ACHIEVING GREENHOUSE GAS EMISSION REDUCTIONS THROUGH BUYER-SUPPLIER COLLABORATION

Lappeenranta–Lahti University of Technology LUT

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ABSTRACT

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Achieving greenhouse gas emission reductions through buyer-supplier collaboration

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Keywords: buyer-supplier collaboration, supplier relationships, sustainability, greenhouse gas emissions

The aim of this study was to get more comprehensive view of the potential emission reduction possibilities and actions thorugh buyer-supplier collaboration. The focus was on a case company and how they could improve their emission efforts and aim towards their Science Based Target goal. In addition, this study aimed to identify the factors that contribute to the success of buyer-supplier collaboration. The role of emission data accuracy and reliability in emission reductions was also further discussed as a part of this study. The theories used in the study included multi-tier supply chain, buyer-supplier relationship, and collaboration. These topics were also addressed through sustainability point of view.

The study was conducted as a qualitative study. Nine semi-structured interviews were done, including five internal interviews with the case company and four interviews with the case company's suppliers.

The results of the study showed that collaboration can be beneficial for both the buying companies and the suppliers in their efforts on emission reductions. The interviews and the theory suggested the nature of the collaboration should be long-term, including commitment, trust, communication and sharing of knowledge. Many challenges were also identified, such as costs, commitment issues and problems with emission data availability and quality. The challenges with emission data accuracy and reliability were also seen as a big challenge for companies worldwide. The lack of mandatory standardised regulations and guidelines really hinders emission reporting and emission reduction efforts. The results of this study gives suggestions on what to consider when thinking of establishing buyer-supplier collaboration.

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Tämän tutkimuksen tavoitteena oli saada kokonaisvaltainen kuva potentiaalisista päästövähennysmahdollisuuksista ja -toimista ostaja-toimittaja yhteistyön kautta. Tutkimuksen keskiössä oli suomalainen case-yritys ja se, kuinka he pystyisivät parantamaan päästövähennystoimiaan ja suuntaamaan kohti Science Based Target tavoitettaan. Lisäksi tämä tutkimus pyrki selvittämään tekijöitä, jotka vaikuttavat ostaja-toimittaja suhteen menestykseen. Osa tätä tukimusta oli myös päästödatan tarkkuuden ja luotettavuuden merkityksen tutkiminen päästövähennyksiin. Tutkimuksessa käytettyihin teorioihin kuului moniportainen toimitusketju, ostaja-toimittaja suhde ja yhteistyö. Näitä aiheita käsiteltiin myös vastuullisuuden näkökulmasta.

Tämä tutkimus toteutettiin laadullisena tutkimuksena. Yhteensä yhdeksän puolistrukturoitua haastattelua toteutettiin, käsittäen viisi sisäistä haastattelua case-yrityksen kanssa ja neljä haastattelua case-yrityksen toimittajien kanssa.

Tutkimuksen tulokset osoittavat, että yhteistyö voi olla hyödyllistä sekä ostaja yritysten että toimittajien päästövähennystoimille. Haastattelut ja teoria esittivät, että yhteistyö tulisi olla luonteeltaan pitkäaikaista, sisältäen sitoutumista, luottamusta, kommunikaatiota ja tiedon jakamista. Myös monia haasteita tunnistettiin, kuten kustannukset, sitoutumisongelmat ja ongelmat päästödatan saatavuudessa ja laadussa. Haasteet päästödatan tarkkuudessa ja luotettavuudessa nähtiin myös isona ongelmana yrityksille maailmanlaajuisesti. Pakollisten standardien ja ohjeiden puute vaikeuttaa päästöraportointia ja päästövähennystoimia. Tutkimuksen tulokset antavat ehdotuksia siitä, mitä kannattaa ottaa huomioon, kun lähdetään tutkimaan ostaja-toimittaja yhteistyön mahdollisuutta.

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1 INTRODUCTION

World organizations, countries, companies, and people from all over the world are experiencing and noticing the drastic changes in our environment due to the increasing amount of pollution and emissions in the atmosphere, in seas and on land, deforestation, overconsumption, and many other things. IPCC report (IPCC 2023, 44) states that climate change is human caused. The report also states that climate change is the consequence of releasing more greenhouse gas emissions to the atmosphere than what have been removed in a long period of time. Climate change means that in a long time-period, the Earth's temperature is rising, and weather patterns are shifting (United Nations 2023a). United Nations' article also notes that the biggest driver for climate change has been the burning of fossil fuels which generate greenhouse gas emissions. The biggest sources of greenhouse gas emissions are carbon dioxide (CO_2) and methane (IPCC 2023, 43-44). IPCC report also identified that the greenhouse gas emissions resulted from energy use, land-use and land-use change, lifestyle and patterns of consumption and production. Luckily, countries, companies, organizations, and citizens have started to take climate change, and the negative effects resulting from it, seriously. Sustainability has become a big theme around the world and companies are implementing sustainability into their everyday business. Sustainability can be defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations 2023b).

Many countries and organizations are adopting new, more sustainable ways to have a positive impact on the climate and environment. Today, sustainability and the actions related to the topic are considered to be very important for companies. When companies are identifying the sources of their greenhouse gas emissions, they often come across that the amount of emissions coming from their supply chains are exceeding the amount of emissions coming from sources owned or controlled by the company (Plambeck 2012, 64). Companies' supply chains are the biggest source of their emissions, accounting for 11.4 times more emissions than direct emissions from their own operations (CDP 2023). The emissions which are coming from activities not owned or controlled by the company but are from activities

related to company's operations are Scope 3 emissions, excluding purchased electricity, steam, heating & cooling for own use. Scope 1 emissions are direct emissions from sources owned or controlled by the company. Scope 2 emissions accounts for emissions from generation of purchased electricity consumed by the company. (GHG Protocol (a))

In this thesis, the focus is on a Finnish food company who has set an ambitious Science Based Target to reduce both their Scope 3 emissions as well as Scope 1 and Scope 2 emissions by 42 % by 2030 from 2020 levels. Science Based Targets initiative (SBTi) is involving companies across industries to commit to reduce greenhouse gas emissions to control the effects of climate change and to comply with the Paris Agreement to limit the global average temperature increase to 1,5 °C above pre-industrial levels (Science Based Targets 2023a; United Nations 2023c). The case company aims to better understand the emissions reduction potential of its supply chain, including where the current and near-future state of the suppliers in terms of the greenhouse gas emission calculations and reduction activities. The assessment of suppliers' emission reduction efforts is important since it directly impacts the case company's ability to achieve its own emission reduction targets through Scope 3 emission reductions. The case company has identified its Scope 3 emissions accounting approximately 95 % of all greenhouse gas emissions. Another topic relevant to the thesis is how the case company could improve its buyer-supplier relationships to reduce their upstream supply chain emissions and develop collaborative strategies and initiatives they could implement to reach the 42 % emission reduction target. This is an important topic to study because nowadays there is a growing corporate emphasis on environmental responsibility and an increasing interest in emission quantification and reduction target setting.

This thesis aims to reveal how greenhouse gas emission reductions could be achieved with buyer-supplier collaboration. As stated earlier, buying company's Scope 3 emissions, which are in the focus of this thesis, are arising mainly from the suppliers' activities. This thesis could help the case company to better understand the current emission reduction status of their suppliers and the possible actions to improve their own greenhouse gas emission reduction efforts. Improving the case company's ability to engage suppliers and collaborate on emission reduction projects as well as to identify possible internal development possibilities could have an impact on reducing its Scope 3 emissions. Since the greenhouse

gas emission reduction process demands enormous efforts in data collection and analysis, this research also helps to reveal the role of data accuracy and reliability in emission reduction efforts. Getting guidance is essential since the whole emission identification and reduction process can and will be a significant workload for companies.

1.1 Research objectives and questions

The focus of this thesis will be on the development of buyer-supplier relationships toward cooperation on greenhouse gas emission reductions. The theory chapters will discuss how sustainability can be improved in multi-tier supply chains and what actions are needed from the focal company as well as from suppliers. Another topic presented in the theory chapter is buyer-supplier relationships and what different viewpoints it comprehends. The research objective of the thesis is to provide the case company with a look at their suppliers' greenhouse gas reduction activities and how supplier relationships could be developed to achieve emission reductions. The research questions are formed to gain better knowledge on these topics. The results of the research will give the case company an overview of the actions they can take to be able to reduce greenhouse gas emissions and to reach their SBTi emission reduction target with the help of suppliers.

To conclude, this study aims to answer the following main research question:

1. *How can buyer-supplier collaboration improve greenhouse gas emission reduction efforts?*

The case company's goal is to achieve its SBTi Scope 3 target which aims to reduce Scope 3 greenhouse gas emissions by 42 % by 2030 to a 2020 baseline year. Answers to this main research question will provide information about the benefits of buyer-supplier collaboration to help the case company move towards their SBTi Scope 3 target.

From the main research question, two sub questions are formed. These sub questions will be giving more detailed information about the subject and help to better answer the main research question. The sub questions are presented below.

2. *Which factors improve buyer-supplier collaboration to achieve greenhouse gas emission reductions?*

With this sub research question the aim is to gather more detailed information about the important factors needed for successful collaborative partnerships. This could include success factors as well as challenges that should be considered. According to Ukko, Saunila, Nasiri and Rantala (2022) collaboration between companies can help them to become more sustainable.

One important aspect in emission reductions is the quality of the calculated emission data. Thus, emission data and the challenges related to the accuracy and reliability of the data are studied. The third research question is formed as follows:

3. *What role does emission data accuracy and reliability play in greenhouse gas emission reduction efforts?*

With this sub research question the aim is to identify how greenhouse gas emission data gathering and monitoring impact the quality of the emission data.

1.2 Definitions of key concepts and conceptual framework

Multi-tier supply chain

Multi-tier supply chain can be defined as a network consisting of a lead firm and its suppliers. The supply chain can have different levels of suppliers based on the interaction they have with the lead firm. The first-tier supplier is the one directly in contact with the lead firm and the second-tier supplier is in contact with the first-tier supplier. Lower-tier suppliers usually have little to no contact with the lead firm and for that, can be hard to manage by the lead firm. (Mena, Humphries, Choi 2013; Tachizawa and Wong 2014)

Buyer-supplier collaboration

Simatupang and Sridharan (2002, 19) defined collaboration occurring when "two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation". Saghiri and Mirzabeiki (2021) identified buyer-supplier collaborative efforts as information sharing, joint efforts/decisions/plans, and mutual understanding and achievement of environmental objectives.

Greenhouse gas (GHG) emissions

Greenhouse gases are gases that trap heat in the atmosphere. Global warming and climate change are caused by the increase of greenhouse gases in the atmosphere and humans are responsible for that increase. The main greenhouse gas is carbon dioxide (CO_2), and it enters the atmosphere through burning of fossil fuels (coal, natural gas, and oil), solid waste, trees, and other biological materials. Another major greenhouse gas is methane (CH_4), which is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and land use. Moreover, also nitrous oxide (N_2O) is emitted during agricultural, land use, and industrial activities; combustion of fossil fuels and solid waste; as well as during treatment of wastewater. (United States Environmental Protection Agency 2024a; United States Environmental Protection Agency 2024b) The largest amount of greenhouse gas emissions is typically not releasing from the focal company's own operations but from its suppliers' production and operations (Tidy et al. 2016).

The aim of the study is to find ways to reduce greenhouse gas emissions through collaboration and ultimately to achieve the case company's Scope 3 emission target. The case company operates in a multi-tier supply chain, so that is one theory used in this thesis. Also, literature on buyer-supplier collaboration is considered for its impact on improving emissions reduction potential. This study is interested in suppliers' actions and viewpoints on emission reduction, because if suppliers reduce their emissions, the focal company's Scope 3 emissions are also reduced. Figure 1 below describes the linkages between focal company and suppliers in their mutual greenhouse gas emission reduction journey.

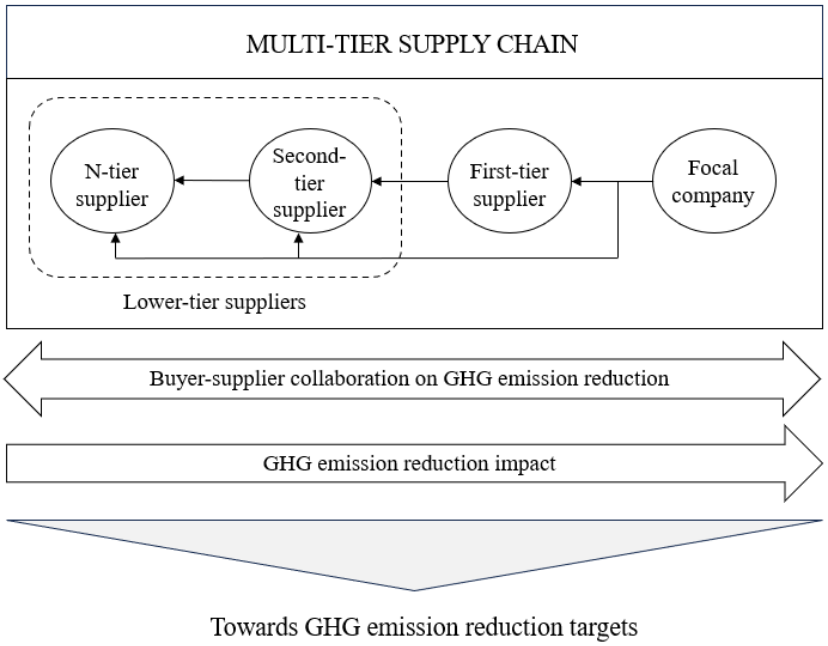

Figure 1: Conceptual framework.

1.3 Limitations

This study is conducted to address the needs of a specific case company and because of that, the suggestions and findings presented based on the empirical findings might not be fully applicable to other companies. Additionally, only a limited number of the case company's suppliers are interviewed for this research and that could lead to a narrow perspective of the case company's whole supplier base. Despite interviewing suppliers from each of the case company's procurement categories, the suppliers which are interviewed for the research do not give a full picture of the case company's supplier base, so it limits off suppliers from other categories. This thesis interviewed only first-tier suppliers; thus, lower-tier suppliers' viewpoint is not presented. Furthermore, Scope 1 and Scope 2 greenhouse gas emissions are not relevant to this study, since this thesis will focus solely on Scope 3 greenhouse gas emissions coming from suppliers. Finally, this thesis does not give guidance or assistance on the actual greenhouse gas technical calculation tasks and processes but rather give comments about emission data quality aspects.

1.4 Structure of the study

This study consists of theoretical parts and empirical study. In chapters 2 and 3, the main theoretical subjects are presented. Chapter 2 focuses on the theory of multi-tier supply chains and how those are and can be managed from sustainability point of view. Chapter 3 is about different viewpoints of buyer-supplier relationships as well as addressing sustainable supply chain management and supplier collaboration. It will focus on how buyer-supplier relationships can be improved to help suppliers implement sustainability actions and to make greenhouse gas emission reductions. Chapter 3 also includes theory behind greenhouse gas emission data quality since it is linked to the actual results of the emission calculations. Chapter 4 describes the used research methodology and process, provide case description, present data collection and data analysis as well as the reliability and validity of the research. Chapter 5 presents the empirical findings. Interviewed suppliers' answers to the interview questions are presented by interview themes. Finally, chapter 6 combines theoretical background as well as empirical findings of the study and presents answers to the research questions. This chapter will also include the suggestions for the case company based on theory and interviews as well as suggestions for future research.

2 MULTI-TIER SUPPLY CHAIN

This chapter will focus on explaining multi-tier supply chains, its participants, and the interdependencies between them. Another large viewpoint of the chapter is on the management of sustainability in multi-tier supply chains described through different tiers' responsibilities.

2.1 Characteristics of multi-tier supply chain

The trends towards globalization, global sourcing, outsourcing and the increasing interdependence between organizations have created more complex multi-tier supply chains (Mena et al. 2013; Senyo and Osabutey 2023). Multi-tier supply chain takes into consideration the supply chain participants beyond the first-tier supplier (Kusi-Sarpong, Gong, Brown, Gupta, Bai, and Orji 2023). One way to describe multi-tier supply chain is to simplify it as a supply chain network which consists of relationships between focal company and first-tier supplier, focal company and lower-tier suppliers and first-tier suppliers and lower-tier suppliers (Mena et al. 2013). In addition, Gong, Jiang, and Jia (2023) described multi-tier supply chain as a complex network consisting of focal company and multiple tiers of suppliers in a complex supply chain network. Choi and Hong (2002) describe multi-tier supply chain as networks of horizontal and vertical linkages between supply chain participants.

According to Seuring and Müller (2008), focal companies are usually the ones ruling or leading the supply chain, maintaining customer relationships, and determining the product or service offered to the customers. Focal companies have a central role in the entire supply network (Kusi-Sarpong et al. 2023). First-tier suppliers are the ones directly in contact with the focal company. For successful sustainability risk management, first-tier suppliers have an important role in pushing sustainability practices to lower-tier suppliers (Kähkönen, Marttinen, Kontio and Lintukangas 2023). On the other hand, lower-tier suppliers usually don't have direct contact with the focal company. Lower-tier suppliers have some characteristics which could explain why focal companies find it complicated to manage their

lower-tier suppliers' sustainability. Firstly, focal companies have less information about lower-tier suppliers than first-tier suppliers with whom they are in direct contact. Secondly, focal companies lack influence power over the lower-tier suppliers. Thirdly, lower-tier suppliers do not feel high pressure from the society to manage their environmental sustainability, because they are usually small and medium sized enterprises and not well-known by the public. Lower-tier suppliers are also usually located in countries, where there are not many regulations for environmental or social sustainability. They can be also quite easily changed to another supplier, so they do not have a stable place in the supply chain. (Tachizawa and Wong 2014) Villena and Gioia (2018) found in their study that lower-tier suppliers are likely to be supply chain's riskiest members. They also revealed that lower-tier suppliers usually tend to address social and environmental issues passively. In addition to that, they also found out that lower-tier suppliers are usually passive about caring sustainability violations. Their comparison between first-tier suppliers and lower-tier suppliers revealed that first-tier suppliers react to violations as they arise, while lower-tier suppliers typically await the intervention of MNCs or their customers before initiating any significant activities. Najjar's and Yasin's (2023) findings indicate that while institutional controls are important in managing first-tier suppliers' sustainability, it is challenging to effectively duplicate the same institutional controls to lower-tier suppliers.

2.2 Multi-tier supply chain structures

Multi-tier supply chains have different structures based on, for example, the interdependence of the supply chain participants. Mena et al. (2013) presented three multi-tier supply chain structures, which are presented in Figure 2. The "open" multi-tier supply chain embodies a traditional supply chain characterizing the information and product flow being linear and lacking direct connection between buyer and lower-tier supplier. In this structure, the supplier in the middle has a mediating role. In the "closed" multi-tier supply chain, the buyer and lower-tier supplier are directly connected to each other. Both companies are in contact with each other regularly, share information and manage their relationship formally or informally. In this structure, the mediating role of a supplier disappears. (Mena et al. 2013) Wilhelm, Blome, Wieck and Xiao (2016) proposed in their study that the non-compliance of environmental sustainability is more traceable and positively affects supply chain transparency. It will help the buyer company to delegate lower-tier sustainability

management to first-tier supplier, which will lead to “open” supply chain structure. Also, the delegation of lower-tier supplier sustainability management and “open” structure are facilitated by low horizontal complexity at the first-tier level and low institutional distance. In the other hand, the non-compliance of social sustainability is less traceable and negatively effects to transparency and could lead to “closed” supply chain structure. (Wilhem et al. 2016) In the “closed” multi-tier supply chain, the focal company and lower-tier supplier have a formal link and are directly connected. They are in regular contact with each other and share information. In this structure the mediating role of the supplier practically disappears. The structure between “closed” multi-tier supply chain and “open” multi-tier supply chain is called “transitional” multi-tier supply chain. This structure initiates to move towards “closed” multi-tier supply chain, because the buyer and supplier’s supplier are building a link between them. (Mena et al. 2013)

Jia, Gong, and Brown (2019) found in their study a new multi-tier supply chain structure in addition to Mena et al. (2013) three structures. They named it as “closed plus triadic supply chain”. This new structure differs from Mena et al. structures because Mena et al. assumed that the lower-tier suppliers already existed in the supply chain. In this structure, a lower-tier supplier relationship is established with the focal company when there is no previous relationship between the lower-tier supplier and first-tier supplier. After this focal company-lower-tier supplier relationship, the lower-tier supplier is then introduced to the first-tier supplier. This requires extra efforts from the focal company to identify and develop the new lower-tier supplier before establishing a connection between first-tier supplier and lower-tier supplier. (Jia et al. 2019) This additional structure is presented in Figure 2 with Mena et al. (2013) structures.

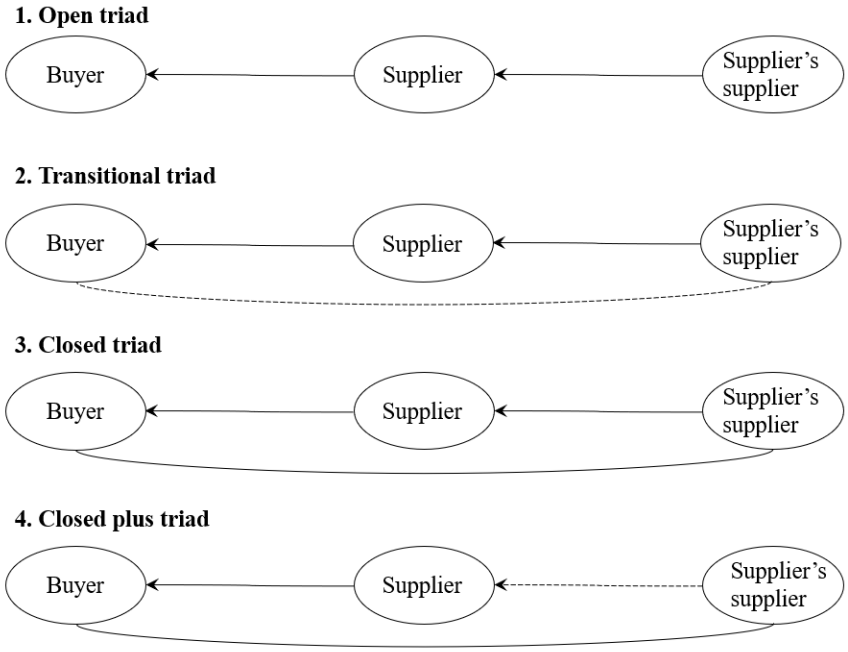

Figure 2: Multi-tier supply chain structures (After Mena et al. 2013; Jia et al. 2019)

In addition to Mena et al. (2013) framework of multi-tier supply chain structures, Tachizawa et al. (2014) suggested their own framework of ways, how focal companies manage their relationships with suppliers in multi-tier supply chains. These management practices were grouped into four approaches: "direct", "indirect", "work with third parties" and "don't bother". Companies can use more than one approach at the same time, so they are complementary to each other. These approaches also have similarities to Mena et al. (2013) multi-tier supply chain structures.

In "direct" approach focal companies can form direct contact with their lower-tier suppliers without involving first-tier supplier in the relationship (Tachizawa et al. 2014). This approach is similar to Mena et al. (2013) "closed" multi-tier supply chain structure. This type of direct connection between focal company and lower-tier suppliers enables monitoring and collaboration to improve, for example, environmental or social sustainability. According to Min, Zacharia and Smith (2019), companies should connect directly with lower-tier suppliers, passing first-tier suppliers, to be able to build sustainable supply chains. "Direct" approach can include various practices for lower-tier supplier management. Focal companies could establish guidelines and expectations for lower-tier suppliers, for example codes of conduct. Another "direct" approach practice is directed

sourcing, where focal companies are directly selecting lower-tiers suppliers or using a list of preferred lower-tier suppliers. In addition, supplier monitoring practices, for example, supplier audits or visits can be used as "direct" practices. Focal companies can also provide training for lower-tier suppliers. (Tachizawa et al. 2014)

In "indirect" approach lower-tier suppliers are contacted through another supplier. With the power focal companies can have over first-tier suppliers, they can make first-tier suppliers to monitor or collaborate with lower-tier suppliers. Focal companies' indirect practices can include requirements for first-tier suppliers, for example in terms of codes of conduct, and require lower-tier suppliers to be certified, for example, with ISO-standards. (Tachizawa et al. 2014) This "indirect" approach is similar to Mena et al. (2013) "open" structure.

The third approach," work with third parties", means that focal companies are collaborating with, for example NGOs or competitors, to gain knowledge on how to improve sustainability or to have help in supplier monitoring. Focal companies can also collaborate with competitors to form industry groups and develop common audit standards. (Tachizawa et al. 2014) Wilhelm et al. (2016) proposed in their study that when the horizontal complexity and institutional distance is high among lower-tier suppliers, it is more likely to include third parties which will lead to "work with third parties" approach.

The focal companies can also take the "don't bother" approach, where they do not have any information about lower-tier suppliers or do not try to influence them in any way. In this scenario, focal companies are only focusing on first-tier suppliers or just their own internal factors. Usually the "don't bother" approach is utilized when focal companies have limited power in the supply chain. It can also be applied when supply chains do not have many tiers, are less complex or when companies have less visibility for the final customer. (Tachizawa et al. 2014) According to Wilhelm et al. (2016) if first-tier suppliers have less developed sustainability management capabilities, it will increase the risk of selecting the "don't bother" approach.

In addition to the approaches focal companies choose, some contingency variables, for example power and stakeholder pressure, can affect the choice. (Tachizawa et al. 2014)

Summary of Tachizawa et al. (2014) framework of sustainable multi-tier supply chain and the contingency variables can be seen from Figure 3.

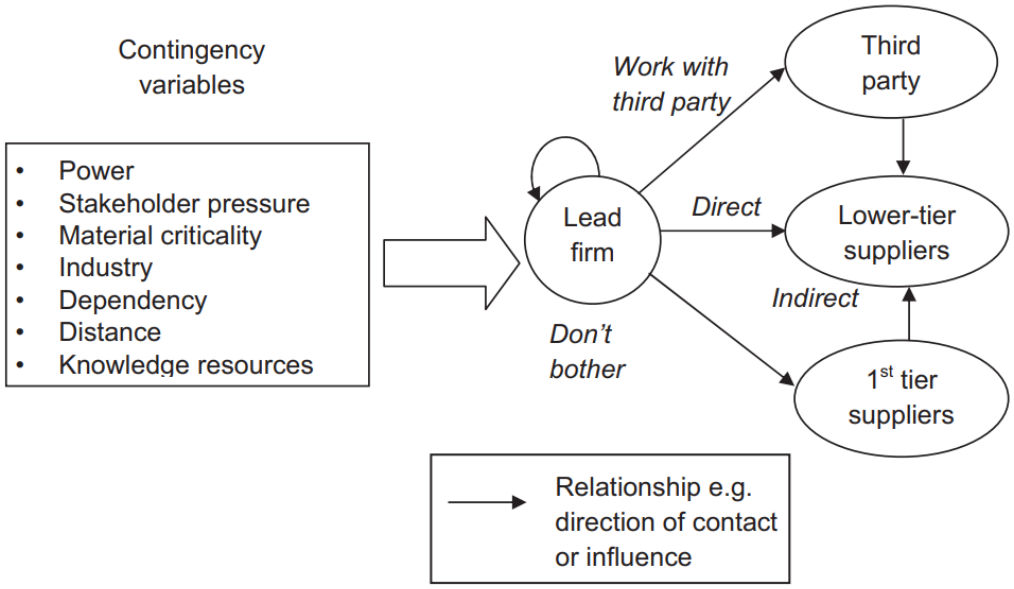

Figure 3: Multi-tier supply chain framework (Tachizawa et al. 2014).

Mena et al. (2013) found three common themes to all the multi-tier supply chain structures: structural power, interdependence, and relationship stability. Depending on the structure of the multi-tier supply chain, the participants hold different amounts of power over other participants. According to Mena et al. (2013) companies drew power from two different sources: possession of resources and positional power. In the "closed" multi-tier supply chain the supplier experiences a very limited amount of power since it does not operate as a bridge between the buyer and supplier's supplier like it did in the "open" multi-tier supply chain structure where it had more power. In "transitional" structure, it was seen that in the shift towards "closed" structure, the changes in power balance appeared to come from structural changes alone. So, the structural changes in the multi-tier supply chain will change the power balance among its participants regardless of the resources each participant holds. (Mena et al. 2013) Power is also named as a contingency variable by Tachizawa et al. (2014) and it will affect which approach the focal company will take with management of lower-tier suppliers. Marttinen and Kähkönen (2022) found in their study that companies' power relations determine, especially in multi-tier supply chain sources, their ability to cascade sustainability requirements to the lower-tiers. Also, Kähkönen (2014) study showed that the

supply chain participant's power position determines its willingness to collaborate with other participants. For example, if the buyer has better power position than the supplier, it is less willing to collaborate with the supplier, which leads to decreased information sharing and trust between the supplier and the buyer. Wilhelm et al. (2016) proposed that when power asymmetries are increasing further up the supply chain, the risk that first-tier suppliers decouple their delegated sustainability responsibilities increases resulting to "don't bother" type of multi-tier supply chain.

In Mena et al. (2013) study, a sense of interdependence, for example a mutual dependence for success or survival, was found in every multi-tier supply chain structure. However, the level of interdependence varied among different structures. In the "closed" structure, all the supply chain participants have clear visibility of each other's contributions, and they understand each other's challenges. This type of visibility strengthens the sensed interdependence among participants. The movement from an "open" multi-tier supply chain structure to "closed" structure also grows the sensed interdependence among supply chain participants. This shift also means that supply chain participants no longer considered power to be the only way to reach their objectives. Trust and cooperation were also seen as good ways to achieve their targets. (Mena et al. 2013)

The perception of relationship stability is also linked with the type of structure multi-tier supply chain has. "Open" multi-tier supply chain structure is weaker in terms of a relationship stability than "closed" structure. In "closed" and "transitional" structures the information becomes more transparent which brings stability to the relationship. It is good to keep in mind that the increased stability also increases the management effort of a company. (Mena et al. 2013)

2.3 Sustainability responsibilities in multi-tier supply chain

The pressure for making a shift towards sustainable business is coming from all around, not just one type of stakeholder. Internal and external stakeholders, consumers, governments, regulators, and non-governmental organizations are all demanding businesses to take proactive and mitigating actions to ensure sustainability in their supply chains (Jabboura,

Lopes de Sousa Jabboura and Sarkis 2019). Lower-tier suppliers are usually the ones doing non-sustainable actions and it is seen that if companies do not manage their first-tier and/or lower-tier suppliers, their disruptive sustainability actions can damage buying companies' reputation and operations (Villena et al. 2018; Wilhelm et al. 2016). According to Grimm, Hofstetter and Sarkis (2016) the difficulty of identifying lower-tier suppliers and engaging them are the main differences between management of first-tier suppliers and lower-tier suppliers.

Marttinen, Kähkönen and Marshall (2023) identified 12 governance mechanisms used in multi-tier supply chains to ensure sustainable supply. They categorized these mechanisms based on their structure and purpose. As seen from Figure 4, the structure of governance mechanisms can be divided into imposed and interactive mechanisms and the purpose of governance mechanisms can be divided into the selection and monitoring of sustainability performance and learning and innovation for sustainability solutions.

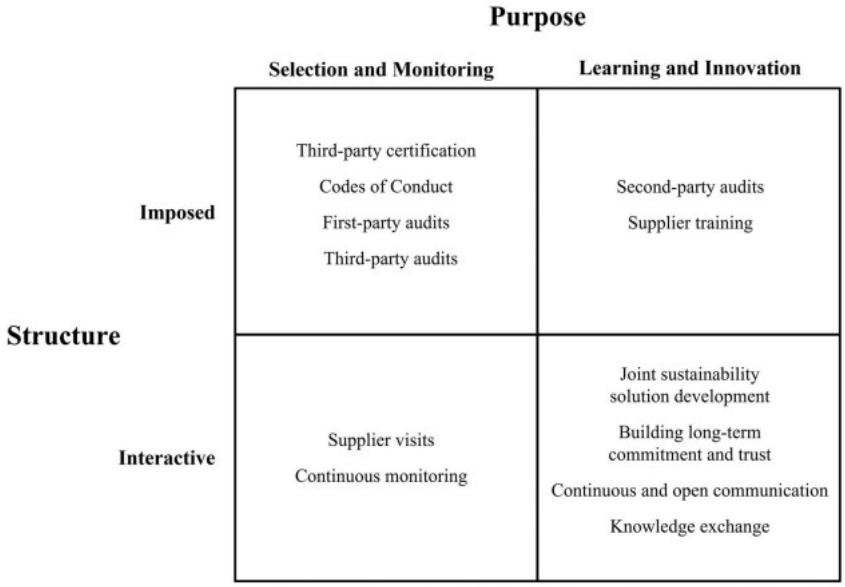

Figure 4: Framework on governance mechanisms in multi-tier supply chains. (Marttinen et al. 2023)

Marttinen et al. (2023) interviewed focal companies, first-tier suppliers, and lower-tier suppliers. The interviews revealed that the most used governance mechanisms to ensure suppliers' sustainability were third-party certification, second-party audits, codes of conduct (CoCs), joint sustainability solution development and long-term commitment and trust. Both

the focal companies as well as the lower-tier suppliers use imposed governance mechanisms in selection and monitoring but also rely on interactive mechanisms for learning and innovation. Similarly, the first-tier suppliers use imposed governance mechanisms for supplier selection and monitoring but use interactive mechanisms for both selection and monitoring and learning and innovation. Third-party certifications, second-party audits and CoCs were used among supply chain tiers while the use of other mechanisms differed between the tiers. In addition to aforementioned mechanisms, the focal companies used third-party audits, supplier visits, continuous and open communication and knowledge exchange. On the other hand, the first-tier suppliers prioritized continuous monitoring, joint sustainability solution development and facilitating the long-term commitment and trust of lower-tier suppliers. The lower-tier suppliers relied on first-party audits, knowledge exchange, joint sustainability solution development, and the building of long-term commitment and trust. Overall, similar governance mechanisms were used among all the supply chain tiers.

Companies should use both imposed and interactive selection and monitoring as well as both imposed and interactive learning and innovation governance mechanisms to facilitate multi-tier sustainable supply chain management. Using just one type of mechanism is usually not enough to ensure sustainable supply. For example, the use of imposed selection and monitoring mechanism CoC could lead to a false sense of security as the company trust its direct suppliers to cascade sustainability requirements across the supply chain, without having the visibility or control over how the practices are followed further down the tiers. Imposed learning and innovation mechanisms can help develop supplier's sustainability capabilities. Moreover, the application of learning and innovation mechanisms with direct and/or lower-tier suppliers is seen as an important way to extend sustainability to lower-tiers. (Marttinen et al. 2023)

Several factors influence companies' ability to extend sustainability further up the supply chain and their ability to adopt the governance mechanisms. These factors include, for example perceived sustainability risk, size of supplier base in relation to resources for ensuring sustainable supply, product type, position in the supply chain, stakeholder demands, suppliers' sustainability capabilities, and the power dynamics between supply chain members. For large focal companies with a wide supplier base and suppliers from high-risk

countries it might be necessary to use imposed governance mechanisms instead of interactive mechanisms to gain supply chain visibility and assurance of sustainability. Wide supplier base might also hinder the efficient and effective building of long-term collaboration and trust. Companies operating in complex supply chains usually face lack of resources, tools, and influence to be able to execute sustainability actions in multi-tier supply chains even when they realize its importance. (Marttinen et al. 2023)

2.3.1 Focal companies' responsibility

According to Kim, Foerstl, Schmidt and Wagner (2022) when focal companies are adopting green supply chain management practices, they are dependent on their suppliers' level of green resources and capabilities available. This resource dependency varies between focal companies and their higher- and lower-tier suppliers in a multi-tier supply chain (Kim et al. 2022). Power also represents a role in sustainability adoption, because Wilhelm and Villena (2021) study showed that when focal company represents a large percentage of a supplier's business, it has more persuasive power over noncompliant supplier to adopt sustainable procurement practices.

According to Marttinen et al. (2023) study, focal companies used independent third-party audits and auditing schemes, supplier visits, continuous and open communication, and knowledge exchange to ensure their suppliers' sustainability performance. Grimm et al. (2016) research investigated the management of lower-tier suppliers by focal companies. Assessment and collaboration were seen as ways to improve lower-tier suppliers' compliance to focal company's sustainability standards. Antecedents to lower-tier supplier management were first-tier suppliers' public attention, perceived risks of lower-tier supplier' non-compliance with sustainability standards and a company's channel power. (Grimm et al. 2016) It is important that the focal company reaches beyond first-tier suppliers to lower-tier suppliers to establish common goals and objectives and form collaboration to reach the targets. Customers often see the focal company as fully responsible for the risks in the supply chain, so it is necessary to include lower-tier suppliers in the actions. (Min et al. 2019)

2.3.2 First-tier supplier's responsibility

From the focal companies' point of view, first-tier suppliers are the ones who are in charge of cascading focal companies' sustainability requirements to lower-tier suppliers and so on (Wilhelm et al. 2021). First-tier suppliers are also the ones who have a key role in sustainability-related risk management (Kähkönen et al. 2023). According to Vachon and Klassen (2007) study, suppliers can also have a valuable role in shaping focal companies' decisions about sustainable practices.

Wilhelm et al. (2021) study showed that first-tier suppliers' which have integrated management system composed of economic, environmental, and social dimensions or engage with key stakeholder networks are more likely to adopt sustainable procurement practices. Marttinen et al. (2023) study revealed that first-tier suppliers use continuous monitoring and joint sustainability solution development as well as prioritize long-term commitment and trust to ensure lower-tier suppliers' sustainability.

3 COLLABORATION TOWARDS EMISSION REDUCTIONS

This chapter focuses on the collaborative aspect of greenhouse gas emission reduction and monitoring between buyers and suppliers. The aim is to explain buyer-supplier relationships and present collaborative activities which would improve the success of collaborative relationships and sustainability. This chapter also focus on suppliers' greenhouse gas emission data availability and gathering.

3.1 Sustainable supply chain management

One of the biggest challenges companies face in achieving environmental sustainability is fostering effective collaboration with their supply chain partners to extend sustainable practices throughout the supply chain. As Krause, Vachon and Klassen (2009, 18) stated: "a company is no more sustainable than its supply chain". Pagell and Shevchenko (2014, 45) define sustainable supply chain management (SSCM) as "the designing, organizing, coordinating, and controlling of supply chains to become truly sustainable with the minimum expectation of a truly sustainable supply chain being to maintain economic viability, while doing no harm to social or environmental systems". Another definition of SSCM by Carter and Rogers (2008, 368) is "the strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual and its supply chain". Companies' willingness to adopt sustainable supply chain management practices is linked to their moral motives and on their perception that it is the right thing to do (Paulraj, Chen and Blome 2017). Paulraj et al. (2017) study also showed that in addition to moral motives, relational motives (concerned with relationships among group members) had a stronger impact on ensuring sustainability in supply chains than instrumental motives (driven by self-interest).

According to Gualandris and Kalchschmidt (2016), as sustainable supply chain management develops, manufacturing companies' sustainability performance improves. They divided sustainable supply management as internal and external practices depending on the

manufacturing company's role. Internal practices, or sustainable process management, included company's direct control and improvement of company's environmental and social performance without direct supplier involvement. External practices, or sustainable supply management, included company level implementation and supplier involvement. Cao and Zhang (2011) define supply chain collaboration as seven interconnecting components: information sharing, goal congruence, decision synchronization, incentive alignment, resources sharing, collaborative communication, and joint knowledge creation. According to Walker and Jones (2012) collaboration is beneficial to sustainable supply chain management. They conducted interviews which revealed that long-term supplier relationships, supplier communication and knowledge sharing are activities that support sustainable supply chain management. Gualandris et al. (2016) also found out that the trust between buyers and suppliers is essential for the success of sustainable supply chain management. Min et al. (2019) mentioned in their study that sharing collaborative philosophies across the supply chain as well as monitoring the upstream end and downstream end of the supply chains are important in building sustainable supply chains.

3.2 Buyer-supplier relationships

Ellram (1991) defined buyer-supplier partnership as an agreement between the participants involving commitment and sharing of information, risks, and rewards. The positive effects of buyer-supplier relationships are presented in many studies. Ellram (1991) identified potential advantages of buyer-supplier relationships such as increased supplier loyalty, joint planning and information sharing based on mutual trust and benefit, and greater cooperation from suppliers to support the company's strategy. Kannan and Choon Tan (2006) study showed that buyer-supplier engagement and supplier selection positively impacts the success of buyer-supplier relationship. Their study also revealed that the success of buyer-supplier relationship positively affected company performance. According to Obayi, Koh, Oglethorpe and Ebrahimi (2017) the relationship between buyers and suppliers somewhat influenced the positive impact of configuration flexibility, and planning and control flexibility on operational performance. Moreover, Yang, Jiang and Xie (2019) discovered that strong buyer-supplier relationships foster strong information sharing and flexibility among suppliers, and these factors mediate the impact of buyer-supplier relationships on marketing capabilities of buying companies.

Ellram (1991) presented success factors in buyer-supplier partnerships. These are classified as partner contribution, personnel issues, and interaction. The partner contribution includes added value from the partner versus other suppliers, total cost perspective rather than price and choosing a key item or items. The personnel issues include mutual trust and openness as well as reduction in the number of suppliers used. The interaction includes communication between companies and their functions and informing and involvement of suppliers in changes. (Ellram 1991)

Kumar and Rahman (2016) found that in the path towards sustainability, top management commitment is an important factor. It was seen that external pressure and expected benefits of sustainability adoption were affecting top management commitment. In addition, top management commitment is directly associated with the adoption of buyer-supplier relationship development practices. Buyer-supplier relationship development practices were categorised as supplier selection, supplier development and supplier performance review. All these practices have positive influence on environmental sustainability performance of supply chain. (Kumar et al. 2016)

According to Gualandris et al. (2016) the influence of external sustainability practices on a manufacturing company's sustainability performance is exclusively mediated by the sustainability performance of its key suppliers. As suppliers develop relationship-specific capabilities and performance outcomes, manufacturing companies will improve their sustainability. According to Mahapatra, Schoenherr and Jayaram (2021) companies that engage with their suppliers to improve their environmental sustainability can reduce their overall greenhouse gas emissions. In the other hand the same study showed that the same companies usually are sourcing from the suppliers which have high emissions but also have carbon reduction activities. This decision could be explained, for example, with those suppliers' better economic performance. (Mahapatra et al. 2021)

According to Foerstl, Azadegan, Leppelt and Hartmann (2015) the pressure coming from stakeholders is the primary driver of sustainability efforts, but it is not enough to engage first-tier suppliers to focus on sustainability actions. Lintukangas, Arminen, Kähkönen and Karttunen (2023) found in their study that ccompanies' who have moral motives to adopt

sustainability in their supply chains are more likely to improve engagement activities and collaboration with suppliers. Another finding of their study is that companies operating in emission-intensive industries collaborate with their suppliers to offset emissions. Lack of resources might grow barriers to companies' sustainability adoption, but engagement practices with external stakeholders, such as suppliers, can compensate for the lack of resources (Agyabeng-Mensah, Afum, Baah and Essel 2022).

Dahlmann and Roehrich (2019) presented three different types of sustainability supply chain partner engagement: basic, transactional, and collaborative. The basic engagement type is characterized by reactive information gathering. Baseline Scope 3 greenhouse gas emission data is gathered because of external requests, such as customer demands or regulatory reasons. The basic engagement type is also characterized as short-term which includes minimal and less detailed internal data processing. The transactional engagement type differs from the basic engagement in that the focal company takes more proactive attitude towards internal data usage and processing. The focus is on using the obtained greenhouse gas emission data to calculate carbon footprints and to identify and make performance improvements. The transactional engagement type is also helping focal companies in incentivizing suppliers to improve their environmental sustainability. Companies involved in collaborative engagement focus on customers, suppliers and beyond to gather and process information. The information is utilized to establish mutually beneficial relationships and further used to, for example, develop supplier training and courses. Collaborative engagement also differs from the transactional engagement in that it seeks to include customers and consumers in information gathering. Information collected through collaborative engagement practices was important in building two-way beneficial relationships to improve sustainability practices through supply chain partners. (Dahlmann and Roehrich 2019)

3.3 The power of buyer-supplier collaboration in sustainability

Companies are building collaborative partnerships with their supply chain to enhance operational efficiencies, flexibility, and foster a sustainable competitive advantage (Nyaga, Whipple, and Lynch 2010). Simatupang et al. (2002, 19) defined collaboration occurring when "two or more independent companies work jointly to plan and execute supply chain

operations with greater success than when acting in isolation". Barratt (2004) divided supply chain collaboration as vertical collaboration and horizontal collaboration. Vertical collaboration can include collaboration with customers, suppliers, and internal collaboration (across functions) when horizontal collaboration can include collaboration with competitors, other external organizations, and internal collaboration (Barratt 2004). This research is focusing on the vertical collaboration between buyers and suppliers and according to Yen (2018), stronger collaboration and cooperation between buying firms and their suppliers leads to enhanced environmental performance. In fact, environmental collaboration with suppliers is seen to lead in investments to pollution prevention technology (Vachon et al. 2007) and has a positive impact on competitiveness and economic performance through environmentally sustainable product design and logistics (Mitra and Datta 2014).

Commitment and understanding of mutual benefit are important for creating an effective collaboration (Cetindamar, Catay and Basmaci 2005). Commitment is needed to establish long-term relationship and will enable cooperation and decrease the possibility for opportunistic behaviour (Min, Roath, Daugherty, Genchev, Chen, Arndt, and Richey 2005). Simatupang et al. (2002, 25) stated that "one of the most essential features for the success of a collaborative supply chain is a high level of commitment by the participating members". According to Chae, Choi, and Hur (2017), buying companies commitment is necessary to engender supplier commitment. Also, Marttinen, Kähkönen and Marshall (2023) study showed, that building long-term commitment and trust is seen as a collaborative mechanism to ensure sustainable supply.

Kwon and Suh (2004) study showed that trust has a positive relationship with commitment. According to Cetindamar et al. (2005), trust has the greatest importance in collaboration. In their study, trust as a way to support collaboration includes mutual trust between participants and information and technical expertise sharing. Cheng, Yeh and Tu (2008) study revealed that communication is also positively related to trust. Kwon et al. (2004) research showed that information sharing will lower the degree of behavioural uncertainty which will lead to improvement of trust. Also, Corsten and Kumar (2005) mentioned that trust result to greater openness between buyer and suppliers which will improve the knowledge and appreciation for each other's contribution to the relationship.

Supplier companies must look past a long-term relationship orientation being the only sufficient strategy to achieve overall strategic advantage. The two-way communication is also needed between buyers and suppliers since it is essential to information sharing, coordination of activities and resolving issues. To get the maximum benefits of buyer-supplier relationships, creating a culture of open and transparent communication is important. (Paulraj, Lado, and Chen 2008) Bilateral communication and information sharing has positive effects on sustainable supply chain performance and on the environment (Tipu and Fantazy 2020). While building communication mechanisms, trust building and information sharing increases which support the management of collaboration (Cetindamar et al. 2005). Another important aspect of information sharing is the quality of information. Wiengarten et al. (2010) investigated the importance of information quality for the success of collaboration. They found out that other collaborative activities are not as efficient if the shared information is of poor quality. Cheng et al. (2008) study found that communication is positively related to knowledge sharing. According to Melander and Pazirandeh (2019), knowledge sharing is a key motivation for companies to participate in green innovation collaborations.

Essential for collaborative relationship to work is that participants work together to plan activities and resolve problems (Nyaga et al. 2010). According to Cetindamar et al. (2005), one of the three key factors supporting collaboration is common goals. In their study, common goals include the mutual belief in the benefits of collaboration and risk/benefit sharing. Also, Cox (2004) argues that effective collaboration needs to have an alignment between goals and aspirations of the buyer and supplier. Moreover, Krause, Handfield, and Tyler (2007) study revealed that when there are similar goals and values in the relationship between buyers and their key suppliers, it will positively affect the performance.

According to Cao et al. (2011) joint knowledge creation is one of the seven components of supply chain collaboration. Capturing, exchanging, and assimilating knowledge between collaboration participants creates innovation and enables long-term competitiveness of the whole supply chain (Cao et al. 2011). Moreover, according to Mitra et al. (2014) long-term and strategic cooperation and coordination with suppliers lead to innovation and improved performance. Also, in Cetindamar et al. (2005) study, collaboration enhances the creation of innovations and the sharing of information about new technologies. This leads to

improved collaborative partners competitive advantage against other competitors (Cetindamar et al. 2005). According to Yen (2018) study, competitors' green practices have indirect influence on buyer-supplier collaboration in green practices through customer pressure. When customers notice that their supplier's competitors are better managing green practices, they will pressure their suppliers to improve their own green practices. The study also found that competitor pressure does not have a direct impact on buyer-supplier collaboration in green practices. Companies are more interested in their customers pressure than competitors' pressure on buyer-supplier collaboration in green practices. (Yen 2018)

When thinking about collaboration, companies need to see it as a multidimensional concept, which consists of several relationship building and binding interacting activities and processes (Wiengarten, Humphreys, Cao, Fynes and McKittrick 2010). Cox (2004) study revealed that there is not a single appropriate choice of relationship between buyer and supplier, since both participants have their own goals, motives, and source of power. The same study mentioned that it is not possible nor necessary to always build long-term, collaborative relationships with suppliers, so in some cases it would be more appropriate to pursue alternative options, for example, reactive, short-term relationships. Thus, it is important to acknowledge that companies' individual characteristics and strategies have influence in their partnerships (Dyer and Hatch 2004) and those can have an impact on the collaborative greenhouse gas emission reduction approaches (Theißen, Spinler & Huchzermeier 2014). Lee (2012) study showed that there is a significant relationship between a company's carbon strategy, sector, and size. For example, companies operating in more energy-intensive sectors tend to choose emission reduction strategies compared to manufacturing sectors focus on energy efficiency. (Lee 2012) In addition, Scholtens and Kleinsmann (2011) study showed that depending on the geographic location, incentives to motivate supply chain partners to provide information about carbon emissions and to adopt emission reduction technologies vary.

Sharfman, Shaft and Anex Jr. (2009) study revealed factors which affect companies' engagement in cooperative supply-chain environmental management (CSCEM). They defined CSCEM as follows: "CSCEM occurs between focal firms, companies that sell either directly to them or to a supplier further up the chain or with downstream firms that focal firms supply. In such activities the focal firm and its supplier(s) work together to reduce the

firms' collective effects on the natural environment through any of the elements of the total product lifecycle (physical system) from the creation of inputs to the final disposal, decontamination, or recycling/reuse of outputs. Such activities may include actions as diverse as joint research and development on materials reduction/toxicity, common sourcing, coordinated training activities and interorganizational product design teams" (Sharfman et al. 2009, 2). This can be seen as a subset of sustainable supply chain management, focusing specifically on cooperation and environmental sustainability. Companies which are proactive in their overall environmental management practices tend to engage more in CSCEM. Also, the trust between supplier and focal companies and effect uncertainty positively effects the engagement in CSCEM. Suppliers with important resources to focal company also generates cooperation between supplier and focal company. Surprisingly, their study showed that companies who face strict environmental regulations do not engage in CSCEM. In their opinion, one reason for this could be that companies do not have time to this cooperation simply because of the time going to compliance-oriented regulatory activities. (Sharfman et al. 2009)

According to Blome, Paulraj and Schuetz (2014) study, the supply chain itself can only be as strong as its weakest link. If companies want to benefit from sustainability collaboration, they must try not to be the weakest link. They added that the more sustainable companies are in their production processes, the more benefits they can achieve through supply chain collaboration and knowledge sharing. Another thing they mentioned is that if companies decide to pursue sustainability, their resources need to be dedicated systematically toward sustainability collaboration as well as internal sustainability practices simultaneously. There should be a holistic view in the supply chain sustainability practices because inconsistent pursuit of external collaboration and internal practices might strongly block the potential benefits. (Blome et al. 2014, 657)

3.4 Scope 3 greenhouse gas emission data

Scope 3 emissions come from activities not owned or controlled by the company but are from activities related to company's operations up- and downstream along the supply chain, for example purchased goods or services. Scope 3 emissions make up 75 % or more of companies' emissions (Blanco, Caro & Corbett 2016). Emission data collection efforts

should be prioritized on the Scope 3 activities which have the most significant GHG emissions, offer the most significant GHG reduction opportunities, and are most relevant to the company's business goals. Companies can use two types of data to calculate Scope 3 emissions. Primary data includes data provided by suppliers or other value chain partners related to specific activities in the reporting company's value chain. Secondary data includes industry-average data (e.g., from published databases, government statistics, literature studies, and industry associations), financial data, proxy data, and other generic data. Thus, the quality of the Scope 3 inventory depends on the quality of the data used in the calculations. Companies should try to collect high quality primary data, but sometimes primary data might not be available or does not meet the quality criteria. In these cases, secondary data may be of higher quality than the primary data. (GHG Protocol (b))

According to GHG Protocol (GHG Protocol (b)), the nature of Scope 3 emissions being activities not under the reporting company's ownership or control, brings challenges relating to data collections and quality. These collection challenges include, for example, reliance on value chain partners to provide data, lesser degree of knowledge about data types, data sources, and data quality and broader need for secondary data. The quality of supplier data may vary widely, and both suppliers and reporting companies should use data quality indicators to select and assess the quality of data. Companies can request suppliers to perform first party or third-party assurance of their data to ensure its accuracy and completeness. It is stated in the GHG Protocol (GHG Protocol (b)), that "higher uncertainty for scope 3 calculations is acceptable as long as the data quality of the inventory is sufficient to support the company's goals and ensures that the scope 3 inventory is relevant (i.e., the inventory appropriately reflects the GHG emissions of the company, and serves the decision-making needs of users, both internal and external to the company)". It is also suggested that companies should develop a data management plan for their GHG inventory, documenting both the process and internal quality assurance and quality control procedures, to ensure quality data from start to finish. (GHG Protocol (b))

Tang & Demeritt (2018) research showed that even before it was mandatory for companies to report their carbon emissions, many top UK companies were already doing it voluntarily. Companies had various reasons for doing so, such as financial gains, building a good reputation and regulatory compulsion. The same study found that making companies report

their carbon emissions might make them look better to the public, but it doesn't always lead to big changes in how they affect the environment, depending on what kind of business they are. Klaaßen and Stoll (2021) paper highlights that, companies' greenhouse gas emissions accounting and reporting practices are unsystematic and not comparable, especially the Scope 3 emissions. They grouped the challenges with publicly disclosed Scope 3 emissions in to three areas, which are reporting inconsistency, boundary incompleteness, and activity exclusion. Reporting inconsistency appear when companies report Scope 3 emissions inconsistently across different communication channels, such as in corporate reports and Carbon Disclosure Project. Boundary inconsistency means that when the quantification of emissions cannot be fully done with primary data and the gaps are not filled with secondary data, the reporting would not be encompassing. Activity exclusion means that since there are not universally accepted reporting standards companies can neglect relevant activities from their calculations. (Klaaßen et al. 2021) Nguyen, Diaz-Rainey, Kitto, McNeil, Pittman and Zhang (2023) study also identified three issues associated with Scope 3 emissions: no regulation and lack of clear guidance, incomplete composition/activity exclusion and measurement divergence/reporting inconsistency. According to Klaver, Griffioen, Mol and Moolhuijsen (2023) five main challenges with Scope 3 emissions are: poor data quality and availability, evolving and inconsistent disclosure standards, challenges in stakeholder engagement, resource constraints and limited integration into businesses operations.

In addition to presented challenges, Klaaßen et al. (2021) also proposes few solutions which could improve the corporate carbon footprints. They saw that the mandatory regulations with clear guidelines would be more effective than the voluntary ones. Also, it would be beneficial to standardize the guidelines, for example with international organizations like the ISO or IFRS. Companies could also be required to report Scope 1 and Scope 2 emissions to improve the accuracy and reductions. They also saw that development of industry-specific standards would authorize to disclose key Scope 3 categories. (Klaaßen et al. 2021) Also Klaver et al. (2023) presented some solutions to the challenges, such as efforts in data collection technology, harmonization of standards and guidance, incentives and long-term perspectives and greater knowledge and awareness across different stakeholders. They also mentioned that the European Commission and the International Sustainability Standards Board (ISSB) took significant steps to harmonize sustainability reporting requirements in 2023, but there is still room for more efforts.

4 RESEARCH METHODOLOGY

This chapter will introduce the used research methodology and the research process. In addition, this chapter will include case description, data collection and data analysis as well as reliability and validity of the research.

4.1 Research methodology

This research is conducted as qualitative research. The differences between quantitative and qualitative research are that quantitative research relies on a structured and standardized methodology. Qualitative research focuses on socially constructed aspect of reality, emphasizing the interpretation and understanding rather than seeking explanations and testing hypotheses. (Eriksson and Kovalainen 2008) Denzin and Lincoln (2005, 5) stated that "qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them". Lapan, Quartaroli and Riemer (2012, 3) stated that "qualitative researchers immerse themselves, viewing meaning as more context- and time-specific and, in most cases, not generalizable".

This research uses case study approach. Case study approach is popular and relevant research strategy (Eisenhardt and Graebner 2007). Case study approach is a good fit to supply chain research and is also seen as a good way to gain information from different stages of supply chain, for example from first-tier suppliers (Seuring 2008). According to Yin (2009), a case study approach can be applied when researcher wants to answer "how" and "why" questions and the research topic is contemporary. Case study approach can be done by using sampling to gain generalizable information about the phenomena (Ellram 1996). Case study allows researchers to get in-depth information about a practical, real-life situation (Farquhar 2012). An important aspect of a case study approach is to select between a single case study and multiple case study. The difference between those is that multiple case study focuses on studying multiple cases to understand the similarities and differences between the cases and the analysis can be done within as well as across each situation (Gustafsson 2017; Yin 2009).

Research data has been collected through interviews with case company's suppliers. The interviews were semi-structured interviews. Semi-structured interviews have a set of guiding questions which lead the interview but allows it to be more flexible than, for example, structured interviews. Unstructured interviews in the other hand are difficult in cases were answers from different interviews needs to be compared. (Wilson 2012) Hirsjärvi and Hurme (2022) called semi-structured interview as a thematic interview, since the interview is constructed based on themes which are discussed. Semi-structured interview approach was selected for the study so that the research data could be analysed based on certain themes but still allowing interviewees to respond in their own words to the interview questions. According to Saunders, Lewis and Thornhil (2016) the interviewer can use a list of themes and some key questions while conducting semi-structured interviews. The contents of the interviews and the questions asked can vary, depending on which way the conversation is going or who is interviewed. Semi-structured interviews are usually used when the research purpose is exploratory, explanatory, or evaluative. (Saunders et al. 2016)

4.2 Case description

The case company is a Finnish food manufacturing company. It is a fast-moving consumer goods (FMCG) company, focused on confectionary, bakery, and lifestyle foods. The case company has a strong position in domestic market and is also operating in the Nordic countries. The case company is committed to Science Based Targets by setting a goal to reduce their greenhouse gas emissions by 42 % by 2030 from 2020 levels. Ritchie (2019) reveals in her article that food production is responsible of 26% of the total global greenhouse gas emissions. This 26% includes, for example, land use activities, crop production and other supply chain activities such as transportation and packaging. Interviewed suppliers were gathered from different industries so that the research could present various viewpoints from different companies. All in all, four interviews were conducted for this thesis. Two of the suppliers are packaging suppliers, one is a logistics supplier, and one is a raw material supplier. The characteristics of each interview are summarized in Table 1.

This thesis is conducted so that the case company could gain knowledge about their supplier's position in sustainability, their sustainability actions and willingness to

collaborate in emission reductions. With that information this thesis analyses the factors affecting buyer-supplier collaboration and how to form mutually beneficial partnerships to reduce greenhouse gas emissions. The case company currently has supplier engagement practices in use and this research aims to present additional supplier collaboration efforts and ways to support case company's journey towards achieving their greenhouse gas emission reduction targets.

4.3 Data collection and data analysis

All in all, 9 interviews were conducted. Four of the interviews were with the case company's suppliers and 5 interviews were internal interviews within the case company. The case company selected the interviewed suppliers. All the interviewed suppliers were contacted via email to schedule the interview. The interview questions were sent in advance to the interviewees so that they could get familiar with the interview themes. The interviews were held via Teams and in Finnish. There were 4 different themes in the interview questions: background and general questions, emission efforts, supplier relationships and buyer-supplier collaboration. All the supplier interviews were recorded to make the empirical data analysis more accurate and easier.

The internal case company's interviews were also scheduled via email and the interview questions were sent in advance. All the interviews were held via Teams. Four interviews were held in Finnish and one in English. There were 3 different themes in the interview questions: background questions, supplier relationships and buyer-supplier collaboration. All the internal interviews were recorded to make the empirical data analysis more accurate and easier.

The characteristics of the interviewed suppliers are summarized in Table 1. Company A is a logistics supplier to the case company. The interviewee from Company A is the Chief Executive Officer and co-founder. Another interview was with the Commercial Director from a packaging company, Company B. With another packaging company, Company C, there were two interviewees: Sustainability Director and Managing Director. Interview with the raw material supplier, Company D, was with Vice President, Sustainability.

Company	Supplier type	Position	Duration of the interview
A	Logistics	Chief Executive Officer	52 min
B	Packaging	Commercial Director	53 min
C	Packaging	X = Sustainability Director	35 min
C	Packaging	Y = Managing Director	
D	Raw material	Vice President, Sustainability	32 min

Table 1: Suppliers' characteristics.

The supplier interviews were on average 43 minutes. All the interviews were individual interviews except one interview with a packaging company C was a group interview with two respondents. Group interview was chosen to this situation to get more comprehensive and in-depth answers from interviewees who are specialised in the interview's themes. This will bring better answers to the questions and improve the whole research.

The characteristics of the internal interviews are summarized in Table 2. These interviews were on average 34 minutes. The interviews were individual interviews. To make sure that the suppliers' interviews and internal interviews would be in line, the interviewed internal participants were also from the fields of logistics, raw materials, and packaging.

Interviewee	Position	Resbonsibility	Duration of the interview
E	Procurement Manager	Logistics	28 min
F	Procurement Manager	Raw materials (e.g. milk, sugar)	32 min
G	Manager, Logistics and Purchasing	Logistics in Sweden	30 min
H	Procurement Manager	Raw materials (e.g. yeast, eggs, soy)	34 min
I	Director, Group Procurement Packaging Materials	Packaging	46 min

Table 2: The case company's interviewees' characteristics.

After the interviews, each interview was transcribed with the help of the interview recordings. The transcribed interviews were then analysed by using, for example, colour

coding and combining. This will enhance deeper understanding of the similarities and the uniqueness' of the responses and makes it easier to analyse the responses.

4.4 Reliability and validity of the research

Qualitative research should be evaluated throughout the research process, not just at the end (Eriksson et al. 2008). The reliability of the research means that the research findings would not change if the study were conducted again. Another explanation is that two different researchers would get the same results. (Hirsjärvi et al. 2022). Hirsjärvi et al. (2022) also saw some challenges related to these explanations since people are prone to change and it is not usually possible that two people would analyze the research findings the same way. Research validity means that the research is replicable, and the research findings accurately describe the phenomena that is studied (Hirsjärvi et al. 2022; Eriksson et al. 2008). It is argued whether reliability and validity could be evaluated in qualitative research (Eriksson et al.2008).

To ensure the reliability of this thesis, the research methodology, case description and data collection and analysis are transparently presented and explained. The interview method is presented, and the interview questions are available at the end of this thesis. The interviews are also recorded to ensure the data accuracy and the correctness of the data analysis. Moreover, data transcription is done to all the interviews the same way. Caution is used when the interviewees straight quotations are translated from Finnish to English.

5 EMPIRICAL FINDINGS

The purpose of this chapter is to present insights gained from the interviews, which were conducted to better understand the effects collaborative buyer-supplier relationship has on greenhouse gas emission reductions. This chapter presents the findings by each interview theme and reveals recurring patterns and combines interviewees' viewpoints providing a comprehensive overview of the interviews.

5.1 Interviewees' background information

The background questions' aim was to get a basic understanding of the interviewee and their company's supplier base. The count of suppliers and suppliers' geographical location gives an overview of the interviewees' companies' size in terms of suppliers and might explain their answers to questions about their suppliers. Since this research is also interested about multi-tier supply chains sustainability, the gained knowledge about the interviewed companies' suppliers helps to gain a better picture on the topic.

Company A is a logistics company. Interviewee A is a Chief Executive Officer and co-founder of the company. Company A has around 200 suppliers, but most of them have been used only for single purchases. Interviewee A told that in logistics it is common that the purchases are mostly from service providers, such as data transmissions, rather than goods suppliers. Company A has around a handful of suppliers which have a meaning to the carbon footprint of the company. Company A's suppliers are mostly located in Finland.

Company B is a packaging company. Interviewee B is a Commercial Director in the company. Company B has 50-60 suppliers and those are mainly located in Finland, but some products are supplied from Europe, depending on the characteristics of the needed product. Interviewee B told that since the company has several factories around Finland, each factory has different kinds of suppliers.

Company C is a packaging company. Company C has two interviewees, interviewee X is a Sustainability Director and interviewee Y is a Managing Director. Company C has around 500-600 main suppliers, but total supplier count is higher. The majority of the suppliers are based in Europe, with a few exceptions in Asia.

Company D is a raw material supplier to the case company. The company is mainly focused on one raw material, which is supplied from around Finland. Interviewee from Company D is a Vice President, Sustainability. Interviewee told that around 80% of all the purchased raw materials are supplied from Finland. Companies background information is summarized in Table 3 below.

Company	Supplier type	Count of suppliers	Suppliers' geographical location
A	Logistics	200, but 10-20 key suppliers	Mainly in Finland
B	Packaging	50-60	Mainly in Finland
C	Packaging	500-600	Mainly in Europe
D	Raw material	Tens of thousands	Mainly in Finland

Table 3: Suppliers' background information

Regarding the internal interviewees, logistics responsibility included for example transportation and warehousing. Two of the Procurement Managers were responsible for different raw materials. It was explained by Procurement Manager interviewee H that their responsibilities include price negotiations and agreements with the suppliers, pricelist management, supplier approval and supplier relationship management as well as category planning and execution. Interviewee I described packaging material responsibilities similarly including price negotiations and agreements, procurement strategies and supplier relationship management.

5.2 Suppliers' greenhouse gas emission reduction efforts

The second theme of the interviews was about suppliers' own greenhouse gas emission efforts. The questions aimed to reveal suppliers' current practices regarding greenhouse gas emission reductions and emission data reliability and accuracy. Suppliers also shared what they have learned from the emission reductions, and which challenges they have faced. This type of knowledge is essential for enabling effective buyer-supplier collaboration aimed at emission reductions.

When discussing the current greenhouse gas emission reduction and management practices, it was clear that all the interviewed case company's suppliers had implemented emission efforts in their business. Interviewee from company A emphasized that sustainability and emissions are considered in every aspect of their business. The efforts in green practices were also seen as a competitive advantage to the company. Company A is making all kinds of emission practices such as efforts in buying carbon-neutral electricity and district heating, having ISO14001 certificate, buying and using low-emission vehicles such as electric trucks and natural gas vehicles, using Artificial Intelligence based transportation optimization system, reusing over 74% of the waste coming from waste compactors, offering remote work possibilities and getting energy storage batteries to collect the solar panel energy surplus. Both Company A and Company D have also committed to the Science Based Targets initiative. Company D is focusing their emission efforts on the main raw material farms, which have the biggest emissions. They are doing emission reductions, establishing carbon sinks, and promoting the circular economy. All the interviewed suppliers have understood the importance of their own energy usage, and they are focusing on improving their energy efficiency.

All the suppliers are currently focusing on emission calculations. Company C is calculating its emissions according to the GHG Protocol, and they are also building cooperation with their suppliers to get more accurate primary data for the calculations. Moreover, Company A is also currently calculating emissions according to the GHG Protocol. Company D is also using GHG Protocol in the emission calculations. Company B is currently doing factory-specific emission calculations in almost all their factories and aims to do those in all their factories in the near future. Company D has calculated their Scope 3 emissions from very

early on, since they are very aware that the purchased main raw material's farms are the biggest source of emissions and because of that, needs attention and actions.

Both packaging suppliers, Company B and Company C, have identified that their emission reductions are strongly linked to the purchased materials and those materials used in the manufactured products. Interviewee from Company B explained that 80-90% of their emissions come from Scope 3 purchased materials and 10-20% from their Scope 1 and 2, such as energy usage. They are focusing on what they could do with suppliers to reduce the emissions coming from purchased materials. Company C highlighted the importance of product design and development on emissions. Company C and Company B also stated that the emission reduction activities vary among products and factories. Interviewee from Company D said that over 80% of the company's emissions are coming from main raw material's farms. These farms are a part of Scope 3 calculations.

What comes to emission data accuracy and reliability, Company A, Company C and Company D are all using GHG Protocol in emission calculations and are making sure they are doing it according to the standard. Company C has previously used and will be using consulting companies' expertise in the emission calculations. Interviewee X from Company C also said that hiring them as a Sustainability Director is also one way to ensure accuracy of the calculations, because of their previous expertise in greenhouse gas calculations. Company D uses The Carbon Trust to certify the main raw material's calculations. They emphasize the need for third-party auditors to validate the emission actions.

Company A and Company C are both doing own internal procedures to ensure the accuracy of the emission data. Company C uses internal checking and accepting processes. Company A uses PowerBI reporting and reviews calculations at the operational level on a monthly basis and then confirms again in the management review. And as a logistics company, Company A gets precise emission information from their transporting. Companies are also using data from official public emission databases when there are not enough primary data available, but Company C emphasizes that they are currently putting in effort to gather more primary data. Company D's main raw material farmers has mobile applications to ensure that the farmers' can calculate their emissions and monitor their actions impacts.

"I would like to think that when we do measurements and other things, we do them transparently and compare them to other operators in the field and to all other companies operating in the food industry. By comparing our own results to others, we can immediately see if we have succeeded particularly well or particularly poorly, or if we or someone else has a completely wrong measure."

- Interviewee from Company A

Interviewee from Company B said that they are receiving Scope 1 and 2 energy usage information and emissions from the energy companies, and they are currently assessing their factories emissions. Company A also gets energy information from the energy companies and added that they know that their purchased energy has zero emissions.

Also, many challenges related to emission reductions raised in the interviews. Company C emphasized the challenge to get the accurate emission data. Interviewee X from Company C said that many suppliers do not currently have emission data according to the standards available to all their supplied products. Some suppliers are not even willing to share any of the emission data with the buyer. Company D saw that emission activities are demanding a lot of work and are time consuming. Company A has faced resistance from their own company as well as from outside of the company. One time, they even had to change a supplier because the supplier did not want to share emission calculations related to the purchased products. Company C also said that it is challenging to get a full picture of the emissions and do the calculations since there are some many data points where the emission data should be gathered. Company D said that one common challenge for all in the emission calculations is that every company is doing calculations differently and according to different standards. They see that there is a need for a common national and international standard and calculation methods to harmonize the calculations and improve the comparability of different companies' emissions.

"Consumers and (B2B) customers are faced with confusion when they cannot compare the (emission) calculations. This is one of the biggest challenges and there should be harmonized and standardized models that all parties can gradually start using."

- Interviewee from Company D

Company B referred to the large set of purchased materials as a challenge, since the purchased goods and services category in Scope 3 has the highest emissions. In their point

of view, the challenge is to know which material is the best option or which changes in materials would lead to better emission reductions. Company C said that they must rely on predictions in what happens to the products after their own processes since they have so many products. Challenges are, for example, how is the product used and what happens in the End-of- Life stage. They also identified that there are technical challenges to providing low emission products which will work also for the end customers' needs.

Suppliers also saw costs as a challenge. Interviewee from Company A said that even when there are regulations and decisions coming from the society regarding to emission reductions, there are little to no subsidies offered to the companies. For example, despite electric trucks being four times more expensive than conventional trucks, Company A faced a lack of subsidies when transitioning from regular trucks to low-emission electric ones. Interviewee Y from the Company C said that everyone is weighting the costs of emission reductions and that some companies are more willing to pay more for more sustainable business and some companies are not. Also, the interviewee X from the Company C said that the challenge is cost against sustainability. The interviewee from Company B said that material solutions with lower emissions are almost always more expensive, except for material thinning, which is undoubtedly more beneficial for emission reductions and price.

> *"One of the biggest challenges in the packaging world is that there are very few material solutions that are a complete win-win for everyone. In general, if you switch materials to reduce emissions, the price will go up."*
>
> - Interviewee from Company B

> *"Both in the selection of raw materials or product design, and then in some technical solutions related to our energy use, it would be possible to do something, but in practice it is so expensive that we cannot make business from that solution."*
>
> - Interviewee X from Company C

Both companies A and C said that the responsibility for improving sustainability and getting emission reductions is not only important for single companies but to everyone in the value chain. Company C emphasized that collaboration and communication are essential between supply chain participants to gain emission reductions. In addition, Company B presented two practical key learnings for emission reductions: renewable materials and overall material

recycling. Company A in the other hand saw that perseverance is the key to success in emission reductions.

5.3 Supplier relationship management efforts

This interview theme includes questions about suppliers' supplier relationship management and how they ensure sustainability in their supplier base. The interview questions also seek to understand interviewed suppliers' methods for collecting and verifying supplier emissions data to ensure its accuracy and reliability. These suppliers' viewpoints are combined with the findings of the internal interviews and their views on their efforts on supplier relationship management and sustainability.

The case company's interviewees were asked what role commitment to sustainability plays in supplier selection compared to, for example, price. The answers varied between different interviewees, because of their different responsibility areas. Interviewee E, who is responsible for group level logistics procurement, mentioned that there is no definition of sustainability policy at group level for suppliers in logistics compared to raw materials. There are also differences between countries maturity to execute logistics sustainability. In Baltics, they do not have enough capacity of electric, biogas, or biodiesel trucks available. The interviewee E mentioned that the price is the determining factor for now because there is no decision made in the group level to pay more for sustainability. They also added that sustainability is considered in the logistics supplier selection decisions, but it is hard to demand it. Another viewpoint on logistics comes from interviewee G who has experience on logistics from Sweden. They said that the case company signed a DLF transport initiative in Sweden, which aims to have fossil free transportation by 2025. Interviewee G also said that the commitment to sustainability is almost equal with other considerations in supplier selection. Throughout the years there has been a huge change in the attitudes from price focus to a wider view of important supplier selection factors like sustainability. The interviewee H, with responsibility of raw materials, told that some raw materials have more strict sustainability criteria which have impacts on the supplier selection. Also, some raw material's certifications might have an impact on its price and then it is balancing between the sustainability demands and price. Another interviewee with responsibility of raw materials, interviewee F, told that discussions with new suppliers are done in terms of, for

example, whether they are committed to SBTi. Interviewee I, with responsibility of packaging materials, said that there are not really any specific sustainability requirements used in supplier selection, rather than the signing of the Supplier Code of Conduct and to fulfil all the other requirements. It was also added that it is still important that the requirements for suppliers are supporting the overall sustainability agenda.

While asking about the Supplier Code of Conduct, it was seen as a very positive way to ensure sustainable supply. According to the interviewees, the case company is currently requiring signing of Supplier Code of Conduct from all their new suppliers. There have been also negotiations with current suppliers to get them to sign the Supplier Code of Conduct. Large amount of the case company's current suppliers has signed it, but there has also been some reluctance. It was also mentioned that logistics category includes very small local companies, and those usually have not signed the Supplier Code of Conduct. But all in all, it was seen as a positive step to ensure the alignment of sustainability commitment.

When asked about supplier companies' supplier relationship management practices, all the interviewees mentioned that they have meetings with their suppliers regularly. In Company C, depending on the supplier and what kind of cooperation they are doing, regular communication and meetings with suppliers are arranged. In addition to that, Company C also mentioned that in supplier selection phase, they are evaluating suppliers and doing risk evaluations. Moreover, Company C is also actively pursuing long-term collaborative partnerships with suppliers because that nourishes two-way development. Company B said that they meet their key suppliers regularly, for example quarterly, but also more frequently if something needs to be discussed. Company A told that there is no supplier management in one-time purchases, but they meet up with 10 to 20 key suppliers regularly. Interviewee from company A emphasized that they are keen to know how their suppliers are doing. That way the company can learn and improve their own business.

The case company's interviewees mentioned that the used supplier relationship management practices depend on the supplier. The suppliers are categorized based on certain criteria in strategic, preferred, and tactical categories and these categorizations are used when thinking about the volume of relationship management. Most common supplier relationship management practice mentioned among the case company's interviewees were regular

supplier relationship management meetings. These meetings are arranged with the most important suppliers and include closer collaboration as well as key performance indicator and target setting and assessment. These meetings also include discussions about sustainability topics. Other supplier relationship management practices mentioned by the case company's interviewees were contract management and cooperation and communication via emails or meetings. About the nature of the communication with suppliers, maintaining strong communication channels and fostering transparency in the dialogue were mentioned by the interviewee G.

> *"I would say that the most important part is maybe to have it (sustainability) on the agenda, like on top of mind all the time in our discussions with the suppliers…"*
>
> - Interviewee G

According to the case company's interviews, sustainability plays an important role in the supplier relationship management. The importance was emphasized by the interviewee F because the decisions made regarding the suppliers have a direct impact on the achievement of the case company's sustainability targets. Interviewee F also mentioned that although sustainability is considered in the purchasing decisions, costs also plays a big role. Interviewee H told that the target is that many of the case company's suppliers would commit to SBT, and they are trying to advance suppliers' knowledge about the SBT and encourage them to commit to it. Also, interviewee E encourages suppliers to commit to the SBT. Interviewee G said that sustainability has an important role in supplier relationship management but would like to see it playing a bigger part. According to interviewee I, the role that sustainability has depends on the supplier. With strategic suppliers there is more collaboration in terms of sustainability while with new suppliers the focus is more in other areas. According to the case company's interviewees, Supplier Code of Conduct, knowledge sharing about SBT and collaborative initiatives with, for example, both companies' sustainability managers were seen as ways to engage suppliers to sustainability. It was also mentioned by interviewee I, that suppliers could be incentivised to sustainability by informing that if the supplier does not fulfil the sustainability needs of the buying company, another supplier who fulfils the needs will be selected instead. This could make the supplier to do some improvements in their sustainability. Interviewee F mentioned that some large companies are already leaders in terms of sustainability and on the other hand some suppliers

might be struggling with profitability, and they are not able to do big investments in sustainability.

According to interviewed suppliers, they have had discussions about sustainability with their suppliers. Company C has arranged sustainability workshops with largest suppliers. With these workshops the aim has been to improve communication and increase mutual understanding and efforts on sustainability themes. Company B has also discussed about carbon footprint improvements and more sustainable options with their key suppliers. Company C also emphasized that they are interested in suppliers' sustainability targets not just their current situation. Company A told that they have arranged company visits with a supplier so that they could both show what they are doing in terms of sustainability, and both could learn from each other.

> *"We have discussed in many meetings about the GHG calculation model with the transportation company that provides waste collection services for us. In these meetings, we have not discussed daily business at all, but we have learned about the GHG topic area and sought out practices on how each of us could benefit from it in our own operations."*
>
> - Interviewee from Company A

Company C's suppliers need to commit to the Code of Conduct. They also have wider "supplier handbook" for suppliers to comply with, which consists of more precise criteria. One aspect in the "supplier handbook" is the sharing of greenhouse gas emission calculations. Company C is currently working on to make the sharing of greenhouse gas emission calculations as a necessity, but currently it is strongly recommended. They have also defined what kind of data they would want suppliers to give. Company A stated that if supplier does not commit to sustainability, they will change supplier. Company D is requiring their suppliers to commit to their responsible way of operating. They are ensuring their suppliers' sustainability with supplier selection and assessment as well as monitoring processes. They are also demanding suppliers to commit to their Code of Conduct. Depending on the purchased products, sometimes it is needed to do deeper analysis on the riskiness of the product and use third-party audits etc. to ensure sustainability.

Interviews with suppliers also revealed some challenges occurring in sustainable supplier engagement. Interviewee from Company A said that they could improve their one-time

purchases in certain company function so that it would be easier to see afterwards how the purchases have been made. Interviewee Y from Company C said that it would be great to find time and possibilities to do supplier visits to all their suppliers, but they have to focus on key suppliers. Company B operates in a field where both its suppliers and customers are very large companies, so the Company B does not have huge power to effect on its suppliers' sustainability. On the other hand, large companies have higher pressure to commit to sustainability. Company B said that those large supplier companies have done a lot of sustainability actions and emission reductions which leads to reduction in Company B's emissions too.

When asked about how well the case company's interviewees get emission data from suppliers, the answers vary depending on the responsibilities of the interviewees. According to interviewee F, who is responsible for, for example, dairy category, said that they have received emission data from suppliers when asked and the efforts have been aimed especially towards suppliers and categories with highest emissions. Moreover, interviewee G, who is responsible of logistics in Sweden, said that they have received emission data from suppliers but explained that the quality of data could be better since the emission calculations are based on generic models and are not specified, for example in exact transportation routes. Another viewpoint from raw materials is that Interviewee H identified a challenge on the received emission data quality, because of different calculation methods used by suppliers and the emission calculations are also a work in progress for many suppliers. Interviewee I from packaging materials said that emission data is poorly obtained from suppliers. Differently from other answers, interviewee E, with group level logistics procurement responsibility, mentioned that there is a lot of emission data available from the largest suppliers, but the difficulty lies currently in the case company's own operations. They said that they are unable to utilize the logistics suppliers' emission data because of the lack of internal tools and processes.

When asked about the case company's efforts on improving emission data accuracy and reliability, the interviewees mentioned that many suppliers are currently trying to improve their emission data quality, and this will also lead to improvement of the case company's emission data quality. Also, the case company's interviewees did not know if there are some concrete ways on how the case company is currently trying to improve emission data

accuracy and reliability. It was mentioned that their own actions to improve emission data quality are quite limited. The things they can do is to focus on gathering emission data from suppliers, to gain knowledge on what are the emission sources in the supply chains and encourage suppliers to sustainability as well as to do emission calculations.

All the supplier companies are getting emission data from their suppliers. Interviewee from Company B said that the data they are getting depends on how suppliers are calculating and reporting their emissions. Company C utilizes Life Cycle Assessment-tool in which they gather emission data received from suppliers via Excel spreadsheets. Company A has information about what they have purchased and uses that information to calculate, what is the products' or services' part of their own emissions. Interviewee from Company B also identified a challenge occurring from supplier data. Suppliers are measuring and calculating their emissions differently, so suppliers' emission calculations are not comparable to each other. Interviewee X from Company C adds that supplier data management needs further development in their company. If considering other suppliers than the main raw material suppliers, Company D has also identified a challenge in getting the emission data from suppliers. Usually, it is needed to rely on secondary emission data.

Ensuring supplier emission data accuracy and reliability, Company C has a sustainability function, which verifies the emission data. They are referencing the data to international standards but does not require third-party verification as for now. Company C says that certain emission data will be mandatory to include in annual reports, and this data must be verified by a third-party. This move is expected to shift the responsibility of ensuring accurate data reporting from companies to the legal framework. Company B is trusting that third-party audits will improve their suppliers' emission data reliability. Interviewee from Company A says that there is not much they can do but to trust the suppliers' data, but they are using "double-entry bookkeeping system" which means that they are also tracking the data themselves to ensure its correctness. Company D is using third-party auditors to ensure that suppliers' emission data is reliable.

> *"We have to trust that there will be third-party assessments, and then there will be auditors who are professionals and who will say whether this is a correct assessment or not. And then we should be able to move at least one step forward in terms of reliability."*

- Interviewee from Company B

The case company's interviewees were also asked about how they see their own work executing the case company's strategic direction in terms of sustainability. The answers showed that the case company's interviewees saw that sustainability is embedded in their procurement work and that they feel like they can execute the case company's sustainability strategy, for example, in supplier selection and evaluation and in sourcing decisions. While sustainability was seen as an embedded aspect of interviewees work, purchasing and procurement practices were also seen to contribute significantly to emissions, making it difficult to execute a holistic sustainability strategy.

5.4 Buyer-supplier collaboration

The last theme of the interviews addressed buyer-supplier collaboration. The case company's questions were related to the current collaboration practices as well as the possible improvements needed for the collaboration to be successful. Both the case company's interview questions as well as supplier companies' interview questions also aimed to reveal what key success factors, challenges and benefits interviewees saw in the collaboration towards greenhouse gas emission reductions.

"Sustainability work is a collaborative effort; we cannot save the world alone."

- Interviewee from Company D

When asked about the willingness to collaborate with a buying company to reduce greenhouse gas emissions, all the supplier companies were interested. Interviewed suppliers were also unanimous about the fact that buying company, as well as supplier, should have clear vision and targets about what is wanted to achieve with buyer-supplier collaboration. Interviewee Y from Company C emphasized the importance of clear and realistic targets as well as honest discussions from the start. Another thing mentioned was buyer's honesty regarding to its willingness to put effort and work into the collaborative target. Interviewee X from Company C highlighted the importance of long-term collaboration and openness. Interviewee from Company D emphasized that collaboration and cooperation is very important when thinking about sustainability improvement. Companies cannot only focus

on the sustainability of their own operations because joint actions are needed to improve the World's sustainability.

> *"Be honest about what you are willing to do and invest, so that you do not waste resources or do a lot of work that just become "nice to know"-information. Instead, focus on what you are really willing to invest, and make sure the other party is also committed on their part."*
>
> - Interviewee Y from Company C

> *"We need to think about goal setting. What do we want? What is the desired state and goal that we want to achieve? That is the number one thing."*
>
> - Interviewee from Company B

> *"Clear environmental goals should be set together, so that we know what we are striving for. And openness is at the core of this collaboration. If there is no openness, we cannot succeed in this kind of work."*
>
> - Interviewee from Company A

According to the case company's interviewees, collaboration practices used at aiming emission reductions were open discussions and meetings with suppliers, sharing best practices and knowledge, joint initiatives and assessment, exploring innovative solutions, data gathering and joint discussions of best purchasing decisions, for example regarding order sizes or delivery intervals. Interviewee F also mentioned that a speaker from a supplier company has given a presentation at the case company's sustainability event, and conversely, the case company's sustainability representative has spoken at the supplier's event.

The next question for the case company's interviewees was about how collaboration towards emission reductions is affecting costs. It was mentioned throughout the interviews that the efforts towards emission reductions will increase costs. Interviewee F mentioned that the suppliers have to do big investments if they want to cut emissions and this means that the prices of the purchased goods will also increase which increases the case company's costs. Moreover, Interviewee I noted that the shift to other, more sustainable, packaging materials can also mean that the case company needs to do expensive investments in their current machinery. Interviewee H mentioned that certifications and being a part of some

organizations, like SBTi, has a price and these are also affecting the prices of purchased goods. Interviewee G saw collaboration as a strategic investment over time and that it could lead to cost savings in the long run. In the interviews it was additionally asked about whether there is some kind of accepted addition to price if the purchased good is more sustainable and who is in charge to make those kinds of decisions. It was mentioned that the decisions made regarding whether to buy more sustainable product are depending on, for example, the product's category. It was also said that the decisions when it is acceptable to pay more from more sustainable purchased goods is either done in cooperation with internal business functions or by the business functions alone. Several case company's interviewees emphasized that in the end it is always down to consumers whether they are willing to pay more for more sustainable product.

The case company's interviewees were also asked how the collaboration towards emission reductions could be improved and what resources or support would they need to be able to improve the collaboration to achieve emission reductions. The things interviewees saw as important for collaboration were discussions, sustainability workshops, webinars, training sessions and having the right and committed people on board. It was also mentioned that it would be important to acknowledge the differences between suppliers and try to have adjusted actions towards different suppliers. One thing that came up in many interviews was that there is a need for better internal definition of policies. For example, there should be clear policies on how the greenhouse gas emissions should be considered in supplier selection, what are the consequences if the supplier is not willing to pay attention to emissions, what is the timeframe for the supplier to make changes and what are the needed changes. One interviewee told that current suppliers does not face any consequences if they are not committed to SBTi or if they do not have any actions to mitigate their carbon footprint. Another interviewee did not saw that they could improve the collaboration by themselves. They saw that there is more need for both companies' sustainability teams to be in contact and that there should be better policies that the procurement managers could then execute to their work with suppliers. It was also mentioned by one interviewee that as a result of defining the key policies it would make it easier to take smaller actions and steps to improve the collaboration towards emission reductions. Another thing that came up in the interviews was that emission calculations and reductions are quite complicated topic due to many uncertainties. There is not a single right way to even calculate the emissions, and

everyone are in different states in their calculations. One interviewee emphasized that it would be necessary to have clear international standards and that all would calculate the emissions similarly so that the collaboration with suppliers would be more successful. Moreover, one interviewee added that the case company is lacking the commitment and willingness to pay more for greener products even though the case company is willing to pay more for higher product quality. One interviewee told that currently the responsibility of spreading the emission reduction awareness to suppliers is on the case company's procurement sustainability function consisting of two employees. Couple of the interviewees mentioned that it would be beneficial to get education, training, and knowledge and to have guidelines and policies on how to improve the collaboration with suppliers regarding emission reductions. It was also said that the responsibility of the emission reduction is on two sustainable procurement employees so it would be beneficial that the regular procurement employees also would have the knowledge to improve emission reduction efforts in their work.

When asked about how the case company's interviewees would prioritize collaboration in the future, interviewee E mentioned that it depends on the assignment. They also mentioned that it would be great if transportation was more electric, but it should be prioritized where changes are made and where are not. Interviewee F said that the case company's top management sets priorities that are then discussed with procurement's leadership and implemented by procurement teams. Interviewee I mentioned that they are already currently prioritizing collaboration with suppliers who share the same sustainability agenda than the case company and those suppliers that does not share the same sustainability agenda will not be their suppliers in the future. Interviewee G plans to intensify the efforts, for example setting ambitious emissions targets and to have suppliers on board on those goals as well. They also mentioned that it would also be good to have those targets also in the agreements so that it would be easier to follow up together. Interviewee H would focus on risk categories where there are known to be large emissions, but where there are also opportunities to find ways to reduce emissions.

5.4.1 Key success factors, challenges, and benefits of collaboration

Both the case company's interviewees as well as the supplier companies' interviewees were asked to identify key success factors, challenges, and benefits of buyer-supplier collaboration to achieve emission reductions. This chapter presents the factors that contribute to successful collaboration, the challenges that need to be considered, and the potential benefits of the collaboration.

Interviewees form supplier companies A and B emphasized openness as the most important factor for collaboration. Interviewee from Company B saw that open communication is a necessity in the formation of the targets and opportunities of the collaboration. Interviewees form Company C and Company D also saw that open communication will have a positive effect on the collaboration. Company D specified that there should be discussion about the whole value chain and where emission reductions could be achieved in the product life cycle. Moreover, they emphasized that other solutions could also be discussed in addition to emission reductions, for example the possibility to take advantage of byproducts and this way enhance the circular economy. Also, the case company's interviewees E, G and F mentioned that communication is important. Interviewee G also emphasized the importance of transparent data sharing. Moreover, Interviewee H saw that good supplier relationship is essential and that both participants have knowledge on each other's business.

"There are no quick wins, but with long-term and open collaboration, we can succeed."

- Interviewee from Company A

In addition to the importance of open communication, interviewees from Company C also brought up the need for concrete collaboration and actions which will lead to emission reductions. Interviewee from Company D also saw that concrete planning is needed for the collaboration to be successful. Interviewee from Company A also shared the thoughts about actions and that it would be beneficial to form common standards on how the emission reductions would be done. They added that it would be good to monitor the decisions and agreements made between participants so that things would really improve. Interviewee G mentioned that there should be meetings with suppliers to see whether the emission goals

are aligned with the suppliers. Moreover, they saw that it would be good to have regular performance assessment to help track progress and identify areas for improvement.

The case company's Interviewee I mentioned that supplier companies should have capabilities and motivation to improve the sustainability projects. They also mentioned that the case company should have time and capabilities to improve things on their side. Interviewee H stated that both participants should have a good motivation to do improvements. Interviewee G mentioned that there should be a common framework on how to work together and that participants are committed to the shared goals. Interviewee E mentioned the importance of reciprocal trust between participants. It was also noted by Interviewee I that the collaboration should be aimed to ensure profitable business for both participants. Moreover, Interviewee F stated that in the perfect world, suppliers would do big investments and shift part of the costs to their prices and the case company would shift the costs to their end product's price. Other success factors mentioned by the interviewee from Company A were incentives, training, and the possibility to explore alternative processes and materials together with another participant. Figure 5 summarise the key success factors for collaboration mentioned by the supplier companies' interviewees as well as the case company's interviewees.

KEY SUCCESS FACTORS FOR COLLABORATION	
SUPPLIERS	**THE CASE COMPANY**
Long-term collaboration & commitment	Open communication
Open information sharing & communication	Commitment to common targets & actions
Common and concrete targets & actions	Monitoring
Guidelines & monitoring	Adequate capabilities & will
Co-creation of sustainable solutions	Transparent data sharing
Training & incentives	Good supplier relationship

Figure 5: Key success factors for collaboration identified by suppliers and the case company.

Challenges for the collaboration might arise when companies have not defined what is important to them and what they want to do, according to Company C. In their opinion it is also problematic for collaboration if a participant company has some departments that are committed to the emission reductions and some departments are not. The case company's Interviewee G saw that it is challenging if the levels of commitment are varying across the supply chain. Interviewee from Company A mentioned that challenges to collaboration might be the lack of commitment and openness and added that those are not simple to achieve in today's hectic world. Interviewee H mentioned that challenges might arise when suppliers are in different states in their emission work. Some suppliers might not have enough resources or knowledge to put on efforts in emission reductions. Interviewee G also noted that resource constraints, for example financial or knowledge-based limitations, can be a challenge. They also mentioned that resistance to change might be a challenge, especially if the changes involve significant operational adjustments. Moreover, Interviewee E saw mistrust as a challenge for the collaboration.

"Commitment issues are maybe the biggest challenge."

- Interviewee G

"Reducing emissions requires major changes. This can lead to a situation where certain suppliers may not have the resources or interest to make those major changes."

- Interviewee H

Interviewee from Company A also mentioned that information availability and sharing can be challenges if the other participant is not willing to share, for example emission data. In addition, interviewee from Company B said that open and transparent communication is not enough if, for example, costs for the change are getting too high. Costs were seen as a challenge also in Company A, since money is an important aspect in everything. In addition, Interviewee from Company B mentioned that nowadays it is very hard to predict years ahead and that makes it hard to form a bigger picture. Without the big picture it is challenging to make a good contribution to emission reductions, and this could lead to just single product improvements instead of more comprehensive emission reductions. In addition to money, also time was seen as a challenge by Interviewee F. Figure 6 summarise the identified challenges for collaboration by suppliers' interviewees and the case company's interviewees.

"There are certainly many different aspects of sustainability that can be improved, but from the perspective of both environmental impact and business profitability, it is of course necessary to focus on the essential ones."

- Interviewee X from Company C

CHALLENGES FOR COLLABORATION	
SUPPLIERS	**THE CASE COMPANY**
Lack of strategic clarity	Resource constraints
Commitment issues	Commitment issues
Lack of openness	Resistance to change
Lack of information availability and willingness to sharing	Mistrust
Costs	Costs

Figure 6: Challenges for collaboration identified by suppliers and the case company.

When thinking about the possible benefits of the collaboration, interviewee Y from Company C mentions that the overall collaboration and cooperation will deepen through emission reduction collaboration. Collaboration to reduce emissions would also benefit the participating companies by offering advantage, since emission reductions are going to stay as an important element of companies' future success. Interviewee from Company A mentioned that collaboration could improve innovation abilities and resource efficiency and bring benefits for risk management as well as sustainability. Interviewee G mentioned that one obvious benefit from the collaboration would be the positive contribution to environmental sustainability. Interviewee E also mentioned that the benefits of sustainability collaboration would be worldwide. Interviewee from Company D mentioned that the biggest impact is achieved through collaboration, not from companies' individual efforts.

"When considering the interests of businesses, it is important to remember that we are talking about the planet, not just companies."

- Interviewee E

Interviewees from Company B and Company A saw a possibility for cost savings. Interviewee from Company B emphasized that even though cost savings can be achieved, those are not easy to get. Interviewee from Company A mentioned that mutually beneficial cost savings might not happen in recent years but in the long run. Moreover, Interviewee G saw that in the long run cost savings can arise from operational efficiencies and having a stable supply network with the newest technology to keep the costs down. Interviewees from Company C also saw that improvements in the visibility of the whole supply chain's needs and opportunities can be achieved through buyer-supplier collaboration. Interviewee H noted that when the collaboration might help suppliers to grow their operational efficiency and decrease emissions it not only decreases the case company's emissions but also might bring cost savings, for example with lower material prices. Interviewee I mentioned that collaboration could help the case company to benefit from more advanced suppliers' knowledge and inventions and from their will to improve and develop more sustainable solutions.

Interviewees from Company B and Company C noticed the position and responsibility of companies in the eyes of consumers. It was seen that emission reduction collaboration could also be an opportunity to find ways on how to guide consumers to make better environmental choices and to offer better options. This was also mentioned by interviewee from Company D. Especially if well-known companies would get together, they could even have the power to affect the consumers behaviour or start a larger movement towards more sustainable future. Moreover, Interviewee G saw collaboration as a way to improve brand reputation by aligning consumer and customer preferences for sustainable products and services. Interviewee F also noted that the consumers are the ones who ultimately decide if they want to pay more for more sustainable products. Figure 7 summarise the benefits of collaboration identified by suppliers' interviewees and the case company's interviewees.

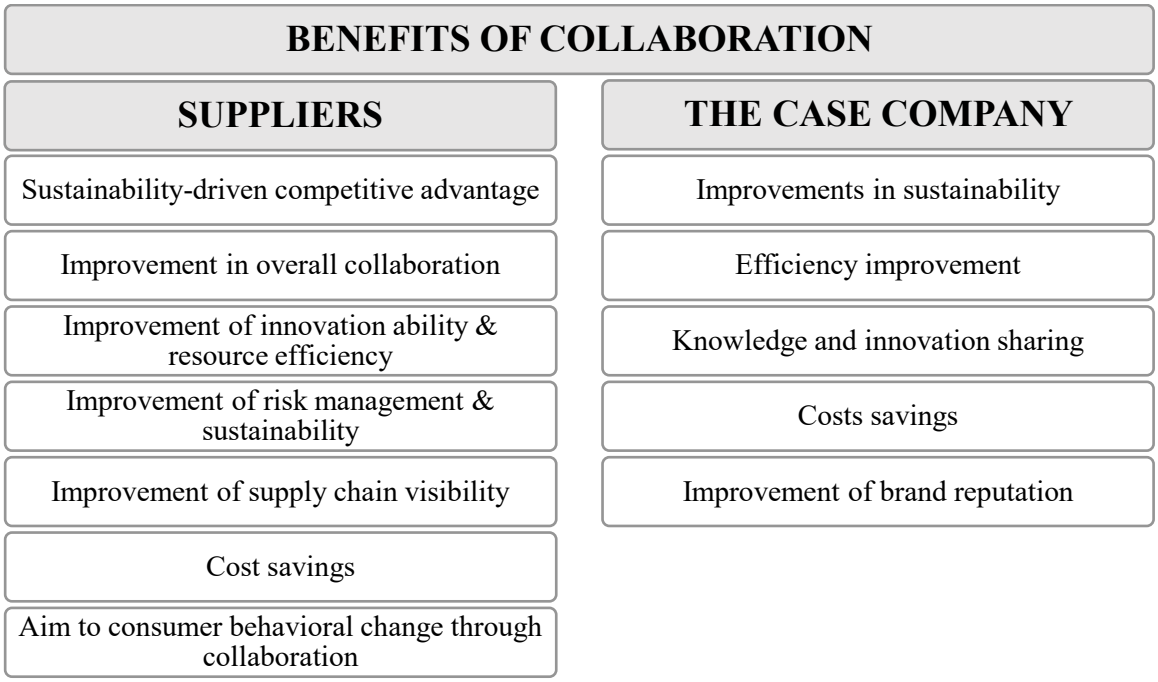

Figure 7: Benefits of collaboration identified by suppliers and the case company.

6 DISCUSSION AND CONCLUSION

This chapter is going to present answers to the main research question as well as two sub-questions. The answers will be combining knowledge from theoretical part and empirical part. Two sub-questions are answered first and then the main research question. Lastly, suggestions for the case company and suggestions for future research are presented.

6.1 Answers to the research questions

From the interviews as well as from the theoretical background, several activities, success factors and benefits of buyer-supplier collaboration were founded. That information is now analysed and combined in this chapter to get the answers for the first sub-question.

First sub-question of the research was:

Which factors improve buyer-supplier collaboration to achieve greenhouse gas emission reductions?

All the interviewed supplier companies emphasized that the collaboration should be long-term for it to be successful. Emission reductions are hard to achieve with short term collaboration since it takes time to improve, innovate, learn, and share thoughts and best practices with participants. Also, as the nature of the collaboration should be long-term, the benefits of the collaboration will also be visible in the long run. According to theory, Theißen et al. (2014) said that sustainability is a longer-term concept and for that collaborative partners need longer time frames to see the benefits of the collaboration. So, it would not be effective to try to achieve emission reductions with short term collaborations since it takes time to see the benefits and results of the collaboration. Based on reviewed literature, commitment is seen as a base for long-term relationship (Min et al. 2005). According to Simatupang et al. (2002), high level of commitment is needed from the participating members to have a successful collaboration. This was also emphasized by both the supplier companies' interviewees as well as the case company's interviewees. Lack of commitment was also seen as a challenge for the collaboration among interviewees. It was pointed out

that companies should be committed to emission reductions throughout the company's departments. This type of challenge would not encourage the other participant to trust and to commit to the collaboration since the collaborative targets and actions would not be fully supported by the other participating company. This finding is in line with the literature since Chae et al. (2017) saw that buying companies commitment is necessary to generate supplier commitment. Usually, the one who initiate the collaboration should also be the one with the strongest commitment at first. Bilateral commitment is crucial for many partnerships, but especially important to emission reduction collaboration since emission reductions are a difficult task for companies to accomplish and it needs a lot of information sharing and efforts from both participants. Collaboration aiming to emission reductions might also require sharing confidential company information and which will emphasize the commitment and trust needed from both participants. Marttinen et al. (2023) study also emphasized long-term commitment and trust as a collaborative way to ensure sustainability in supply chain. Interestingly, none of the supplier companies' interviewees mentioned trust as a success factor to collaboration and only one case company's interviewee mentioned it. Previous research show that trust is an important factor in collaborative relationships. Kwon et al. (2004) and Cheng et al. (2008) studies mentioned that communication and information sharing are positively related to trust and those actions will improve trust between participants. So, the interviewees might see trust as result of communication and information sharing because they emphasized the importance of commitment as well as communication and information sharing. Kwon et al. (2004) study revealed that trust and commitment have a positive relationship, so it could be analysed that increased commitment will lead to increased trust between participants.

Openness was another important factor for successful collaboration according to interviewees. Couple of supplier companies' interviewees even said it is the most important factor. According to theory, Corsten et al. (2005) mentioned that trust result to greater openness between buyer and suppliers. This will improve the knowledge and appreciation for each other's contribution to the relationship. While aiming to emission reductions, openness in the collaboration will lead to better results than when companies are hiding something. Also, interviewees emphasized the meaning of open communication. Open communication will build trust and cooperation between participants and that will increase transparency and cooperation. Information sharing and working together will be easier when

there is trust between participants and everyone is committed to the collaborative target. Paulraj et al. (2008) also shared the idea that two-way communication is essential to information sharing, coordination of activities and resolving issues. Atmosphere for open communication will make it easier for participants to share positive as well as negative information with each other. This makes the management of collaboration easier because everyone is aware of the current state of the collaboration as well as the future plans and challenges. Interviewees also shared the same ideas about the positive effect of open communication in the target formation and sharing opportunities. In theory, this is also supported by the Cetindamar et al. (2005) study that open communication helps the management of collaboration. Tipu et al. (2020) also saw the benefits of two-way communication and information sharing to sustainable supply chain performance and the environment. So, it can be said that open communication and information sharing has a positive effect on collaboration and will help the collaboration to achieve the sustainability targets.

Interviews emphasized that collaboration's vision and targets should be clearly stated. If the buying company is the one initiating the collaboration with the supplier, it should be able to present clear and realistic targets to the supplier. This way the supplier has better knowledge about the collaboration right from the start and is capable of understanding both participants responsibilities and needs. According to Cetindamar et al. (2005), common goals, for example mutual beliefs of the benefits of the collaboration, between participants are supporting the collaboration. Clear vision and targets also improve the visibility of the relationship and would foster trust and support. It is also important that buyers and suppliers share the same interest and willingness to act. Collaboration cannot work if the participants disagree on the goals or have different opinions on the actions. Cox (2004) study is supporting this since effective collaboration needs to have an alignment between goals and aspirations of the buyer and supplier. It was said in the interviews that sustainability related discussions between buyer and supplier should no longer be just information sharing and discussions about sustainability but include concrete sustainability aims, actions and targets. These concrete actions could include, for example emission reduction actions and targets and the planning on how to achieve emission reductions. The establishment of common activities and targets needs work from both participants for the collaboration to be successful. This is supported by Nyaga et al. (2010) study where it was said that participants

should work together to plan activities and resolve problems. In emission reduction collaboration it would be necessary that there would be mutual understanding and vision on how the reductions would be made, which materials or products this would include and what is the time frame for emission reductions. The case company's interviews highlighted that there should be commitment to common targets and actions. In the supplier interviews, lack of strategic clarity was seen as a challenge for the collaboration which emphasize the importance of clear plans, targets, and actions. This is also linked to openness and communication between participants, because only that will lead to mutual understanding of the collaboration. Similar goals and values in the relationship between buyers and key suppliers will improve the performance of the collaboration (Krause et al. 2007).

As mentioned earlier, open discussion and communication is important for the collaboration's success. One viewpoint is that communication and discussion between participants about their own actions and challenges in emission reductions could lead to identification of new emission reduction opportunities. These new opportunities they might had not noticed on their own. So, open communication and information sharing could lead to the development of new innovative emission reduction actions and strategies as well as bring competitive advantage. According to one interview, sustainability and emission reductions are continuing to be a hot topic also in the future and the efforts put in the reductions now could offer competitive advantage in the future. This gained competitive advantage is seen as a mutual benefit of the collaboration. The companies who are currently trying to improve their carbon footprint will have an advantage over the companies who will consider it so far only in the future. As seen from the Cetindamar et al. (2005) study, collaboration enhances the creation of innovations and the sharing of information about new technologies which will lead to improved competitive advantage against other competitors. Therefore, collaboration is not only sharing of information but creating new innovations. With collaboration, companies' own efforts to sustainability will become more effective when two or more companies combine their knowledge and can innovate new solutions. This is supported by Mitra et al. (2014) study, where it was seen that long-term and strategic cooperation with suppliers led to innovation and improved performance. Long-term commitment and longer periods of time are needed for companies to share information, gain knowledge, create new innovations, and see benefits and result of the collaboration. This should motivate companies to put effort in long-term collaboration, especially when this type

of relationship will make sure that competitive advantage and emission reductions could be achieved through collaborative innovation.

Second sub-question is:

What role does emission data accuracy and reliability play in emission reduction efforts?

The interviews showed that all the interviewed suppliers are currently calculating their own emissions. The GHG Protocol emission calculation standard is used by most of the interviewed suppliers, as well as by the case company. In the ideal world supplier companies and buying companies would use the same calculation standard, since this way it would ease the utilization of the data as well as improve data comparability and transparency across the supply chain. But this is not the case in many buyer-supplier relationships, since there are many ways how emissions can be calculated and there is not a single standardized method. There is also a very wide range of ways to calculate and report greenhouse gas emissions, which makes it even harder for companies to compare different suppliers' emission data. Klaaßen et al. (2021) also mentioned in their study that companies' greenhouse gas emissions accounting and reporting practices are unsystematic and not comparable, especially the Scope 3 emissions. This was also seen as a big challenge by the interviewees. Many interviewees emphasized that there are challenges in greenhouse gas emission data availability as well as in verification, accuracy, and reliability of the emission data. Maturity of GHG emission gathering and reporting varies between companies making it hard to do comprehensive calculations when there are some companies who are not calculating emissions or are not willing to put in the needed efforts. These variations make it difficult for companies to come up with a strategy on how to improve emission calculation process and enhance the emission data accuracy and reliability. According to the interviews, all the companies are struggling with these same problems. There is a big need for standardized calculation guidelines and methods at national and international level. According to the theory, Nguyen et al. (2023) and Klaver et al. (2023) also emphasized many challenges associated with Scope 3 emissions, including poor data quality and availability as well as no regulation and lack of clear guidance. Many companies might be eager to calculate their emissions and contribute to emission reductions, but the lack of clear regulation is hindering their actions. These challenges and insufficiencies have an impact on companies' Scope 3

calculations and potentially underestimate the true level of needed emission reductions further postponing the achievement of sustainability targets and goals.

Despite the challenges associated with Scope 3 emissions, interviewed companies are still trying to improve the accuracy and reliability of emission data with, for example, third-party audits and internal data checking. It could also be seen from the interviews that it is quite limited what the interviewees can do about the emission data quality improvement. But like mentioned before, they try to encourage suppliers to improve their overall sustainability which can also eventually lead to improvement of the emission data quality. As this Scope 3 emission data accuracy and reliability problem is universal challenge, there is only a limited amount of possible improvement that the companies can do. Moreover, it is not only in the hands of the reporting company to improve the emission data quality, so it needs collaborative efforts and will.

One part of Scope 3 emissions are emissions coming from purchased goods or services. Suppliers' emissions will affect the case company's Scope 3 emissions and further the whole greenhouse gas emissions of the company. This is why it would be important to get reliable emission data from suppliers. In multi-tier supply chains, lower-tier suppliers' emissions also have an impact on the focal company's emissions. According to theory, Grimm et al. (2016) study revealed that the difficulty of identifying lower-tier suppliers and engaging them are the main differences in the management between first-tier suppliers and lower-tier suppliers. It is easier for companies to engage and collaborate with their first-tier suppliers in sustainability or emission reductions, since they usually already have some sort of relationship. Transparency and knowledge-sharing on the maturity and motivation of the case company's supplier's lower-tier supplier's in terms of greenhouse gas emission calculations and actions is an important element of collaboration with its first-tier suppliers. By improving the emission data availability and reliability of first-tier suppliers, they could then also bypass the requirements upstream to their suppliers.

As a conclusion, although emission data accuracy and reliability are very important for the success of emission calculations, both the interviews as the theory revealed major challenges in the Scope 3 emission calculations and emission data. Currently companies need more regulation and legislation in the emission calculations so that they could effectively focus on

the improvement of emission data accuracy and reliability rather than wasting time and resources trying to navigate through different standards, calculation guidelines and verification methods. This need for standardised regulations and guidelines was also emphasized in theory by Klaaßen et al. (2021) and Klaver et al. (2023).

Main research question is:

How can buyer-supplier collaboration improve greenhouse gas emission reduction efforts?

According to Gualandris et al. (2016) manufacturers' sustainability depends on its key suppliers' sustainability performance. Moreover, Blome et al. (2014) stated that supply chains are as strong as their weakest link. In fact, companies are a part of a variety of supply chains and are linked to other companies. The links between companies can be direct or indirect, but companies' actions have consequences to many parts of the supply chain. The improvement of sustainability in supply chains cannot be done by individual companies alone, so collaborative efforts are needed. Especially when talking about greenhouse gas emission reductions and Scope 3 emissions, companies should work together to be able to get quality emission data and to make accurate emission calculations. Kumar et al. (2016) found in their study that the development of strong buyer-supplier relationship improves supply chain's sustainability efforts. It was also highlighted by the interviewees from both supplier and the case company's interviewees that world-wide environmental sustainability improvements need to be a collaborative effort and that no one can do it alone.

Both theory and interviews highlighted many success factors for buyer-supplier collaboration aiming emission reductions. The nature of the collaboration should be long-term, including bilateral commitment to common targets and actions, trust, open communication, transparent knowledge, and data sharing, and monitoring the efforts. Moreover, interviewees from supplier companies were willing to participate in emission reduction collaborations. They also saw that emission reductions are a complicated topic and there should be commitment to the common targets from the buyer's side as well as the supplier's side. The case company's interviewees saw that collaboration can have benefits to emission reduction efforts. But they also mentioned that they have quite limited possibilities to influence the suppliers to take emission reduction efforts. The reasons for that

are lack of internal guidelines and policies, lack of know-how, lack of common international and national calculation standards and suppliers' different situations and commitment in terms of sustainability and emission calculations. However, interviewees from supplier companies and the case company are aware of the benefits emission reduction collaboration could bring and what are the beneficial characteristics that the collaboration should have to be able to form a successful collaboration. It is important to acknowledge that there can be different types of collaborations, and the needed capabilities and know-how will depend on what is tried to achieve with the collaboration. For example, since emission reductions are a complicated topic, the nature of the collaboration could first be more of knowledge sharing or innovative rather than having strict guidelines and demands for each participant. On the other hand, it was mentioned by the supplier interviewee that they would want concrete actions and targets in the collaboration and do not want just "nice to know" information sharing. This feedback emphasizes the need for resilience when considering what type of collaboration should be done with which suppliers.

The buyer-supplier collaboration can be a win-win situation for both participants. It has the ability to not only improve sustainability outcomes but also foster the buyer-supplier relationship. According to Agyabeng-Mensah et al. (2022) engagement practices with external stakeholders, such as suppliers, can compensate for the lack of resources. So, collaboration between buyers and suppliers can complement each other and offer something new to the relationship. But it is important to remember that there is not a single right way to collaborate with everyone, because of the uniqueness of every buyer-supplier relationship. There are many things that companies need to consider when thinking about establishing a successful emission reduction collaboration, including for example the desired targets and possible challenges. Although emission reduction collaboration might face challenges, such as increased costs and commitment issues, it has an amazing opportunity to bring many benefits to both companies. As long as both participants have clear internal aspirations, actions, and commitment towards emission reductions and willingness to collaborate, it can lead to a mutually beneficial pathway to achieve the ambitious sustainability targets.

6.2 Suggestions for the case company

This chapter presents managerial suggestions for the case company about what could be done to improve procurement's emission efforts and how they could give more support and resources to the procurement professionals in their work towards emission reductions. The suggestions are based on the findings from the theory and interviews.

According to Blome et al. (2014) management of supply chains is complex, particularly within the context of sustainability, as external collaboration and internal sustainability practices are closely connected in a complex manner. There should be a holistic view in the supply chain sustainability practices because inconsistent pursuit of external collaboration and internal practices might strongly block the potential benefits. Companies must establish strong internal sustainability practices to maximize the benefits of collaboration with external partners. (Blome et al. 2014) This structured approach to sustainability is important for the case company because the case company's interviews revealed that internal capabilities and practices in emission reductions need more clarification. Before establishing collaboration there should be a clear understanding of the internal efforts and commitment as well as how the collaboration needs to be done, who is responsible and what are the aspired outcomes. These things were also seen as important by the supplier companies, when talking about what they are expecting from the buying company and what they see as key success factors for the collaboration. The case company is also currently calculating their logistics emissions based on spend. They are unable to utilize logistics suppliers' emission data in their current systems although it was mentioned by an interviewee that suppliers have a lot of data available to share. System development by the case company is required to ensure this type of primary emission data can be utilized properly in their calculations.

The case company's interviewees are aware that the sustainability efforts are expensive. Emission efforts demands budgeting and strategic decisions so that the concrete actions can be implemented in the everyday work. It is important that the case company's top management knows about the concrete needs that the procurement function has in their work towards emission reductions. The needed top management efforts mandate further investigation internally, but it was said by the interviewees that there is not clear and concrete policies and guidelines on how the procurement professionals can really put efforts on

emission reductions. According to Kumar et al. (2016), top management commitment is seen to be directly associated with the adoption of buyer-supplier relationship development practices. They categorised buyer-supplier relationship development practices as supplier selection, supplier development and supplier performance review. It was mentioned by the interviewees that there are no clear sustainability demands for the suppliers, besides the Supplier Code of Conduct. It would be beneficial to study the links between top management, different business functions wants and needs, and supplier relationship practices, such as supplier selection. This could lead to a more comprehensive understanding of the needed top management efforts, opinions of different business functions as well as clearer guidelines for procurement professionals on how to execute emission efforts in their work in supplier relationship management. The need for concrete guidelines, targets and actions also came up in the case company interviews. It was seen that there should be guidance on how greenhouse gas emissions should be taken into consideration, for example in supplier selection. The interviews also revealed that procurement professionals would like to get training and education on how they should proceed with suppliers in terms of emission reductions. They currently feel like they do not have enough knowledge to establish concrete emission reduction collaboration with suppliers.

6.3 Suggestions for future research

This research has provided an overview of buyer-supplier collaboration towards emission reductions from both buying company's and supplier companies' point of view. But, because of the wide and complex nature of the topic, there are suggestions for future research. This research was done for a case company, and it studied the case company's suppliers. Another research could be expanded to cover multiple buying companies as well as their suppliers to get even bigger and more generalizable and comprehensive results. Moreover, as this research focused on interviewing first-tier suppliers, it would be interesting to also get lower-tier suppliers' vision on what they see as success factors and challenges of collaboration or where they stand in terms of their emission reduction efforts. It would also be interesting to study top management commitment and successful emission efforts implementation as this was something that came up in the case company's interviews.

Since Scope 3 emission calculations are currently a difficult task to companies, it would be interesting to study this topic again after a few years and to see if there have been improvements in policies and legislation and how these would affect the capabilities or the nature of greenhouse gas emission reduction collaboration.

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Appendices

Appendix 1: Interview questions for suppliers.

Background and general questions

1. What is your role in the company?
2. How many suppliers does your company have?
3. Where are your suppliers located geographically?

Emission efforts

4. What are your company's current practices for managing and reducing greenhouse gas emissions?
5. How do you validate the accuracy and reliability of your own emission data?
6. Are there any challenges in reducing emissions?
7. What key lessons have you learned from your experiences with emissions reduction?

Supplier relationships

8. How does your company manage and develop supplier relationships?
9. How does your company engage suppliers to ensure environmental sustainability?
10. How does your company collect emission data from suppliers?
11. How do you validate the accuracy and reliability of the emission data given by suppliers?

Buyer-supplier collaboration

12. How do you see your company's willingness to collaborate with a buying company on joint emission reduction initiatives?
    a. Could you specify what actions would you expect from the buying company in this scenario of buyer-supplier collaboration?

13. What are the key success factors from your company's point of view for building mutually beneficial partnerships with buyers to achieve emission reductions?
14. What are the possible challenges from your company's point of view regarding buyer-supplier collaboration to achieve emission reductions?
15. What are the benefits that your company would experience from buyer-supplier collaboration?

Appendix 2: Interview questions for the case company.

Background Questions

1. What is your role in the company and what are your responsibilities?

Supplier relationships

2. What role does commitment to sustainability play in supplier selection compared to, for example, price?
    a. How would you feel if signing a Supplier Code of Conduct was a prerequisite for cooperation?
3. How does your company manage and develop supplier relationships?
4. What role does sustainability play in supplier relationship management?
5. How does your company engage suppliers to ensure environmental sustainability?
6. How well do you currently receive emissions data from suppliers?
    a. How is the accuracy of emissions data being improved at the moment?
7. How do you see your own procurement work executing company's strategic direction in terms of sustainability?

Buyer-supplier collaboration

8. What kind of collaboration do you have with suppliers regarding emission reductions?

9. How do you see the collaboration towards emission reductions affecting costs?
10. How could collaboration be improved to achieve emission reductions?
11. What resources or support would you need to improve collaboration to achieve emission reductions?
12. How would you prioritize collaboration on emission reductions in the future?
13. What are the key success factors regarding buyer-supplier collaboration to achieve emission reductions?
14. What are the possible challenges regarding buyer-supplier collaboration to achieve emission reductions?
15. What benefits could be experienced from buyer-supplier collaboration?