIVISTELMÄ:
Kestävyys ja toimitusketjun resilienssi ovat nousseet viime vuosina yhä tärkeämmiksi teemoiksi yritysten toimitusketjujen hallinnassa. Yrityksiin kohdistuu kasvavaa painetta toimia vastuullisemmin ja raportoida toiminnastaan aiempaa läpinäkyvämmin, sillä sidosryhmät, sääntely ja muuttuvat toimintaympäristöt edellyttävät kattavampaa tietoa toimitusketjun vastuullisuudesta ja riskienhallinnasta. Samalla toimitusketjujen monimutkistuminen ja erilaiset häiriöt ovat lisänneet tarvetta ymmärtää, miten yritykset käsittelevät resilienssiä osana toimitusketjuihin liittyvää raportointia.

Tässä tutkimuksessa tutkitaan, miten suomalaiset metsäteollisuusyhtiöt kommunikoivat toimitusketjun kestävyydestä ja resilienssistä vuoden 2023 vuosikertomuksissaan. Tämä tutkimus keskittyy kolmeen suomalaiseen metsäyhtiöön, jotka ovat Stora Enso, UPM ja Metsä Group. Tutkimusaineisto koostuu yritysten julkaisemista vuosikertomuksista, joita analysoidaan laadullisen dokumenttianalyysin avulla. Tutkimuksen analyysin tarkoituksena on selvittää, millaisia kestävyyteen liittyviä teemoja raporteissa esiintyy, miten resilienssiä kuvataan osana toimitusketjuja ja mitä samankaltaisuuksia ja eroavaisuuksia nousee esille yritysten raportoinnissa.

Tutkimuksen tulosten mukaan kestävyys esitetään integroituna osana toimitusketjun hallintaa. Vuosikertomukissa korostuu erityisesti hallintomekanismit, muun muassa toimittajien käytännesäännöt, sekä operatiiviset käytännöt, kuten materiaalitehokkuus ja yhteistyö. Raportoinnissa myöskin painottuu kasvava datan, läpinäkyvyyden ja jäljitettävyyden merkitys. Tutkimuksen tulokset osoittavat, että toimitusketjun resilienssiä ei käsitellä raportoinnissa erillisenä käsitteenä. Resilienssi ilmenee epäsuorasti kestävyyteen liittyvien käytäntöjen kautta. Yritysten välillä havaitaan eroja siinä, kuinka paljon ne painottavat teknologisia ratkaisuja, hallintamekanismeja ja yhteistyötä kestävyyden toteuttamisessa.

Kaikenkaikkiaan tutkimus osoittaa, että kestävyys ja toimitusketjun resiliessi ovat yhteydssä toisiinsa vaikka tätä ei aina tuodakkaan esille. Kestävyyteen liittyvät käytännöt näyttävän tukevan tukevan resilienssiä etenkin läpinäkyvyyden, toimittajayhteistyön, riskienhallinnan ja jäljitettävyyden kautta.

AVAINSANAT: kestävä toimitusketjun hallinta, toimitusketjun resilienssi, yritysraportointi, metsäteollisuus, vastuullinen hankinta

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1 Introduction

This chapter explains the study's background and provides evidence for the topic's topicality. First, it explains why supply chains and corporate reporting now heavily emphasise sustainability and resilience. The research context is then limited to the Finnish forest industry, and the data selection is supported. Finally, the research goal, research questions, and research gap are discussed, with a special emphasis on supply chain reporting in annual reports.

1.1 Background

Sustainability and resilience have become one of the key themes in modern supply chain management and are increasingly emphasized in companies' external communications (Lu et al., 2024; Roos, 2023; Seuring & Müller, 2008). The global disruptions of recent years have made it clear that even highly developed supply chains require the ability to adapt and continue operations in changing circumstances (García-Jácome et al., 2025; Kravchenko et al., 2024; Nel, 2024; Wang et al., 2023). At the same time, companies are under increasing pressure to operate sustainably and to report visibly on their environmental and social impacts and the responsibility of their operations (Bateman et al., 2017; Lungu et al., 2025; Silvola et al., 2025; Stora Enso, 2024).

In Finland, the forest industry is a resource-intensive sector and plays a significant role in both the national economy and international trade (Stora Enso, 2024; Metsä Group, 2024). The forest industry's supply chains are often discussed in relation to their contribution to sustainable logistics and economic growth (García-Jácome et al., 2025; Wang et al., 2023). In the forest industry, supply chains are closely linked to raw material sourcing, production and logistics, and companies are dependent on functioning networks both domestically and internationally (Lu et al., 2024; Wang et al., 2023). For this reason, resilience can be seen as the practical ability of a supply chain to maintain its operational capacity and adapt to change, while sustainability guides the objectives

and expectations for how the impacts of supply chains are managed and reported (Marchese et al., 2018; Ponomarov & Holcomb, 2009; Seuring & Müller, 2008).

In 2023, Finnish forest industry companies such as Stora Enso, Metsä Group, and UPM operated in a challenging global market environment characterised by weak economic growth and high costs (Metsä Group, 2024; Stora Enso, 2024; UPM, 2024). Companies are emphasizing sustainability in their strategies and highlighting measures aimed at strengthening the long-term nature of their operating methods and the ability of their supply chains to function in changing conditions (Metsä Group, 2024; Stora Enso, 2024; UPM, 2024). For example, UPM describes a shift to double materiality assessment thinking in order to identify sustainability issues and their economic impacts for the upcoming EU Corporate Sustainability Reporting Directive regulation (UPM, 2024). Metsä Group (2024), on the other hand, aims to transition to a regenerative forestry model by 2030 and links this to the vitality, diversity, and climate resilience of forest resources.

Annual reports are important communication tools for companies, as they describe their business operations, strategic priorities, sustainable development issues, and how they are implemented (Bateman et al., 2017). Examining how sustainability and resilience are presented in annual reports provides insight into the concepts and emphases companies use to describe their supply chains and to respond to stakeholder expectations. This study analyses how Finnish forest industry companies, such as Stora Enso (2024), Metsä Group (2024), and UPM (2024) communicate sustainability and supply chain resilience in their 2023 annual reports. The 2023 annual reports are particularly interesting as they represent a transition phase towards reporting in accordance with Corporate Sustainability Reporting Directive (CSRD) requirements (Metsä Group, 2024; Stora Enso, 2024; UPM, 2024).

1.2 Research gap and contribution

Although the resilience and sustainability of supply chains have been studied extensively in various industries, there is still limited research in the context of the forest industry on how these themes are reflected in companies' external reporting and how companies structure and communicate them in their annual reports (Wang et al., 2023; Roos, 2023) Previous research has emphasised the specific characteristics of forest industry value chains and the need to understand resilience also in local and regionally varying operating environments (García-Jácome et al., 2025) Nevertheless, there is less information available on how large forest industry operators communicate resilience and sustainability from a supply chain perspective and what themes, indicators, or targets they highlight.

The relevance of this study lies in the fact that it examines annual reports as source material and analyses how globally significant forest industry companies report on sustainability and resilience in their supply chain reporting. In particular, the EU's CSRD has increased pressure to develop reporting and take into account the double materiality assessment approach, which examines both the company's environmental impact and the economic impact of sustainability issues (Baumüller & Sopp, 2022; Stora Enso, 2024; UPM, 2024; Metsä Group, 2024; Silvola et al., 2025). By analysing the 2023 annual reports of Metsä Group, Stora Enso, and UPM, the study provides a timely picture of how sustainability and resilience are linked to strategic communication in the transition to new regulations. This study examines how resilience-related aspects appear within sustainability reporting.

1.3 Research questions and objectives

The main objective of this thesis is to analyze how Finnish forest industry companies communicate sustainability and resilience in their 2023 annual reports in relation to supply chain reporting. In this thesis, supply chain-related reporting refers to the

sections of annual reports that discuss procurement, sourcing, suppliers, logistics, and broader value chain topics.

Main research question:

How do Finnish forest industry companies communicate sustainability and resilience in supply chain-related reporting in their 2023 annual reports?

In addition, the sub-questions of the thesis are:

1. What sustainability related themes appear in supply chain-related reporting?
2. How is supply chain resilience described in supply chain-related reporting, and how is it linked to sustainability?
3. What similarities or differences can be observed in companies' approaches to supply chain-related reporting?

The main research question aims to develop an overall understanding of how Finnish forest industry companies communicate sustainability and resilience in supply chain-related reporting in their 2023 annual reports. The sub-questions clarify this goal by identifying key sustainability themes, examining how resilience is described and linked to sustainability, and comparing similarities and differences between companies.

1.4 Structure of the research

The thesis consists of six chapters. The introduction presents the background and motivation for the study, defines key terms, and presents the objectives and questions of the study. The theoretical framework examines literature related to sustainable development, supply chain resilience, and corporate reporting and develops the analytical perspective used in the study.

The research methodology describes the structure of the study, the selection of cases, the data, and the qualitative approach applied to the analysis of supply chain reporting in the 2023 annual reports of Finnish companies. The research results and discussion present empirical results, compare similarities and differences between companies, and discuss the results in relation to the theoretical framework and previous research. Finally, the conclusions present the most important findings, emphasize the significance of the research, present limitations, and suggest guidelines for future research.

2 Theoretical Framework

This chapter presents the theoretical foundations of the study. First, supply chain resilience is examined as a key capability enabling firms to manage disruptions and maintain operational continuity. Second, sustainability reporting in supply chains is discussed to explain how companies communicate environmental, social and governance responsibilities. Finally, the specific characteristics of the forest industry are explored to contextualise the relationship between sustainability and resilience within the empirical setting of this study.

2.1 Supply chain resilience

Modern supply chains operate in the VUCA environment, which is characterized by volatility, uncertainty, complexity, and ambiguity (Wang et al., 2024). Many global disruptions, such as the Covid pandemic, geopolitical tensions and trade wars between countries, have shown that even highly developed supply chains require the ability to adapt and continue operating in changing and challenging environments (Bednarski et al., 2025; Wang et al., 2023). Traditional supply chain models have emphasised efficiency, cost minimisation and lean operating methods, but recent crises have revealed the vulnerabilities of globally dispersed and optimised networks (Christopher & Peck, 2004; Bednarski et al., 2025). Disruptions often tend to cause ripple effects in supply chains, where even a minor disruption at one part of the chain spreads systematically and disrupts the entire structure and performance (Kravchenko et al., 2024; Warmbier et al., 2022).

Supply chain resilience (SCRES) is defined as the ability of a supply chain to prepare for unexpected situations, respond to disruptions and recover from them while maintaining the continuity of operations (Warmbier et al., 2022; Nel, 2024). In earlier studies, supply chain resilience was defined as the ability to recover from disruptions, but today's literature focuses more on proactive capabilities such as adaptability, visibility and collaboration across the entire chain. This development illustrates how complex supply

chains have become today, as flexibility is no longer seen merely as the ability to recover, but also as the ability to anticipate and adapt to new disruptions (Christopher & Peck, 2004; Ivanov, 2020; Warmbier et al., 2022). Christopher and Peck (2004) describe resilience as the ability of a system to return to its original state or move to a more desirable state after a disturbance. In current research, resilience is seen as a critical dynamic capability that includes both risk identification and the ability to reorganize in crisis situations (Wang et al., 2024; Nel, 2024).

Several studies conceptualise supply chain resilience as a process that progresses through different stages of a disruption (Lu et al., 2024; Nel, 2024). This process is often divided into three different stages: preparedness before disruptions, response during disruptions and recovery after disruptions (Nel, 2024; Ponomarov & Holcomb, 2009; Warmbier et al., 2022). Preparedness involves activities, such as risk identification, supplier diversification and contingency planning (Christopher & Peck, 2004; Wang et al., 2024). During disruptions, companies rely on their flexibility, collaboration and visibility to respond quickly to unexpected events (Brandon-Jones et al., 2014; Christopher & Peck, 2004; Warmbier et al., 2022). Recovery refers to the ability of a company to restore operational performance and adapt supply chain structures after disruptions (Brandon-Jones et al., 2014; Mackay et al., 2020). This process-oriented perspective highlight that resilience is not only about recovery, but also about proactive preparation and adaptation (Christopher & Peck, 2004; Lu et al., 2024; Wang et al., 2024).

The literature differentiates between two related terms: robustness and resilience. Robustness refers to a system's ability to maintain functionality without structural changes in the event of disruptions. It can be understood as absorption capacity, which gives the supply chain the ability to recover from disruptions within certain limits without compromising performance (Mackay et al., 2020; Scholz et al., 2012). Robustness emphasises proactive continuity through fault tolerant mechanisms and strategic redundancies, such as buffer stocks or backup suppliers, while resilience focuses on post-disruption recovery and reorganisation (Brandon-Jones et al., 2014; Mackay et al., 2020).

Although robustness is sometimes considered as a static feature, it often requires adaptation at the component or structural level to keep the entire system functioning despite environmental instability (Brandon-Jones et al., 2014; Scholz et al., 2012).

Viability refers to a system's ability to survive and maintain operations under long-term and systemic disruptions (Kravchenko et al., 2024). While resilience is often linked to responding to and recovering from disruptions, viability emphasises continued functionality in changing operating environments (Warmbier et al., 2022; Kravchenko et al., 2024). This distinction is important in today's supply chains, where disruptions are no longer just occasional events but can be part of normal operating conditions (Ivanov, 2020; Kravchenko et al., 2024). Viability also connects resilience to sustainability by linking operational continuity to environmental, social and governance conditions (Kravchenko et al., 2024). A supply chain cannot remain viable if it overlooks risks related to raw material availability, environmental regulation, stakeholder trust or supplier responsibility (Roos, 2023; Wang et al., 2023). Sustainability practices can be understood not only as responsibility measures, but also as mechanisms that support the long-term functioning of supply chains (Sarkis, 2021; Warmbier et al., 2022).

Resilience also consists of many different but complementary capabilities. The first is agility, which refers to the ability to respond quickly to changes in supply and demand (Nel, 2024; Alshahrani & Salam, 2022). The second is flexibility, which refers to the ability to make structural changes in response to changing circumstances, such as sources of supply (Nel, 2024; Alshahrani & Salam, 2022). Redundancy refers to backup resources in case of disruptions, such as emergency stocks or alternative suppliers (Nel, 2024; Warmbier et al., 2022). In addition, collaboration and visibility enable real-time information sharing and transparency along the entire supply chain, which speeds up response times in the event of disruptions (Nel, 2024; Warmbier et al., 2022). These capabilities are relevant for this study because they make it possible to identify resilience-related meanings in annual reports, even when resilience is not explicitly named by the companies.

Researchers have begun to increasingly examine the relationship between sustainability and supply chain resilience (Marchese et al., 2018; Warmbier et al., 2022). Although resilience research has traditionally focused on disruption management and recovery, i.e., the ability of a system to return to its original state after a disruption, recent studies suggest that sustainability practices can also strengthen supply chain resilience (Christopher & Peck, 2004; Ivanov, 2020). Responsible sourcing, transparency and stronger supplier relationships can reduce environmental and social risks while improving the stability and viability of the supply chain (Bateman et al., 2017; Wang et al., 2024; Zheng et al., 2024). Sustainability and resilience should not be viewed as separate organisational goals. In supply chain management, sustainability practices may strengthen resilience by helping supply chains prepare for, respond to and adapt to disruptions (Marchese et al., 2018; Warmbier et al., 2022).

The growing importance of supply chain resilience can be explained by the increasing complexity and globalisation of supply networks. Modern supply chains often involve multiple supplier tiers, geographically dispersed production facilities and logistics systems that depent on each other (Bateman et al., 2017; Brandon-Jones et al., 2014; Christopher & Peck, 2004; Nel, 2024). As a result, disruptions in one part of the network can quickly spread across the entire network and impact operational performance (Bednarski et al., 2025; Mackay et al., 2020; Abbasian & Jamili, 2025). Resilient supply chains are therefore better prepared to sustain operational continuity and minimise the negative effects of disruptions because they enable organisations to respond quickly and adapt their operations when unexpected events occur (Ivanov, 2020; Mackay et al., 2020).

Resilience is not limited to recovery after disruptions, but rather as a capability that allows organisations to anticipate risks, adapt their structures and maintain long-term operational continuity (Christopher & Peck, 2004; Kravchenko et al., 2024; Mackay et al., 2020). This approach is especially relevant in industries that depend on natural raw

materials and environmental conditions, where exposure to disruption may be higher (García-Jácome et al., 2025; Roos, 2023). In such contexts, resilience is also closely connected to sustainability, as companies must manage environmental risks, supply disruptions and stakeholder expectations related to social and governance responsibility (Wang et al., 2024; Warmbier et al., 2022; Zheng et al., 2024).

Although resilience is an important concept in uncertain supply chain environments, it may not always appear explicitly in companies' external reporting (Christopher & Peck, 2004; Warmbier et al., 2022). Instead, resilience-related meanings may be communicated through descriptions of sustainability governance, risk management, supplier collaboration, traceability and continuity-related practices (Christopher & Peck, 2004; Seuring & Müller, 2008; Warmbier et al., 2022). Sustainability reporting is therefore a relevant source for examining how companies communicate resilience-related capabilities (Wang et al., 2023; Zheng et al., 2024). The following section examines sustainability reporting in supply chains and its role in communicating responsibility, transparency and risk management.

2.2 Sustainability reporting in supply chains

While resilience focuses primarily on how companies manage disruptions, sustainability reporting examines how companies communicate their environmental, social and governance impacts and responsibilities (Warmbier et al., 2022). Corporate sustainability reporting has changed significantly over the past decades. Previously, reporting used to focus more on financial indicators, but today it has moved from a secondary role to become part of strategic management (Zheng et al., 2024). Reporting is expected to be more transparent and data-driven and companies are expected to describe their performance through concrete sustainability indicators (Warmbier et al., 2022; Zheng et al., 2024).

In today's uncertain and turbulent market environment, global sourcing and increasingly complex supply chains are making companies more vulnerable, which has made risk

management and communication more demanding (Christopher & Peck, 2004; Wang et al., 2023). In this context, it is useful to make a distinction between the disclosure of information and reporting. Disclosure is the information itself, which was usually considered confidential. Reporting is the process which this information is systematically communicated to public, shareholders and the board of directors (Bateman et al., 2024) According to Bateman et al. (2024) companies decisions about disclosure by balancing internal objectives, external pressures and regulatory requirements.

Transparency and accountability are improved by sustainability reporting, which encourages organisations to disclose information about their environmental and social impacts along with their governance practices (Bateman et al., 2017; Wang et al., 2024; Zheng et al., 2024).

From a theoretical perspective, sustainability reporting is closely tied to stakeholder theory. This perspective states that organisations should consider the expectations and interests of a broad range of stakeholders, including investors, regulators, customers and civil society (Wang et al., 2024; Zheng et al., 2024). Companies are using sustainability reporting more in order to show their responsibility and to keep their credibility with stakeholders (Bateman et al., 2017; Zheng et al., 2024). By communicating sustainability strategies and performance indicatrs, organisations seek to strengthen stakeholder trust and demonstrate their commitment to responsible business practices (Bateman et al., 2017; Wang et al., 2024).

In this study, transparency refers to how clearly companies describe supplier requirements, sourcing practices, traceability systems, emissions data and risk management practices in their annual reports. Accountability refers to how companies present responsibilities, targets and monitoring mechanisms related to these supply chain issues.

Sustainability reporting can also support organisational resilience. By systematically monitoring environmental, social and governance (ESG) issues, companies may become better equipped to identify emerging risks and opportunities within their operating environment (Wang et al., 2024). Reporting can also contribute to resilience, as it can promote the formation of a so-called resilience culture, since it can make it easier to identify slowly developing risks in addition to rapid disruptions (Wang et al., 2024).

The growing importance of sustainability reporting is closely linked to stronger role of ESG principles in companies' decision making (Bateman et al., 2017; Zheng et al., 2024). ESG frameworks provide organisations with a structured approach to evaluating environmental risks, social responsibility and governance practices in all their activities (Zheng et al., 2024). Previous literature suggests that companies with stronger ESG governance structures are often better prepared to manage sustainability risks and maintain the long-term viability of the organisation (Wang et al., 2024; Zheng et al., 2024). In supply chains, ESG considerations often influence supplier selection, sourcing practices and risk management strategies, which highlight the growing integration of sustainability and supply chain management (Abbasian & Jamili, 2025; Warmbier et al., 2022; Zheng et al., 2024). These ESG-related supply chain issues appear in corporate reporting through topics such as supplier codes of conduct, supplier audits, human rights requirements, environmental monitoring and climate-related supplier expectations.

Sustainability reporting is also closely connected to supply chain management. Modern production systems often rely on broad global supplier networks, which means that many environmental and social risks arise outside company’s core operations (Bateman et al., 2017; Christopher & Peck, 2004). Research shows that these risks often emerge in the early stages of the supply chain, where working conditions, environmental impacts and resource use can be difficult to monitor across several supplier tiers (Bateman et al., 2017; Zheng et al., 2024). For this reason, companies are increasingly expected to show how they manage supplier relationships, monitor sustainability performance and apply responsible sourcing practices throughout their supply chains (Bateman et al., 2017;

Wang et al., 2024). In this context, sustainability reporting is not only a way to increase transparency, but also a tool for managing sustainability expectations across complex supply chains (Bateman et al., 2017; Zheng et al., 2024).

Traceability is also an important part of sustainable governance in global supply chains (Bateman et al., 2017; Zheng et al., 2024). It refers to the ability to track the origin, movement and transformation of products and raw materials throughout the supply network (Abbasian & Jamili, 2025; Christopher & Peck, 2004). Stronger traceability systems can help companies identify environmental risks, comply with sustainability standards and improve transparency across supplier networks (Bateman et al., 2017; Bednarski et al., 2025; Zheng et al., 2024). Traceability and visibility can also support supply chain sustainability by helping organisations identify disruptions early and respond more effectively to supply risks (Brandon-Jones et al., 2014; Kravchenko et al., 2024; Nel, 2024).

Supplier sustainability evaluation tools have also become more important in managing sustainability risks in global supply chains (Abbasian & Jamili, 2025; Bateman et al., 2017). One notable platform is EcoVadis, which provides standardised evaluation of suppliers' environmental, social and governance performance (Bateman et al., 2017). These third-party tools help companies monitor supplier compliance, improve transparency and measure sustainability performance across supplier networks (Bateman et al., 2017; Lu et al., 2024). They therefore support both sustainability reporting and supply chain risk management, especially in complex multilevel supplier networks (Abbasian & Jamili, 2025; Bateman et al., 2017).

Within supply chains, sustainability reporting commonly covers areas, including responsible sourcing practices, supplier monitoring, environmental impacts and raw material traceability (Bateman et al., 2017; Zheng et al., 2024). Previous literature indicates that companies are increasingly expected to report information on emissions across the value chain, responsible sourcing practices and human rights issues in supplier

networks (Bateman et al., 2017; Zheng et al., 2024). In particular, Scope 3 emissions, which originate from upstream and downstream supply chain activities, have become an important part of corporate sustainability disclosures (Bateman et al., 2017). Together these developments suggest that sustainability performance cannot be assessed solely within the boundaries of a single organisation but must be considered across the entire value chain (Bateman et al., 2017; Zheng et al., 2024).

The concept of double materiality has become central in European sustainability reporting (Baumüller & Sopp, 2022; Silvola et al., 2025). Double materiality refers to the requirement that companies assess sustainability issues from two complementary perspectives, impact materiality and financial materiality (Lungu et al., 2025; Silvola et al., 2025). Impact materiality concerns how corporate activities affect the environment and society, whereas financial materiality examines how environmental and social risks and opportunities influence a company's financial performance and long-term value creation (Baumüller & Sopp, 2022; Lungu et al., 2025; Silvola et al., 2025).

This dual perspective gives sustainability a stronger role in strategic decision making, as companies must evaluate both the external impacts of their operations and the potential financial consequences of sustainability related risks (Lungu et al., 2025; Silvola et al., 2025). The importance of double materiality has been reinforced by the European Union's Corporate Sustainability Reporting Directive (CSRD), which expanded the scope and detail of sustainability disclosures within the EU (Baumüller & Sopp, 2022; Silvola et al., 2025). Previous literature indicates that the CSRD aims to improve comparability, reliability and transparency in sustainability reporting through more standardised reporting requirements and mandatory disclosures related to environmental, social and governance issues (Lungu et al., 2025; Silvola et al., 2025).

As regulatory requirements become stricter, companies are expected to develop more comprehensive reporting practices and integrate sustainability aspects more systematically into governance and risk management structures (Bateman et al., 2017; Wang et al., 2024; Zheng et al., 2024). Sustainability reporting can therefore also be

understood as a form of strategic communication (Bateman et al., 2017; Wang et al., 2024). Annual and sustainability reports do more than present operational information as they also reflect how organisations interpret sustainability challenges and communicate their priorities to stakeholders (Mäkelä, 2017; Zheng et al., 2024). Several studies emphasise that reporting often presents sustainability risks, governance practices, and long-term strategic goals in ways that help maint organisational legitimacy and stakeholder trust (Bateman et al., 2017; Wang et al., 2024; Zheng et al., 2024).

However, it is important to note that annual reporting is not always neutral. Some studies suggest that it can be used for strategic purposes, as organisations selectively present sustainability information in ways that help them maintain legitimacy and strengthen stakeholder trust (Mäkelä, 2017; Zheng et al.,2024). In this sense, corporate reporting is not only a transparency mechanisms. It is also a method for companies to shape how stakeholders perceive their sustainability practices and risk management approaches.

Sustainability reporting has evolved from a voluntary practice of communication to strategic management mechanism that promotes transparency, accountability and risk management in global supply chains (Bateman et al., 2017; Seuring & Müller, 2008). While earlier studies focused more on the disclosure of environmental data, but more recent studies emphasizes the broader role of sustainability reporting (Mäkelä, 2017; Sering & Müller, 2008) This role is important in managing supply chain risks, as it helps strengthen stakeholders trust and it improves organisational resilience (Sarkis, 2021; Wang et al., 2024; Zheng et al., 2024)

Research on sustainability reporting and supply chain resilience has typically been examined separately (Warmbier et al., 2022; Zheng et al., 2024). While research on sustainability reporting has focused primarily on transparency and accountability, research on supply chain resilience has concentrated on how organisations prepare for and repond to disruptions (Bateman et al., 2017; Christopher & Peck, 2004; Nel, 2024; Warmbier et al., 2022; Zheng et al., 2024). There has been little research to explore the relationship between the two topics in corporate reporting.

This gap is especially relevant in resource-dependent sectors, where operations rely on natural ecosystems and raw material supply chains. Stakeholders and regulators are placing pressure to demonstrate responsible resource management, raw material traceability and sustainable production practices (Bateman et al., 2017; García-Jácome et al., 2025; Roos, 2023). In this context, companies use sustainability reporting to show how they manage environmental risks, ensure responsible sourcing and support long-term resource availability (Mäkelä, 2017; Wang et al., 2024; Zheng et al., 2024). In the forest industry, this relationship must be understood in light of the specific characteristics of value chains, such as long production cycles and vulnerability to biophysical disturbances (Roos, 2023; Wang et al., 2023).

2.3 Forest industry as a supply chain context

The forest industry is an ideal context in examining the relationship between sustainability and supply chain resilience. Previous literature indicates that industries relying heavily on natural resources face unique supply chain challenges compared to many other manufacturing sectors (Roos, 2023; Wang et al., 2023). In forest-based industries, production processes depend directly on biological raw materials and ecological systems, which makes supply chains strongly influenced by environmental conditions and long natural regeneration cycles (Roos, 2023; García-Jácome et al., 2025).

Forest-based supply chains differ from many other industrial supply networks because they rely on renewable biological resources that require long growth periods before they can be utilised for industrial production (Roos, 2023; García-Jácome et al., 2025; Wang et al., 2023). Unlike manufactured inputs that can be produced on demand, forest resources depend on ecological processes that unfold over several decades (Roos, 2023). As a result, disturbances affecting forest ecosystems may influence the availability of raw materials for extended periods of time (Roos, 2023; García-Jácome et al., 2025). Environmental disruptions such as pest outbreaks, storms, droughts and forest fires may significantly affect timber supply and therefore create supply uncertainty within forest-based industries (Roos, 2023; García-Jácome et al., 2025; Wang et al., 2023).

In addition to ecological dependency, forest supply chains are often characterised by geographically dispersed sourcing networks and complex logistics structures (Wang et al., 2023). Forest raw materials are typically harvested in remote locations and transported over long distances before reaching processing facilities. This creates strong interdependencies between harvesting operations, transportation systems and industrial production processes (Wang et al., 2023). As a result, disruptions in one part of the network may spread across the supply chain and affect operational performance (Wang et al., 2023; Kravchenko et al., 2024).

Environmental sustainability has become a central issue in forest-based supply chains (Lu et al., 2024; Wang et al., 2023). Stakeholders increasingly expect companies to demonstrate responsible forest management practices, sustainable sourcing and transparency regarding the origin of raw materials (Seuring & Müller, 2008). Previous literature indicates that sustainability concerns in the forest sector often relate to issues such as biodiversity protection, climate change mitigation, responsible forest management and the long-term availability of forest resources (Roos, 2023; García-Jácome et al., 2025). These expectations have increased the importance of sustainability governance mechanisms throughout forest supply chains (Zheng et al., 2024).

At the same time, regulatory frameworks and policy initiatives have strengthened requirements for sustainability and traceability within forest-based industries (Lungu et al., 2025; Seuring & Müller, 2008; Silvola et al., 2025). Companies operating in the forest sector are increasingly expected to monitor the origin of raw materials and ensure that their supply chains comply with environmental regulations and sustainability standards (Bateman et al., 2017; Seuring & Müller, 2008). These requirements have increased the importance of supply chain transparency, traceability systems and responsible sourcing practices across supplier networks (Lu et al., 2024; Wang et al., 2023).

In addition to environmental and regulatory pressures, forest supply chains may also be affected by geopolitical and market-related disruptions (Bednarski et al., 2025; Wang et al., 2023). Changes in international trade, supply constraints or fluctuations in the availability of raw materials can cause significant consequences for industries that depend on certain natural resources (Roos, 2023; Wang et al., 2023). This is particularly important in forest-based supply chains, which involve multiple parties, such as forest owners, contractors and logistics service providers. As a result, a disruption in one part of the network can quickly affect other parts of the system (Kravchenko et al., 2024).

Supply chains in the forest industry are characterised by strong interdependence between operators at different stages of the value chain (Mackay et al., 2020; Wang et al., 2023). The interconnected structure not only increases the complexity of supply networks but also affects how disruptions spread throughout the system (Kravchenko et al., 2024; Lu et al., 2024; Wang et al., 2023) . Since operations are closely connected, communication and coordination among operators are essential for maintaining the stability and operational efficiency of supply chains (Roos, 2023; Wang et al., 2023). Previous research suggests that this kind of complexity can increase the vulnerability of supply chains, but it can also enable resilience when collaboration and transparency are effectively managed (Christopher & Peck, 2004; Brandon-Jones et al., 2014; Lu et al., 2024). These characteristics make supply chain resilience in the forest industry different from many other industrial contexts. Supply disruptions are not only related to supplier or logistics capacity, but also to ecological conditions, forest growth cycles, biodiversity requirements and the availability of certified raw materials (García-Jácome et al., 2025; Roos, 2023; Wang et al., 2023). Sustainability and resilience are therefore closely linked in this sector, as responsible forest management and raw material traceability support long-term supply stability (García-Jácome et al., 2025; Lu et al., 2024; Roos, 2023).

These characteristics make the forest industry a suitable context for examining how sustainability and supply chain resilience connected. Production is directly dependent on natural ecosystems and long biological cycles and disruptions. As a result, disruptiond

in environmental conditions can quickly affect the stability of raw material availability (Wang et al., 2023; García-Jácome et al., 2025; Roos, 2023). A meanwhile, regulatory pressure and stakeholder expectations require companies to adopt transparent and responsible sourcing practices (Bateman et al., 2017; Wang et al., 2023; Zheng et al., 2024). Forestry companies must therefore manage environmental sustainability, supply chain risks and the long-term availability of resources, which reflects the close relationship between sustainability practices and supply chain resilience. The following chapter presents the methodological approach used to examine how these issues are communicated in corporate reporting.

3 Methodology

This chapter presents the methodological approach of the study. The first subheading discusses the research design. Next, the data collection for the study is discussed, followed by the analytical procedures used to examine how sustainability and resilience are communicated in the annual reports of Finnish forest industry companies. Finally, the chapter discusses the reliability and limitations of the study.

3.1 Research Approach

This study is based on a qualitative approach to explore how sustainability and resilience are communicated in supply chain reporting in the Finnish forest industry. A qualitative approach is particularly suitable for exploring complex organisational phenomena and understanding how organisations interpret and communicate issues related to sustainability and supply chain resilience. This method allows a deeper understanding of how companies communicate complex issues, such as supply chain disruptions. (Creswell, 2009; Saunders et al., 2023).

This study is interpretive in nature, as it examines how companies seek to understand the world around them through their own narratives (Saunders et al., 2023). Interpretive research is a form of qualitative research that focuses on understanding how individuals and organisations construct meaning within their social contexts. Annual reports are treated as strategic communication documents and examined through document analysis, which provides a systematic assessment of the annual report as a source of information for identifying patterns that reflect corporate priorities, but also operational realities (Bowen, 2009).

There has been little research on the connection between sustainability and resilience, so a qualitative approach provides flexibility in identifying emerging themes and relationships (Creswell, 2009; Saunders et al., 2023). The aim of this study is to better

understand how sustainability and supply chain resilience are communicated in the reporting practices of Finnish forest industry companies.

3.2 Data collection and case selection

This study's empirical data consist of publicly available annual reports from three Finnish forest companies for financial year 2023: Metsä Group, UPM and Stora Enso. The companies in the study were chosen by theoretical sampling based on their relevance to study's objectives. All three operate globally and depent heavily on forest-based supply chains. They also demonstrate detailed sustainability reporting practices, including the early adaption of double materiality assessments and CSRD-aligned reporting structures. As a leading actors in the Finnish forest industry, they are suitable for examining how they communicate sustainability and supply chain resilience in a resource-dependent sector.

Annual reports were selected as the primary data source. They provide a broad overview of corporate strategy, risk management, sustainability commitments and supply chain governance (Bowen, 2009). Companies also use them as strategic communications tools to present their priorities, respong to stakeholder expectations and describe long-term value creation. This makes annual reports suitable for analysing how sustainability and resilience are portrayed in supply chain-related reporting.

The analysis concentrated on sections of the report that covered supply chain management, sourcing practices, sustainability strategy, risk management, logistics and supplier relations. These sections were relevant for identifying how supply chain, sustainability challenges and resilience-related activities are described by companies. The selected reports provided qualitative material for examining explicit information, such as targets and commitments, and narrative elemts reflecting how companies interpret sustainability and supply chain issues.

Publicly available corporate reports were suitable data sources because they provide consistent, current and verifiable informations (Eisenhardt & Graebner, 2007). While corporate reporting may involve strategic framing and selective disclosure, it is relevant to the study's purpose of examining how companies communicate sustainability and resilience in supply chain-related reporting.

3.3 Data analysis

The empirical data were analysed using thematic analysis, which allows for the systematic recognition and interpretation of recurring patterns in the textual material. This approach is suitable for the interpretation of annual reports, as it allows for both direct narratives and indirect statements related to the sustainability and resilience of firms.

The analysis followed an iterative process in which the data were reviewed multiple times and interpreted in relation to the theoretical framework. In the first phase, the annual reports were read through several times to become familiar with the material and to form overall understanding of how sustainability and resilience are reflected in the data. The reading focused more on the chapters where companies reported on sourcing practices, supplier management, logistics, environmental impact and risk management, as these areas were the most relevant to the study.

In the second phase, relevant text sections were identified and coded so that interpretations developed as the analysis progressed. The coding process combined both deductive and inductive elements. Pre-defined themes such as transparency, collaboration and risk management were derived from the theoretical framework presented in Chapter 2, where these concepts were identified in previous literature as important dimensions of supply chain resilience and sustainability reporting. These theory-driven themes helped to structure the analysis and ensured that the empirical findings could be interpreted in relation to the existing research. At the same time, the coding process also allowed new themes to emerge directly from the data. These themes

were broadly aligned with key sustainability dimensions discussed in the literature, including environmental, social and governance aspects of supply chain management.

As the coding continued, codes with similar content were grouped into broader categories. Through this process, the recurring themes were organised into two broader thematic areas. The first was responsible sourcing, which included supplier codes of conducts, certification and traceability, supplier audits and Scope 3 emissions. The second was environmental and social sustainability in supply chains, which included social responsibility, supplier collaboration and sustainable logistics and material efficiency. These themes formed the structure of the findings chapter.

Lastly, a cross-comparison was conducted to examine similarities and differences between the companies in relation to the research topics. Comparative analysis was able to provide more detailed insight and support for analytical generalisation by revealing specific patterns and strategic priorities. Thematic analysis helps to move beyond just descriptive reporting. It enables a deeper interpretation of how companies communicate sustainability and supply chain resilience. In this study, resilience was identified through themes and practices discussed in the supply chain resilience literature, such as risk management, supplier collaboration, supply chain visibility, traceability and strategies aimed at maintaining operational continuity during disruptions (Christopher & Peck, 2004; Ivanov, 2020; Warmbier et al., 2022). These concepts provided a way to understand how resilience-related capabilities are communicated in the corporate reports, even when the term “resilience” itself is not explicitly used.

3.4 Reliability and limitations

The trustworthiness of the study was supported by a systematic and transparent research process. The reliability of the analysis was strengthened through careful familiarisation with the data and repeated coding, which supported a consistent interpretation of how sustainability and supply chain resilience are communicated in the

selected reports. The systematic application of thematic analysis helped ensure that the same analytical logic was applied across all three companies.

Credibility was supported by analysing reports from three companies rather than relying on single organisational perspective. This cross-case comparison made it possible to identify recurring patterns and differences. The use of publicly available annual reports improves transparency because data sources are accessible and can be verified by other researchers.

The validity was supported by linking the analysis to the theoretical framework presented in Chapter 2. Concepts from the literature on supply chain resilience and sustainability reporting guided the interpretation of the empirical material. The description of the coding and theme development, also improves transparency and allows readers to evaluate how the conclusions were reached.

The study has limitations. First, the analysis is based on publicly available annual reports, which means that the findings reflect corporate reporting rather than operational practices. As annual reports represent approved documents , they may involve selective disclosure or strategic framing. Second, the focus on three Finnish forest industry companies limits the generalisability of the findings to other industries or geographical contexts.

4 Findings

This chapter presents the empirical findings of the study based on a analysis of the annual reports of Stora Enso, UPM and Metsä Group. The coding process found common themes, including responsible sourcing, environmental sustainability in supply chains, social responsibility in supplier networks, supplier collaboration, and sustainable logistics practices. The analysis focused on how companies communicate sustainability and how resilience-related meanings emerge through supply chain practices. The following sections examine these themes in detail and show how they appear in the reporting practices of the selected companies.

4.1 Responsible sourcing

Responsible sourcing is a key element in managing sustainability risks in supply chains. It is particularly important in the forest industry, where companies rely on natural resources and a complex supplier networks, including forest owners, contractors and logistics providers. Companies must ensure that environmental, social and governance standards are followed throughout the supply chain.

The annual reports of Stora Enso, UPM and Metsä Group highlight several mechanisms used to implement and monitor responsible sourcing. These include supplier codes of conduct, certification systems, supplier audits and Scope 3 emissions related to suppliers and logistics operations. Together, they form a governance framework through which companies incorporate sustainability requirements into in their sourcing processes.

The following sections examine in more detail how these three companies have integrated sustainable sourcing into their supply chains.

4.1.1 Supplier codes of conduct

UPM, Stora Enso and Metsä Group highlight the supplier codes of conduct as one of the main tools for ensuring responsible sourcing. All three companies use this code to ensure that suppliers meet minimum requirements and that environmental, ethical and social standards are followed throughout their supply chains. In the forest industry, supplier codes of conduct are particularly important because they enable companies to extend their sustainability policies to their wide network of suppliers. This is particularly relevant in industries where supply chains involve many actors, such as forest owners, logistics providers and contractors.

All three companies emphasise that suppliers' commitment to these rules is an important indicator of responsible sourcing practices. Stora Enso states that the supplier code of conduct is legally binding and that suppliers must accept it as a condition of cooperation. The company monitors supplier compliance using a coverage indicator, which was 95% of total purchases from suppliers in 2023. UPM states that its supplier code of conduct defines minimum performance levels and that it requires its suppliers to apply similar standards in their own supply chains. In its annual report, UPM stated that in 2023, 89% of its total purchases and 98% of its raw material purchases were from suppliers who complied with the codes of conduct. Metsä Group, in turn, requires suppliers to commit to its ethical operating principles or comply with equivalent standards. Metsä Group's suppliers must also pass a background check known as the "Know Your Business Partner" process. In 2023, 98.7% of the company's purchases were made from suppliers who had committed to these requirements. Although the level of coverage varies slightly from company to company, the results suggest that suppliers' codes of conduct have been widely implemented across supply chains.

Corporate codes of conduct often address environmental, social and governance (ESG). Human rights and working conditions are highlighted in all three annual reports. These requirements include, for example, a living wage, fair working conditions, a ban on child and forced labor and the right to freedom of association. Health and safety requirements

are also highlighted, as companies require their suppliers to have certified occupational safety systems or equivalent measures in place. Supplier requirements are increasingly focusing on environmental and climate issues, particularly efforts to reduce Scope 3 emissions related to supply chains. Suppliers are encouraged to develop their own science-based climate targets and improve transparency regarding their environmental performance. This is part of a wider trend in the supply chain, where companies expect their suppliers to contribute to the fight against climate change and to sustainable reporting.

Compliance with these codes of conduct is based on self-assessment and supplier audits. Companies largely use third-party platforms for this, including EcoVadis, which can be used to monitor suppliers' performance in terms of sustainable practices. If any issues arise during the audits, companies generally seek to influence suppliers through corrective action plans and cooperation. However, if corrective measures fail or the supplier is unwilling to remedy serious violations, this may result in the termination of cooperation. As an example of this, Metsä Group announced that it had removed ten companies from the construction site of the Kemi biorefinery that did not comply with the sustainability requirements. All three companies also offer an anonymous reporting channel that allows company employees and supply chain partners to report potential misconduct. These reporting channels, often referred to as "Speak Up" or "Report Misconduct" channels, promote transparency and lower the barrier to reporting ethical or sustainability-related violations.

Overall, the findings indicate that supplier governance mechanisms play a central role in how companies manage sustainability risks in their supply chains. Through supplier codes of conduct, companies seek to ensure that environmental, social and ethical requirements are considered at different levels of the supply chain. These mechanisms also improve transparency. Companies can monitor supplier performance and also enable companies to address issues before they escalate into larger problems, which could affect operations and damage reputation. Therefore, supplier codes of conduct are

used by all three companies as a central tool for setting sustainability expectations and monitoring supplier perfomance.

4.1.2 Certification and traceability

The forest industry is concerned with ensuring the origin of wood and sustainable forest management. Forest certifications and traceability systems are used by analysed companies to demonstrate the sustainability of the raw materials. Certification systems are presented as important tools for supporting responsible sourcing by all three companies.

Two internationally recognised certification systems, the Programme for the Endorsement of Forest Certifications (PEFC) and the Forest Stewardsships council (FSC), are used by Metsä Group, Stora Enso and UPM (Metsä Group, 2024; Stora Enso, 2024; UPM, 2024). According to their annual reports, most of the wood used by these companies comes from certified forests. This shows that certification is an important way to make sure that wood raw materials come from forests that are managed in a responsible way. Third-party verification also promotes transparency and demonstrates to customers ans other stakeholders that companies meet regulatory requirements and sustainability standards.

Among the analysed companies, Metsä Group had the highest certification coverage. In 2023, 93% of the wood sourced by Metsä Group came from forests that were PEFC or FSC certified. The company had previously set a certification rate target of over 90% by 2023 (Metsä Group, 2024). UPM reported that 87% of the fiber raw materials used in production were certified. The company also highlighted the high certification coverage of its own forest resources, noting that 91% of its forests are dual-certified under both FSC and PEFC systems (UPM, 2024). Stora Enso reported that 81% of its wood supply came from third party certified forests. (Stora Enso, 2024). However, 99% of the forest areas owned or directly managed by the company are certified (Stora Enso, 2024). Although all three companies had high certification coverage, some differences can be

observed. These differences can be partly explained by the companies' sourcing methods, their geographic supply areas and whether the company owns or manages the forest itself. Companies that own or manage their own forests are better positioned to manage certification processes, whereas companies that rely on external suppliers may experience greater variation in the scope of certification.

In addition to certification, traceability is an important requirement in responsible sourcing. Traceability refers to the ability to track the origin and movement of raw materials throughout the supply chain. This is especially important in the forestry industry, as it allows companies to ensure that wood raw materials come from legal and sustainably managed sources. All three companies analysed emphasised that the origin of the wood used in their operations is fully known and verified (Metsä Group, 2024; Stora Enso, 2024; UPM, 2024). Traceability systems are typically based on chain-of-custody mechanisms that help companies track the movement of raw materials across the entire supply chain and ensure that the wood does not come from controversial sources, such as illegal logging or protected areas (Metsä Group, 2024; UPM, 2024).

Over the past few years, companies have also invested in digital technology to improve product traceability. UPM reports that it uses digital mapping tools and integrated forest resource databases to track fiber flows from the forests all the way to its production facilities (UPM, 2024). Similarly, Metsä Group reports that 94% of its raw material purchases, including chemicals, can be traced back at least to their country of origin, whereas the traceability of wood raw materials is reported to be complete. (Metsä Group, 2024). Stora Enso has also increased its use of digital traceability systems in response to stricter regulatory requirements. The company particularly stresses the need to develop location-based traceability in order to comply with the European Union's Deforestation Regulation (EUDR), which requires detailed location data on timber sourcing (Stora Enso, 2024). As supply chain transparency has become a central part of sustainability reporting and responsible sourcing, these mechanisms have become more important.

Overall, the findings suggest that certification and traceability are a key role in companies' responsible sourcing. These systems help companies to verify the origin of wood, improve transparency of raw materials and meet regulatory requirements and stakeholder expectations. Certification and digital traceability systems can also help manage sustainability risks in forest industry supply chains.

4.1.3 Supplier audits and monitoring

The annual reports show that supplier audits and monitoring mechanisms are central tools for ensuring that suppliers comply with sustainability requirements. All three companies emphasise that systematic supplier evaluation and auditing help them identify environmental, social and governance-related risks. Supplier audits therefore help companies assess whether suppliers follow the sustainability guidelines set for them.

One commonly used tool for evaluating suppliers' sustainability performance is the EcoVadis platform. All three companies used the EcoVadis in their supplier evaluation processes, although their approaches and levels of implementation differed. UPM and Stora Enso have achieved the highest EcoVadis rating, which is Platinum, places them in the top 1% of all companies globally. UPM reported that approximately 540 of its suppliers completed the EcoVadis sustainability evaluation in 2023. Metsä Group implemented platform in the same year, which led to a significant increase in supplier evaluations. The company reported 602 supplier evaluations or audits in 2023, compared to 266 in the previous year. These figures show how digital supplier evaluation platforms are becoming more common in monitoring supplier sustainability and improving transparency within supplier networks.

In addition to digital assessments, companies conduct on-site audits to ensure that suppliers are complying with sustainability requirements. UPM stated in its annual report that it conducted 95 supplier audits in 2023 based on identified risk areas.

Additionally, they conducted 890 contractor evaluations in Uruguay, focusing specifically on working conditions during the construction and operation of a new pulp mill. Stora Enso, for its part, reported that it conducted 25 audits of its supplier codes of conduct, which were primarily focused on China. The findings of these assessments revealed non-compliance, particularly regarding working hours, basic employee rights, and emergency preparedness. In addition, the company conducted 22 health, safety, environmental, and quality audits, but these focused primarily on contractors operating at production sites in Finland. These examples illustrate how supplier audits are generally focused on those areas or operations that are considered to have a higher risk in terms of sustainability.

Metsä Group emphasises the evaluation of core and strategic suppliers in its monitoring practices. In 2023, the company achieved 57% coverage in the evaluation and auditing of core and key suppliers. In large industrial projects, Metsä Group also applies specific monitoring practices to address risks related to the grey economy and labour compliance. These monitoring mechanisms can lead to concrete corrective actions, such as the removal of companies from projects due to non-compliance with sustainability requirements. This example demonstrates how a supplier monitoring mechanism can lead to concrete corrective actions when a supplier does not comply with the sustainability standards set for them.

Monitoring practices are increasingly based on risk-based evaluation models, in which audits are targeted at specific suppliers and regions associated with higher sustainability risks. Stora Enso reports that it has launched a pilot project for a new sustainable development risk identification tool, which will enable the company to improve its visibility into supplier risks across geographic regions and industries. Based on this analysis, suppliers identified as high-risk can be selected for more detailed third-party audits. Similar to this, UPM uses an internal ESG risk register to assess risks related to suppliers' locations, industries, and commodity categories. In addition, the company updated its responsible sourcing guidelines in 2023, which strengthen supply chain risk management and resilience. By conducting this type of risk assessment, companies can

better allocate their monitoring resources and focus on those suppliers that may cause the greatest sustainability risks.

Metsä Group uses a background screening process called “Know Your Business Partner” for its suppliers, which includes screening for sanctions, corruption risks, and human rights issues both before and during supplier relationships. According to the company’s reporting, background screening was performed on 89 % of new suppliers in 2023. Due diligence processes like this help companies identify potential risks at an early stage and enable more responsible supplier selection practices.

4.1.4 Scope 3 emissions

The reports indicate that Scope 3 emissions form a significant part of the forest industry’s total climate impact, which makes emissions measurement and management across the supply chain increasingly important. The annual reports of Stora Enso, Metsä Group and UPM highlight the role of sourcing in collecting emissions data from suppliers. This reflects a larger shift in corporate work, where companies focus more on emissions across the entire value chain rather than on emissions from their own operations.

In its annual report, Stora Enso states that Scope 3 emissions account for approximately 76% of the company’s greenhouse gas emissions. For this reason, the company has started to focus more on improving the accuracy of emissions data from its suppliers. The company has moved away from general industry-specific factors towards primary data collected directly from suppliers, which allows for greater accuracy in Scope 3 emissions calculations, for example, primary data already covers 49% of the emissions associated with purchased chemicals.

UPM has launched a program called “-30 by 30,” which aims to reduce emissions related to purchased materials and logistics by 30% by 2030 compared to 2018 levels. As part of this initiative, UPM requires both new and existing suppliers to provide information on the carbon footprint of the products and services they produce. According to the annual

report, in 2023, 57% of pigment purchases were covered by the primary emissions data provided by suppliers, and over 62% of deliveries were calculated based on supplier-specific data. In contrast, Metsä Group announced that it started collecting data on all Scope 3 emissions for the first time in 2023. This is part of a broader project aimed at obtaining more accurate data for calculating value chain emissions. The company has shifted from using general database factors to supplier-specific emissions data.

In addition to starting to collect emissions data, companies have set clear targets to reduce emissions in their supply chains. Stora Enso's goal is to reduce absolute Scope 3 emissions by 50% by 2030 compared to 2019 levels. According to the company, one possible solution for reducing emissions lies in changes to logistics, such as transferring freight transport from roads to railways. The company estimates that, as a result of this change, rail transport could reduce emissions by up to 65% per tonne transported. UPM's goal is the previously announced "30 by 30" program. By 2023, the company had achieved a 23% reduction. In its report, UPM also noted that it has introduced new vessels powered by liquefied natural gas and renewable diesel in its logistics operations, which can reduce route-specific emissions by up to 90%.

For its part, Metsä Group has established a strategic goal that all raw materials and packaging materials it uses will be fossil-free by 2030. Its goal is to reduce transport emissions from wood procurement in Finland by 30 % by 2030 by using trucks powered by electricity and biogas. The company also collaborates with logistics partners to reduce transport emissions; for example, together with VR, they have set a joint goal of halving emissions from rail transport covered by the collaboration. This example illustrates how emission reduction strategies increasingly involve collaboration with other stakeholders, such as logistics partners.

These findings suggest that, collaboration with suppliers plays a key role in achieving emissions reductions across the value chains. Suppliers are increasingly being encouraged or required to set their own science-based climate targets. These

expectations are often embedded in suppliers' governance mechanisms, including codes of conduct and sustainability monitoring processes. This shows that managing Scope 3 emissions requires not only internal corporate climate strategies, but also active collaboration with suppliers and logistics partners across the entire supply chain.

4.2 Environmental and social sustainability in supply chains

The sustainability of supply chains is influenced not only by governance mechanisms, such as supplier codes of conduct and certification systems, but also by the practices implemented throughout the entire value chain. In the forest industry, logistics, transportation, and material efficiency have a particularly important role in defining the environmental impacts of supply chains. Transportation and logistics operations often represent a significant portion of the value chain’s emissions in many industries.

The annual reports of Stora Enso, UPM and Metsä Group describe practices related to lower-emission, material efficiency and increasing collaboration with suppliers and logistics partners. These practices aim to reduce the environmental impact of supply chains and improve collaboration, risk management and operational continuity. By addressing risk related to labour issues and supplier non-compliance, these practices can improve the stability and reliability of supply chain operations.

4.2.1 Social responsibility

Reports show that social responsibility is an essential part of managing sustainability in global supply chains. The companies analysed emphasise that their suppliers must comply with requirements related to working conditions, human rights and occupational safety. These requirements are embedded in supplier governance structures designed to ensure that minimum social standards are applied throughout the supply chain. In global supply chains, social risks tend to arise particularly at the beginning of the chain, which underscores the importance of ensuring that suppliers follow common labour and human rights standards.

According to the reports, all three companies require their suppliers to comply with practices that prohibit child labour and forced labour and promote fair working conditions. In addition, suppliers are expected to respect the freedom of association and provide safe working conditions for employees. Occupational health and safety requirements are also emphasised in the reports, as suppliers are expected to maintain certified safety management systems or similar practices.

These requirements demonstrate how companies are striving to extend corporate social responsibility standards beyond their own organisational boundaries. Since many sustainability risks arise at the beginning of supply chains, companies rely on governance mechanisms to influence their suppliers' practices in their own operations. Various monitoring mechanisms, such as supplier audits and contractor evaluations, are therefore used to evaluate compliance with social requirements and working conditions, as well as to identify potential risks related to employee safety.

Differences can also be observed among companies in how these social responsibility practices are implemented. Although all companies emphasize corporate requirements and monitoring mechanisms, the evaluation of suppliers and contractors varies from company to company. These differences suggest that companies use slightly different approaches to managing social risks within their supplier networks.

Overall, the reports present social responsibility as part of supplier governance, particularly through requirements related to human rights, working conditions and occupational safety. These requirements show how the companies aim to extend social responsibility standards beyond their own operations into their supplier networks.

4.2.2 Supplier collaboration and partnerships

Supplier collaboration is a central part of how companies address sustainability challenges in their supply chains. The annual reports show that cooperation with

suppliers is especially important for environmental targets related to greenhouse gas emissions and climate commitments (Stora Enso, 2024; UPM, 2024; Metsä Group, 2024).

The reports highlight that companies increasingly rely on suppliers to provide environmental data and participate in sustainability initiatives. For example, the analysed companies collect emissions data directly from suppliers in order to improve the accuracy of Scope 3 emissions calculations. Stora Enso reports that it has increased the use of primary emissions data collected from suppliers instead of relying solely on general emission factors (Stora Enso, 2024). Similarly, UPM requires suppliers to provide information on the carbon footprint of their products and services as part of its emissions reduction initiatives (UPM, 2024). Metsä Group has also started to expand the collection of supplier-specific emissions data as part of its efforts to improve the accuracy of value chain emissions calculations (Metsä Group, 2024). This indicates that collaboration with suppliers is closely linked to the growing importance of data-driven sustainability and improved visibility in supply chains.

In addition to data collection, suppliers are increasingly encouraged to participate in climate-related initiatives. The findings indicate that companies expect suppliers to improve transparency regarding their environmental performance and, in some cases, develop their own science-based climate targets (Stora Enso, 2024; UPM, 2024). Such expectations demonstrate that companies not only monitor the performance of their suppliers but also actively influence their sustainability practices. These expectations illustrate how sustainability governance increasingly relies on cooperation between companies and their suppliers across supply networks.
Collaboration is also seen in logistics partnerships and joint initiativesz to reduce emissions.

Partnerships and joint initiatives focused on reducing emissions in the logistics sector are also a sign of collaboration. The companies describe working with logistics partner to decrease transport emissions and improve supply chain efficiency. UPM has

incorporated new vessels powered by liquefied natural gas and renewable diesel into its logistics operations to reduce transport emissions (UPM, 2024). Metsä Group also hightlight cooperation with logistics partners to lower emissions related to timber transportation (Metsä Group, 2024). While all three companies emphasise their partnerships, their operational priorities differ. Some focus more on technological innovation, while others give more attention to long-term relationships with logistics partners.

Overall, the findings indicate that collaboration with suppliers is essential for achieving sustainability objectives in supply chains. Including suppliers in emission reductions and sustainability monitoring processes enchaces transparency and environmental performance across networks. Such collaboration extends sustainability efforts beyond individual companies and addresses challenges that require collective action.

4.2.3 Sustainable logistics and material efficiency

Annual reports show that sustainable logistics and material efficiency are important factors in the sustainability of supply chains. In the forest industry, logistics operations are closely connected to environmental performance, as raw materials, intermediate products, and goods are transported over long distances via domestic and international networks. Material efficiency is critical for forest industry companies, which are dependent on natural resources and large-scale industrial processing. Stora Enso, UPM and Metsä Group are aiming to reduce the environmental impact of their supply chains through lower-emission transport solutions, collaboration with logistics partners, and better utilisation of by-products.

One of the clearest common themes in the reports is the growing importance of reducing carbon dioxide emissions from logistics. All three companies have set climate targets that extend beyond their own operations to cover emissions generated throughout the entire value chain. Stora Enso highlights significant progress in reducing value chain emissions and places increasing emphasis on logistics decarbonisation (Stora Enso,

2024).UPM implements a range of logistics solutions, including renewable fuels and more efficient transport configurations, to reduce emissions across its supply chain. Metsä Group reports new targets for reducing transport emissions and has expanded its emissions reporting as part of its broader sustainability strategy (Metsä Group, 2024). These examples highlight that logistics decarbonisation has become a central element of corporate climate strategies.

According to annual reports, companies are working to reduce logistics-related emissions by utilising multiple modes of transport, adopting alternative fuels, and transitioning to electric vehicles. Stora Enso strongly emphasises the shift of freight from road transport to intermodal rail transport. According to the company, this shift could reduce emissions by up to 65% per ton transported (Stora Enso, 2024). The company also reports on the use of electric trucks, for example at the Skoghall mill in Sweden, where route-specific carbon dioxide emissions were reduced by 93%, as well as the use of electric forklifts in terminal operations (Stora Enso, 2024). The report also refers to use of biofuels in land and maritime transport. One notable feature of Stora Enso's reporting is its plan to reintroduce log floating as a method of transport.

UPM also reports on several concrete measures that can help reduce logistics-related emissions. The company particularly highlights the use of renewable diesel on selected timber transport routes, such as those between the Seiku sawmill and the port, which has reduced emissions on these routes by up to 90% (UPM, 2024). In addition, the company states in its annual report that it has begun using larger High Capacity Transport trucks, which have reduced carbon dioxide emissions by up to 40% compared to traditional road transport arrangements (UPM, 2024). Maritime logistics also plays an important role in UPM's sustainability strategy, as the company uses new ships powered by liquefied natural gas on European shipping routes. These examples demonstrate that UPM approaches sustainable logistics by combining vehicle efficiency with lower-emission fuel solutions.

Metsä Group also reports on low-emission transport solutions, but its reporting places particular emphasis on collaboration with logistics partners and infrastructure development. The company describes pilot projects involving the use of electric and biogas-powered trucks to transport timber to a bioproduct mill, as well as the construction of charging infrastructure to support the wider adoption of electric logistics solutions (Metsä Group, 2024). Metsä Group also highlighted its shared goal with VR to halve rail transport emissions by 2030, which would reduce emissions by approximately 14,000 metric tons of carbon dioxide equivalents per year (Metsä Group, 2024). The company also aims to reduce emissions from maritime logistics. Together with Royal Wagenborg, it has set a joint target to reduce maritime transport emissions by 30% per ton-kilometer by 2030 (Metsä Group, 2024). Overall, Metsä Group's reporting presents sustainable logistics mainly through long-term partnerships and infrasturcture development, rather than through individual transport technologies.

The companies have similar goals, particularly reducing transport-related emissions and using more lower-emission transport solutions, but their reported approaches differ. Stora Enso emphasises the modal shifts and electrification, while UPM highlight structured emissions reduction programmes and transport innovations and Metsä Group focuses more on partnerships and infrastructure development. This comparison shows that the companies pursue similar sustainability goals through different logistics strategies.

4.3 Comparison of companies

A comparison of Stora Enso, UPM, and Metsä Group shows both clear similarities and differences in how sustainability is communicated in forest-based supply chains. Although the companies operate in the same industry and face similar regulatory pressures and stakeholder expectations, their reporting practices and strategic priorities vary in many ways. Overall, the findings indicate a shift toward more transparent and data-driven reporting that extend beyond their own operations to the wider value chain.

Several similarities can be observed in how companies communicate and structure their approaches to supply chain sustainability. First, all three companies use internationally recognised reporting frameworks to guide their sustainability reporting. They report in accordance with the Global Reporting Initiative (GRI) standards and include climate-related information based on recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). The companies have also begun to apply elements of the Task Force on Nature-related Financial Disclosures (TNFD) framework in response to the risks and opportunities related to biodiversity. These frameworks support a more structured and comparable approach to sustainability reporting across companies.

Another common element concerns supplier management. The findings indicate that all three companies emphasise supplier codes of conduct as a key tool for communicating sustainability expectations within their supplier networks. Throught these codes of conduct, suppliers are required to comply with the environmental, ethical and social standards set by the companies. In addition, the companies use third-party sustainability assessment platforms, particularly EcoVadis, to evaluate supplier performance and identify potential risks in their supplier networks. These machanisms demonstrates that responsible sourcing and supplier monitoring provide an important foundation for sustainability management in forest industry supply chains.

The companies are also placing greater emphasis on accuracy and transparency of emissions data throught their supply chains. The evidence shows a shift in Scope 3 emissions calculations from general emission factors to supplier-specific primary data. For example, Stora Enso reported that primary data now covers a significant portion of emissions relatd to purchased chemicals. UPM indicated that supplier-provided emissions data is increasingly utilized in its sourcing and logistics operations. Metsä Group similarly noted the growing use of supplier-specific emissions factors, particularly in logistics. This trend shows increasing pressure from stakeholders and regulatory authorities to improve the reliability and credibility of supply chainemissions reporting.

Traceability and digital transparency are also shared priorities in the companies' sustainability communications. All three companies highlight traceability systems as a crucial means for verifying the origin of forest-based raw materials throughout the cupply chain. These initiatives are closely linked to regulatory developments, such as the EUDR, which requires companies in the forest products sector to demonstrate the geographical origin of their products. Consequently, companies have invested in digital platforms that facilitate supply chain traceability and data integration. These systems allow companies to track supplier information, trace raw materials and share compliance-related information with customers and regulatory authorities. Table 1 summarise the main differences in sustainability and supply chain reporting among the analysed companies. It shows that all companies address similar themes, such as emissions, supplier governance and collaboration, but differ in how they emphasise and implement.

Tablet 1 Differences in reporting practices among companies

Dimension	**Stora Enso**	**UPM**	**Metsä Group**
Strategic tools	Emphasis on long term transformation and regenerative products	Programme-based sustainability approach (e.g. 30 by 30)	Strong focus on cooperative ownership and sustainable forestry practices
Emission strategy	Broad value chain emission reductions (Scope 3 focus)	Target reductions in sourcing and logistics emission	Focus on emission from wood sourcing and domestic logistics
Supplier governance	Strong monitoring and target deep-dive evalutions	Structured supplier evalutions and risk-based assessments	Strict compliance requirements and escalation procedures
Collaboration approach	Emphasis on technological solutions and digital transparency	Participation in industry-wide sustainability initiatives	Strong partnerships with logistics and transport actors
Logistics strategy	Modal shift, electrification and alternative transport solutions	Use of renewable fuels and transport efficiency improvements	Focus on partnerships and infrastructure development

Dimension	Stora Enso	UPM	Metsä Group
Reporting style	Transformation-oriented and future-focused communications	Structured and programme-driven reporting	Operational and partnership-oriented reporting

Although several similarities were identifed, the analysis also reveals differences in how companies define and prioritise sustainability in their supply chains. One key difference concerns the strategic framing of sustainability initiatives. UPM emphasises program-based sustainability strategies and communicates its initiatives through branded programs, such as the “30 by 30” emissions reduction program and the “Biofore Share and Care” initiative. Metsä Group places greater emphasis on its cooperative ownership structure and collaboration with Finnish forest owners, highlighting initiatives related to regenerative forestry and sustainable forest management practices. Stora Enso’s communications focus strongly on long-term transformation goals, such as the goal of offering fully regenerative products and solutions by 2050.

Differences are also visible in the scope and focus of their emission reduction strategies. Among the analysed companies, Stora Enso has the most ambitious value chain climate target, as it aims to reduce its absolute Scope 3 emissions by 50% by 2030 compared to 2019 levels. UPM focuses more specifically on reducing emissions from purchased materials and logistics, as it aims for a 30% reduction by 2030 compared to 2018 levels. Metsä Group places stronger emphasis on reducing emissions from domestic wood sourcing and logistics. These differences demonstrate that although all three companies share the strategic objective of reducing climate change, they prioritise distinct segments of their supply chains according to their operationa-level structures and supply chain configurations.

The third difference relates to how companies communicate social sustainability risks in their supply chains. Stora Enso conducts detailed studies of specific supply chains using targeted “deep dive# projects that focus on issues such as the working confitions of migrant workers and the sourcing of recycled materials. UPM emphasizes extensive contractor management and human right assessments, particularly in relation to its

operations in Uruguay. Metsä Group highlights strict escalation procedures when sustainability requirements are nor met, including the possible termination of supplier relationships. These examples show that social responsibility is recognised in all these companies, but their communication approaches and risk management methods differ in emphasis and scope.

The last key difference is how each company works with supply chain partners. Metsä Group focuses on strong partnerships with logistics and transport companies, setting shared goals to cut emissions with rail and maritime transport partners. UPM takes part in broader industry efforts to improve supply chain sustainability, such as being an active member of Together For Sustainability. Stora Enso puts priority on new technology and digital tools that help make supply chains more transparent and meet reguations.

Overall, the comparison shows that these companies have a shared vision of sustainable supply chains, which are characterized by greater transparency, better emissions data and effective supplier management. However, they differ in their prioritisation of sustainability initiatives, reflecting variations in organizational structures, supply chain configurations and managerial priorities. These finginds suggest that the development of sustainability practices in forest-based supply chains is influenced by industry-wide trends and company-specific strategic decisions.

These results also indicate that supply chain resilience is not addressed as a distinct topic in annual reports, but is instead integrated into wider sustainability practices. Mechanisms including supplier monitoring, traceability, collaboration and emissions management, contribute to resilience by improving transparency, enabling risk identication and increasing aoadtability within supply chains.

5 Discussion

This chapter analyses the findings of the study in relation with current literature on sustainablility and supply chain resilience. The aim is to interpret the empirical findings of Chapter 4 and explain how they can contribute to understanding the sustainability practices in forest-based supply chains.

The results imply that sustainability is now a key factor in supply chain management and is no longer limited to conforming with environmental regulations and social standards. This aligns with previous studies that found sustainability helps companies improve competitiveness and create long-term value (Abbasian & Jamili, 2025; Warmbier et al., 2022). The results also show companies are shifting from individual sustainability projects to system-wide approaches involving stakeholders across the entire supply chain.

An important finding concerns the role of governance mechanisms, such as codes of conduct for suppliers, certification systems, and supplier audits. These mechanisms are used to set minimum standards for responsible sourcing and to manage environmental and social risks. This supports previous research, which states that governance tools are essential for extending sustainability requirements beyond organisational boundaries (Bateman et al., 2017). At the same time, governance alone is not enough, as companies increasingly rely on collaboration and information sharing with suppliers to achieve their sustainability goals.

Another finding concerns the growing emphasis on Scope 3 emissions on data-driven sustainability management. The analysed companies have shifted from generic emission factors to supplier-specific primary data, which improves the accuracy of emissions calculations and transparency. This reflects a broader trend observed in the literature, in

which supply chain sustainability is increasingly based on data availability and digital traceability (Abbasian & Jamili, 2025; Bednarski et al., 2025; Kravchenko et al., 2024).

In addition, the results highlight the growing importance of operational practices, including sustainable logistics and material efficiency. Various investments in low-emission transport solutions, alternative fuels, and the circular economy for materials demonstrate that sustainability is increasingly becoming part of day-to-day supply chain operations. This supports previous studies that show that operational capabilities have a central role in achieving sustainability outcomes (Warmbier et al., 2022; Zheng et al., 2024).

5.1 Sustainability and resilience in supply chain reporting

The findings of this study show that sustainability and supply chain resilience are closely connected in companies' reporting, particularly in the context of supply chain management. Although previous literature has often treated sustainability and resilience as separate research areas, this study suggest that, in practice, these concepts are increasingly integrated into corporate reporting narratives, as sustainability practices also support supply chain risk management.

A key finding is that many of the sustainability-related practices identified in the study closely correspond to the capabilities associated with supply chain resilience in the literature. All of the companies analysed reported a broad use of supplier management mechanisms, including codes of conduct, certification systems, and supplier audits. These mechanisms are mainly used by companies to ensure that their supply chains comply with environmental and social requirements. Previous studies suggest that, they also promote risk management, transparency and monitoring in supplier networks, which are key elements of supply chain resilience (Christopher & Peck, 2004; Ivanov, 2020; Brandon-Jones et al., 2014; Warmbier et al., 2022).

This finding supports the idea that resilience does not merely mean reacting to disruptions, but also proactively building capabilities that reduce vulnerability. Supplier governance mechanisms can function as practices that support early risk identification and corrective action plan. This links the findings to resilience literature, where visibility, collaboration and preparedness are identified as important capabilities for managing disruptions (Brandon-Jones et al., 2014; Ponomarov & Holcomb, 2009; Warmbier et al., 2022)

These results also show that governance mechanisms extend beyond the focal company to the entire supply chain. Since modern supply chains consist of multiple supplier tiers, companies can no longer manage risks only within their own operations. They must also influence supplier behavior and ensure compliance with sustainability and risk management standards across their supply chains. This is in line with earlier research, which suggests that resilience is a network-level characteristic rather than a characteristic of individual companies (Christopher & Peck, 2004; Ponomarov & Holcomb, 2009; Wang et al., 2024). The results suggest that code of conduct and monitoring mechanisms are presented as practices that may support resilience across extented supply chains.

Another important aspect is the visibility and traceability of supply chains. The companies analysed placed particular emphasis on the importance of traceability of the origin of raw materials and improving the visibility in the supply network. Visibility is widely recognised in the literature as a key factor in supply chain resilience, as it enables companies to detect and respond to disruptions earlier (Brandon-Jones et al., 2014; Christopher & Peck, 2004; Warmbier et al., 2022). These findings suggest that traceability systems not only support sustainability goals such as responsible sourcing and regulatory compliance, but also resilience by increasing situational awareness. Traceability can reduce uncertainty by providing more accurate and up-to-date information on materials, helping companies to prepare for problems and change their operations as needed (Brandon-Jones et al., 2014; Christopher & Peck, 2004; Zhang et

al., 2011). Certification and traceability are practices that support resilience. They improve the supply chain by making it more transparent and reducing uncertainty about the origin of raw materials (Brandon-Jones et al., 2014; Lu et al., 2024; Ponomarov & Holcomb, 2009; Sarkis, 2021).

Collaboration with suppliers and logistics partners also links sustainability and resilience. The analysed companies emphasised cooperation in areas such as emissions reduction, data sharing and sustainability monitoring. This idea is supported by earlier studies that identified cooperation as an important skill for improving supply chain resilience as well as sustainability performance (Christopher & Peck, 2004; Nel, 2024; Ponomarov & Holcomb, 2009; Warmbier et al., 2022; Zheng et al., 2024). Through building strong relationships with suppliers and logistics partners, companies can respond quicker and efficiently to sudden events and reduce the impact of disruptions on their supply chains.

The findings also emphasise the growing role of data and digitalisation in supply chain management. Companies seem to be increasingly relying on supplier-specific data, particularly in relation to Scope 3 emissions reporting. Although this trend has been largely driven by sustainability reporting requirements and regulatory pressures, it also helps companies monitor their suppliers' performance, identify risks and make data-driven decisions. This supports previous studies indicating that data collection capabilities are central to supply chain resilience, as the ability to collect, process and utilise data is crucial for detecting disruptions and responding effectively (Brandon-Jones et al., 2014; Bednarski et al., 2025; Kravchenko et al., 2024).

A broader interpretation of the findings implies that sustainability reporting in itself contributes to the development of supply chain resilience. When companies systematically publish information on supplier management, emissions and sustainability initiatives, they create a structured picture of their supply chains. As part of this process, it supports internal risk management by encouraging companies to monitor their operations more closely and identify potential vulnerabilities (Bateman et

al., 2017). From this perspective, sustainability reporting can be understood not only as a communication tool but also as a governance mechanism that promotes sustainability through transparency and accountability.

One important finding is that companies do not really address resilience explicitly in their annual reports. Instead, the capabilities associated with resilience are embedded in their sustainability narratives. This suggests that companies treat resilience as an implicit outcome of sustainability practices rather than as a separate strategic objective. Although sustainability is increasingly reported through structured frameworks, such as ESG and CSRD, resilience remains less clearly defined and less standardised concept in corporate reporting (Bateman et al., 2017; Scholz et al., 2012).

Reporting itself also has a role in how resilience is communicated. Annual reports are strategic tools through which companies present their priorities, risks and long-term directions to stakeholders (Bateman et al., 2017). In this study, resilience was not reported as a separate concept, but many sustainability-related practices could still be understood as supporting supply chain continuity and adaptability. This may indicate that companies may benefit from explaining more clearly how sustainability practices also contribute to resilience. However, not all aspects of resilience are easy to report. Some resilience capabilities may be internal, informal or difficult to measure, such as organisational learning, decision-making routines, operational flexibility or supplier relationships (Brandon-Jones et al., 2014; Ponomarov & Holcomb, 2009). Companies may also avoid reporting detailed information about vulnerabilities, supplier dependencies or risk management strategies (Zheng et al., 2024). Corporate reports therefore provide useful insight into resilience-related practices, but may show only part of how resilience is built and maintained in supply chains.

This can create a gap between practice and communication. Companies appear to be developing resilience-related capabilities through sustainability initiatives, but these

capabilities are not always clearly expressed or labelled as resilience. As a result, stakeholders may not fully understand how companies manage supply chain risks and build resilience into their operations.

The findings support a broader theoretical argument that sustainability and resilience are mutually reinforcing concepts rather than competing goals. Various sustainable practices, such as responsible sourcing, transparency, and collaboration, reduce environmental and social risks while strengthening supply chains ability to withstand disruptions (Brandon-Jones et al., 2014; Wang et al., 2024; Warmbier et al., 2022). At the same time, a potential tension can be identified between efficiency-focused sustainability goals and capabilities centered on resilience. Sustainability initiatives tend to focus on optimising resource use and reducing emissions, whereas the literature on resilience particularly emphasises the need for redundancy, flexibility, and buffer capacity (Christopher & Peck, 2004; Sarkis, 2021; Warmbier et al., 2022). This refers to the need for companies to balance efficiency and resilience when planning sustainable supply chains, so that both operational performance and resilience can be maintained.

Overall, the findings show that sustainability and supply chain resilience are connected in companies' operating practices, even though this connection is not always recognised or communicated. Sustainability practices appear to support resilience by improving transparency, strengthening supplier relationships and enhancing risk management capabilities. This highlights the need for more integrated theoretical perspectives in which sustainability and resilience are considered overlapping and mutually reinforcing dimensions of supply chain management.

5.2 Differences between companies' reporting approaches

The findings reveal several common themes among the analysed companies, but also differences in how sustainability and supply chain resilience are emphasised and communicated in corporate reporting. These differences are not inconsistencies, but

rather reflect companies' strategic priorities, the context of their operations, and their approaches to managing supply chains.

One of the clearest differences concerns the balance between technological solutions and governance mechanisms. All analysed companies emphasise governance mechanisms, but they differ in how strongly these are presented in relation to technological solutions. Some companies place greater emphasis on digitalisation, data-driven systems and technological innovations as tools for improving the sustainability and supply chain performance. In particular, digital traceability systems, supplier-specific emissions data and logistics optimisation technologies are emphasised more strongly in some annual reports than in others. These findings are aligned with existing literature, which indicates that digital technologies improve both sustainability and resilience by increasing visibility, information flow, and decision-making capabilities within supply chains (Bednarski et al., 2025; Kache & Seuring, 2017; Lu et al., 2024; Wang et al., 2024; Zheng et al., 2024).

At the same time, governance mechanisms remained important across all companies. These mechanisms highlight the role of formal rules, compliance systems and long-term supplier relationships in managing sustainability risks. From a theoretical perspective, governance mechanisms are especially relevant in complex supplier networks, where companies need to maintain consistent standards across multiple levels of the supply chain (Kache & Seuring, 2017; Seuring & Müller, 2008). The comparison suggests that companies may adopt either a more technology-focused or a more governance-focused approach, depending on their capabilities and strategic priorities.

The annual reports differ in how detailed and transparent their reporting practices are. All companies shared sustainability-related data, but the depth and precision of this information varied. Some companies presented detailed quantitative data, like emissions, supplier assessment scores and certification levels. Other focudes more on

describing their policies and initiatives. These differences suggest that companies are at different stages in their reporting processes, have varying access to data and internal capabilities. Companies may also be making strategic choices about how to present their sustainability performance to stakeholders, since reporting is both a way to be transparent and shape how stakeholders view the company (Mäkelä, 2017).

Companies use different strategies to cooperate in supply chains. All are working withsuppliers and partners, but their methods can vary. Some focus more on technology, such as information sharing and digital platforms, while others focus more on buildings long-term partnerships in their supply chains. These findings suggest that collaboration is not a standard practice, but rather a flexible mechanism that varies depending on the organisational context and supply chain structure. Previous studies have also shown that collaboration strategies vary across companies based on their capabilities and the complexity of their supply networks (Brandon-Jones et al., 2014; Christopher & Peck, 2004; Kache & Seuring, 2017).

In addition, differences between companies can be observed in how clearly they address supply chain risks and challenges related to resilience. Although all companies communicate resilience indirectly through sustainable development practices, the clarity of their discussions regarding risk management and disruption-related issues varies. Some companies refer more directly to risks such as geopolitical uncertainty, regulatory changes and environmental disruptions, while others focus more on long-term sustainability goals and strategic commitments. This illustrates that companies differ in how they describe uncertainty and risk in their reporting narratives. From a theoretical perspective, this reflects different levels of risk awareness or differences in how companies prioritise short-term risk management compared to long-term strategic positioning (Bednarski et al., 2025; Kravchenko et al., 2024; Wang et al., 2024).

Another significant difference concerns the balance between efficiency and resilience in their supply chain strategies. In certain companies, sustainability practices aimed at

efficiency are more prominent, such as reducing emissions and cost-effective logistics solutions. In contrast, other companies focus relatively more on collaboration, redundancy, and long-term partnerships, which are more closely linked to resilience capabilities. These differences between companies reflect how they prioritise supply chain performance across various areas based on their strategic focus. This also highlights a potential trade-off between sustainability-driven efficiency and resilience-oriented flexibility, since practices that optimise resource utilisation can simultaneously reduce buffer capacity and adaptability in supply chains (Christopher & Peck, 2004; Mackay et al., 2020).

Although there are differences between companies, it is important to note that all of the companies analysed have a broadly similar approach to integrating sustainability into supply chain management. Responsible sourcing, traceability, emissions reduction and supplier collaborations appear consistently across all three cases. This indicates that, although companies' priorities and communication styles differ, there is a shared understanding within the forest industry regarding the key components of sustainable and flexible supply chains.

Finally, the differences observed in this study underscore the fact that there is no single approach to managing and reporting on sustainability and supply chain resilience. Instead, companies adopt context-dependent strategies that reflect their operational structures, resources, and strategic priorities. This is consistent with previous research, which has found that supply chain management practices are shaped by organisational and industry-specific factors rather than universal models (Brandon-Jones et al., 2014; Nel, 2024; Ponomarov & Holcomb, 2009). It should also be noted that the variations observed across companies suggest that corporate reporting still has potential for improvement when it comes to integrating and communicating sustainability and resilience. Figure 1 summarises the relationship between sustainability practices and supply chain resilience based on the findings of the study. The figure illustrates how governance mechanisms, traceability and collaboration contribute to both sustainability

outcomes and resilience capabilites. It also hightlights how these practices are interconnected.

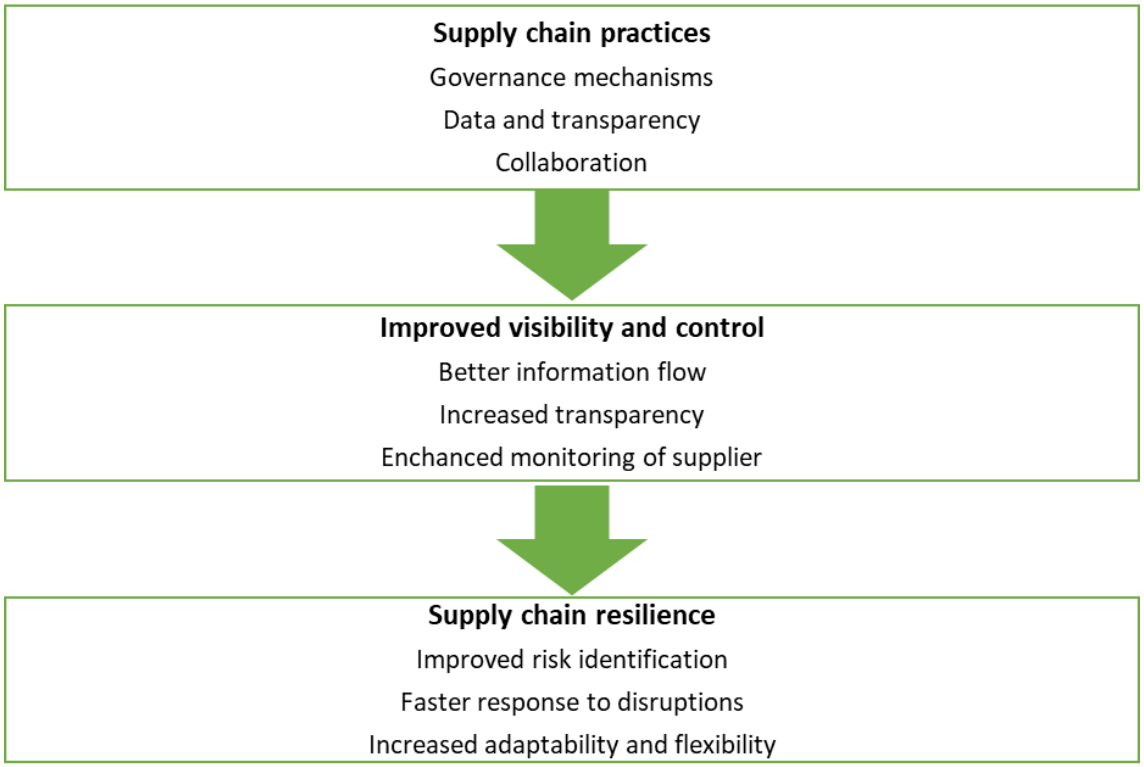

Figure 1 Relationship between sustainability practices and supply chain resilience

5.3 Implications of the study

The findings of this study provide insights into supply chain management practices and the relationship between sustainability and supply chain resilience. The findings show that sustainability is not solely a compliance issue but an increasingly strategic component of supply chain management that also supports resilience.

The findings imply that companies should not treat sustainability and resilience as separate areas, but rather integrate them into their supply chain strategies and decision-making. Various practices, such as supplier monitoring, traceability, and collaboration with partners, not only support environmental and social goals but also improve the

supply chain's ability to manage potential risks and respond to various disruptions. This emphasises the importance of adopting a more holistic approach, in line with which initiatives to promote sustainable development are designed in a way that also strengthens the company's resilience.

The results also highlight the growing importance of data and transparency in supply chain management. Companies increasingly rely on supplier-specific data, particularly in emissions reporting and traceability systems. From a practical perspective, investments in data collection, digital tools and data sharing can improve both sustainability performance and risk management (Kravchenko et al., 2024; Sarkis, 2021; Zheng et al., 2024). Companies with a more extensive view of their supply chains are in a better position to identify and respond to potential disruptions more effectively (Brandon-Jones et al., 2014; Christopher & Peck, 2004; Nel, 2024).

The findings also emphasise the role of cooperation with suppliers and logistics partners. Companies cannot achieve sustainability and resilience alone, but depend on collaboration with their supplier network. Strong relationships with suppliers and other partners allow for better information exchange, coordination and joint problem solving (Christopher & Peck, 2004; Nel, 2024). This suggests that companies should invest in long-term supplier relationships rather than focusing on transactional relationships.

The study contributes to existing literature by showing that sustainability-related practices can also support resilience (Sarkis, 2021; Warmbier et al., 2022). While previous studies have often treated them separately, this study suggests that sustainability practices may also function as mechanisms that support resilience. Sustainability and resilience should therefore be viewed as overlapping rather than independent concepts in supply chain management research.

Another important observation relates to corporate reporting. The results show that the resilience of the supply chain is rarely directly reported in companies' annual reports.

This may potentially reveal a gap in companies' actual operations and their communication to stakeholders. By making resilience more visible in companies' reporting, it may help stakeholders to better understand how companies manage supply chain risks and how they prepare for potential risks (Christopher & Peck, 2004; Wang et al., 2024).

Overall, the results suggest that sustainability and supply chain resilience should not be seen as separate objectives, but as interdependent parts of the supply chain. Combining sustainable operations with risk management, information transparency and collaboration can support both the sustainability and resilience of the supply chain (Brandon-Jones et al., 2014; Nel, 2024; Wang et al., 2024; Zheng et al., 2024). This suggests that sustainability and resilience need to be considered together, both in research and in practice.

6 Conclusion

This chapter concludes the study by summarising the main findings and answering the research questions. It also discusses the theoretical and practical contributions of the study, indentifes the limitations and outlines directions for future research.

6.1 Summary of findings

The purpose of the study was to examine how companies have communicated sustainability and resilience in their annual reports. The results show that sustainability is presented as part of supply chain management as an integrated and multidimensional function, rather than as a separate concept.

The analysis indicates that companies communicate sustainability through governance mechanisms, operational practices and collaboration. Codes of conduct, certification systems and supplier audits are used to set minimum requirements and monitor compliance in supply chains. Sustainable logistics and material efficiency illustrate how companies translate sustainability goals into practical actions to reduce environmental impact. Collaboration with suppliers and logistics partners is also important, particularly relation to data collection and emission reduction initiatives.

The results also show that sustainability reporting is now more focused on data, especially when measuring supplier emissions and tracking materials. This shows a broader move toward clearer, more measurable supply chain operations.

6.2 Answers to research questions

The results show indicate sustainability is communicated directly, whereas resilience is communicated more indirectly through related practices and governance mechanisms. The findings provide the following answers to the research questions.

How do Finnish forest industry companies communicate sustainability and resilience in supply chain-related reporting in their 2023 annual reports?

The findings indicate that sustainability is communicated through governance mechanisms, operational practices and collaboration. In the annual reports, the companies highlight tools such as supplier codes of conduct, certification systems, supplier audits and Scope 3 emissions reporting to show how they manage sustainability across the value chain. These mechanisms are presented as ways for companies to set requirements for suppliers and monitor whether sustainability standards are followed throughout the supply chain.

Operational activities, such as sustainable logistics solutions and improvements in material efficiency, illustrate how sustainability is presented as part of supply chain practices. These activities indicate that companies not only set sustainability targets but also take practical steps to reduce the environmental impact of their operations. Collaboration with suppliers and logistics partners further supports sustainability by enabling data sharing, joint initiatives and coordination across supply chains.

Resilience is communicated less directly. Rather than being presented as a separate reporting category, it appears through practices such as supplier monitoring, traceability, emissions management and collaborations. This may suggests that companies may view resilience more as an outcome of well-managed supply chain operations than as an independent reporting theme.

What sustainability-related themes appear in supply chain-related reporting?

The analysis identified several recurring sustainability-related themes in supply chain-related reporting. Responsible sourcing is especially visible in supplier codes of conduct, certification schemes and supplier audits. These tools are used to ensure that suppliers

meet environmental and social standards and to reduce risks related to unethical or unsustainable practices.

Environmental sustainability appears mainly through emissions reduction, logistics optimisation and material effiency. The analysed companies report initiatives aimed at reducing carbon dioxide emissions, improving energy efficiency and increasing the use of renewable and recycled materials. These measures indicate that the companies address environmental impacts across the value chain.

Social responsibility is addressed through labour conditions, human rights and occupational safety. Companies emphasise fair labour conditions and supplier compliance with social standards. Collaboration and data sharing also appear as part of sustainability implementation, as they help companies improve transparency and monitor performance across their supply chains.

How is supply chain resilience described in supply chain-related reporting and how is it linked to sustainability?

The findings suggest that supply chain resilience is not presented as a separate reporting category in the analysed companies' annual reports. Instead, it communicated indirectly through sustainability-related practices. Companies do not clearly identify resilience as an independent strategic objective, but reflect it through activities that also support sustainability.

The link between resilience and sustainability can be seen in many different areas. Data collection and traceability systems increase the visibility of the supply chain and thus help companies to identify potential risks and disruptions earlier. Collaboration with suppliers helps in coordination and data sharing, which is needed in the event of a disruption, for example. Operational functions such as flexible logistics operations and resource efficiency can contribute to supply chain resilience.

These findings suggest that sustainability practices can strengthen resilience. By These findings suggest that sustainability practices can strengthen resilience. By improving transparency, collaboration and operational efficiency, companies may better manage risks and adapt to changing conditions. Sustainability can therefore be seen as a enabler of resilience in the supply chain, although this connection is not directly captured in the annual report.

What similarities or differences can be observed in companies' approaches to supply chain-related reporting?

The comparison reveals both similarities and differences between the analysed companies. The annual reports share many common features, including the use of standrard reporting frameworks, supplier management mechanisms, Scope 3 emissions reporting and data transparency. Thesee similarities imply that Finnish forest industry companies have a shared understanding of the main elements of sustainable supply chain management.

The differences are mostly visible in how sustainability practices are emphasised and implemented. Some companies place their emphasis on programme-based and technological solutions, such as digital traceability systems and data-driven tools. Others focus more on partnerships, collaboration and infrastructure development. These differences indicate that companies prioritise sustainability practices according to their organisational structure and strategic focus.

The level of detail in the reports also varies between companies. Some provide more quantitative data, while others offer more qualitative descriptions. This may point to differences in the maturity of reporting as well as internal data capabilities. Overall, it can be concluded that while companies have similar sustainability objectives, they differ in how they pursue them.

6.3 Contributions of the study

This study adds to the literature by showing that companies rarely mention supply chain resilience as separate idea in their reports. Instead, they show resilience through sustainability practices. Earlier studies often treated sustainability ans resilience as separate topics, but findings suggest that companies combine them in practice through governance, transparency and collaboration. These results help better understand how companies communicate resilience in their annual reporst, especially in forest industry.

These findings can have practical implications for companies looking to improve the sustainability and resilience of their supply chains. Using supplier-specific data, collaboration with suppliers and flexible logistics can support companies reach environmental goals and manage risks better.

This study also suggest that there is no single best approach to managing a sustainable supply chain. Instead, companies should adopt practices that suit their operations, which emphasises the importance of being flexible and strategically compatible. Managers should therefore consider how to integrate sustainability functions into their supply chain structures and operating environments.

6.4 Limitations and future research

This study has some limitations. The analysis uses only public annual reports, so the findings show how companies describe their sustainability and resilience, rather than how they actually implement these practices. As a result, the findings reflect only how the companies communicate sustainability and resilience, rather than how these practices are implemented. Second, the study focuses on one reporting year, which limits the ability to analyse changes over time. Third, the study is limited to a single industry, which may affect the generalisability of the findings to other industries.

Future research could include these limitations by analysing how sustainability and resilience communication changes over time, using several reporting years. In addition, qualitative methods such as interviews with supply chain managers could provide deeper understanding into how sustainability practices are implemented. Comparative studies across different industries could also help identify whether similar patterns appear outside the forest industry.

Overall, the study emphasises the growing importance of embedding resilience and sustainability into supply chain management. It also suggests that corporate reporting could address resilience more directly, even in uncertain and complicated operating environments.

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