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Supplier commitment for a long-term sustainable development: Gaining competitive advantage together with a sustainable supply chain

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ABSTRACT:
Climate change is a global challenge driving firms to adopt sustainable practices and comply with EU carbon-neutral targets. To mitigate environmental impact and ensure long-term sustainability, companies must integrate sustainability into their operations, focusing on reducing greenhouse gas emissions. Organizations are increasingly focused on the environmental performance of their entire supply chain, viewing sustainable supply chains as both a competitive advantage and a strategic priority. For the case company, engaging suppliers in sustainability efforts is important, as suppliers significantly influence the company's overall sustainability and its ability to meet decarbonization targets. The case company's approach involves ensuring supplier compliance with environmental standards and fostering a collective commitment to sustainability.

The research studies how Finnish machine building company can engage existing suppliers to be compliant with their environmental sustainability goals. Research examines the means and the possibilities for case company to increase and secure its competitiveness in the market by collaborating with suppliers on environmentally sustainable initiatives. The outcome was achieved by examining the current state of the supplier selection process, sending a decarbonization survey to the 130 biggest emitters across 14 different component categories, and attending supplier interviews. The research is executed as qualitative research, focusing on a current state analysis.

Results indicate that the arranged survey was a first step towards supplier engagement. Collaboration and open communication play a vital role in implementing new sustainability requirements. Supplier engagement and communication can be developed through regular workshops, open communication sessions, and dedicated sustainability channels. This approach helps suppliers to understand case company's sustainability goals and promote continuous improvement. Although environmental sustainability is considered in the supplier selection process, the research suggests refining the criteria. The research finds that case company could consider adding sustainability subcategories, more detailed risk assessments, and performance metrics to the process. New requirements can be integrated into the process using the supplier development framework.

The arranged survey and interviews are the initial step in evaluating the current state of environmental sustainability implementation. Sustainability audits and performance reviews with suppliers ensure ongoing compliance and commitment to continuous improvement. Lastly, the research examines the emission data to identify the most polluting suppliers and regions. Once identified, case company can consider conducting a detailed study of the climate policies and regulatory frameworks governing these regions.

KEYWORDS: Supply chain, supplier engagement, sustainable development, competitive advantage

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TIIVISTELMÄ:
Ilmastonmuutos on globaali haaste, joka pakottaa yritykset omaksumaan kestäviä käytäntöjä ja noudattamaan EU:n hiilineutraaliustavoitteita. Ympäristövaikutusten vähentämiseksi ja pitkän aikavälin kestävyyden varmistamiseksi yritysten on integroitava kestävyys toimintaansa keskittyen kasvihuonekaasupäästöjen vähentämiseen. Organisaatiot keskittyvät yhä enemmän koko toimitusketjunsa ympäristösuorituskykyyn, pitäen kestävää toimitusketjua sekä kilpailuetuna että strategisena prioriteettina. Tapausyritykselle toimittajien sitouttaminen kestävän kehityksen pyrkimyksiin on tärkeää, sillä toimittajat vaikuttavat merkittävästi yrityksen kokonaiskestävyyteen ja sen kykyyn saavuttaa hiilidioksidipäästöjen vähentämistavoitteensa. Tapausyrityksen lähestymistapa sisältää toimittajien vaatimustenmukaisuuden varmistamisen ympäristöstandardien suhteen sekä yhteisen sitoutumisen edistäminen kestävään kehitykseen.

Tutkimus selvittää, kuinka suomalainen koneenrakennusyritys voi sitouttaa nykyiset toimittajansa noudattamaan ympäristön kestävyystavoitteitaan. Tutkimus tarkastelee keinoja ja mahdollisuuksia, joilla tapausyritys voi lisätä ja turvata kilpailukykyään markkinoilla yhteistyössä toimittajien kanssa ympäristöystävällisten aloitteiden parissa. Tulos saavutettiin tutkimalla toimittajavalintaprosessin nykytilaa, lähettämällä hiilidioksidipäästöjen vähentämiseen liittyvä kysely 130 suurimmalle päästöjen tuottajalle 14 eri komponenttikategoriassa sekä osallistumalla toimittajahaastatteluihin. Tutkimus toteutetaan laadullisena tutkimuksena, jossa keskitytään nykytila-analyysiin.

Tulokset osoittavat, että järjestetty kysely oli ensimmäinen askel toimittajien sitouttamisessa. Yhteistyöllä ja avoimella viestinnällä on keskeinen rooli uusien kestävyysvaatimusten toteuttamisessa. Toimittajien sitoutumista ja viestintää voidaan kehittää säännöllisten työpajojen, avoimien viestintätilaisuuksien ja vastuullisuudelle omistettujen kanavien avulla. Tämä lähestymistapa auttaa toimittajia ymmärtämään tapausyrityksen kestävän kehityksen tavoitteita ja edistämään jatkuvaa kehittämistä. Vaikka ympäristön kestävyys otetaan huomioon toimittajien valintaprosessissa, tutkimus ehdottaa kriteerien tarkentamista. Tutkimus osoittaa, että tapausyritys voisi harkita kestävän kehityksen alaluokkien, tarkempien riskinarviointien ja suorituskykymittareiden lisäämistä prosessiin. Uudet vaatimukset voidaan integroida prosessiin toimittajan kehittämisen viitekehyksen avulla.

Järjestetty kysely ja haastattelut ovat ensimmäinen askel ympäristön kestävän kehityksen toteuttamisen nykytilan arvioimisessa. Kestävyystarkastukset ja suorituskykyarvioinnit toimittajien kanssa varmistavat jatkuvan vaatimustenmukaisuuden ja sitoutumisen jatkuvaan parantamiseen. Lopuksi tutkimus tarkastelee päästötietoja tunnistaakseen saastuttavimmat toimittajat ja alueet. Kun tapausyritys on tunnistettu, se voi harkita yksityiskohtaisen tutkimuksen tekemistä näiden alueiden ilmastopolitiikoista ja sääntelykehyksistä.

AVAINSANAT: Toimitusketju, toimittajan sitouttaminen, kestävä kehitys, kilpailuetu

Contents

Pictures

Figures

Tables

1 Introduction

1.1 Background of the study and research gap

Climate change is a significant global environmental challenge. It is pushing industries to adopt sustainable practices to meet EU carbon-neutral targets. Every EU industry is responsible for its sustainable performance towards it. Companies must integrate sustainability and Corporate Social Responsibility (CSR) into their operations, ensuring that their business practices contribute to the broader goal of reducing environmental impact. The key element is to focus on reducing greenhouse gas emissions across all three emissions scopes: direct emissions (Scope 1), indirect emissions from purchased energy (Scope 2), and indirect emissions across the value chain (Scope 3). This comprehensive approach is vital for mitigating environmental impacts and ensuring long-term sustainability.

Environmental pressure from legal authorities and the public is increasing. As a result, large organizations have started to evaluate their suppliers' environmental performance across the entire supply chain. Research shows that purchasing functions play a key role in implementing and improving sustainable practices. A sustainable supply chain is seen as a competitive advantage and a strategic viewpoint for businesses to develop. Businesses that successfully integrate sustainability into their supply chains not only reduce their environmental footprint but also secure their market position as a forerunner of sustainability.

This thesis is written on behalf of Finnish Machine building company. In the text, the company is also referred to as case company. The work has been carried out under a supply management team. The case company is a large global innovative technology company that provides lifecycle solutions for energy and marine markets. It has a wide existing supplier base supplying their products and services. The supplier onboarding

process is executed by following case company's requirements and their own Code of Conduct. Suppliers have an important role in case company´s business performance. According to the European Union case company is required to report on its emissions and as a collaboration, all suppliers working with it are also responsible for their sustainability reporting and performance. Suppliers must work under case company´s supplier requirements. The Supplier Compliance Assurance process ensures that all these requirements are implemented by all of the suppliers. The case company requires environmental management system from its suppliers. The existing supplier base is located across multiple regions around the world. There are geographical and regulatory matters between the countries in terms of climate policy. The challenge is to get all suppliers to be at the same level of reporting. Machine building company´s target is to ensure the suppliers' compliance with environmental requirements.

Suppliers have a major role in the case company's overall sustainability as well as its capacity to meet its sustainability goals. The case company aims to decarbonize its own operations in Research & Development and factory engine testing areas (scope 1) and purchase energy (scope 2) until 2030 by reducing its energy consumption, CO2, and greenhouse gas emissions. As a forerunner of decarbonized organizations, case company maintains and increases its competitiveness. Due to the competitive advantage, case company should engage its supplier base to align with the same environmental sustainability targets and understand the importance behind them. Machine building company's role is to support suppliers in making more sustainable decisions, guiding them toward adopting practices that reduce their carbon footprint and contribute to overall decarbonization.

Previous studies written on behalf of Machine building company focus on examining the current supplier selection in terms of sustainability. It has limited the research to consider environmental and social areas of sustainability and aims to outline how ethical organizational culture affects the selection. Whereas this research focuses on supplier

relations and whether engagement produces long-term competitive advantage for the organization.

Overall, the challenge is to find business models and tools that take all sustainability aspects under consideration. Currently, there is limited research on the direct impact that supplier engagement has on achieving a company's sustainability targets, particularly in a complex global supply chain like case company's. Furthermore, there is a shortage of studies on which measures would be most suitable and efficient for assessing the impact of supplier engagement, especially in terms of aligning with sustainability goals. Developing these business models and measurement tools would provide valuable numerical data, offering insights into how supplier engagement contributes to competitive advantage and overall business success. It is crucial to address the research gaps to enhance the strategic value of sustainability efforts across the supply chain.

There are no studies of how the supplier onboarding process can be enhanced to ensure that new suppliers are fully aligned with companies like case company´s environmental and sustainability targets from the beginning of their engagement. To make engagement profitable when gaining a competitive advantage through environmental sustainability, several behavioral factors influence suppliers' adoption of total commitment. These factors vary across national borders due to cultural differences. Related to this, there are lack of comprehensive studies of supplier compliance in policy and sustainability reporting across geographies. This research identifies and divides suppliers into regions because there are regulatory differences between countries. The buyer organization should be aware of the differences. The upcoming new requirements will consider these differences and ensure consistency. Given the large number of suppliers, some level of specification is necessary.

1.2 Research questions and objectives

The purpose of the research is to provide recommendations on how the selected machine building company can engage existing suppliers to be compliant with its environmental sustainability goals Then, address how the suppliers can improve their capabilities to meet these targets. This involves exploring the means and possibilities for case company to increase and secure its competitiveness in the market by collaborating with suppliers on environmentally sustainable initiatives. This outcome is achieved by examining the current challenges the case company is facing regarding suppliers' ability to align with the sustainability targets of the company. The proposed recommendations aim to represent a new way of working and sharing knowledge between case company and its suppliers. The following research questions aim to answer and fulfill the purpose of the research.

1. How is sustainability integrated into the current supplier selection process?
2. How to engage the supplier base to reach case company´s sustainability targets?
3. How to make sure suppliers commit to continuous sustainable improvement?
4. How can environmental sustainability be developed to be a permanent part of the business?

The research questions have been created together with the advisors from the case company. With the first question, the research aims to study the current state of the sustainability requirements and visibility when selecting suppliers. With questions 2 and 3, the case company wants to understand how to involve suppliers more and ensure their trustworthiness in implementing sustainability. Based on the questions machine building company wants to outline what can be required from the existing supplier and how willing they are for new investments and increasing costs in terms of buyer-organizations targets. It is important to view environmental sustainability as a continuous effort due to regulations, value creation for the business, and, most importantly, the planet. Therefore, the fourth question summarizes the need to study how these goals are achieved

through target engagement and suppliers' commitment to continuous sustainable improvement.

1.3 Definitions and delimitations

The scope of this study is delimited to focus on the existing supplier base of the Finnish machine building company, specifically targeting the largest emitters of greenhouse gases within selected component categories. 20 component categories have been identified and selected. The data collection focused on the top 200 emitters and to 22 already interviewed suppliers by the consultancy firm. The study limits its analysis of sustainability to environmental aspects, excluding social, governance, and economic sustainability considerations. Additionally, scope 3 downstream emissions, which means the customer use of case company's products, are not considered in this research.

1.4 Structure of the research

The research begins with the introduction, which provides an overview of the subject, explains the background of the study, discusses why it is a relevant topic, and outlines the research aims. The research objectives and questions are also presented in the introduction. Following the introduction, there is a literature review based on previous studies, articles, and theories related to the topic. This section includes relevant EU directives and laws, discusses the chosen topic in detail, and explains the keywords used in the study. The literature review establishes a foundation for addressing the research questions and identifying a research gap, suggesting areas for potential development.

The literature review is followed by the methodology section, where the chosen methodology is presented. This section focuses on the data collection and data analysis steps. The methodology section explains how the research part of the study is conducted. The research section implements the steps outlined in the methodology in practice, including

a presentation of the case company, an analysis of the current situation, interviews, and the results of the survey and reflection. Finally, the conclusion and results section summarize the research, presenting the findings and recommendations developed by the study. The conclusion discusses the study's reliability, assesses its limitations, and suggests potential areas for further development and continuation.

2 Literature review

2.1 Supply chain management (SCM)

A supply chain is all the facilities, functions, and activities involved in producing and delivering a product or service from the supplier to the customer. Supply chains can be described as processes that include sourcing, production, and delivery—in other words, procurement, manufacturing, and distribution, all supported by shared information. The most common components of a supply chain are manufacturers, suppliers, transportation, warehousing, retailers, and customers. (Pukkila-Palmunen, 2023)

Supply chain management (SCM) focuses on integrating supplier and customer activities to ensure that products or services are produced with the right quality, at the right price, in the right location, at the right time, and in the right quantity while achieving cost efficiency. SCM involves managing the flow of information and products across a network of customers and supply chain partners to meet high-service-level requirements. Additionally, SCM is influenced by Corporate Social Responsibility (CSR), which introduces ethical, labor, and environmental challenges. CSR extends responsibility to all stakeholders involved, including both the primary organization and its suppliers contributing to the final product or service (Visser et al., 2010).

It has become more and more valuable to put effort into supply chain management. Supply chain management has a vital role in developing services, improving finances, and reducing operating costs. Well-implemented supply chain management provides a competitive business advantage and makes the company's marketplace more stable. The purpose of supply chain management is to plan and execute the supply chain and the organization's business operations effectively. This involves achieving optimal lead times, good quality, and cost-effectiveness. Economic value creation is the key element when completing the supply chain management while delivering the best value solutions for its customers. (Doumkos, 2018)

2.2 Sustainable development

Sustainability is determined as a global, regional, and local process of continuous and managed social change aimed at securing good living conditions for present and future generations. This also means taking equal account of the three sustainability dimensions environmental, social, and economic in decision-making and action. (Ympäristöministeriö, 2023). Sustainability can be referred to as the three Ps (3Ps) profit, people, and planet. (Bányai, 2022)

Sustainability was first introduced by the United Nations, World Commission on Environment, and Development in 1987. United Nations determines sustainability as (Visser et al., 2010):

"development that meets the needs of present generations without compromising the ability of future generations to meet their needs"

Sustainability policy has gradually developed and taken shape as an increasingly comprehensive and multifaceted policy (Ympäristöministeriö, 2023).

Sustainability is the responsibility of companies, public administrations, and other organizations for the impact of their activities on the surrounding society, stakeholders, and the environment. It is also referred to by other terms such as responsible business, social responsibility, corporate responsibility, and corporate citizenship. (Työ- ja elinkeinoministeriö, n.d.)

These three sustainability dimensions can be called as triple bottom line (Wosinska, 2023) Triple Bottom line (TBL) is a practical framework of sustainability that was created to expand environmental sustainability thinking to integrate also economic and social sustainability. TBL is created for the organizational level to focus on balancing the perspectives of environmental economic and social sustainability. (Alhaddi, 2015)

TBL can be defined as an accounting framework that includes these three dimensions. TBL is a sustainability measure and was created for the lack of it. TBL aims to measure and analyze the impact of organizations' activities on the world. TBL can be customized according to the organization's own needs and objectives. (Slaper & Hall, 2011)

At the organizational level sustainability can be seen as sustainability reports and legislations. Sustainability is nowadays a competitive advantage in business functions. Sustainability at the corporation level is implemented as Corporate Social Responsibility (CSR) or Environment, Social, Governance (ESG). As told sustainability, CRS, and ESG are all related to concepts focusing on sustainable business practices. Sustainability not only balances economic, social, and environmental considerations but also ensures business continuity and growth for the long term. For example, reducing greenhouse gas emissions, waste production, fair labor practices, cost-effectiveness choices, and increasing customer loyalty and brand reputation are all sustainability in business practices. (Wosinska, 2023)

CSR and ESG are approaches to demonstrate sustainability. CSR involves voluntary actions toward sustainability that go beyond legal requirements. ESG is a group of criteria that evaluates organizations' performance at environmental, social, and governance levels. (Wosinska, 2023)

Integrating the basic idea of sustainability into the supply chain and moreover to supply chain management it creates Sustainable Supply Chain Management (SSCM). SSCM includes sustainable procurement, includes sustainable production, packaging, materials, and transportation. This complete way of thinking about sustainability is becoming more and more important for businesses to stay competitive in today's fast-changing market. (Bányai,2022)

Sustainable development is related to sustainability. Sustainable development is an approach to development that aims to achieve sustainability by safeguarding resources for future generations while also addressing the needs of the current generation. Sustainable development aims to balance economic, social, and environmental dimensions for long-term continuity. Development should provide real improvements for human life while at the same time maintaining the diversity of Earth. (Visser et al., 2010)

Sustainable development balances human development activities while maintaining a stable environment. Climate change is one of the top challenges for sustainable development. Sustainable development provides new business opportunities for organizations and such as certification through firms can be part of the development and can qualify their products and manufacturing to buyer companies. (Visser et al., 2010) Organizations are highly trying to achieve and improve the best possible sustainable performance in their supply chain. Organizations do have a demand for sustainable development goals. (Wu et al., 2021)

Creative thinking is a trend that can be seen as cooperation for sustainable development. With a focus on creative thinking and problem-solving, sustainable development emphasizes improving processes, sharing information, and fostering cooperation. This collaborative approach not only drives innovation but also fosters a sense of shared responsibility, empowering communities to address complex challenges and create long-lasting positive impacts. (Awan et al., 2019)

2.2.1 Environmental sustainability

Environmental sustainability aims to maintain natural biodiversity and the functioning of ecosystems. Environmental sustainability takes care of nature and the environment. Some practical examples of environmental sustainability are responsible use of natural resources and responsible consumption. The purpose is to prevent releasing any harmful

substances into the environment. Prevention is a key element of the environmental dimension of sustainability. CO2 emissions, climate change, wastes, all other emissions, and harmful poisonous substances are all considered when working with environmental sustainability. (Ympäristöministeriö, 2023)

Environmental awareness means understanding the environment and understanding the impacts that humans have on it and the choices that benefit nature. Activities to prevent negative environmental impacts are carbon neutrality, a circular economy, cleaning oceans, protection of forests, and biodiversity protection. Carbon neutrality means reducing greenhouse gas emissions from energy production, transport, and industrial processes. The circular economy is a system designed to reduce, reuse, and recycle. Its purpose is to minimize waste by repurposing materials and resources. Cleaning the ocean refers to reducing pollution and waste from the whole environment and the ocean. Protecting forests is key to cleaning the air because trees store carbon dioxide. (Wärtsilä, n.d.)

The climate change is one of the most known global challenges. Most of the greenhouse gas emissions are coming from outside of the organizations, operated in their supplier's supply chain (Tidy et al., 2016). Because of climate change, organizations must show their responsibility and implement practices in their business, against climate change. These practices are referred to as carbon management practices. Carbon management should collaborate with companies' supply chains. Engaging suppliers in carbon management, climate-related risks reduce, and the flexibility of supply chains increases. It is very important to why and what it takes for companies to get involved in supply chain engagement especially those who are actively implementing carbon management into their supply chains. Research based on the company 345 Carbon Disclosure Project indicates that companies integrating climate change into their strategies and developing environmental public policies are more likely to involve their suppliers and customers in carbon management. Carbon management also includes adherence to quality management systems standards, such as ISO 9000 (Lintukangas et al., 2023).

Green Supply Chain Management (GSCM) is one of the green innovation concepts that focuses on waste reduction, product life cycle, and process improvements aiming to have minimal environmental impact (Srivastava, 2007). GSCM is categorized under supply chain management practices as sustainable supply chain management. GSCM can be seen as environmental management, customer cooperation, and other green practices (Sarkis et al., 2010). The environmental management system includes ISO standards and policies (Humphreys et al., 2003).

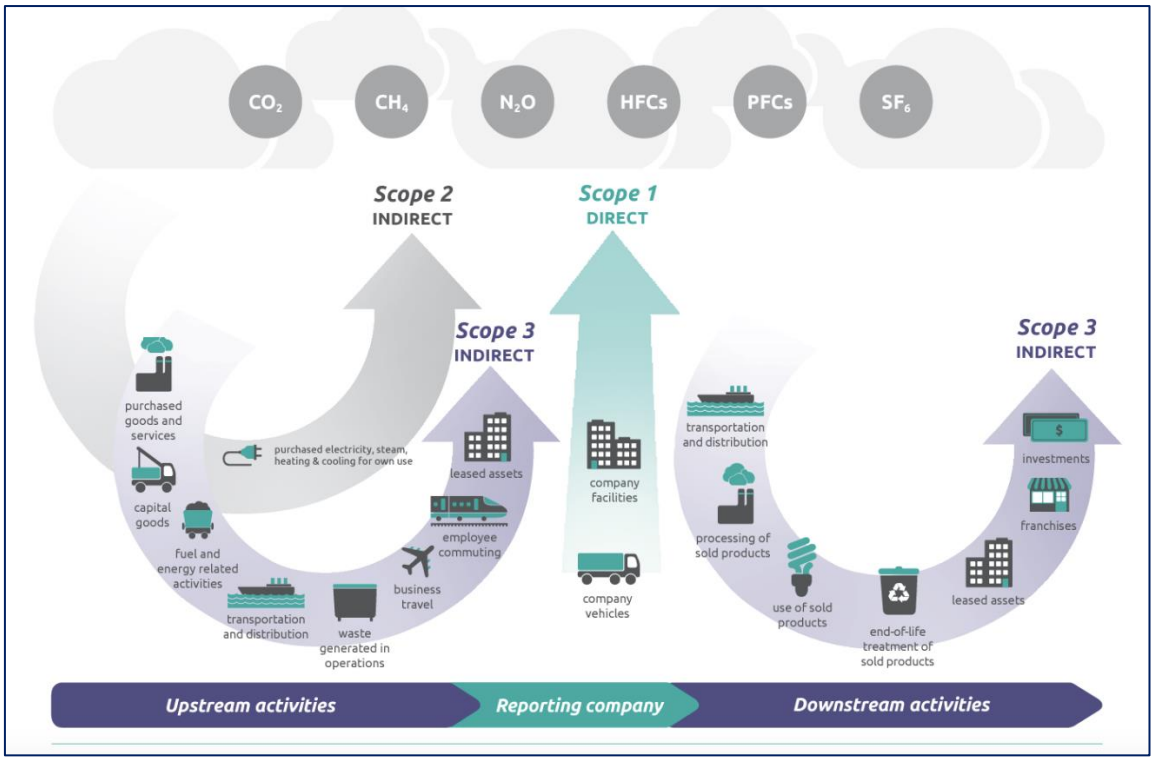
GSCM and green innovation work together, in terms of developing new environmentally friendly products and processes. This integration extends to eco-design and green operations, which aim to produce, deliver, and maximize sustainability benefits through innovative products and processes, with a focus on material use and energy efficiency. GSCM and green innovation add sustainable and environmental considerations to supply chain management practices. (Awan et al., 2019) Environmental competencies are for example, clean technology, use of eco-friendly materials, waste management, reduction of pollution, recycling, reuse, and remanufacturing (Humphreys et al., 2003).

2.2.2 Greenhouse Gas Emission Scopes

As said, there is a lot of pressure at the organizational level to act against climate change. The Greenhouse Gas Protocol is created to account and report greenhouse gas emissions, including all the activities in a company. This protocol serves as a tool for generating transparent information in accordance with policy terms, while also fostering a positive image among stakeholders and enhancing organizational competitiveness. (Feist, 2018)

GHG protocol divides emissions from the supply chain into three categories. These categories are referred to as Scopes. Scope 1 direct emissions are from the company production facilities. Scope 1 represents the reporting company. Emissions that are coming from the company itself from its own facilities (Kircher, 2021). Scope 2 indirect emissions

are from the purchased energies like cooling, heating, and electricity. Scope 3 indirect emissions are not owned, not from or cannot be controlled by the company. Emissions are divided to upstream and downstream emissions. Scope 2 and Scope 3 emissions from the purchased products and services belong under the upstream activities. Scope 3 emissions generated from processing, use, disposal, and end-life treatment are under the downstream activities. (Kircher, 2021) In other words, upstream scope 3 emissions are from the manufacturing phase of the supply chain as scope 2. Downstream scope 3 emissions are from the use after the company has delivered the product produced in the supply chain. (Feist, 2018; Ecohz, 2022)



Picture 1. Three scopes of supply chain emissions (Ecohz, 2022)

The protocol is designed to make it easier for organizations to understand emissions' impact on climate (Ecohz, 2022). The chart of greenhouse gasses increases the awareness of how all sustainable actions reduce greenhouse gasses. With the knowledge of the scope, there is a significant opportunity to impact carbon reduction targets and fight against climate change. (Feist, 2018)

2.2.3 EU climate policy

EU climate policy is created according to the United Nations Framework Convention on Climate Change, the Kyoto Protocol to the Convention, and the Paris Agreement on Climate Change. The EU is committed to reduce its greenhouse gas emissions. Additionally, the EU is targeting to achieve climate neutrality, including balancing and removing emissions by 2050. These emissions are regulated by the EU legislation. (European Commission, n.d; Ministry of the Environment n.d.)

The European Council has set “building a climate-neutral, green, fair and social Europe” as one of its strategic objectives. These 5-year strategic priorities for the EU aim to respond to the current global situation of climate change. The EU Commission has also set priorities for the years 2019-2024. The first is the European Green Deal. Green Deal purpose is to transform the EU into “a modern, resource-efficient, and competitive economy”. While at the same time protecting Europe´s natural environment, taking climate change under consideration, and making Europe carbon neutral and resource-efficient by 2050. (European Commission, n.d)

The European Climate Law incorporates these goals into legislation to ensure that every EU policy supports them and that all sectors of the economy and society contribute to achieving them. The EU Member States are responsible for implementing EU law on the ground. Every EU Member State can use and utilize even more intermediate targets. Members are responsible for their methods and tools to achieve remission reductions. EU offers financial support for each Member State to make the green transition possible. (European Commission, n.d)

EU emission trading system (ETS) is created for the climate policy. ETS includes large industrial, power plants, and electricity organizations from the European Economic Area (EEA). From the beginning of 2024 including also large marine transport emissions. The new ETS tool is launching in 2027 or 2028 for fuel distribution. ETS provides a consistent

approach for every Member State. (European Commission, n.d; Ministry of the Environment n.d.)

EU experiences risks of carbon leakage. The risk of carbon leakage is generated when organizations from EU Member States outsource some of their business function to a country that does not have climate policies or differs from the EU´s. EU has created a practical tool for the countries outside of the EU borders. Carbon Adjustment Mechanism (CBAM) purpose is to set up a fair price on the carbon emitted during production. CBAM determines carbon emissions cost for imported products. This way EU companies are in an equal position compared to companies from countries that have geographical and regulatory matters between the countries in terms of climate policy.

CBAM aims to ensure that the price of CO2 emissions from imports matches the price of CO2 emissions from outsourced production. EU encourages to clean industrial production. CBAM is created to be comparable to WTO regulations and it is aligned with the ETS It is an alternative for ETS not an overlap. The tool is applicable from 2026 but the implementation has started in 2023. (European Commission, n.d)

The CBAM tool requires a company to report or announce its carbon emissions associated with imported goods every year to ensure compliance with the European Union's carbon pricing regulations. This possible declaration should include the total quantity of goods imported, the total quantity of emissions from the imported goods, and the number of CBAM certificates corresponding to the total emissions. In addition, if the corresponding organization has not provided sufficient information or if the actual emissions cannot be verified, the number of CBAM certificates will be determined by specific default values. The cost of CBAM certificates will be connected to the weekly average closing prices of EU ETS allowances from all auctions. Each Member State will appoint a responsible authority to manage the duties outlined in the CBAM regulation, such as selling CBAM certificates and reviewing CBAM declarations. The Commission will provide support and coordination for the activities of these authorities.

The EU Corporate Sustainability Due Diligence Directive's purpose is to adapt sustainability into corporate governance and management systems. The EU companies have requested these kinds of rules and do think it is needed. The directive was proposed to the EU Commission in 2022. With the directive environmental considerations and responsible behavior can be seen as part of the organization's operations. The new rules will make sure that businesses take responsibility for the negative effects of their actions, both within their operations and throughout their supply chains, whether these are in Europe or elsewhere. (European Commission, n.d; Työ- ja elinkeinoministeriö, n.d.)

For companies, these new rules provide a unified legal framework across the EU, ensuring clear regulations and fair competition. This leads to higher customer trust and stronger employee dedication. Companies will gain a better understanding of their negative impacts on the environment, improving their ability to manage risks and adapt. These changes make companies more accessible to new workers, sustainability-focused investors, and public sector buyers. Additionally, there will be increased focus on innovation and easier access to funding. (European Commission, n.d)

For developing countries, countries where the supplier or production of buyer-organization may be located, the new rules will offer better protection for human rights and the environment. The countries will raise awareness among stakeholders about important sustainability issues, encourage sustainable investments, and enhance sustainability practices. Additionally, there will be a greater adoption of international standards and policies. (European Commission, n.d)

The key element of the directive is to recognize negative human rights and environmental impacts in the organization´s own operations. Large organizations must have a strategy against climate change and climate warming. The EU continuously encourages management to promote sustainable development and climate policies. the implementation

of the directive requires integrating the due diligence processes and practices into business operations and strategy. The implementation generates transition and operational costs for a company. EU Corporate Sustainability Due Diligence Directive adds administrative rules on sustainability-related activities, and enforcement of these rules with the threat of compensation and fines. (European Commission, n.d; Työ- ja elinkeinoministeriö, n.d.)

Businesses have a vital role when creating a sustainable economy and society. Companies do act against climate change and adapt sustainability to their businesses, but the transition is slow. The supply chain complexity and globalization make it challenging to get trustworthy information on suppliers´ operations. Therefore, it is challenging to create a responsible entity that operates according to a coherent set of rules, objectives, and policies. (European Commission, n.d)

2.3 Competitive advantage

Competitive advantage is determined to be the factor that differentiates the organization from other firms and enables the organization to establish its position compared to its competitors. The most common competitive advantages are price, quality, delivery, and flexibility. Organizations are always aiming to improve their organizational performance. Organizational performance reflects on how the market-oriented targets are achieved. With improved organizational performance and competitive advantages, firms can improve their economics, customer satisfaction, position in the markets, and reputation among stakeholders. (Li et al., 2006)

Well-executed supply chain management is a significant factor when achieving competitive advantage and developing organizational performance. Organizations are used to competing for the marketplace and customer demand. Competition has moved more into supply chains. Organizations were perceived as competitive if they delivered prod-

ucts or services to the right place at the right time and the lowest cost. Nowadays, development focuses on the supply chain to achieve the best competitive position. (Li et al., 2006)

Value creation is a product market strategy function, which determines the critical suppliers. Suppliers should capture value back but at the same time, buyer limits the supplier´s value capture. Buyers need to maintain value creation while designing the supply chain to decrease the supplier power. The value creation starts with finding out the suppliers' capabilities and how the ability can cause too much power for a supplier and this way to the whole supply chain. (Skilton, 2024)

2.3.1 Sustainable supply chain as a competitive advantage

When creating value through supply chain management, it is recommended to share the SCM to categories like purchasing and supply management, logistics and transportation, marketing, operation and organization management, and lastly information systems. These operations have been developed to be more efficient with functions, systems, and automation. It has been studied that SCM practices and their development do have an impact on the organizational performance and competitive advantage of an organization. (Li et al., 2006)

Value is created when the value of the production is lower than the value after the sale. For this reason, the development of the supply chain is vital. The products are usually outsourced to a supplier that has the critical capabilities. With these critical capabilities, suppliers have negotiating power. Thus, buyers want to limit the power of such suppliers. With multi-procurement, the buyer can control the power of suppliers or buy products from less capable suppliers. However, this is not clear, and products are often sourced elsewhere if they are cheaper or if it is otherwise convenient for the supply chain. Often the negotiating power of suppliers is also affected by the location of their production.

Studies have shown that negotiating power is limited by physical and cultural distance. (Skilton, 2024)

SCM practices can be evaluated and measured by various factors, the most vital for the research to focus on are supplier base reduction and long-term relationships. To measure buyer-supplier relationships, communication between supplier and the buyer-organization, cross-functional teams, and supplier involvement are involved. All these factors cover supply chains upstream and downstream. Other important factors regarding supplier engagement are information sharing and its quality, agreed vision, and objectives. Information sharing adds the partnership quality and flexibility in the supply chain. The impact of the supplier selection process on supplier involvement and production performance on competitiveness has been studied in how supplier relationships affect to cooperation and responsiveness. (Li et al., 2006)

SCM practice sub-constructs:

1. Strategic supplier partnership
2. Customer relationship
3. Level of information sharing
4. Quality of information sharing
5. Postponement

Globally, the aim is to double production but reduce resource use and CO2 emissions by 80% by 2050. Industrial sustainability concepts that organizations aim to achieve are cleaner production, eco-innovations which means life-cycle solutions, competitive goods, and corporate social responsibility (CSR). The redesign of business models to improve sustainable performance has been explored. The business model redesign is perceived as a more holistic view at the organizational level. (Bocken et al., 2013)

Redesigned business models:

1. Customer segmentation and value proposition

2. Key resources, activities, and partnership
3. Revenue streams and cost structure

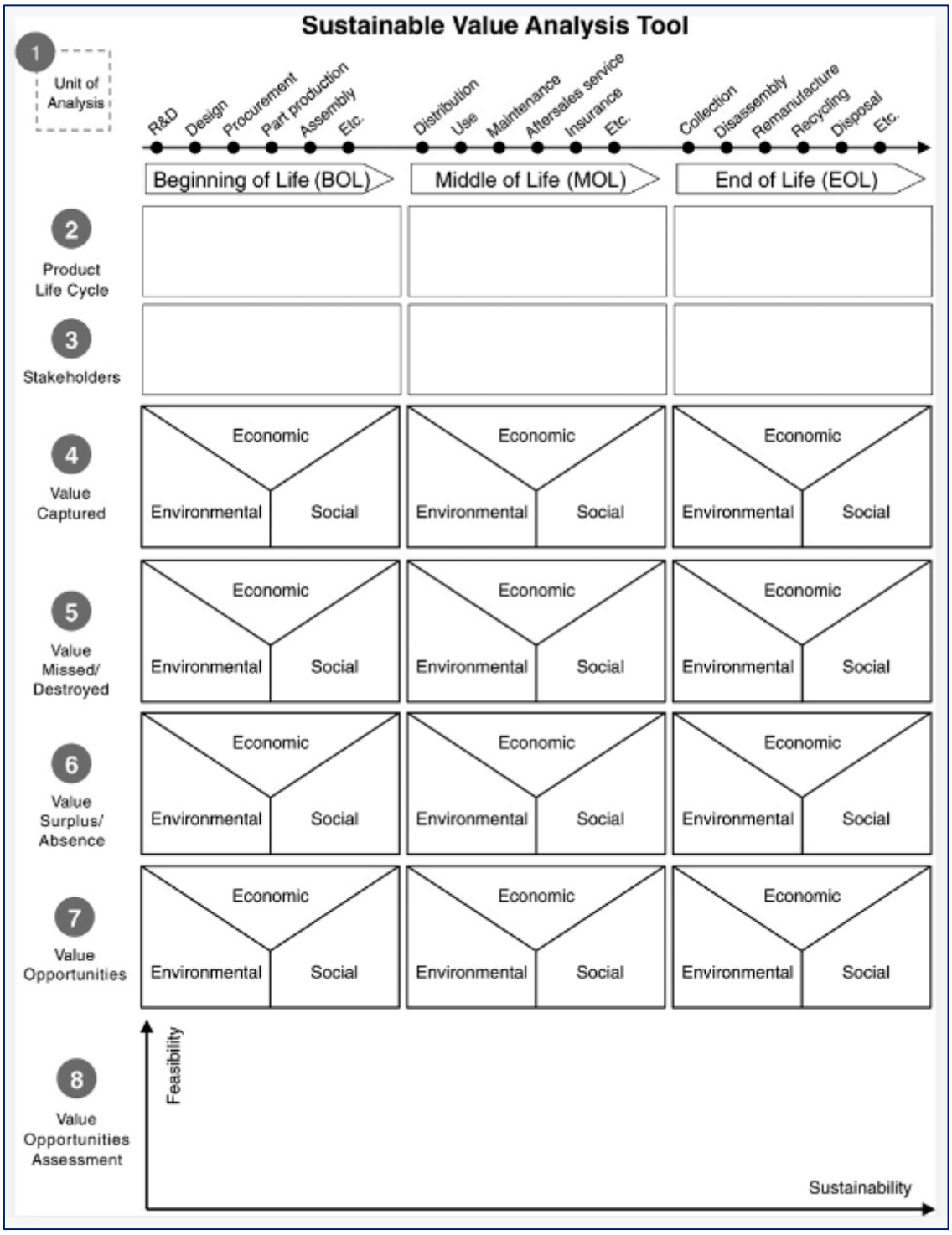
With a sustainable business model competitive advantage is created through customer value while developing sustainability at the same time. It has been researched that sustainable business models use both system and firm-level perspectives. The sustainable business model is based on the triple-bottom-line approach. It utilizes stakeholders broadly. Customers, investors, employees, suppliers, environment and the society. One example of a sustainable business model is a product service system (PSS), which has been said to have the potential to generate environmental benefits by internalizing negative environmental and social externalities. (Bocken et al., 2013)

Sustainable business models are found to be economically sustainable. Therefore, it is a solution for organizations to create economic value while improving environmental sustainability. Business models aim to innovate based on rethinking the value proposition. The challenge is that most of the business models tend not to focus on the dimensions of sustainability. (Bocken et al., 2013)

Yang et al., (2017) write that sustainability does not take place in business models or does not take notice of all three dimensions. Recommends not only to produce sustainable products but make the business itself sustainable. The Sustainable Value Analysis Tool provides a tool that addresses sustainability from the start of the process. Including the product life cycle value, environmental value, social and economic value. This tool creates an innovative process. Value creation from sustainability is based on four concepts.

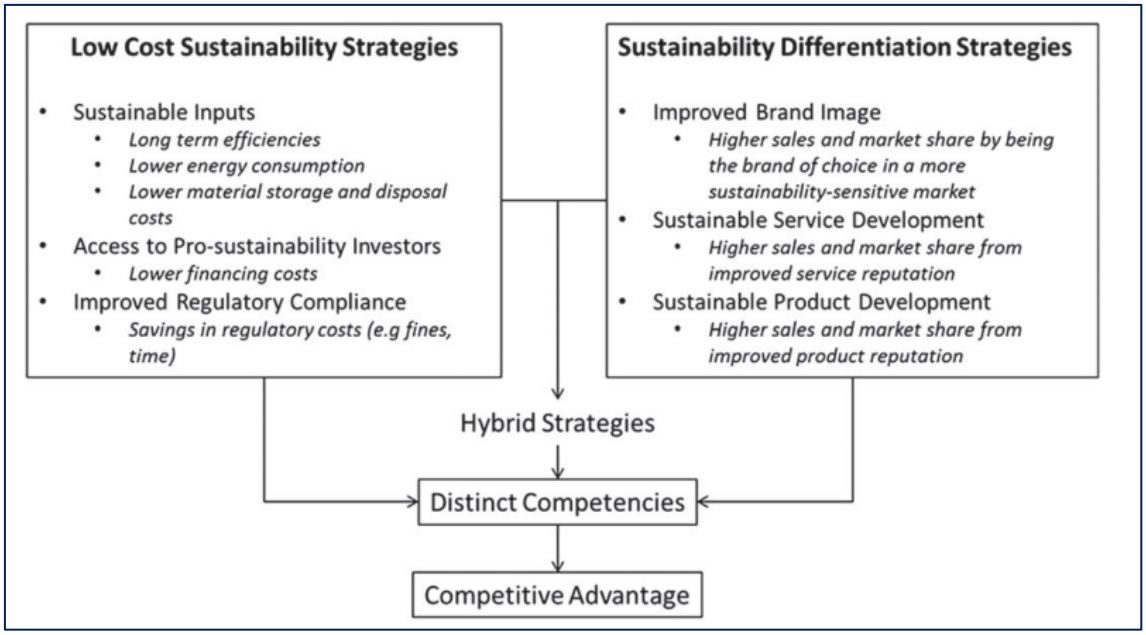
1. Lifecycle thinking
2. Multiple stakeholders
3. Value uncaptured
4. Economic, social, and environmental value

With these concepts, the framework can be created. With the framework, sustainability is evaluated and considered at every step of the process.



Picture 2. Sustainable Value Analysis Tool (Yang et al., 2017)

Environmental responsibility is claimed to provide a competitive advantage by increasing efficiency, meeting customer demand, and obtaining business performance. Marketing environmental responsibility is a strategic tool for the company. This marketing can establish a position in the market and build trust among stakeholders for whom sustainability and the environment are important. Companies compete to obtain various standards and certifications. Eco-labeling is intended to raise customer awareness of sustainability. Recognize that an eco-label on a product contributes to a competitive advantage. The key to sustainability marketing is to link the objectives of the individual organization with those of a sustainable environmental society. Companies willing to commit themselves to developing and implementing environmental sustainability because of public pressure or requirements have discovered the increase in consumer demand. The main dimensions to achieve organizational sustainability are risk reduction, increased efficiency, branding, and new market creation. However, the diagram below combines the pursuit of low cost and the four main dimensions of a hybrid strategy. (Walsh et al., 2017)



Picture 3. Competitive advantage from sustainable strategies (Walsh, 2017)

Sustainability workshops are presented to be one way to develop cooperation. During the workshops, information is shared and an understanding of key issues in sustainability are determined. Business models can enhance the exploration of value opportunities by considering possible shifts in technology, regulations, societal trends, environmental challenges, and competition that affect business performance. With the workshop approach, the idea is to form ideas and innovations for sustainability and to create sustainable value, workshops function well as two-way communication space also for stakeholders to express their needs. (Bocken et al., 2013)

2.4 Supplier selection process

The need for suppliers develops when some part of the business functions is outsourced. Usually, the non-core activity for example manufacturing is outsourced. When these kinds of functions are needed outside of the company, the supplier selection process starts. (Kannan &Tan 2002) The supplier selection process varies between every organization. Organizations have their own methods to certify suppliers**.** Some of the methods confirm supplier suitability with specific qualifications, for example, ISO certification. Some organizations might require certification by a third party. Organizations may demand a specific environmental policy or alignment to responsibility regulations for reached status. If all or some of the requirements are used only by your organization, it is recommended to develop a program where buyer-organization can communicate about requirements and supporting the supplier to achieve them. (Sollish & Semanik, 2012)

Suppliers' competitiveness depends on factors like quality, costs, materials, and the effectiveness of their supply chain. Logistics, packaging, and manufacturing processes are also all considered when evaluating the suppliers. Moreover, the ability to adapt to changing market demands, and technological advancements is increasingly becoming a key factor of supplier competitiveness in today's business environment. (Doumkos, 2018)

The most familiar supplier selection criteria are quality, on-time delivery, and price (Ho et al., 2008). Other valid criteria studied are cost delivery, reliability, flexibility, and quality (Chang et al., 2011). Nowadays supplier evaluation process should evaluate a wide range of factors. The latest, for example, technology and capacity (Buyuközkan and Cifci, 2011) It has been researched that with high-quality products, economic, environmental, and social losses can be prevented. Therefore, supplier selection has become a vital element in creating durable sustainable supply chain management. (Chen et al., 2019)

Table 1. Supplier Selection Criteria (Kumar & Pani, 2014)

Supplier selection criteria		
Different criteria used in supplier selection literature:		
Product quality	Delivery reliability	Warranties
Product pricing	Prodution	Technical cpability
Management capability	Supplier´s reputation	Finacial position
Labor relations	Service quality experience	Past business records
Reciprocal arrangements	Cultrual fitment	Communication barriers
Geographical distance	Foreign exhange rates	Trade tariffs
Trade restrictions	Buyer´s commitment	e-transiction capabilities
Quality management	IT standards	Cost reduction capability
Documentation	Design capability	Supply variety
Lead time/response time	Indirect costs	Response flexibility
Innovation	Favility planning	Safety adherence
Domain experience	Exporting status	Conflict relosulution systems
Customs duties	Product line dversity	Intimacy of relationships
Inventory positions	Electronic data interchange	Value-added productivity
Total cost of acquisition	Risk perception	Certification and standards
Research and development	Organicationl culture	Availability of parts
Sub-component pricing	Regulatory compliance	Self-audits
Billing accuracy	Cost reduction performance	Indirect costs
Service quality cedence	Supplier´s commitment	Skill level of staff
Exporting status	Packaking capability	Intellectual property rights
Data administration	Improvement commitment	Procedural compliance

When considering this on the manufacturing level factors such as cost, delivery time, quality, and transit losses are the most critical ones (Kannan et al., 2002). (Buyuközkan & Cifci, 2011) has found that companies have demanded the use of ISO 14001. ISO 14001 is an environmental management system, and it is aiming to highlight the use of environmentally friendly materials and technology (Govindan, 2013). The organization has assessed and combined models and methods to multi-criteria decision-making models to get the best out of supplier selection (Govindan, 2015).

2.4.1 Sustainable criteria

As said global awareness continuously rises about sustainability. Companies are applying sustainability to their functions like sustainable supply chains because of the regulations, policies, and consumer demand. (Lin et al., 2015) Global industries do not only aim to choose more sustainable suppliers but also try to respond to market demands and maintain high competitiveness in the market. Aiming to be a more sustainable company, organizations should make current decisions without any harmful impact on the environment society, or business stability. (Tirkolaee et al., 2020)

Sustainable development can be seen now as a strategic task in organizations. (Benn, 2013) Environmental challenges have received more and more attention from the government and the public. Sustainability has become a long-term objective in every sector. Consequently, supplier selection models have taken into consideration even more responsible factors. (Azadnia et al., 2013) Suppliers have an important role in implementing sustainable supply chain activities and initiatives when achieving the social, environmental, and economic aspects. Unsuitable suppliers must be constantly evaluated based on social responsibility and environmental harm. (Shen et al., 2013)

Factors that can used as sustainable criteria are, for example, packaging materials, amount of pollution, emissions, and energy consumption. Buying organizations can consider modes of transport and the origin and location of materials. There are also interest in the recyclability of products and the circulation of material. (Humphreys et al., 2003)

Green supplier selection is a multi-criteria decision-making approach (MCDM). Commonly supplier selection criteria are cost, quality, delivery time, and service levels. There are very few studies on a supplier selection process that consider all economic, environmental, and operational factors. A benchmarked model or framework is not yet provided. (Govindan et al. 2015)

The table below presents a wide range of valid sustainable criteria that a buying organization can use in the supplier selection process but also, of course, in defining the supplier's requirements. These criteria are called Green Supplier Selection Criteria, regarding the previously mentioned multi-criteria decision-making approach. The table consists of four sustainability categories environmental, economic, social, and operational dimensions. (Govindan, 2015)

Table 2. Green Supplier Selection Criteria (Govindan et al., 2015)

List of GSSC, Green Supplier Selection Criteria	
Environmental	
Pollution control	Green transportation and distribution
Environmental awareness	Green marketing
Pollution production	Green image
Emission control system	Green innovation
Total carbon footprint	Reverse logistics
Effective waste management	Green competencies
Recycling	Environmental planning
Environmental Management System (EMS)	Use of renewable energy
Top management commitment	ISO 14001 certification
Use of eco-friendly material	Collaboration with suppliers for GSCM
Eco-design/Green design	Clean production technology
Green product	Environmental legislation
Green purchasing	
Economic	
Transportation cost	Investment in environmental protection
Water usage cost	Green product cost
Cost of disposal, recovery, and recycling	Energy consumption cost
Investment in corporate social responsibility	Cost reduction
Social	
Health and safety measures	Social responsibility
Employee wellbeing	Comfort and convenience
Staff training	
Operational	
Latest machinery	Resource consumption
Lead time	Scrap reduction
Quality improvement	Technology standard
Wastewater treatment	Product disposal
Inventory management	Design for proper utilization of resource
Production management	Co-operation with customers for green product development
Technology capabilities	Use of energy-efficient technology

2.5 Supplier engagement

Early supplier engagement in product design increases cost efficiency and decreases cycle time by utilizing the supplier's process strength. Supplier engagement enables finding the optimal solutions. It is found to be profitable to engage multiple suppliers so that you can ensure alignment of processes. Working in cross-functional, multiorganizational teams delivers the best possible result. Finding the methods and processes that give the best advantage for both parties. (Sollish & Semanik, 2012)

Supplier engagement focuses on mutual goals in the buyer´s organization's operations. Collaboration can be participation in problem-solving, other business functions, or an interest in working towards common goals. A collaborative project where the responsibilities are shared gathers strengths from both parties to develop improvements. Shared knowledge as it is jointly developed, provides a competitive advantage to the entire supply chain. Output from collaborative working adds marketplace value and offers sustainability. (Sollish & Semanik, 2012)

Product innovation and improvement require continuous stakeholder participation. Research has shown that supplier engagement is vital for adapting new sustainability practices (Awan et al., 2019). Supplier engagement is determined as a shared decision-making process (Molm, 1990). It is crucial to have interaction and good communication between the buyer and supplier for improving and developing learning abilities through social capital and combining business operations. Sharing information and resources creates positive organizational creativity and new solutions (De Clercq et al., 2012). Social capital increases relationships and collaboration (Sundgren et al., 2005). Engaging with suppliers is useful for generating sustainability-oriented ideas and solutions, especially those that go beyond what creative thinking alone can achieve. (Kajzer Mitchell and Walinga, 2017).

The article presents a FUSION a supplier-partner program. Fusion creates strategic value for project-based organizations. Every company is aiming for cost savings, but FUSION

considers a more holistic approach to provide the best value. Everything is based on the price structure of the product or service. The price mostly consists of maintenance, environment, quality, and transport costs. The FUSION program creates value for the customer supply chain and provides innovations, cost options, and quality by focusing on early supplier engagement. Article presents that suppliers should be engaged in the business when 80% of the product costs are recognized. It creates value for both if the supplier is engaged in the early stage of the product design. (Doumkos, 2018)

FUSION aims not only to cost savings but also to produce added value and optimize the supply chain. With FUSION customer value is added but also the common strategy and the roadmap between the organization and the supplier have been created to achieve long-term objectives. For example, sustainability goals and environmental targets. (Doumkos, 2018)

This way organization can offer additional benefits for its supplier like extended warranties and payment terms. Highlighting the life-cycle services and sustainability initiatives. FUSION focuses on metrics like Key performance indicators (KPI), service level agreements (SLA), and other benchmarking for more individual implementation. (Doumkos, 2018)

2.5.1 Supplier Relationship Management (SRM)

One of the key responsibilities of the procurement department is to effectively manage relationships with suppliers. Regular meetings and the use of communication tools are the basics of good working relations. A close, collaborative relationship makes it easier to negotiate on possibilities, requirements, and prices with suppliers. Regular meetings offer a great opportunity for management or representatives from both organizations to exchange technology or business development plans and strategies. Consequently, the strategic relationship is utilized. (Sollish & Semanik, 2012)

Other possibilities to maintain regular contact between the buyer and supplier are orderly supplier surveys, improvement teams, newsletters, and mutual visits. Surveys not only provide information about organizations' effectiveness but also identify problem areas that may cause additional costs. Surveys are a way for open communication and feedback tools for suppliers. Surveys summarize the development journey of the supplier. Improvement teams offer an opportunity for suppliers to attend projects or workshops that help to improve overall operations. Newsletter via email is an easy way to give overlook to suppliers what is happening currently in buyers' organizations. (Sollish & Semanik, 2012)

Such a project or meeting does not have to be directly related to the product but helps to share information on current issues, and organizational goals and plans. Visits enable both parties to get to know how operations work so that especially buyers can be aware of capabilities, strengths, weaknesses, and subjects that need support from one another. Visits offer a possibility for buyers to see step-by-step how products or services are produced. (Sollish & Semanik, 2012)

Interorganizational communication works best when it goes both ways and includes everyone in the organization. Good communication can lead to great results. For instance, sharing trends and forecasts can help reduce delays by getting suppliers ready to quickly handle unexpected demands. (Sollish & Semanik, 2012)

Expected supplier performance levels are included in the contract details, product specifications, or in the description of work for purchase. Service levels are often evaluated, they can also be included in the contract known as a service-level agreement (SLA). SLA metrics or key performance indicators (KPI) are included to define the expected performance of the supplier. (Sollish & Semanik, 2012)

Organizations use automated platforms and systems determined by procedures to observe supplier performance. The supplier review process is implemented and executed

as regular meetings, site visits, product testing, and customer surveys to find challenges when reaching common targets. The next step is to execute a corrective action plan. (Sollish & Semanik, 2012)

An organization's business review process is one of the most accepted formats used to review performance. The performance scorecard is a collaborative tool to deliver supplier reviews. The scorecard summarizes the supplier's performance according to the metrics determined in the SLA. Performance is categorized into quality, cost, on-time delivery, and service on the scorecard. (Sollish & Semanik, 2012)

When developing performance improvement first the current state should be analyzed, likewise, challenges are gathered. After the analysis action plan is created and then implemented into the business. Afterward, improvements are discussed and then the cycle framework is ready to repeat. (Sollish & Semanik, 2012)

At the organizational level supply chain and procurement departments have an advantage and the right position to add strategic value for the organization, find new business opportunities, build valuable relationships with other companies as a part of the supply chain, share values, innovation, ideas, and information of the business. Collaboration with suppliers has contributed to new learning that develops improved methods and creates new business opportunities. The buyer organization can utilize a priorities system based on the level of supplier qualification or certification. However, it is important to offer support and guidance if needed. Not forgetting to encourage suppliers to work towards the common targets. (Sollish & Semanik, 2012)

One way to develop supplier relations is by forming partnerships and alliances. Partnerships and business alliances are usually created to fill specific needs. Partnership or alliance suit well for companies that have a target to create a new product, service or to develop their performance that neither have the resources or capabilities to forward

alone. These kinds of ideas are found in market research or opportunity analysis. (Sollish & Semanik, 2012)

Before approval outlining the partnership, the strategic benefits, and potential threats are prepared and discussed through. Suppliers are good to know that generally, this kind of alliance adds investments. The partnerships and alliance projects are executed with cross-functional collaboration that aligns two organizations' strategic objectives. Organizations engaged in partnerships or alliances form contracts about roles and responsibilities, as well as performance-based benefits. Successful partnerships depend on everyone fully participating. It's important to develop measurements to evaluate how well each partner is committed. There must be continuing benefit for both parties to maintain the relationships. In general, successful long-term partnerships have to have high-level awareness and support. The relationship will continue as long as both parties have the willingness and resources to continue. (Sollish & Semanik, 2012)

Many of the processes mentioned above are strengthening supplier relations. These processes that are used to form the relationship can also continue to be used to strengthen them. It is the buyers' organization's responsibility to build and sustain important working relationships with suppliers. Trust between the buyer and supplier is one of the key elements in well working relationship. Research has shown that with open and honest communication and commitment, supplier relations have succeeded. (Sollish & Semanik, 2012) The relationship between the supplier and the organization is vital. Challenges with deliveries or quality are easier to handle and deal with when there is open communication, common expectations, and objectives between the stakeholders. (Kannan & Tan, 2002)

2.5.2 Sustainable supplier engagement

Environmental pressure is increasing, therefore big organizations have begun to evaluate their supplier's environmental performance. It has been researched that purchasing

functions have a significant role in performing and developing sustainable factors. A sustainable supplier selection process does not only answer to legal or public pressure but also gives competitive advantages and a competitive viewpoint for businesses to develop. Consequently, large organizations have started two major processes to change purchasing processes. First, reducing the number of firms from the supplier base. Second, organize close and reliable collaboration with the supplying companies. (Humphreys et al., 2003)

It has been studied that supplier engagement increases if the supplier company is profitable. There is no cause-effect relationship between the organizations that have strict environmental regulations and supplier engagement. A well-executed collaboration between the supplier and the main organization can increase supplier engagement to produce and deliver their products more sustainably according to their buyer's targets and strategies. (Lintukangas, et al., 2023)

The strategies firms adopt to reduce emissions are often driven by their ethical values and motivations for embracing carbon management and engaging supply chain members to seek sustainability (Paulraj et al., 2017). Companies choose to involve their supply chain partners in disclosing emissions to encourage collaboration, driven by either their relational or moral motivations. Organizations' reasons for acting, whether driven by ethical concerns or relationship-building, are connected to their business strategies, operations, and the environments where they engage with their supply chains. Different levels of commitment and engagement can be executed between a large number of suppliers. Disclosure of the amount of the emissions can be one of the options to make environmental decision-making easier. One of the drivers to engage the supplier into sustainability is searched to be buyer’s pressure. Therefore, it is important to consider consumer behavioral perspectives and customers’ willingness to engage in sustainability initiatives (O’Brien et al., 2020).

Organizations have a lot of reasons to implement sustainability into their business. A company can have a motive to achieve economic benefits, improve its performance, or increase shareholder value (Paulraj et al., 2017). Sustainability and carbon management have also an effect on a company's reputation. Companies may strive to respond to customer awareness, expectations, and demand by increasing responsibility. Of course, environmental regulations are the biggest reason that adds pressure to respond to the responsibility. (Paulraj et al., 2017)

The strategic and competitive advantages are achieved the best with the collaboration with suppliers with a common mindset of producing and developing products in a sustainable way. Organizations committed to carbon management view their suppliers as a vital resource. Sustainability does not only occur in the buyer’s company but also in the suppliers' supply chain through active collaboration based on supplier engagement. Systems that are common for both parties implementing sustainability assessment foster transparency through disclosure (Gualandris et al., 2015).

Previous studies have emphasized the importance of involving suppliers to enhance the sustainability performance of companies. (Sancha et al., 2016; Tidy et al., 2016). Companies cannot control their suppliers, buyers can lead as role models, work together with them, and set standards, developing their suppliers’ engagement in their sustainability execution (Amaeshi et al., 2008). By using sustainable supply management practices, organizations can affect and engage their suppliers, and by building on collaborative relational practices drive the company to competitive advantages (Kähkönen et al., 2018). The relational view explains economic, environmental, and social benefits (Villena et a., 2021l)

Supplier engagement programs are important tools used in emissions mapping (Tidy et al., 2016). Marketing and purchasing functions have an essential role when implementing sustainability more into the supplier's supply chain. When suppliers can demonstrate

new sustainability efforts in their products and services, like obtaining a sustainability certificate, it encourages them to engage even more (Foerstl et al., 2015).

2.5.3 Supplier development

Sustainability as a part of supplier development is a critical factor of sustainable supply chain management and requires multi-stakeholder collaboration. Global competition among organizations takes place in supply chains (Li et al., 2006). Sustainable supply chain management (SSCM) is a key strategic tool. Sustainability can provide improved business performance, innovations in products, and risk management. (Hofmann et al., 2014). Supplier development is considered as important strategy among the other SSCM practices. Supplier development practice is determined as a practice executed by buyers that improves suppliers' performance and capabilities in a short and long-term target (Krause et al., 2000).

It is not profitable to find new ones or change suppliers to fulfill sustainability goals because of the high transactional costs. Therefore, supplier development becomes more important in terms of sustainability. It is more profitable for a major buying organization to focus on developing the sustainability of its suppliers than to consider supplier replacement of a valuable supplier that guarantees material availability, economic performance, and reliable deliveries. (Liu et al., 2018) Supplier development for sustainability is not only achieving the responsibility goals but also affects to supplier selection and evaluation (Zimmeret al., 2016).

It has been perceived as challenging to research because the Supplier Development of Sustainability (SDS) literature is not extensive, and it is already very difficult to obtain answers as a case study of one company. Suppliers are also often considered as an external part of the responsibility strategy. Participation roles should be identifiable in SDS practices, as well as the impact these roles have on goals, processes, and efficiency. (Liu et al., 2018)

The strategy proposed by (Krause et al., 2000) includes factors like competitive pressure (CP), incentives (IC), evaluation and assessment (EA), and management involvement (MI) in terms of supplier involvement in sustainability. (Modi and Mabert,2007; Douet al., 2015) has added a fifth factor that is knowledge transfer (KT) to the framework.

In the industrial sector, because of the wide coverage and high diversity, the resources for implementing SDS are challenging to recognize. The support from the buying organization can be challenging to get due to minimal resources, because of this the supplier development becomes more combined with the supplier selection and evaluation business processes. (Liu et al., 2018)

A simple four-step framework includes planning, recruitment and engagement, implementation, and follow-up. Previously mentioned factors: competitive pressure, incentives, evaluation and assessment, management involvement, and knowledge transfer are also included in the framework. Going through the framework can lead to supplier selection, re-selection, or ongoing improvement of the current suppliers. Progress is tracked through supply chain management performance metrics. (Liu et al., 2018)

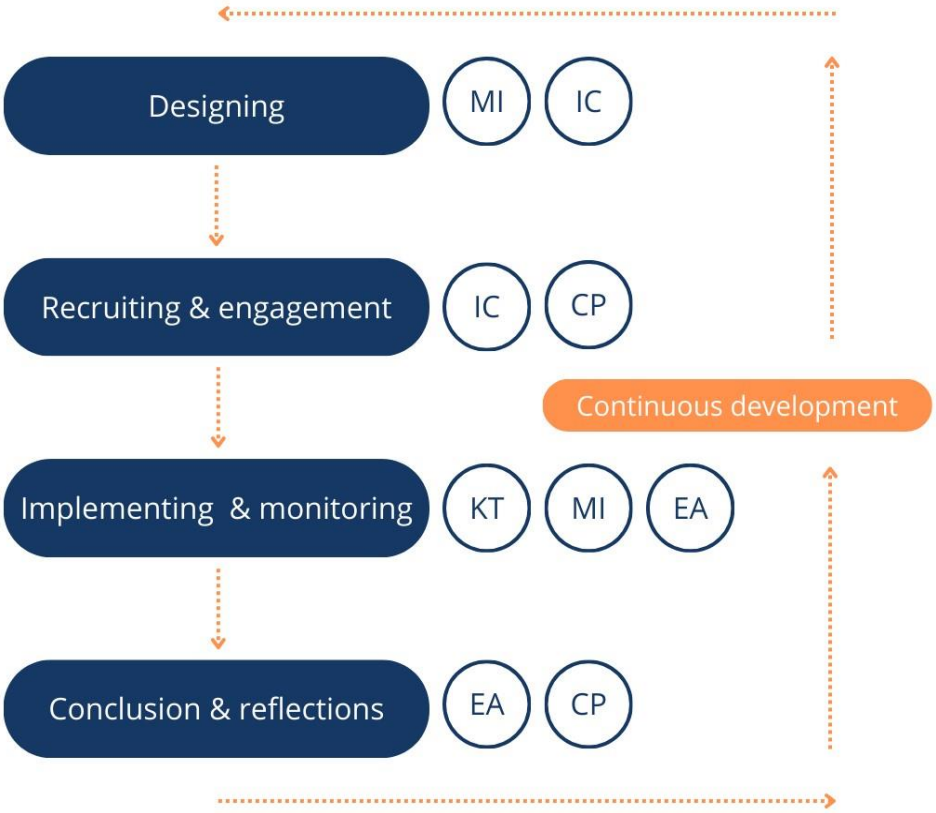


Figure 1. Supplier development framework (Liu et al., 2018).

Briefly, everything starts by determining the scope of the sustainability or common issues to be addressed. By determining the participating suppliers, enhancing regular open communication between these two parties, and having feedback sessions on how sustainable practices have been taken into business functions the cycle has been completed. When the cycle is done, the future strategies for sustainable practices are determined. The long-term impact is qualified with the cycle function as a continuous development. (Liu et al., 2018)

There are two approaches to utilize the framework coverage and performance. The coverage approach focuses on resources and work capacity. The performance approach considers to the managerial and behavioral results of suppliers. The performance ap-

proach is shown in practice as a numerical presentation, for example, emissions, consumption, and injuries. Coverage is more practical and can be for example training sessions, and human interaction. (Liu et al., 2018)

3 Methodology

3.1 Data collection

Since the aim is to study the current state of supplier engagement in case company, the data collection is carried out with their documents and process descriptions. Therefore, the first step of data collection is executed by examining the case company's internal data, documents, website, and other relevant materials. Internal data captures documents on Sustainability targets, Emission data, Supplier requirements, supply chain decarbonization, directives, and laws. Also, examining process descriptions of Supplier Compliance Assurance assessment which includes the supplier selection process and vendor management system rating (VMS) executed in the case company is part of the current state data collection.

The second step of the research and data collection is executed by a third-party consultant firm. Case company has instructed them to carry out a survey about decarbonization and emission reduction targets. My role is to be an observer and attend to the interviews. The third party is executing 20 interviews for suppliers from x different component categories. The interview questions are planned in advance but are open for discussion. Representatives of suppliers share quantitative and qualitative data about their sustainability and emissions. With these interviews, case company aims to understand what can be expected and demanded from the suppliers.

The last part of the data collection is to send a supplier questionnaire. The questionnaire is to be sent to approximately 200 selected suppliers from the remaining categories. These questions are the same as the third party has used in interviews. The survey is done by the form of a forms-survey. Before sending the questionnaire, I contacted approximately 14 category managers to share the supplier contact details. Case company expects a 1/3 answer rate from the survey.

Since the aim is to provide recommendations for developing the current state, the research collects data on the existing implementation. Therefore, interviews and surveys are chosen as data collection methods. This approach allows the study to gain insights from both the company's perspective and the perspectives of the interviewed suppliers. By identifying any differences or varying opinions and responses, potential gaps can be addressed. Additionally, based on the interviews and survey results, case company plans to establish numerical targets for suppliers to reduce emissions and support decarbonization by the end of the year. These targets will be used to evaluate the commitment, competence, and cooperation of the suppliers in the study.

3.2 Data analysis

Once enough information has been collected, the analysis phase begins. The research can be said to be qualitative even though the interviews contain a lot of numerical data. However, it is not the purpose of the study to analyze that. The study is a qualitative content analysis, which can be described as a subset of current state analysis. The idea of content analysis is to explore the content and themes available in the data. If the current state analysis is to identify and assess the current state of an organization or process, the content analysis method is used.

Because the data is analyzed by conducting a current state analysis, the analysis is an examination of current issues and challenges regarding supplier engagement in environmental sustainability. The analysis phase identifies areas for development and action. The proposals and suggestions that this master thesis aims to establish will be outlined according to data, interviews, questionnaire, and collected information from the literature part.

The size of how big customer case company is to the supplier can be identified and adapt sustainability requirements accordingly. We can locate key suppliers geographically and

rate them based on the emissions they cause. Suppliers are compared by emission numerical data. Even though quantitative methods are used as diagrams in this part the result the research is looking for is qualitative. Therefore, the comparison executed as quantitative does not affect to qualitative research.

Here under, the methodology is presented as a research methodology structure.

Figure 2. Research methodology structure

4 Research results

Research is written on behalf of Finnish Machine building company. The company is a large global innovative technology company that provides lifecycle solutions. The business areas are Energy, Marine and Portfolio Business. Company´s main products are engines for marine applications. It provides electrical, fresh water, gas, waste solutions, and all kinds of navigation, automation, propulsors, and gears for ships. For energy, this case company provides power plant products and solutions for energy storage and energy power systems. Because of case company´s broad product category, it needs a large network of suppliers around the world to work with. Case company works together with 25,000 suppliers. Alongside a wide range of products, the case company continuously aims to improve its environmental and economic performance together with its suppliers. Case company´s values are customer success, passion, and performance. The case company works in 79 different countries and has 17,800 employees. The company has been very successful recently. The turnover is about 6000 million.

Despite a wide and successful range of products, the research focuses on supplier relations and their engagement in value creation with the environmental sustainability supply chain. All business functions operate in accordance with case company´s Code of Conduct. The most relevant document for this work and for the current state analysis is the Supplier Compliance Assurance process procedure which contains a detailed description of the supplier selection process and the various supplier definitions. The supplier Compliance Assurance process verifies that all suppliers meet the supplier requirements. This also applies to all case company´s freight carriers and their subcontractors.

4.1 Current state analysis

When considering big manufacturing organizations, there are a lot of suppliers all around the world. Supply chain and supply chain management should be carefully thought out and planned. The current state analysis aims to examine and provides an overview of

the current state of the supplier selection process in the case company and focuses on evaluating the criteria used in the selection process. The analysis more closely presents how everything is executed now and focuses on identifying gaps that can be developed to enhance environmental sustainability. Overall, the organization has mandatory requirements for suppliers to comply with. These are case company´s supplier requirements, Code of Conduct and Quality, Environmental, Health and safety policy. The compliance is ensured by the following Supplier compliance assurance process.

4.1.1 Supplier Selection Process

Supply Management is responsible for the supplier evaluation. Case company determines suppliers as potential, prospect, or as an active supplier. A potential supplier is determined as a company that offers products or services but is not yet case company´s supplier. A prospect supplier is a company that offers products or services that are required or needed by case company and demonstrates compliance with case company´s supplier requirements and will be further assessed before possible approval but is still not yet a part of the supplier base. Active Supplier is a company that is acting as case company´s supplier and has an active vendor ID.

After the need or demand for a new supplier is discovered, it may arise from the supplier's interest in offering products, case company's interest in establishing new business with a supplier, or the expiration of an existing supplier's approval status. The Supplier Compliance Assurance process is then executed step-by-step. This process includes three steps, which must be carried out in order.

1. Information collection
2. Risk evaluation
3. VMS rating

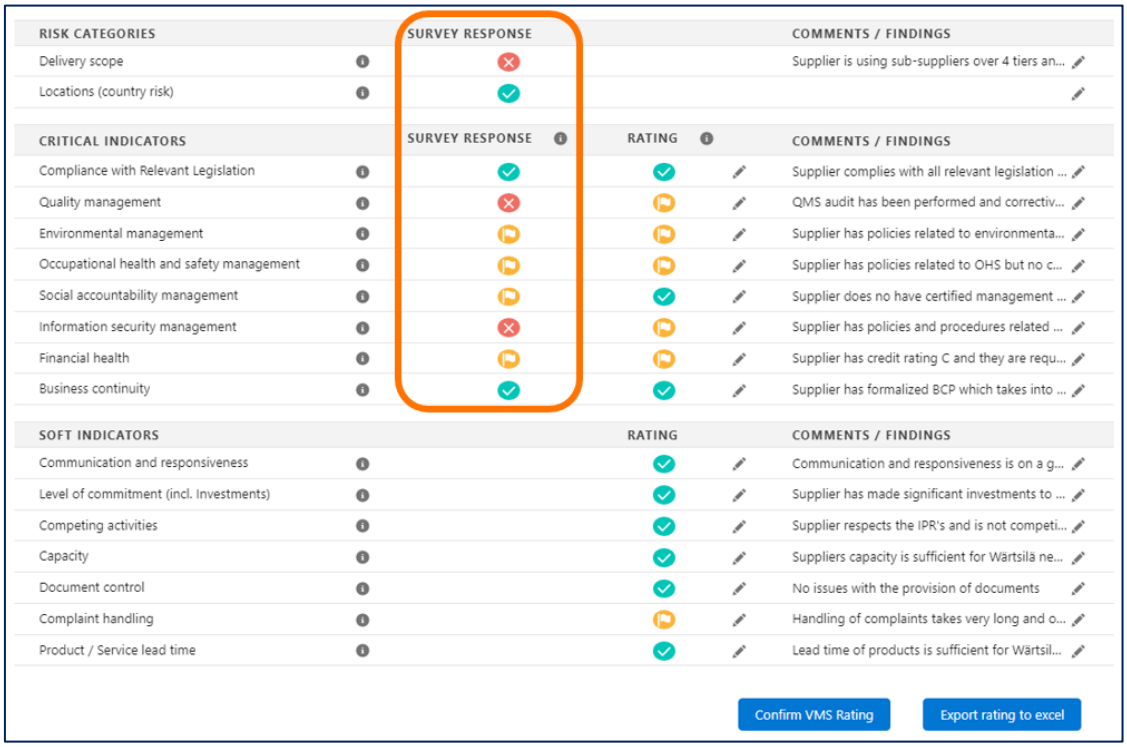
In addition, case company has additional steps and further requirements for new suppliers providing safety-classified components. These will not be covered within the scope of this study due to its limitations.

The case company has many ways to collect the information, but the most efficient way to get the overview is to use the Supplier Assessment Questionnaire. The questionnaire is recommended for use whenever the company is onboarding a new supplier. Interviews, information searched from the internet, and feedback from the previous internal stakeholders can all be used as needed information. In addition, case company conducts Due Diligence research to help identify and manage risks associated with a supplier, ensure compliance with regulations, and safeguard case company's interests and reputation. Supplier Assessment Questionnaire is an information collection tool that collects information on the supplier’s operations and capabilities from the following 10 areas:

1. Delivery scope
2. Country-Location
3. Compliance with relevant legislation
4. Quality management
5. Environmental management
6. OH&S management
7. Social accountability management
8. Information security management
9. Financial Health
10. Business continuity

New suppliers get access to fill out the questionnaire if the company has applied as a new supplier at the case company´s website or by receiving an invitation to fill out the questionnaire. Once the questionnaire is fulfilled, it provides an automatic risk evaluation based on the answers. Topics from the questionnaire are categorized under risk categories, soft indicators, or critical indicators. A three-color system evaluates critical and

risk factors. Color green identifies low-risk levels that do not need any actions. Color yellow identifies a medium risk level. The risks identified in this category should be investigated more. The third color is red which presents a high-risk level. Identified risks can significantly impact sourcing and should therefore be thoroughly investigated. The below image is visualizing the system.



Picture 4. Three-color risk evaluation system

All suppliers are evaluated by the Supplier Risk Impact Score. The risk impact score expresses the possible harm that potential supplier failure would cause to the company's business. The score is automatically calculated after the questionnaire. There are three different point scales for all three colors. The risk impact score is used as an input for performing supplier segmentation. Supplier segmentation is presented further after VMS rating.

The next step in the selection process is Vendor Management System (VSM) rating, which analyses the strengths and weaknesses of the suppliers. VMS rating is supporting the supplier selection, developing the active supplier base and supporting suppliers to

meet additional expectations. The purpose is to complete case company´s supplier requirements. If there are any lacks, an improvement action plan shall be used.

VMS rating evaluates 15 areas:

1. Compliance with relevant legislation
2. Quality management
3. Environmental management
4. Occupational health & safety management
5. Social accountability management
6. Information security management
7. Financial health
8. Business continuity
9. Communication & responsiveness
10. Level of commitment
11. Competing activities
12. Capacity
13. Document control
14. Complaint handling
15. Product/service lead-time

The result of the VMS rating is presented as approval status. Approval status reflects the level of compliance with the Supplier Requirements. Status can be approved, approved with remarks, or banned. If the potential supplier is rated as approved, the supplier is noticed as a supplier without any limitation. Suppliers approved with remarks must take an action plan and implement it within the deadline. If the supplier gets status banned, a supplier cannot be used as the case company's supplier in all matters.

Active suppliers are evaluated again regularly, and the VMS rating is executed again to evaluate the supplier's suitability. There are four main reasons for renewing the VMS rating. First, before the current rating expires. If there are any significant changes in the

supplier's organization. Also, if the performance of the supplier is declining. Lastly, if the renewed rating is otherwise seen necessary to execute once again.

The case company has 4 segmentations where suppliers can be allocated. Segmentation is performed after the VMS rating. The risk impact score is used as an input for performing supplier segmentation. Segmentation is highly relevant and an integral part of the Supplier Relationship Management strategy. Segmentation helps to understand where to focus and how to use and utilize resources effectively. Four segmentation sectors are leverage, strategic, standard, and bottleneck. Allocation is handled considering the business value in relation to risk impact score.

4.1.2 Supplier relations

Machine building company believes that active engagement with their stakeholders is important for developing business activities. Case company values as well shared information, long-lasting relationships, and the contribution of building sustainable societies. Case company´s most important stakeholders at the corporate level are customers, owners, suppliers, employees, and society. Subsidiaries of case company define their own primary stakeholders. The stakeholders mentioned before, includes residents as well close to production, academic institutes, and public authorities. Stakeholder relations are maintained and guided with the Code of Conduct and other supporting policies. The core principle of case company´s Code of Conduct is to encourage transparency and effective communication with stakeholders, both globally and within our local communities.

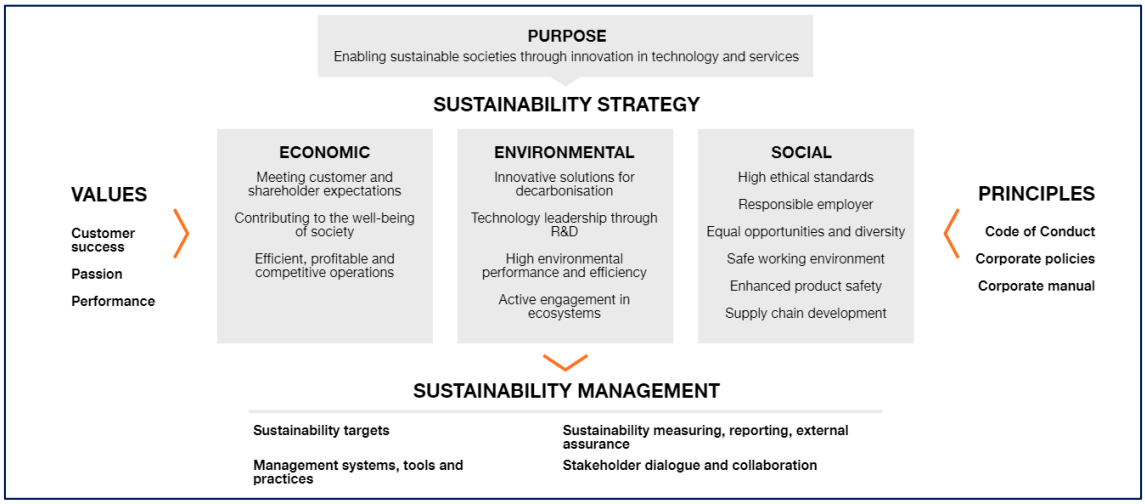
Suppliers are considered as main stakeholders of case company. As stated in case company´s website, company aims to have close and functional relationships with key suppliers around the world. Besides financial benefits, supplier engagement motivates knowledge sharing, creates innovations, and lets key suppliers become more closely integrated into our value chain.

Case company uses supplier channels like frequent dialogue with suppliers about supplier performance, supplier portal eTool, supplier development support, and organized supplier days. In addition to these, case company organizes supplier assessments and audits continuously as mentioned before in chapter 4.1.1.

4.1.3 Environmental sustainability in case company

Case company´s sustainability targets from the external website:

1. Towards carbon neutrality: Decarbonization in our operations, and the products and solutions we deliver.
2. Enhancing safety, diversity, and wellbeing: Driving safety as a top priority and creating well-being for our employees, business partners, and the societies we engage with.
3. An active and responsible member of society: Being a responsible company with high ethical standards and engaging with key stakeholders to enhance sustainability.



Picture 5. Framework for Sustainable Development at the case company

Focusing on the carbon neutrality target. Case company is committed to being carbon neutral in its own operations by 2030. Case company aims to provide a product portfolio that will be ready for zero-carbon fuels. The carbon neutrality target includes direct greenhouse gas emissions. Target includes the Research & Development and factory engine testing areas (scope 1), and the purchased energy (scope 2).

1. Energy efficiency and energy saving
2. Switching to low-emission company vehicles
3. Utilization of self-generated energy and the purchase of green electricity
4. Reducing the time needed for R&D and factory engine testing
5. Utilization of heat pumps in heating
6. Replacing fossil fuels with alternative fuels in R&D and factory engine testing
7. Utilization of various technologies to reduce the GHG emissions in engine testing

By these targets, case company aims to support their customers to be decarbonized as well. Environmental requirements guide the case company´s whole production, solutions, and services.

Case company demonstrates their responsibility by minimizing their own environmental footprint. Its decarbonization roadmap includes measures such as energy savings, green electricity purchases, switching fuels, and the use of more efficient technologies. There are two main visions for sustainability. Towards a 100% renewable energy future and decarbonization. Collaboration with stakeholders is defined as a core element of case company´s decarbonization actions. With the collaboration, the purpose is to join forces with stakeholders in promoting climate and environmental actions.

Case company´s environmental targets are guided by a Code of Conduct, policies related to Quality, Environment, Health, and Safety, and case company EHSS (Environment, Health, Safety and Security) team. Environmental Management System Environment, Health, and Safety (EHS) management systems are based on ISO 14001 /ISO 45001. This

management system covers all operations implemented by case company´s subsidiaries. EHS management system includes compliance with legal requirements, identifying and reducing environmental impacts and risks, learning sessions for employees and definition of responsibilities, the full documentation of activities and procedures, actions in emergency situations, and the continuous improvement of environmental sustainability performance. Case company´s subsidiaries and business units set their own targets for executing the environmental aspects of their operations, and for reviewing the overall performance of their management systems.

Environmentally case company aims to reduce emissions in their customers´ operations by producing efficient products and solutions. The company complies with global environmental regulations and guidelines. Aiming to achieve environmental standards for its own operations. Not only by producing but also by offering innovative solutions for decarbonization. Consequently, case company improves environmental performance by supplying technologies and services that reduce climate change and protect oceans. Active engagement in the ecosystem, collaboration, and partnerships helps to reach the case company´s environmental goals.

The case company determines decarbonization as a process of changing energy from fossil fuels to energy sources that do not cause carbon or other greenhouse gases into the atmosphere. For case company, carbon neutrality means reducing, avoiding, and compensating GHG gases with carbon credits. Carbon credits or offsets represent GHG emissions generated from verified projects that reduce, avoid, or capture emissions according to standards. Emissions can be said to be carbon neutral if the CO2 emissions released into the atmosphere by energy production are equal to the CO2 emissions removed from the atmosphere by the production process. Energy sources can be labeled as carbon-free. Carbon-free labels represent resources that do not create any carbon emissions.

Case company´s supplier requirements section “Environment” addresses following matters. Case company demands suppliers to have an environmental management system and environmental plan that follows ISO standard 14001 or Eco-Management and Audit Scheme (EMAS). The environmental requirements prohibit the use of specific substances that are not listed in the study. With the management systems, case company wants to ensure that suppliers plan, improve, and control all environmental aspects and risks. Suppliers have to be aware of and comply the local environmental legislation and the laws relevant to their products and services. In addition, suppliers should be able to provide information about the environmental impacts of their production, like materials, emissions, and energy consumption, requested by the case company.

4.2 Supplier Survey

The supplier survey was related to case company’s decarbonization strategy work. The company wants to understand better, what type of impacts future decarbonization targets might have on its supply chain. Also, it wants to better understand suppliers' ongoing efforts regarding decarbonization and do they have requirements from their other customers.

The sustainability journey focuses on shaping the decarbonization of marine and energy. In case company´s decarbonization journey, the company looks forward to collaborating with suppliers and identifying opportunities to reduce GHG emissions in its supply chain.

The survey included below questions:

Table 3. Questions for the decarbonization supplier survey

Background information:
1. Organization name
2. Name, work position, email address
3. Please indicate the main production location (country - [redacted] relevant products)
4. Select products and services you offer
5. How big of a customer is [redacted] to you? (percentage of EBIT, or percentage of production)
Energy, fuels and emissions - available data
6. What are your major emission sources?
7. What type of greenhouse gas emissions calculations do you currently have available?
8. Which emission scopes are included in the above calculations?
9. Please provide your energy consumption data (heat and electricity, fuels)
10. Which fuels or sources are you using in your own operations and processes?
11. How much of them are you using in your own operations and processes?
12. What are the more sustainable options available or possible for you regarding fuels and energy? What type of a cost impact would it have to you to change to these "greener" options? Would change in the fuels or energy require additional investments in your production processes?
13. Can you elaborate on the costs of energy and fuels regarding the products supplied to [redacted]?
Emission reduction targets
14. Do you have set decarbonization targets by 2030 (or later)?
15. Have you identified or initiated major emission reduction activities?
16. How do your possible company-level emission reduction targets impact product-level emissions?
17. Do you have plans for larger investments in your operations to reduce emissions?
18. If "YES" Are the investments related to product categories or processes relevant for [redacted]?
19. Have any of your major clients set decarbonization targets relevant for you?
20. If "YES" please elaborate. Do you have standardized template?
21. Would it have an impact on your emission reductions, if [redacted] made an emission reduction target for its supply chain?
22. At which point would it have an impact on your emissions or investments, if [redacted] or your other major clients set emission targets for their supply chain?

The relevant information regarding the research questions achieved through the survey is to find out the current state of sustainability executed in suppliers, how big the customer case company is for the supplier, and where their production is located. With the survey, I collected vital information for supply management team to utilize regarding future requirement development. The survey is already one way to engage the supplier base in sustainability matters. Therefore, it is interesting to see how willing they are to respond to the survey in general, and with what quality and how much data they share with the case company. Secondly, the survey will identify existing sustainability efforts, whether suppliers are committed to the requirements of other buyers, and whether they have a personal desire to improve sustainability. As the research focuses on environmental sustainability, the survey provides good data on suppliers' current emission levels, calculations, and emission scopes. The third essential aspect of the survey for the re-

search is to see how any new requirements from the case company would affect suppliers and production processes. For example, would new requirements require innovations from suppliers.

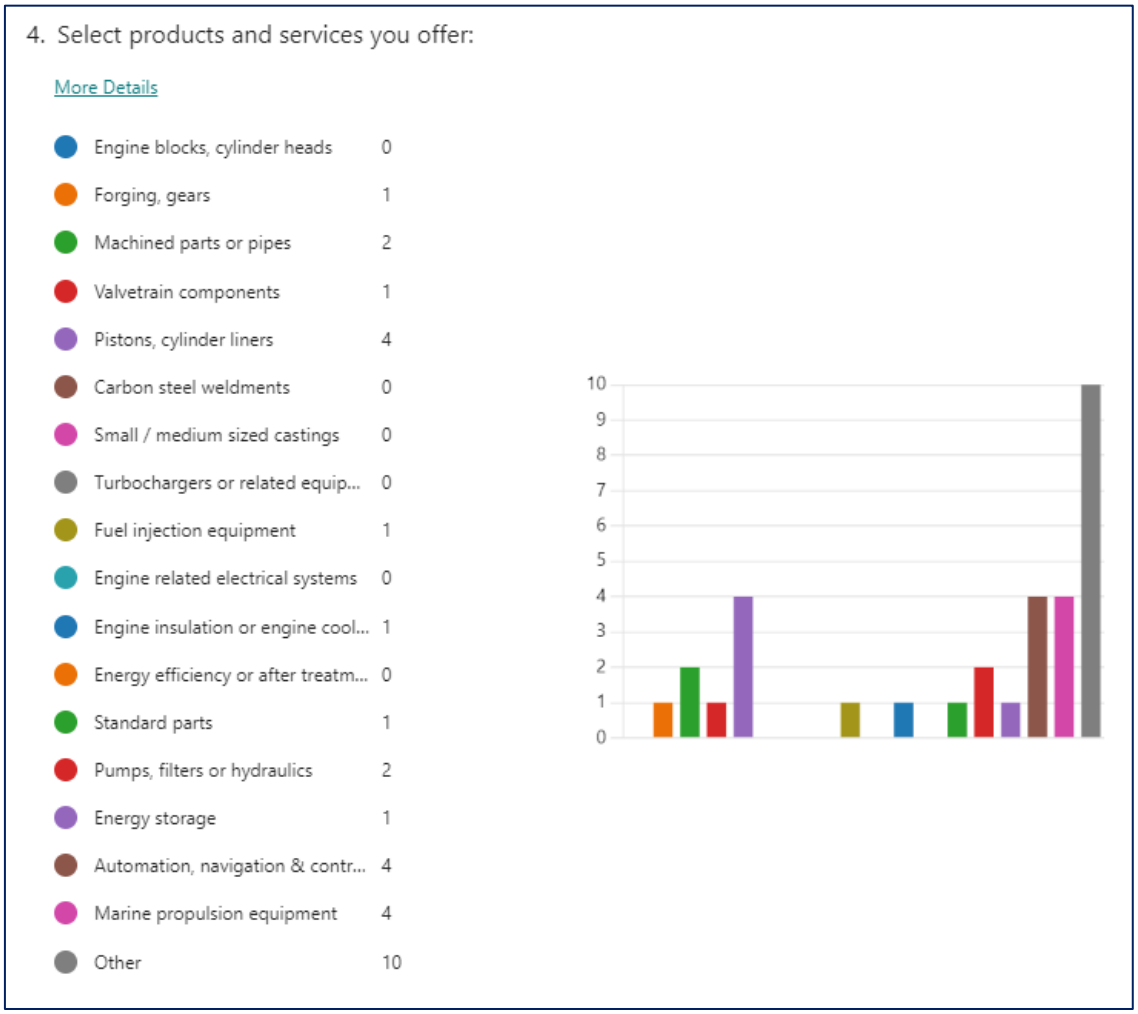
With the survey, purpose is to collect same data as from the interviews but from other categories. The initial plan was to collect contact information from 200 suppliers and the response rate was targeted to be 1/3. Category managers provided 130 contacts in the next phase. The survey was sent to suppliers by email. The response time for the survey was 3 weeks. It was known that the response time would fall around the summer holiday period which may affect the response rate The number of responses remained at 27. Response rate remained at 21%. Due to low response rate, it is not possible to fully ascertain the level of engagement or interest of suppliers in sustainability. Although the response rate now looks weak, all the responses received give us an indication of the current state of the subject. Also, it received answers from all over the world from multiple countries from Europe and Asia. The conclusions and analysis will be written based on these responses, and the interviews conducted by the consultancy firm.

The consultancy firm arranged 22 interviews with organizations from 7 other high-impact component categories than the survey. This was thought to broaden the view and the amount of information available to a wider audience. Each interview included one or more representatives from the supplier's organization, representatives from the consultancy company, and the case company's category manager, i.e. the person responsible for working with the supplier, as well as the person in charge of the project and me.

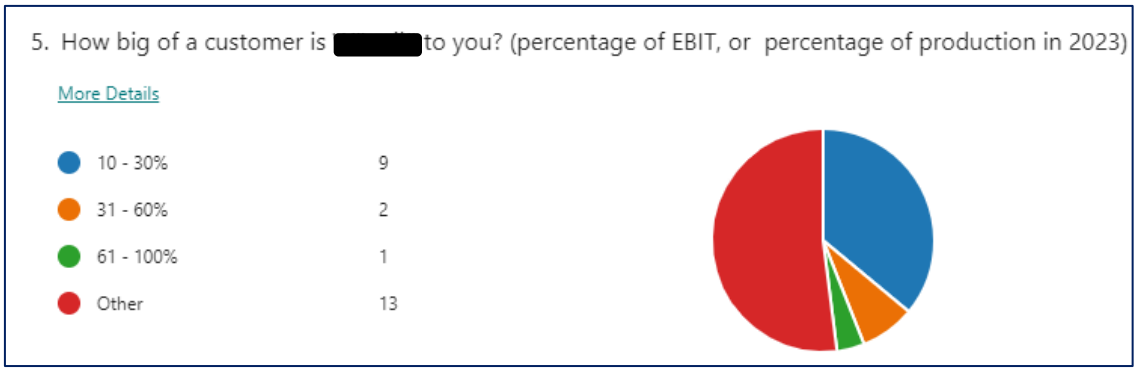
4.2.1 Survey responses

Supplier Compliance Assurance activities ensure that all these requirements are implemented by all suppliers of case company. Before case company selected the suppliers to be interviewed or surveyed, they ensure that all requirements available at that time are

met. To make sure suppliers' commitment to long-term continuous sustainable improvement and to ensure the engagement, the current status of suppliers´ knowledge and implementation of sustainability should be mapped. With the survey information is collected and provided to case company´s supply management team to create environmental sustainability requirements for suppliers. Different experts from 11 different countries applied to the questionnaire. Answers were collected from 11 and more component categories and each customer size category. Picture 5 represents all the component categories that the case company has for suppliers and picture 6 represents how big the customer case company is for suppliers. It could have one more segment because most of the answers were under 10 percent.

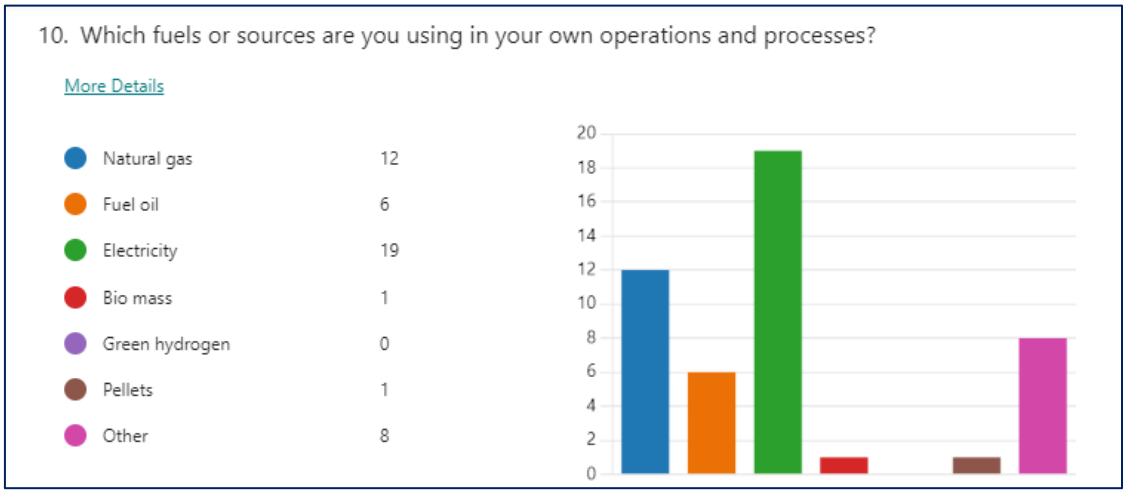


Picture 6. Component categories

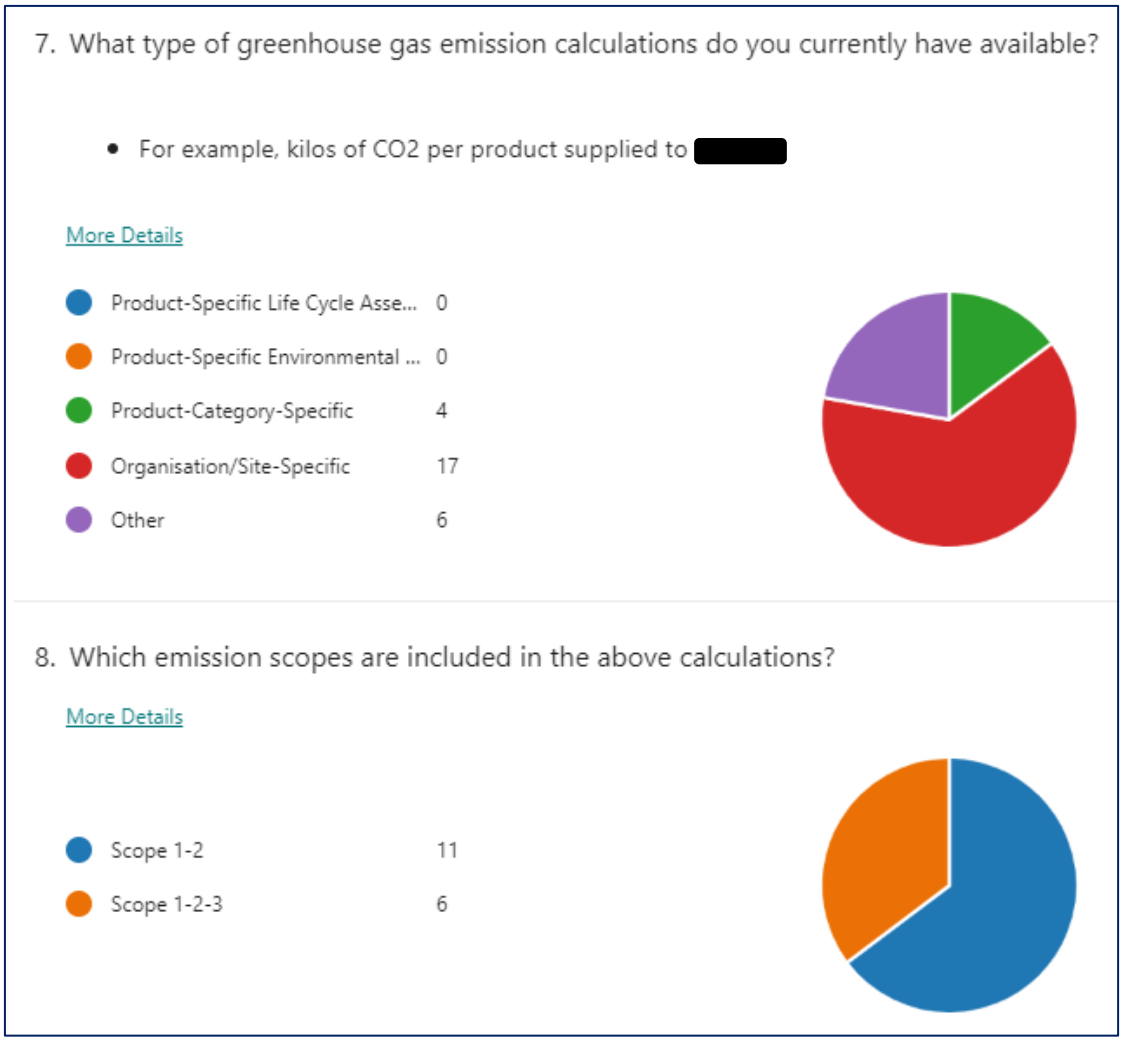


Picture 7. Customer size

Based on the survey, picture 7, the primary fuel source is electricity. The aim is to explore the possibility of a greener renewable resource option. Biogas and solar panel electricity capturing were mentioned in the interviews. Other answers capture; district heal or diesel. Second short-term requirement from consultancy firm was to increase the share of renewable energy sources. Supplier should think more greener electricity options like wind and solar.



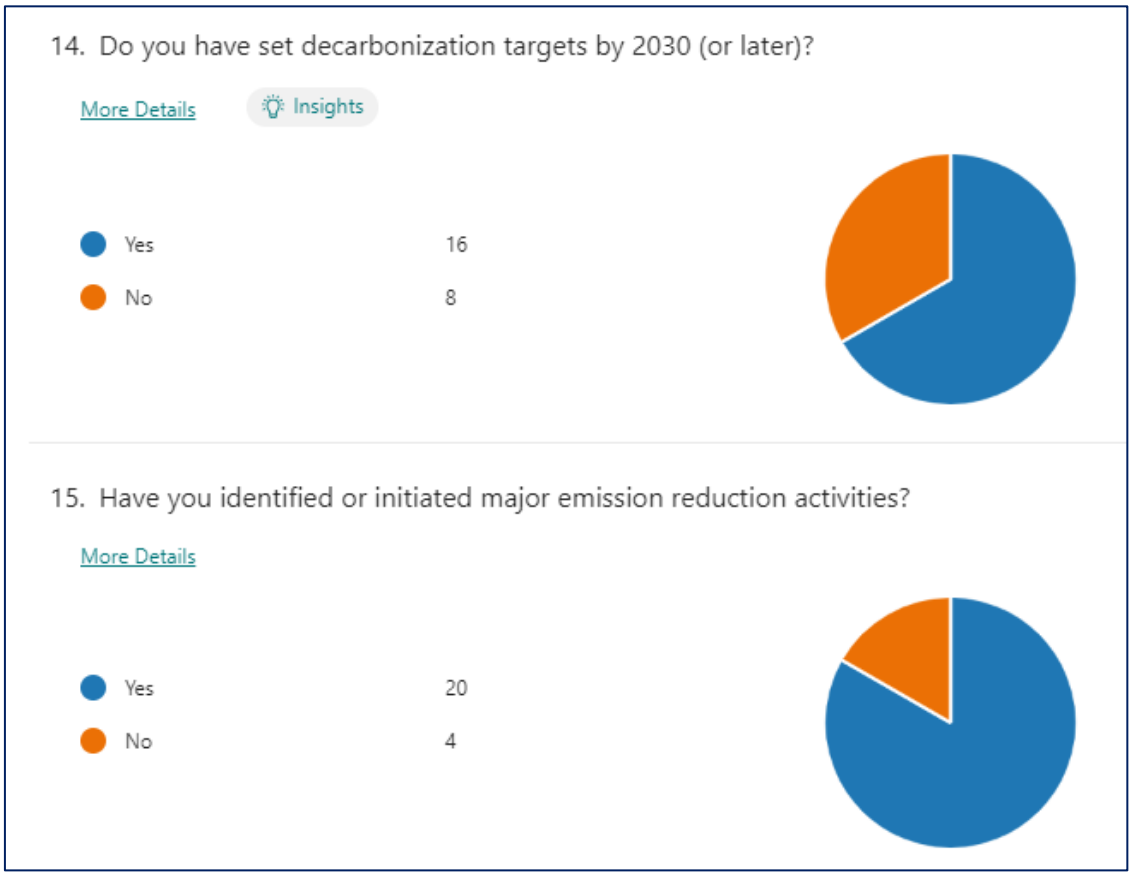
Picture 8. Fuels



Picture 9. Emission calculation and scopes

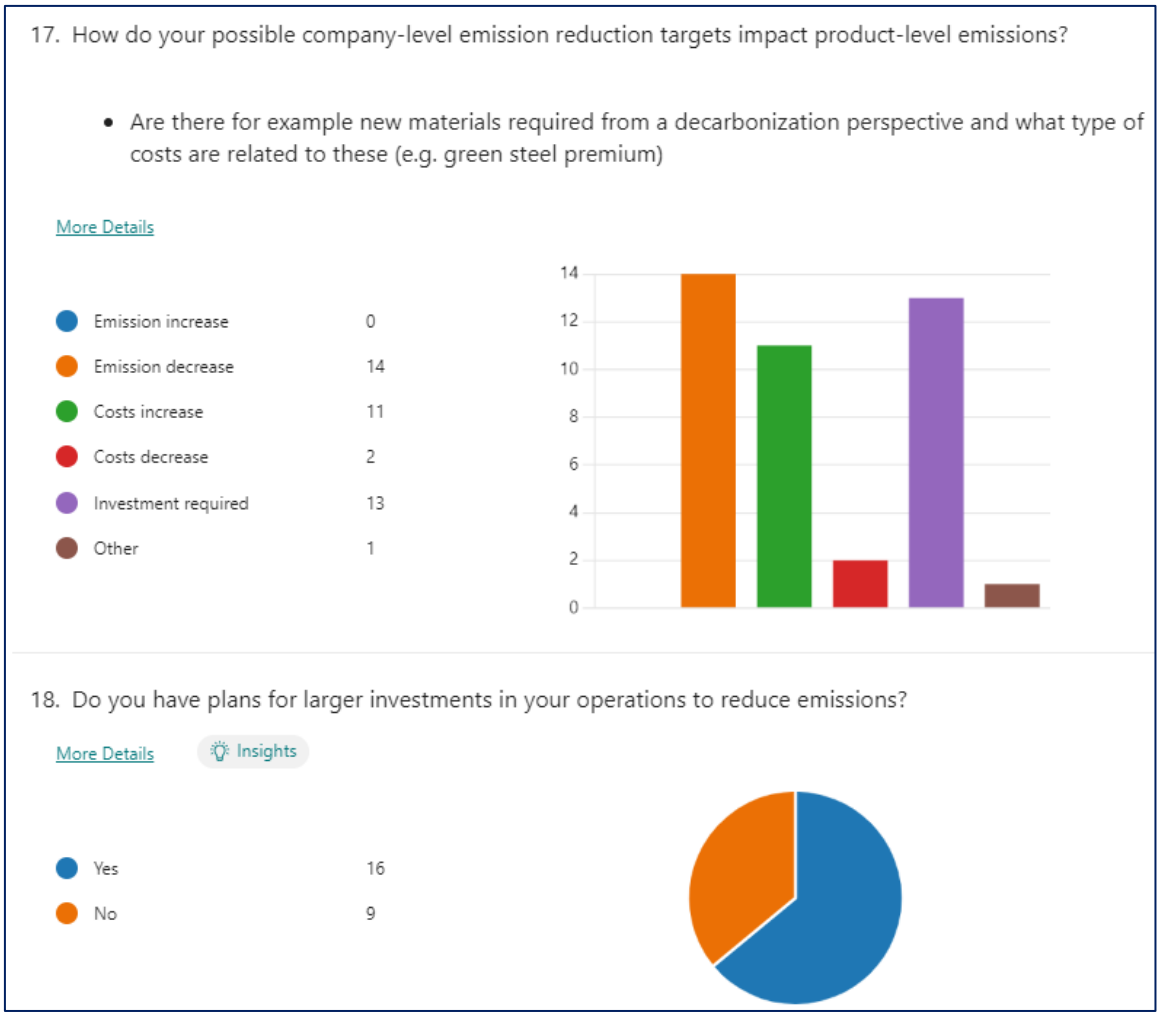
The consultancy firm´s one short-term possible target for suppliers was to improve and develop the emission calculations and prefer to focus to emission scopes 1 and 2. As the questionnaire, picture 8, shows there are mostly organizational calculations that provide only a general overview whereas Life Cycle Assessment or Environmental Product Declaration calculations provide more accurate information. With these product-specific calculations suppliers could get more precise data of environmental impacts, adds comparability between products, helps to target the particular stages of product life cycle for improvements, enables green marketing and differentiation. Most importantly it enables better collaboration with suppliers to reduce the environmental impact of materials. Also, carbon footprint and sustainability reporting become more accurate. The following requirements and targets could focus on scopes 1 and 2 because there is a clear gap in

implementation in emission scope 3 among the responded suppliers, picture 8. Most of the interviewees and the respondents to the questionnaire have already short-term targets, picture 9. Also, targets focus mostly on emissions in scopes 1 and 2.



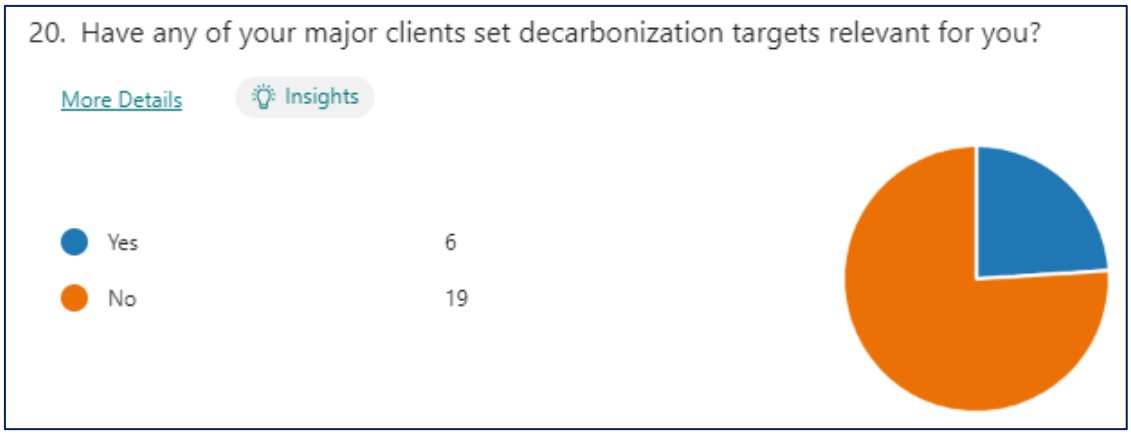
Picture 10. Decarbonization targets and emission reduction activities

New requirements are created to lower the emissions, and suppliers own targets are aiming the same. However, if reducing emissions, it requires new investment in material, and fuel resources, so the costs do increase. Picture 10, question 17, presents the organizational reduction target impact on emissions and costs. As the consultancy firm notes, cost efficiency is one key bottleneck to lower emissions. The following question, question 18, shows that most of respondents have plans for these investments, so it can be said that the increase in costs does not prevent actions. These plans considered mostly carbon and climate neutrality.



Picture 11. Possible impacts of new targets

With question 20, picture 11, the case company's purpose was to elaborate on what other buyer-organizations require, so that the upcoming requirements will be comparable. This way the implementation will be as effective and functional as possible. The last short-term target of the consultancy firm was to develop the circular economy. This applies most to scope 3, recycling and re-use opportunities. Costs do increase but they do not prevent the engagement and requirements creation.



Picture 12. Comparison to other clients of suppliers

The last questions of the survey were about scaling the impact if case company makes emission reduction targets for the supply chain and figuring out at which point of the production it would affect to emissions. The scale was from 1 to 10. The small number represented the early stage of the production and low impact. Most answers were ranked under the middle. So, there is no significant impact on emission reduction but still has an impact when looking at the whole picture. This may mean that these respondents already have emission reduction at a good level still 8 answered above the level 8. Therefore, new targets would have an impact. New targets would impact in early stage 18 answers were from 1-6. New targets would really affect supplier supply chains already from the start of the process. This reflects to commitment.

Based on the interviews and the survey, the responding suppliers implement and are committed according to their targets of continuous sustainable development. As stated earlier, the response rate was small, but successful interviews showed that suppliers are willing to cooperate and share information. The interviews and survey are tool to engage and a source of open communication and information on what is happening and what case company aims to achieve with their help.

4.3 Discussion

4.3.1 Supplier selection process and supplier relations

When considering how environmental sustainability is taken under consideration in the selection process. It can be stated that the selection process is executed following the Supplier Compliance Assurance process which is created to ensure that all the case company´s suppliers do meet all the supplier requirements. Supplier requirements do have their own part for the environment and state that every supplier needs to have an environmental management system that follows ISO standard 14001 or Eco-Management and Audit Scheme (EMAS). In the selection process, the current state analysis shows that environmental sustainability has been fully considered as a separate part of "Environmental management" of the Supplier Assessment Questionnaire, which is part of the first step of three of the whole selection process. It is said that the questionnaire can be tailored, allowing for a more precise collection of the required information from the supplier.

The second step is the risk evaluation. Environmental management has its own categories here as well. It is not clear how environmental sustainability is considered in the other categories of risk evaluation or what potential environmental risks have been selected for the evaluation. Also, other categories like country location and delivery scope relate to environmental matters because they affect transportation emissions and regulatory compliance. A supplier's location can influence the carbon footprint due to longer transportation distances and varying local environmental laws. Similarly, the delivery scope impacts the environmental footprint depending on the modes of transportation used and the frequency of deliveries, which can increase fuel consumption and emissions. As a result, it is not possible to fully analyze the current state. Risk evaluation is an important element in the case of gaining a competitive advantage because of under-

standing potential threats and opportunities. This allows for better allocation of resources, identification of new market opportunities, and increased efficiency, all of which ensure the organization's continuity. Although the potential risks are not categorized and examined more specifically in this study, the three-color system focuses only on the supplier risk impact score, but it does not indicate which specific risks correspond to which colors or risk levels.

The last step of three is the VMS rating. VMS rating includes 15 areas to evaluate. The environmental management is also its own area here. In VMS rating there is a "Level of commitment" area. Sustainability commitment could be developed here. There are also areas of communication and responsiveness which is very vital for the supplier relationship and trust. And therefore, important in terms of supplier engagement. The result of the VMS rating is presented as approval status. Approval status reflects the level of compliance with the case company´s Supplier Requirements. Here is the last chance to evaluate the implementation of sustainability if the status demands additional checks before the supplier approval. Suppliers are provided with an action plan, where documents demonstrating suitability and compliance can be included.

The case company already prefers supplier engagement a lot. As listed before there are multiple channels to cooperate, maintain stakeholder relations, and interact with suppliers. The accessibility and utilization rate could be considered and developed further according to continuous improvement. These channels and their functionality could be examined separately. This makes it easier to share information and communicate. One way to add engagement is to arrange open communication workshops where case company share their targets and ideas of how to get there. Workshops could be arranged annually. It is important for suppliers to understand the larger system they are part of and how their supply chain and its environmental impact affect the buying organization. Other ways to engage suppliers are supplier surveys, improvement teams, newsletters, and mutual visits. It is good for the buyer organization to know what kind of suppliers they have, what their resources are, and what can be expected and demanded from

them. Especially where they come from and what kind of law and climate policy guides them. It is easy to see the suppliers' own desire to implement and promote sustainability. One way to engage suppliers to the goals of the case company is to organize exactly this kind of interviews and surveys, based on which concrete requirements are then created.

When considering the suppliers´ commitment to continuous sustainable improvement, starts from the selection process. In the case of selecting new suppliers, sustainability targets and requirements should be clear from the early stage of the process. So, when they have agreed with all the contracts, suppliers commit to sustainable improvement from the beginning of the process, and the whole cooperative relationship starts with the commitment. There are already the environmental management system demands. Now the situation is that the company is creating the numerical requirements for the suppliers in case of decarbonization. Therefore, it is vital to understand how to commit the current suppliers to the new targets. As told, the company re-evaluates all their suppliers once the current rating expires, if any significant changes occur, or if the renewed rating is relevant. Starting the supplier commitment and engagement journey in this context would be most practical. During this rating, all new documents can be shared and signed. Of course, it is not considered how much this would affect to duration and implementation of the ratings. Also, it is not calculated how much the reforming requires additional resources from the company itself. Also, do these new requirements need a lot of specification among of the suppliers. The best understanding of supplier engagement is surely the category managers of a case company.

4.3.2 Sustainability and Emissions

The case company has an environmentally sustainable target in the first place of the sustainability targets. It is for the decarbonization journey. Carbon neutrality has been taken major consideration and the case company often underlines the important role that suppliers have towards it. Case company does want to have a positive impact on climate and environment through their products they offer to the customers and therefore they want

to achieve environmental standards already themselves in the production phase and conduct to work for the climate and environment. Based on the data produced by that case company it is sure that suppliers are a core element and have a great impact on sustainability business performance. It is clear that sustainability and especially environmental management play as a part in the organization's activities.

After going through the sustainability information, emission data was studied. Case company´s average emission factor calculated on kgCO2e/EUR is 0,39533. The emission factor describes the rate of any activity that releases greenhouse gases into the atmosphere. The emission factor can rate suppliers, but the case company has analyzed and categorized suppliers and their CO2 emissions by consumption. As said climate policy and regulations differ between countries. It can be stated that based on the CO2 emissions data highest emission factors among the top 200 biggest emitters are located in Asia. Approximately 17 percent of the 200 suppliers come from Asia. One supplier stands out clearly, this one supplier is located in Europe.

Therefore, research could be developed to focus on the suppliers in this region and examine the climate policies and laws there. Could the supply chain be possibly made more responsible and how to engage these producers to be more responsible in line with case company's targets and values in this area. In areas where regulations might not be so advanced and strict, the focus should be more on the producers' own willingness to be responsible. However, it is also important to consider the price-quality of the products and especially the availability of materials, as there is a shortage of suppliers for some materials.

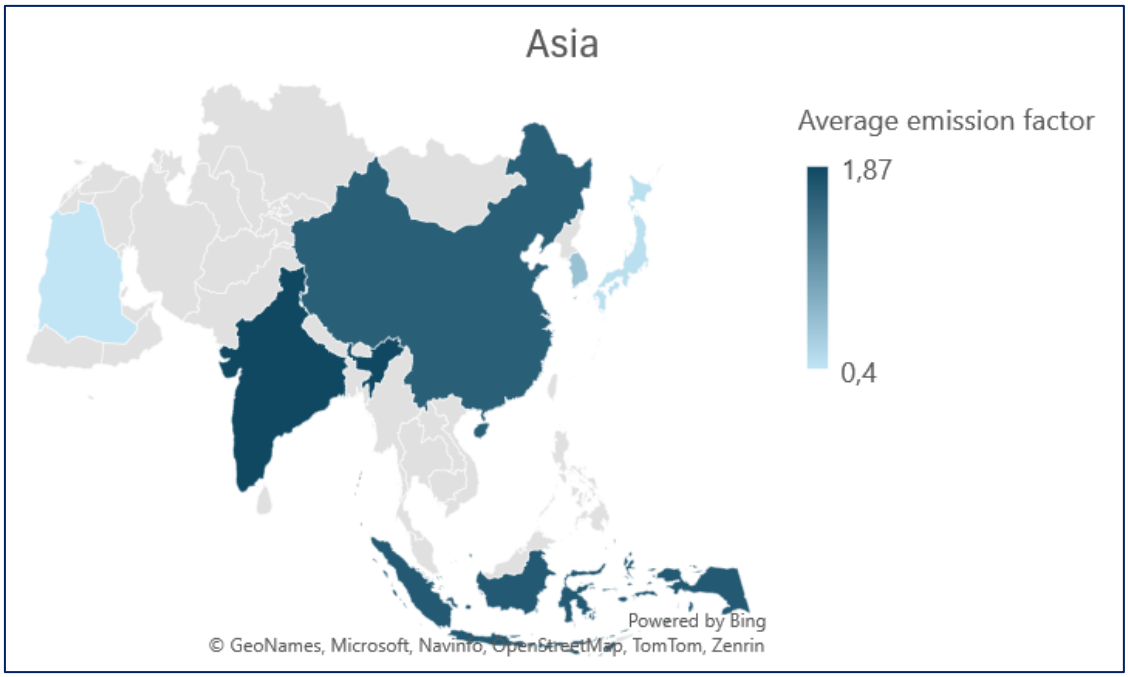


Figure 3. Asia - emission factor map

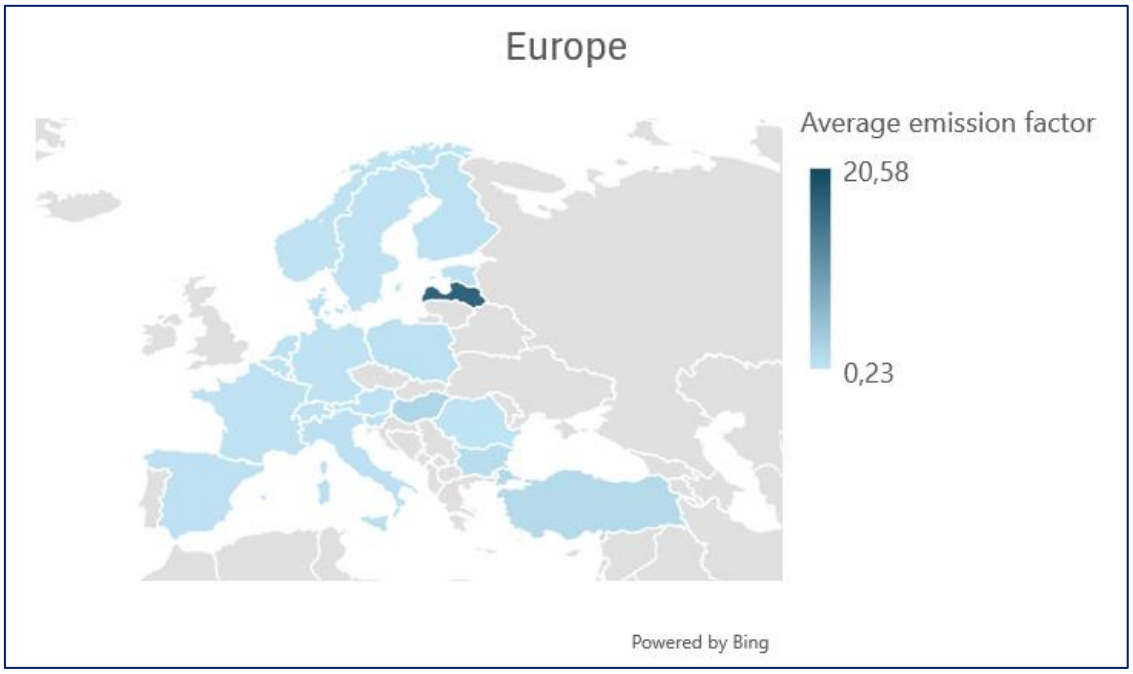


Figure 4. Europe - emission factor map

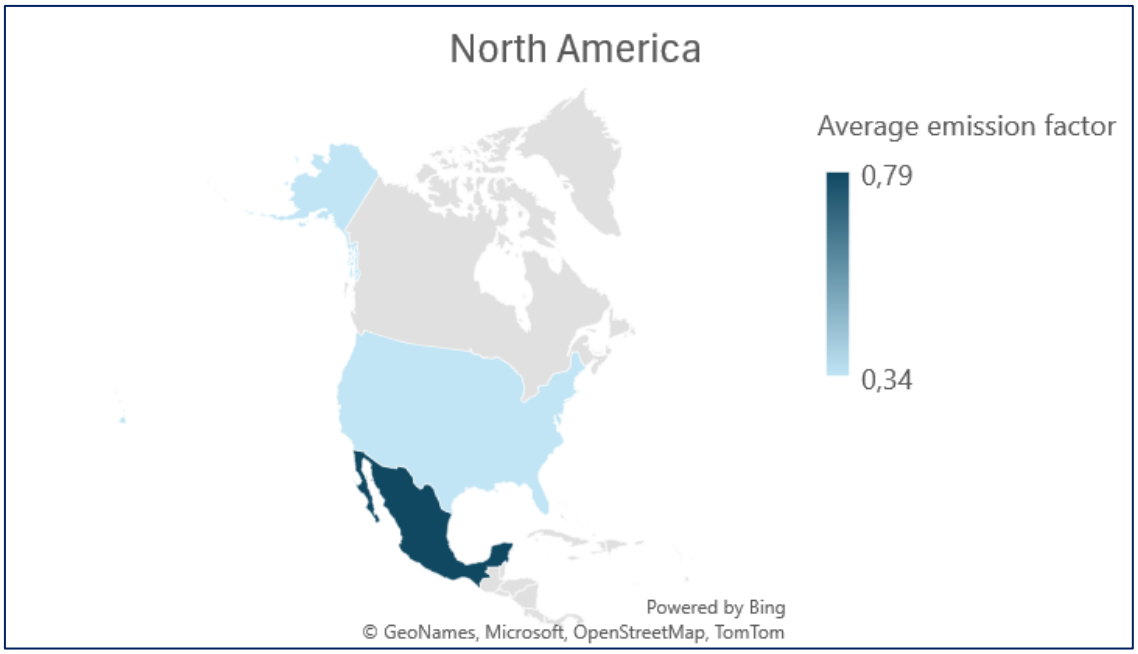


Figure 5. North America - emission factor map

With these emission factor maps, figures 3-5, the purpose was to identify better, region by region, areas of high pollution that may need more attention. High emission factor areas could represent the most difficult areas to implement environmental sustainability.

The CO2 Spend method calculates GHG emissions by multiplying the financial value of the purchased product or service by the emission factor. When comparing suppliers based on the CO spend method (tCO2e) one specific supplier stands out from the crowd. Its emission factor is very low. So, it can be seen that this single supplier is very important to the organization and critical to the business because of its high financial value. When looking at suppliers individually, the largest CO2 emissions according to the spend method come from suppliers in Asia, which are higher than the others.

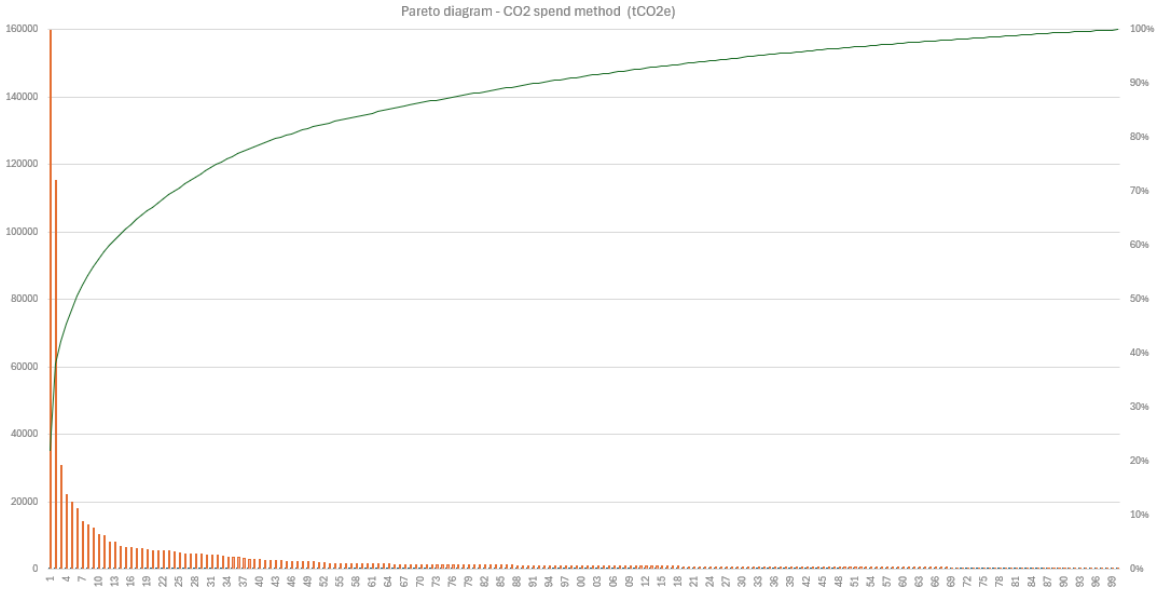


Figure 6. Pareto diagram – CO2 spend method per supplier

Pareto diagram analysis, figure 6, is executed using the 200 selected suppliers. It is seen that only 6 suppliers have already created 50% of the total CO2 emissions. None of these suppliers do not have very high emission factors so the emissions come from the high volume of purchasing from these suppliers.

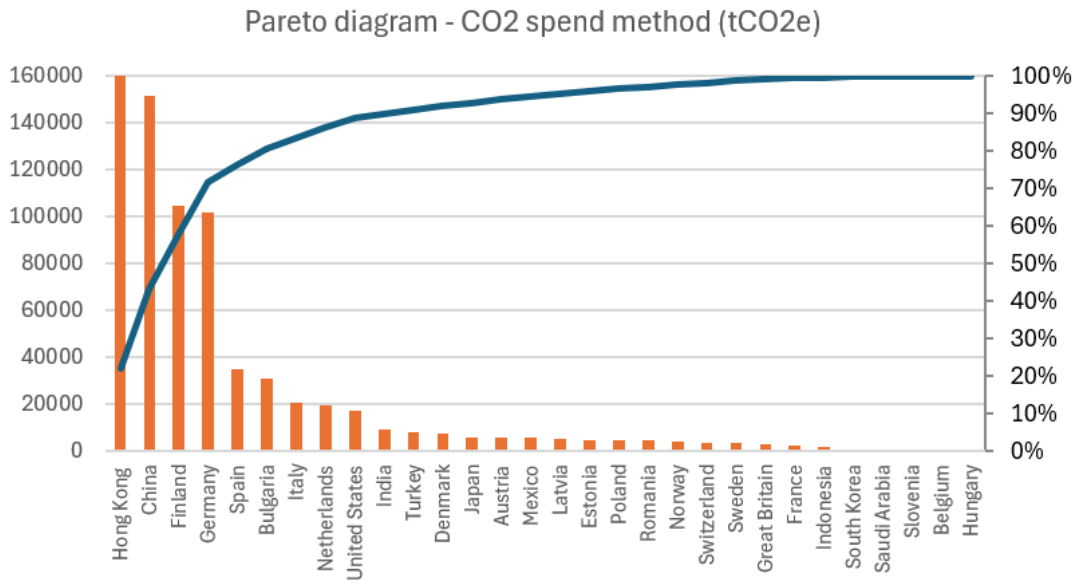


Figure 7. Pareto diagram – CO2 spend method per country

In the Pareto diagram, Figure 7, 200 selected suppliers are analyzed based on the countries. 50 % of the CO2 emissions come from only three countries. Of course, it should be noted that these countries include the country that has most of the suppliers (28%) among of the total of 200. There are a lot of countries with only 1 supplier in a total of 200.

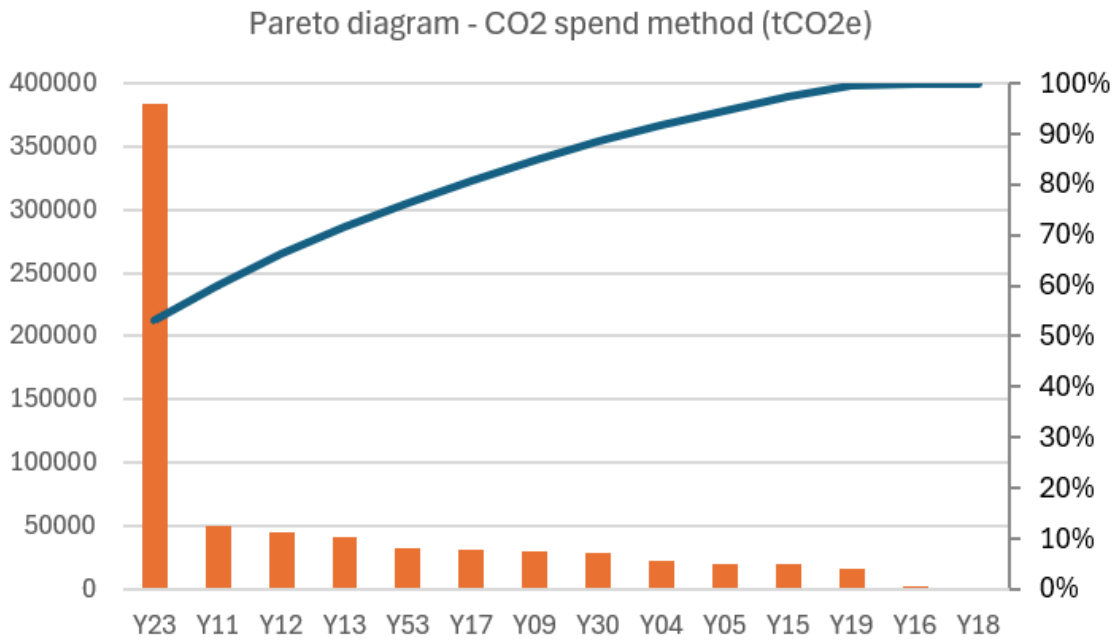


Figure 8. Pareto diagram – CO2 spend method per category

Based on the last Pareto diagram, figure 8, where CO2 emissions are analyzed per component categories, 60 percent of the total CO2 emission according to the spend method comes from category Y23. This category includes mainly propulsion control systems, energy storage, and battery components. The high result of the category can be explained because of complex and rare materials. Also, the manufacturing process is more challenging and has high energy demand which increases the CO2 emissions. In addition, these products are challenging to recycle. (Ellingsen et al., 2016)

4.3.3 Survey

It was noticeable how well the suppliers had prepared for the interviews, as well as how open they were to discuss and share responsibility practices and ideas. A clear picture has emerged of how responsibility has been incorporated or how responsibility is seen as part of the suppliers' production chain, values, and goals. Several suppliers had already sent their answers in advance, and during the interview, there was time to get to know their sustainability calculation systems or target charts. We also got a picture of how much investments in increasing sustainability targets, e.g. in used fuels, would increase the supplier's costs. It is kept confidential to share this kind of information between corporations but it also tells about trust, cooperation, and importance between companies. It takes engagement to build this kind of relationship. Based on this we could state the suppliers who participated in the interviews as already committed to the sustainable cooperative journey.

When the thesis considers how the case company engages the suppliers, the simple question is the cooperation. The cooperation includes and always increases the amount of shared information. The survey was already a step toward supplier engagement. As stated in the literature review, surveys not only provide information about organizations' effectiveness but also identify problem areas that may cause additional costs supplier surveys are great feedback tool and help to find them. The engagement process starts with selecting the suppliers to work with. The range of suppliers in the case company is so wide, so it is good to take categories at a time. So, after the selection of the suppliers, the communication starts with presenting the subject and the innovation. It is vital to include suppliers to know what will be happening and how. So, in the survey, we presented the decarbonization a little which were followed by the questions. The survey is a great tool to involve suppliers to make their own contribution and to show their willingness to share information and cooperate.

The supplier requirements creation can be implemented to the “supplier development framework” which is presented in the literature part of the research. The research aims

to develop continuous improvement and study how to establish environmental sustainability as a permanent part of the business. The complete cycle of the framework ensures continuity. Below, research is illustrated into the framework, and future re-evaluation or development of suppliers can be done the same way.

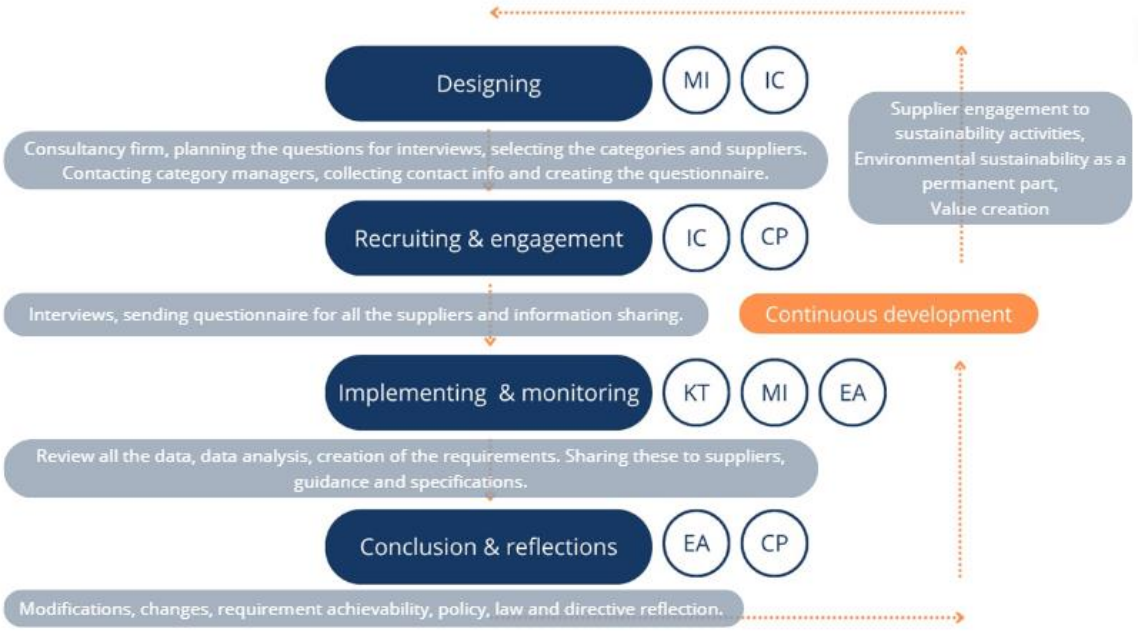


Figure 9. Research implementation – supplier development framework

Environmental sustainability to become a permanent part of the business, it should create some value for the organization and show in the business performance. It was said that it is not profitable to find new suppliers or change suppliers to fulfill sustainability goals because of the high transactional costs. The research is needed to develop the engagement of the available supplier base. With the Sustainable Value Analysis tool, the case company could view all aspects of sustainability but focus on the environmental side by itself. Sustainable Value Analysis would consider the whole supply chain as a process, or separately consider more closely some parts as their own processes. Suppliers or as previously called stakeholders have their own segment in the analysis. With the tool considering suppliers and sustainable suppliers, value can be found in cost efficiency, better resource allocation, risk reduction, regulatory compliance, innovations, and long-term positive impact which is desired in terms of establishing permanency. Improved

stakeholder relationships add continuity which affects sustainably to material flow and customer loyalty. With the engagement joint initiatives and strategic partnerships add to the business performance.

Many opportunities to create added value for business as positive brand image and market differentiation. The same results and strategic value for the long term are achieved by the FUSION supplier-partner program, presented in the literature part. Even though there is a lack of business models that include all aspects of sustainability, they are constantly being developed. Hybrid - strategies address that sustainability in supply chains can be achieved with cost savings. It could be successful to mix coverage and performance approaches if the coverage approach focuses on resources and the performance approach focuses on managerial and behavioral results. With the performance approach, numerical data like emissions are considered, and with coverage, more practical actions are executed like human interactions.

5 Conclusions

The purpose of the research was to study how a Finnish Machine building company can engage existing suppliers to be compliant with its environmental sustainability goals. The research explored the means and the possibilities for the case company to increase and secure its competitiveness in the market by collaborating with suppliers on environmentally sustainable initiatives. The outcome was achieved by examining the current challenges the company is facing regarding suppliers' ability to align with the sustainability targets of the company. The proposed recommendations aim to represent a new way of working and sharing knowledge between the case company and its suppliers.

The research questions were created together with the advisors from the case company. With the first question, the research aims to study the current state of the sustainability requirements and visibility when selecting the suppliers. With questions 2 and 3 case company wants to understand how to involve suppliers more and be sure of their trustworthiness in implementing sustainability. Based on the questions case company wants to outline what can be demanded from the existing supplier and how willing they are for new investments and increasing cost in terms of buyer-organization targets. It is important to see environmental sustainability as a continuous implementation because of regulations, the value creation for the business and especially for the planet. Therefore, the fourth question kind of summarizes the need to study that all these are achieved with the engagement and commitment to the targets.

The research was limited to study only the environmental aspect of sustainability. Therefore, the emission data was used. Also, the interview and survey were related to decarbonization. The scope focuses on the existing supplier base and specifically the biggest emitters from the selected component categories. The 14 categories were selected to answer the survey and then the 200 biggest emitter suppliers from these categories were used for the emission data analysis. In addition, 7 different categories, 22 suppliers were involved in the interviews arranged by the consultancy firm. Additionally, scope 3

downstream emissions, which means the customer use of the case company's products, are not considered in this research.

Data collection for the thesis starts with the literature review. The review is written based on previous studies, articles, and theories of the same subject base. The most relevant themes from the literature review are value creation with sustainability, sustainability as a competitive advantage, supplier development, and sustainable supplier engagement through different ways of supplier relationship management. In addition, environmental sustainability awareness in the supply chain, EU climate policy and its requirements, greenhouse gas protocol and emission scopes, and green supplier selection criteria (GSSC). Lastly, embracement of carbon management and sustainable supply chain management (SSCD).

The approach of the research was qualitative research. The research was executed as a current state analysis. Data was collected from internal documents, third-party interviews, and supplier questionnaire. Internal documents included general information, sustainability targets, directives, emission data, supplier relations, and importantly the Supplier Compliance Assurance process, which contains the supplier selection process description. The process is created to ensure that all the company´s requirements for suppliers are met.

The survey was sent to 130 suppliers, and 26 of them responded. The survey received answers from all over the world from multiple countries from Europe and Asia. Answers were collected from 11 and more component categories and each customer size category. The survey aimed to assess the current state of sustainability practices among the case company's suppliers, the significance of the case company as a customer for these suppliers, and the location of their production facilities. It also gathered crucial information for future sustainability requirements and engaged the supplier base in sustainability matters. The survey explored suppliers' willingness to participate, the quality of

their responses, and the extent of data shared. Additionally, it identified existing sustainability efforts, suppliers' commitments to other buyers' requirements, and their desire to enhance sustainability. The survey provided valuable data on suppliers' current energy resources emission levels and scopes and examined how new sustainability requirements from the case company might impact suppliers and their production processes, potentially driving for innovations.

Based on all the data collected, research questions, suggestions are summaries below.

1. How is sustainability integrated into the current supplier selection process?

The Supplier Compliance Assurance process ensures the supplier selection process considers all supplier requirements. The case company requires an environmental management system from all the suppliers. Sustainability, especially environmental sustainability is separated into its own category “environmental management” in all three steps of the supplier selection process. The first step is the data collection. Which is shortly made through the questionnaire. There is a possibility for specification in the questionnaire if more info is needed from specific subjects for example sustainability. In the future emission data, fuel, and energy sources data could be shared and demanded here.

The next step, risk evaluation does not accurately the risks, but it is a vital step to ensure gaining a competitive advantage and business continuity. Risk evaluation includes other relevant areas like location and delivery scope that consider environmental matters, Risk evaluation uses a three-color rating system, and what case company can develop or could consider in the future is that the system considers only the score, but not which of the risks are colored to which one. Therefore, there is a possibility that all other business functions score so well that poor sustainability matters are not taking notice. For the last step, the VMS rating also includes environmental management as its own area. It studies also the “level of commitment” Sustainable commitment could be a subcategory. The communication and responsiveness areas are vital to rate because of the importance of

engaging suppliers in the early stage in terms of building thrust-worthy relations and sustainability engagement. Approval status offers a last chance to review and check the suitability and compliance of sustainability if needed.

2. How to engage the supplier base to reach case company´s sustainability targets?

Case company´s sustainability targets underline the decarbonization of the company´s own operations and be carbon neutral in 2030. Enhancing safety, diversity, and well-being. Targeting being an active and responsible member of society. Suppliers are engaged to meet and implement the sustainability targets already in the selection process. The selection process ensures the required sustainable matters implementation. Case company's supplier requirements are created to ensure that suppliers, a vital and large part of case company's production, work to guarantee the company´s values and targets. Supplier engagement has a vital role in the case company. There are multiple channels to cooperate, maintain stakeholder relations, and interact with suppliers. Continued engagement and information sharing happen through these channels. The accessibility and utilization rate can always be considered and developed further.

One way to add engagement is to arrange open communication workshops where case company share their targets and ideas of how to get there. Workshops could be arranged annually. Also, supplier channels can always be developed to be more practical and accessible. This makes it easier to share information and communicate. It is really important to make the suppliers understand what whole they are a part of and how their supply chain and its environmental friendliness have an impact to the buying organization. For successful engagement, it is good to find out where are suppliers located and what kind of law and climate policy guides them, to know what can be expected. Suppliers' engagement for upcoming requirements is more ensured if there are the knowledge and specification opportunities. Supplier engagement motivates knowledge sharing, creates innovations, and lets key suppliers become more closely integrated into the case company´s value chain.

The executed survey was a tool for supplier engagement. The range of suppliers in the case company is so wide, so it is good to take categories at a time. So, after the selection of the suppliers, the communication starts with presenting the subject and the innovation. It is vital to include suppliers to know what will be happening and how. So, in the survey, a decarbonization target was presented which was followed by the questions. The survey is a great tool to involve suppliers to make their own contribution and to show their willingness to share information and cooperate.

3. How to make sure suppliers commit to continuous sustainable improvement?

The first step of the commitment is to successfully engage the supplier to sustainability targets. When all the sustainability matters in the selection process are cleared. Suppliers agree with all the contracts, the whole cooperative relationship starts with the commitment to work under the requirements. There are already the environmental management system demands. The case company is creating the numerical requirements for the suppliers in case of decarbonization. The challenging question was how to get the current supplier base committed. As told, the company re-evaluates all their suppliers once the current rating expires, if any significant changes occur, or if the renewed rating is relevant. Reviewing the commitment could be most practical in this context. During this rating, all new documents can be shared and signed. Research does not consider how much this would affect to additional resource needs, duration, and implementation of the ratings.

Suppliers were very well prepared for the interviews and were open in discussing their sustainability practices and ideas. The interviews provided a clear understanding of how responsibility is integrated into their production chains, values, and goals. Some suppliers even shared their sustainability systems and targets in advance, allowing for deeper discussions. Sharing confidential data tells about trust and the importance of cooperation. The level of openness and engagement indicates that the suppliers are already committed to the sustainable cooperative journey. To further commit suppliers, fostering

trust and cooperation through transparent communication and shared goals is essential, as these elements build strong, lasting partnerships.

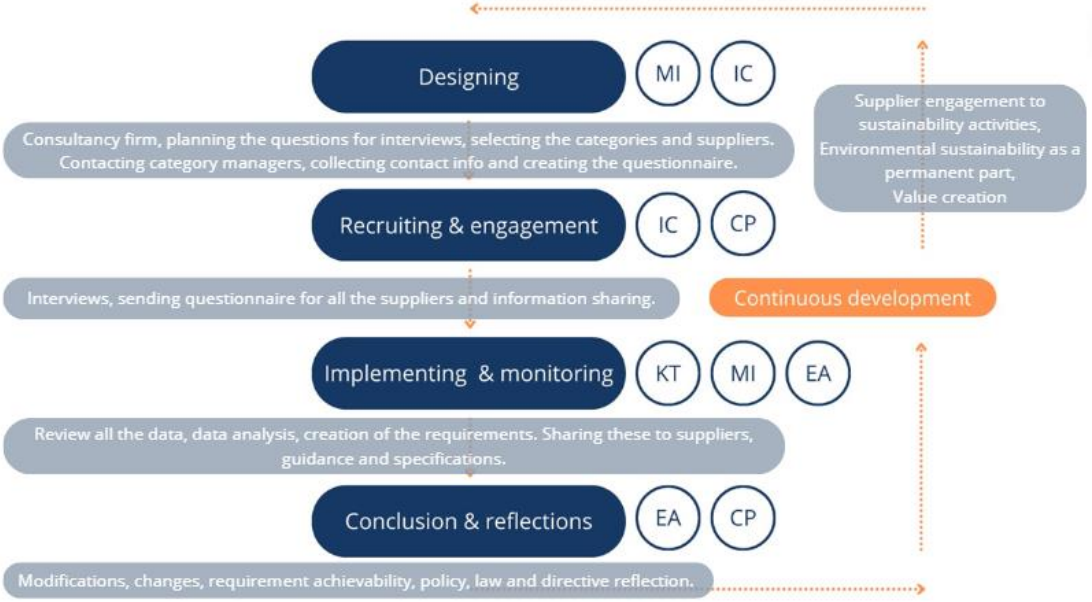
With these emission factor maps, the purpose was to identify better, region by region, areas of high pollution that may need more attention. The research found that most of the emissions come from Asia. On an average level, there were the highest emission factors, except for one country in Europe. The climate policies and laws could be considered more. Based on these the knowledge increases of could the supply chain be possibly made more responsible and how to engage these producers to be more responsible in line with case company's targets and values in this area. The price-quality of the products and the availability of materials should still be considered because for some products there is a lack of suppliers for some materials.

Pareto diagrams show that a single supplier is very important to the organization and critical to the business because of its high financial value. 6 suppliers create 50% of the total CO2 emissions. When the comparison was made per country, 3 countries created 50% of the total emissions among of 200 suppliers. The last Pareto diagram was executed per category. 60 percent of the total CO2 emission according to the spend method comes from the category Y23. This category includes mainly propulsion control systems, energy storage, and battery components. The high result of the category can be explained because of complex and rare materials. With the Pareto diagrams 200 suppliers were compared, and it was easy to see which of them, or which of the production countries, were the most polluting. Concentrate on the creation of requirements in these areas.

4. How can environmental sustainability be developed to be a permanent part of the business?

The supplier requirements creation can be implemented to the “supplier development framework”, presented in the literature part of the research. The idea is to determine the scope of the sustainability or common issues to be addressed. The framework is

completed by selecting participating suppliers, enhancing regular open communication between both parties and holding feedback sessions on integrating sustainable practices into business functions. When the cycle is done, the future strategies for sustainable practices could be determined. The aim is to develop continuous improvement and find an opportunity to establish environmental sustainability as a permanent part of the business. The complete cycle of the framework below ensures continuity. Below, research is illustrated into the framework, and future re-evaluation or development of suppliers can be executed the same way.



To make environmental sustainability a permanent aspect of business, it needs to create value and reflect in business performance. However, finding or changing suppliers for sustainability goals can be costly due to high transaction costs. The Sustainable Value Analysis tool allows case company to focus on environmental sustainability by analyzing the entire supply chain or specific segments as separate processes. By considering suppliers as stakeholders, the tool identifies value in cost efficiency, resource allocation, risk reduction, regulatory compliance, innovation, and long-term impact. Improved relationships with stakeholders enhance material flow, customer loyalty, and contribute to business performance through joint initiatives and strategic partnerships.

5.1 Managerial implications

The case company has identified the current status and already initiated important actions. Based on analyses considering the following managerial implications would be recommended in the next steps:

1. Supplier engagement and communication through regular workshops, open communication sessions, and dedicated sustainability channels. Information sharing will help suppliers understand the case company's sustainability targets and foster a collaborative environment for continuous improvement.
2. Refine the supplier selection criteria and add new sustainable requirements to as part of each stage of the selection process. Consider adding sustainability subcategories, more detailed risk assessments, and sustainability performance metrics.
3. Implement regular sustainability audits, Key performance indicators (KPI), and feedback sessions which could be used for monitoring achieved targets. Sustainability audits and performance reviews with suppliers ensure understanding, ongoing compliance, and commitment to continuous improvement. The organized survey and interviews were a step to see the current state of environmental sustainability among suppliers.
4. Use emission data to identify the most polluting suppliers and regions. Once identified, conduct a detailed study of the climate policies and regulatory frameworks governing these regions. Quantified metrics can be used for both identification and performance indicators. This approach should be efficient as the study showed that focusing on 6 selected suppliers would have an impact on 50% of the total CO2 emissions.

These are generic recommendations. However, it might be useful to adjust actions for various parts of the organization or product categories based on actual experience.

5.2 Future research and limitations

For future research, some suggestions and possibilities have already been underlined during the research. For example, the survey that was addressed for sustainability and emission issues. It collected vital data for the case company´s following actions and was a practical tool to engage the suppliers. The future study could focus more on suppliers' thoughts on engagement and commitment, interviewing them about what they think and want from the buyer-organization. Also, because new requirements require investments, there is an opportunity to study the return on investment (ROI) by comparing costs to the emission reduction value in CO2 trading markets. The category managers would be useful in being more engaged in the research because they are the nearest contact between the case company and the supplier. They were part of the contact info gathering and part of the interviews, but they could also have been interviewed in terms of the research questions. Future research could be more limited to some component categories or supplier countries. It would be interesting to study the differences in climate policy and regulation by region. In addition, it found that there is a shortage of business models that include all sustainability aspects.

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