



THE IMPLEMENTATION OF A REPORTING PROCESS FOR CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

Lappeenranta–Lahti University of Technology LUT

Degree Programme in Circular Economy, Master's thesis

2024

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Abstract

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86 pages, 11 figures and 5 tables

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Keywords: Carbon border adjustment mechanism, CBAM, EU regulation

Carbon border adjustment mechanism (CBAM) is a new EU regulation that aims at reducing carbon leakage from the EU. The regulation entered into force in October 2023 and began with a transitional period, which requires the importers to report the embedded emissions of their imported CBAM goods quarterly to the European Commission. After the transitional period in 2026, the definitive regime will enter into force, and the companies are required to surround CBAM certificates corresponding to the amount of emissions embedded in their imports. The regulation was introduced and entered into force on a fast schedule and requires actions from companies to which they are not prepared for. This study aims at implementing an optimal CBAM reporting process for the case company Valmet, by whom the research is commissioned. The research uses internal and external benchmarking to seek answers to what are the current issues with CBAM reporting, and how can they be addressed. Moreover, the thesis answers to what are the main principles guiding the implementation and optimisation of CBAM reporting.

The main challenges were related to the import data collection and engaging suppliers to provide emission data. One key finding from the benchmarking was that to improve import data collection, the storing of customs declaration data needs to be improved and the used methods for storing unified between business lines. In addition, the roles and responsibilities need to be defined so that ownership is defined for each process and a core team needs to be established to improve supplier communication. The suppliers must be provided with

assistance to emission calculations and the emission data collection must be centralised. The guiding principles in the implementation of a reporting process were established to be centralised and resource efficient processes, as well as optimised data collection processes.

Tiivistelmä

Lappeenrannan–Lahden teknillinen yliopisto LUT

LUTin energiajärjestelmien tiedekunta

Kiertotalouden koulutusohjelma

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Hiilirajamekanismin (CBAM) mukaisen raportoinnin toteuttaminen

Diplomityö

2024

86 sivua, 11 kuvaa ja 5 taulukkoa

Tarkastajat: Professori Lassi Linnanen ja Nuorempi tutkija Miika Marttila ja Nuorempi tutkija Katariina Buure

Avainsanat: Hiilirajamekanismi, CBAM, EU-asetus

Hiilirajamekanismi (CBAM) on EU:n uusi asetus, joka pyrkii vähentämään hiilivuotoa EU:sta. Asetus astui voimaan lokakuussa 2023 siirtymäajalla ja vaatii maahantuojia raportoimaan maahantuotuihin tuotteisiin sitoutuneet päästöt EU:n komissiolle vuosineljänneksittäin. Siirtymäajan jälkeen, alkaen vuodesta 2026, asetuksen lopullinen järjestelmä astuu voimaan. Lopullisessa järjestelmässä yrityksiä vaaditaan vuosittain hankkimaan tuotuihin tuotteisiin sitoutuneita päästöjä vastaava määrä maksullisia CBAM-todistuksia. Asetus esiteltiin ja asetettiin voimaan nopealla aikataululla, sekä vaatii yrityksiltä toimenpiteitä, joihin niillä ei ennestään ole valmiuksia. Tämän työn tavoitteena on luoda optimoitu CBAM-raportointiprosessi tapaustutkimuksena Valmetille, jonka toimeksiannosta työ suoritetaan. Työn tutkimusmenetelmäinä käytetään sisäistä ja ulkoista vertaisanalyysia, jotta ymmärretään raportoinnin nykyiset haasteet, sekä löydetään niihin parhaiten sopivat ratkaisut. Lisäksi tutkimuksessa pyritään tunnistamaan pääperiaatteet, jotka ohjaavat raportointiprosessin luomista ja optimointia.

Suurimmiksi ongelmiksi tunnistettiin tuontidatan kerääminen ja toimittajien sitouttaminen päästödatan toimittamiseen. Vertaisanalyysin tuloksena havaittiin, että tuontidatan keräämisen parantamiseksi tullauspäätöksistä saatavaa dataa on alettava tallentamaan tehokkaammin ja yhdenmukaisemmin yritysten ja tytäryhtiöiden sisällä. Lisäksi raportoinnin roolit ja vastuut tulee jakaa niin, että jokaiselle prosessille on määritetty omistajuus. Raportoinnille tulee myös määrittää ydintiimi vastaamaan raportoinnin sujuvuudesta sekä toimittajien sitouttamisen ja koko raportointiprosessin kehittämisestä. Toimittajille tulee pystyä tarjoamaan ohjeistusta päästölaskentaan ja päästödatan keräämiseen tulee keskittää. Ohjaaviksi pääperiaatteiksi

raportointiprosessin luomiselle todettiin keskitetyt ja resurssitehokkaat raportointiprosessit, sekä optimoidut datankeruuprosessit.

Acknowledgements

I would like to express my gratitude to my supervisor Minna Viinikangas, who trusted me with this opportunity to write my thesis at Valmet. Thank you for your valuable feedback, guidance and support. In addition, I would like to sincerely thank all my colleagues and friends at Valmet. I have received a lot of support and encouragement throughout my time here, for which I will forever be grateful.

I want to thank my examiners Lassi Linnanen, Miika Marttila and Katariina Buure for providing valuable feedback and guiding me forward during the process. In addition, I would like to thank the people who participated in the benchmarks, introduced their current methods and best practices, and thus provided important information and data for this thesis. I would especially like to express my gratitude to the representatives who participated in the external benchmarking. First of all, thank you for responding to my contact and for considering this an important topic for discussion, and secondly, for participating in the benchmarking with an open mind.

Last but not least, I would like to sincerely thank my fellow students from LUT with whom I got to work with during my studies. I also want to express my gratitude to my friends and family who have supported me along the way. Also, special thanks to all my international friends from my exchange studies at the University of Southern Denmark. My years at university have included a lot of new and exciting experiences, but they would have been a lot less fun without all of the friends I made along the way. Thank you!

Tampere, 22.4.2024

Liisa Roihupalo

Abbreviations

AI	Artificial Intelligence
BAM	Business Activity Model
CBAM	Carbon Border Adjustment Mechanism
CFP	Carbon Footprint of Products
CN	Combined Nomenclature
EORI	Economic Operators Registration and Identification Number
ERP	Enterprise Resource Planning
EU ETS	European Union Emissions Trading System
EU	European Union
GHG	Greenhouse Gas
LCA	Life Cycle Assessment
LSP	Logistic Service Provider
LULUCF	Land Use, Land-Use Change and Forestry
MMD	Monitoring Methodology Documentation
PDM	Product Data Management
SDGs	Sustainable Development Goals
SRM	Supplier Relationship Management
UN	United Nations

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1 Introduction

Climate change is a global threat that forces the society to global emission reductions. There are various different programs that aim at emission reductions globally, in the EU, and in other areas, each program considering different stakeholders. For example, 194 parties, including the European Union (EU) have joined the Paris Agreement, which is an international agreement on reducing emissions and working together to mitigate climate change. The Paris Agreement has three key elements, or targets. The main target is to limit the global increase in temperature in the current century to 2 degrees, or even further to 1.5 degrees Celsius. The other targets are to review each countries' commitment every five years, and to give financial support to developing countries to mitigate climate change. (United Nations, 2023a.) In addition, the United Nations (UN) has introduced the Sustainable Development Agenda for 2030, which includes 17 sustainable development goals (SDGs) and 169 targets which consider all levels of sustainability (United Nations, 2023b).

The EU has also defined their own goals for sustainability and emission reductions in order to achieve the global targets set in the Paris Agreement. In 2019 the European Commission adopted the European Green Deal, which is a set of proposals that aims at making the climate, energy, transport and taxation policies fit to achieve an emission reductions of at least 55 % by 2030, compared to 1990 levels. Other key figures in the European Green Deal are to make Europe the first climate neutral continent by 2050, and to plant 3 billion new trees in the EU by 2030. On the 4th of March a proposal for the European Climate Law was made to ensure the achievement of the targets set in the European Green Deal. (European Commission, 2023h.) The Regulation (EU) 2021/1119 of the European Parliament and of the Council (2021) entered into force on the 29th of July in 2021.

The goals set in the European Green Deal and regulated by the European Climate Law are to be achieved by 2030 and 2050. The "Fit for 55" package is a set of legislation that aims at making all the sectors fit to meet the 2030 target of a 55 % reduction in greenhouse gas (GHG) emissions (European Commission, 2023f). The package includes the EU emissions trading system (EU ETS), the carbon border adjustment mechanism (CBAM), the land use, land-use change and forestry (LULUCF) regulation, the renewable energy directive, and several other legislation regarding emissions of buildings and road transport, emission standards for cars and vans, methane reduction in the energy sector, alternative and sustainable fuels for aviation and shipping, energy efficiency and energy performance of buildings, as well as energy taxation and annual emission reductions targets for member states (European Council, 2023). These regulations also play an important role so the goal of climate neutrality by 2050 will be achieved.

The EU ETS is a part of the “Fit for 55” package, but was introduced for the first time already in 2005. Since then it has been the main means for addressing emission reductions in the EU. After its introduction, the total emissions in the EU have decreased by 41 %, and from power and industry plants by 37 %. The EU ETS is a “cap and trade” system, where a cap is set on the total amount of allowed GHG emissions for covered installations and aircraft operators. The system is based on emission allowances which companies need to surrender by buying, receiving or trading them in order to cover for all their yearly emitted emissions. (European Council, 2023; European Commission, 2023i.) Since phase 3 of the EU ETS (2013-2020), the cap for allowances has been set for the EU as a whole (European Commission, 2023e).

However, as the climate ambition and the cost of emissions in the EU are rising, the risk for carbon leakage increases. This is due to the companies either importing carbon-intensive products from outside of the EU or transferring production to countries with less strict climate policies. To reduce this risk, the EU has adopted the CBAM regulation. The regulation targets in reducing carbon leakage, and enters into force gradually. It initially applies to imports of products at most risk of carbon leakage, which are hydrogen, fertilizers, electricity, iron and steel, cement and aluminium. The companies concerned by the regulation need to report the emissions embedded in their imports, and pay accordingly for certificates. The certificates are priced according to the current EU ETS allowances, as € per ton of emitted CO₂ equivalent. The mechanism is encouraging non-EU countries to cleaner production, as well as puts a fair price to emissions emitted in the production of carbon-intensive products. The system will gradually phase-out the allocation of free EU ETS allowances between 2026 and 2034. (European Commission, 2023a.)

1.1 Motivation

CBAM regulation is entering into force gradually, and has a transitional period from October 2023 to December 2025. During the transitional period importers landing in the scope of the regulation must report quarterly the emitted direct and indirect GHG emissions embedded in their imports. In the end of January 2024 the first reporting period ends for the importers and the first report needs to be submitted. After the transitional period the definitive regime effects into force, and the importers have to declare the quantity and the embedded emissions of their imported CBAM goods from the previous year. As the reporting responsibility has already started, it is essential for companies to get an idea of how the reporting should be done, the data collected and the calculations carried out. It is necessary for the companies to find out what are their biggest problems with reporting, and how to overcome them. The scope for CBAM products will be gradually expanded, which means that the companies should learn to adapt to the new regulation and find an optimal reporting process for the future. (European Commission, 2023a.)

1.2 Research problem

As the CBAM regulation is new, and the transitional period is requiring the involved companies to submit their reports quarterly during the first two years, the companies must create an optimal reporting process to answer to the requirements of the regulation. The transitional period gives the companies the flexibility to adapt to the new regulation, but as the definitive regime will begin already in 2026, optimising the reporting process is essential. CBAM reporting requires that the company importing the products is responsible for providing the report to the European Commission. The information required for the report is the amount of imported products, the direct and indirect emissions of the products, the possible price paid for the carbon emissions in the country of origin, and the compensations received. (Tulli, 2023b.) To achieve the required information and follow the requirements of the CBAM regulation, the companies need to cooperate with other stakeholders such as suppliers and authorities to collect necessary information about the embedded emissions of their imports. The importers also have to hand out guidance of the calculation requirements and methods to the suppliers, as they are required to provide the emission data and calculations according to the requirements of the CBAM (Directorate-general Taxation and Customs Union, 2023b).

The aim of this thesis is to study the CBAM regulation and research its requirements and the initially occurred challenges in the reporting process. The goal is to create an optimal reporting process for the case company by first studying the current challenges and then researching ways to overcome them. This is done by utilising the available information as well as by benchmarking relevant stakeholders. The theoretical study is conducted by a literature review, which focuses on the current climate actions in the EU as well as the new CBAM regulation and its aims and requirements. The benchmarking is targeted internally to different stakeholders at the case company and externally to companies that are affected by the CBAM regulation, and might have already established a CBAM reporting process or found answers to the occurred challenges. The empirical study focuses on finding out the guiding principles in the implementation and optimisation of the reporting process and planning an optimal way for CBAM reporting at the case company. The research questions of this study are presented below.

“What are the main challenges with CBAM reporting and how can they be addressed?”

“What are the main principles guiding the implementation and optimisation of the reporting process at the case company?”

The first research question focuses on the results from benchmarking and seeks an answer to what do the companies consider as the biggest challenges in CBAM reporting. It also includes information of how have companies adapted to the new regulation and collected the required data for reporting. In addition, it focuses on finding out how have the companies succeeded with the first reporting period, and defined the roles and responsibilities for the process. The findings from the first research question are then used to find out the main principles to consider while creating an optimal reporting process for the case company. Therefore, the objective of this thesis is to get familiar with the new CBAM regulation, its objectives, requirements and challenges for importers and other stakeholders, and use the information to create an optimal reporting process for the case company. The study is done to further the adaptation to CBAM reporting at the case company, and will provide a framework for an optimal reporting process according to the CBAM regulation.

1.3 Research scope

The scope of the literature review is on the current climate actions in the EU, and the new CBAM regulation. The literature review introduces the aims and requirements of the regulation for both the companies importing goods and products to the EU (later also referred to as importers) and installation operators outside of the EU (later also referred to as suppliers). The guidance documents for both cases are introduced and the calculation methods are presented. The aim of the literature review is to understand the regulation and the reporting principles, as well as the calculation methods and requirements.

The empirical study focuses on finding out the current challenges with CBAM reporting, as well as the views on the regulation in general. It also tries to find out how the regulation is seen to affect current business operations in and outside the EU. The scope of the empirical study is limited to the importers and the people who are either working with the CBAM regulation or are in other ways closely in touch with the regulation or the challenges related to it. This study includes internal and external benchmarking, which takes into consideration internal stakeholders, and large-scale manufacturing companies, which are similar to the case company Valmet. Valmet is a major importer of aluminium, iron and steel, which means that it is concerned by the requirements of CBAM.

The case company Valmet is a leading, globally operating manufacturing company that provides process technologies, automation systems and services for pulp, paper and energy industries. The company has its roots in Finland, and a history for over 220 years. Valmet operates in five business lines; Pulp and Energy, Services, Flow Control, Automation Systems, and Paper. (Valmet, 2023d; Valmet, 2023c.) Valmet has a large supply chain network that operates in more than 25 countries in five continents. It has over 30 000 suppliers glob-

ally, which makes the supply chain complex and challenging to monitor. (Valmet, 2023b.) Around 40 % of Valmet's total annual procurement spend is coming from 600 main suppliers (Valmet, 2023a). The scope of the case study takes into consideration the whole supply chain, and all Valmet's business lines are included in the study.

1.4 Thesis structure

The thesis starts with an introduction, which provides a reasoning and a short background for the study. The introduction also provides an explanation for the need of this study. The second section introduces the research methodology used in the thesis.

The literature review consists of two parts. The first part covers the current climate actions in the EU, focusing on the European Climate Law that sets the climate goals for 2030 and 2050. The EU ETS is introduced in more detail, as CBAM is planned to function in parallel with the EU ETS, and thus gives important information about the current situation. Lastly, a short introduction to CBAM regulation and its scope and purpose is given. The second part of the literature review introduces the CBAM regulation in more detail by focusing on the requirements and guidelines of the regulation.

The empirical study is conducted for the case company Valmet. The case study first investigates the current situation at Valmet, including sustainable supply chain practices and products falling under the CBAM regulation. The results from the internal and external benchmarking are then introduced and analysed in order to find out what were the main challenges with CBAM reporting occurred during the first reporting period. The empirical study uses the results from the previous steps to find out the main principles guiding the implementation and optimisation of the reporting process. Lastly, the main requirements for CBAM reporting in general and a final reporting process suggestion for Valmet are summarised and concluded.

The thesis ends in discussion and conclusions. Finally, the key findings, limitations and opportunities for further research are concluded.

2 Research methodology

This section presents the research methodology used in this thesis. The first paragraphs present the basis for qualitative analysis which in this thesis is done by analysing information from the available literature and the internet. The paragraphs after that shortly present the internal and external benchmarking. Lastly, the internal interviews are introduced shortly.

The research methodology used in this thesis is a qualitative analysis. A qualitative analysis can be carried out in multiple different ways, and in this thesis the used method is a literature review. A literature review is performed by first investigating the existing research, theories and evidence, and after that evaluating and discussing on the covered material. It aims at providing understanding and showing knowledge of a specific topic and its context. In addition to a literature review being a form of writing, it provides a critical analysis of the material. (The University of Edinburgh, 2023.) In this thesis the data is collected by a literature review, on the basis of which the CBAM reporting requirements, guidelines and goals, as well as performing the reporting process are further analysed. The information is also used to create an optimal reporting process for CBAM.

The literature review focuses on the CBAM regulation and the legislation behind it. First the focus is on the EU's climate goals set in the European Green Deal and the European Climate Law that writes the goals of the Green Deal into law. The European Climate Law includes a set of proposals, one of them being a reform of the EU ETS, and one the regulation for CBAM. The literature review focuses on finding out relevant information about the legislation and form a baseline for the CBAM reporting. It also investigates the guidelines and requirements for importers and installation operators, which helps in understanding the requirements of the regulation. This information assists in creating the reporting process, as it includes information of the data needed for the reporting. The information from the literature review is further used in drafting an optimal reporting process.

This study uses benchmarking as a reference framework. Benchmarking is a process where one's own actions are compared with others in order to improve internal operations. Usually benchmarking is targeted at successful businesses in the same field, but also other relevant companies can be included in the comparison. Benchmarking can lead to changes in current practices in different departments, and thus create significant upgrades in internal operations and processes. (Impiö, 2022.) Benchmarking is a method that combines the qualitative analysis and the empirical study, as it provides background information on how other stakeholders have addressed certain topics.

In this study the internal benchmarking is targeted to the legal entities at Valmet to find out

how the reporting requirements have been approached and what were the main challenges occurred during the first reporting period. The benchmarking will also focus on the views on CBAM in general and how it is seen to affect the business and its operations. The aim of the benchmarking is to map the current situation inside the company in order to find out the stumbling blocks in the current situation with CBAM. The interviewed people are chosen because they have been chosen as being responsible for CBAM reporting at the entities.

In this thesis the external benchmarking is targeted to companies similar to the case company Valmet. The chosen companies are large-scale manufacturing companies affected by the CBAM regulation, and were chosen because their organisational structure is similar to Valmet. The benchmarking process is conducted by interviewing people who have been in touch with the CBAM reporting or are responsible for the reporting at the companies. The aim of the external benchmarking is to find out how other companies have addressed the reporting requirements and started the adaptation to CBAM reporting. It will also investigate if there has been any challenges in the process, and how have they addressed them. The benchmarking will also find out answers to how the companies have addressed the challenges identified at Valmet. The collected information is further used in this study to create an optimal reporting process for Valmet.

The optimal reporting process is drafted by using existing internal data, the results from the internal and external benchmarking, as well as by performing internal interviews for people working in relevant positions regarding CBAM reporting. The interviews focus on finding out how the solutions could be implemented, and if there are certain challenges slowing down the accomplishing of an optimal reporting process. The people chosen for the internal interviews work with the business activity model (BAM) and data.

3 Background

This section provides a literature review on the current climate targets and regulation in the EU, as well as explains the EU ETS and CBAM which are the EU's main tools in addressing climate change and achieving the set climate targets (European Council, 2023). The literature review gives a broad view on the background of the study as well as introduces the driving forces behind the new regulation. It also provides information about the CBAM regulation, which is needed and utilised later in this research to plan an optimal reporting process.

This literature review aims to collect relevant information about the new regulation taking into account the recent changes and updates in the situation. The information is gathered from different authorities, academic literature, laws and regulations, and then critically reviewed to collect the most relevant information.

3.1 The European Green Deal and the European Climate Law

The European Commission first presented the European Green Deal in a press release on the 11th of December in 2019. It aims at making the EU's economy sustainable by providing actions that enhance the efficient use of resources by transitioning to cleaner and circular economy, mitigating climate change and cutting pollution, as well as recovering the lost biodiversity. According to the press release, all sectors of the economy are covered by the European Green Deal. This includes energy, transport, buildings, different industries and agriculture. (European Commission, 2019c.)

The Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions by the European Commission (2019a) sets out the European Green Deal for the EU and the EU citizens. It aims at reducing the effects of climate change, such as increased temperature, biodiversity loss and increased pollution. The European Green Deal sets a goal and a framework for achieving net zero GHG emissions in 2050, as well as aims to decrease the economic growth's dependency on resource use. The Communication also states that while striving to a carbon neutral continent, the actions must be done in a way that human well-being and health, as well as the EU's natural capital is enhanced and protected. The transition must be fair and especially consider the areas, industries and people facing the most challenges. (European Commission, 2019a.)

The Annex to the Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions by the European Commission (2019b) includes a roadmap for actions

to achieve the goals set in the European Green Deal. The roadmap includes an intermediate target of increasing the previous target set for 2030 to 50 % or even further to 55 % emissions reduction compared to the base year of 1990. A change in the policies is necessary, as according to the Communication by the European Commission (2019a) the current policies can only reduce emissions by 60 % by 2050, compared to 1990. In order to achieve the ambitious climate targets, the EU's actions alone are not enough. To reach the target set for 2050, actions need to be done globally, and the EU can with its influence affect the climate actions done in the neighbouring countries and by its partners. (European Commission, 2019a.)

The Green Deal roadmap in the Annex to the Communication (European Commission, 2019b) includes an action of proposing a European Climate Law that sets into legislation and affirms the goals set in the European Green Deal. The Regulation (EU) 2021/1119 of the European Parliament and of the Council (2021) was introduced in 2021 as a result of the ambitious goals set in the Green Deal. The law establishes a framework for achieving the climate targets for 2030 and 2050.

3.2 The “Fit for 55” package

The “Fit for 55” package is a set of proposals introduced in order to achieve the targets set in the European Green Deal and confirmed by the European Climate Law. The proposals aim at achieving the 2030 target of reducing emissions by 55 %, as well as help in reaching the 2050 target of climate neutrality. The proposals are introduced to update the existing legislation and ensure that the policies are in line with the set targets. (European Council, 2023.)

The press release by the European Commission (2023c) states that the Commission has introduced the key legislation to complete the “Fit for 55” package, which helps in keeping the EU on track with the set climate targets. The package consists of the following set of legislation: EU ETS reform; Social Climate Fund; Revised EU Emission Trading System for aviation; Notification on the Carbon Offsetting and Reduction Scheme for International Aviation; Monitoring, Reporting and Verification Maritime Regulation; Effort Sharing Regulation; LULUCF Regulation; Energy Efficiency Directive; CO₂ emissions standards for new cars and vans; Alternative Fuels Infrastructure Regulation; FuelEU Maritime Regulation; and CBAM. The legislation was completed with the revised Renewable Energy Directive and the ReFuelEU Aviation Regulation. (European Commission, 2023c.)

The legislation included in the “Fit for 55” package covers all sectors of the EU's economy, as well as legally binds the member states to act accordingly to the climate targets. According to the press release, the package aims at overall emissions reduction and includes emissions

reduction targets for a wide range of sectors, as well as aims at strengthening natural carbon sinks. The legislation also includes an update on the renewable energy and energy efficiency targets, and will affect on the share of current vehicles for transport. This is because the new polluting vehicles will be phased out by 2035, and the infrastructure for electric vehicles will be boosted. The legislation also promotes the use of alternative fuels in different transportation methods. (European Commission, 2023c.)

3.3 EU emissions trading system (EU ETS)

The EU ETS is a mechanism by the EU aiming at reducing emissions from stationary installations and aviation. The system is based on a “cap and trade” principle, where an annual EU wide cap is set on the emissions in the form of emission allowances. (European Commission, 2023e.) Each allowance is equal to one emitted ton of CO₂ equivalent of emissions. It is required for each company covered by the regulation to acquire enough allowances to account for all their yearly emitted emissions. The companies can buy, receive or trade allowances, which gives the companies a possibility to either save the allowances for later, or sell them to other companies. (European Commission, 2023i.)

The system was introduced in 2003 in the Directive 2003/87/EC of the European Parliament and of the Council (2003) as a result of the Kyoto Protocol in 1997, which introduced the first legally-binding targets for emissions reduction. It was launched in 2005, and has after that gone through three phases, the fourth and current being from 2021 to 2030. (European Commission, 2023d.) The first phase was a three-year pilot period, which was followed by the second phase in which there were actual emissions reduction targets for the countries to achieve. The third phase included major changes, for example the national cap for emissions was changed for an EU wide cap, and the default allocation method was changed from giving out free allowances to auctioning. The system was reformed first for the third phase from 2013 to 2020, and later for the fourth phase from 2021 to 2030. (European Commission, 2023d.) The latest reform is also a part of the “Fit for 55” package (European Commission, 2023i).

The EU ETS puts a price on emissions, creates investments around the green transition, and provides social support for citizens and small businesses (European Commission, 2023c). The latest reform provides a new reduced starting amount for allowances, as well as a new linear reduction factor for their annual reduction. The Commission Decision (EU) 2020/1722 (2020) sets the 2021 cap for allowances allocated to stationary installations, which is 1 571 538 007 in the beginning of the fourth phase. The cap on allowances for stationary installations is decreasing annually, in phase 3 by a linear factor of 1.74 %, and in phase 4 by a linear factor of 2.2 % (European Commission, 2023e). Thus, the annual reduction in allowances

after 2021 is 43 003 515. The Notice on the Union-wide quantity of allowances for 2021 and the Market Stability Reserve under the EU Emissions Trading System (2020) states that the base value of approximately 24.5 million allowances is allocated to aviation in 2021, with the same linear reduction factor of 2.2 % as for stationary installations. Thus, the annual reduction of allowances for aviation is around 539 000 allowances. The annual reduction in allowances makes sure that the allowances keep having market value. It also pushes the companies into reducing their emissions, and keeps the companies aware of the scarcity of the amount of available allowances. (European Commission, 2023i.)

Article 10 in the original EU ETS 2003 directive, the Directive 2003/87/EC of the European Parliament and of the Council (2003), states that *“For the three-year period beginning 1 January 2005 Member States shall allocate at least 95 % of the allowances free of charge. For the five-year period beginning 1 January 2008, Member States shall allocate at least 90 % of the allowances free of charge”*. As mentioned before, the default allocation method was changed in 2013 from free allowances to auctioning. After 2013, over the next tracking period from 2013 to 2020, 43 % of all allowances were allocated for free. The share will continue decreasing, and for example in 2013 the manufacturing industry got 80 % of its allowances for free, but in 2020 only 30 %. (European Commission, 2023g.)

The allocation of free allowances mostly considers some energy-intensive industrial installations that have the highest risk of carbon leakage. Carbon leakage occurs if production is moved to countries with less strict climate policies, which is usually due to the high costs related to climate policies. The goal of free EU ETS allowances is to keep production in the EU by supporting these industries with covering the emitted emissions for free. The system also protects the competitiveness of these industries and tries to prevent carbon leakage from the EU. (European Commission, 2023b.)

3.4 Carbon border adjustment mechanism (CBAM)

The CBAM regulation is a part of the “Fit for 55” package, and was adopted in May 2023. It is introduced in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) which states the subject matter as follows:

1. *This Regulation establishes a carbon border adjustment mechanism (the ‘CBAM’) to address greenhouse gas emissions embedded in the goods listed in Annex I on their importation into the customs territory of the Union in order to prevent the risk of carbon leakage, thereby reducing global carbon emissions and supporting the goals of the Paris Agreement, also by creating incentives for the reduction of emissions by operators in third countries.*

2. *The CBAM complements the system for greenhouse gas emission allowance trading within the Union established under Directive 2003/87/EC (the 'EU ETS') by applying an equivalent set of rules to imports into the customs territory of the Union of the goods referred to in Article 2 of this Regulation.*
3. *The CBAM is set to replace the mechanisms established under Directive 2003/87/EC to prevent the risk of carbon leakage by reflecting the extent to which EU ETS allowances are allocated free of charge in accordance with Article 10a of that Directive.*

According to the subject matter, the regulation aims at supporting the global climate goals by tackling the EU ETS issue of carbon leakage. It will complete the EU ETS by adding a fair price for the emissions embedded in imports coming from outside of the EU. The introduction of CBAM is aligned with the phasing out of the EU ETS free allowances. The CBAM regulation works similarly to the EU ETS, as the importer of CBAM goods has to report the emissions embedded in their imports, and acquire enough CBAM certificates to account for the emissions. The price of the CBAM certificates is determined by the price of the weekly EU ETS allowances. (European Commission, 2023a.) The pricing also aims to encourage importers, installation operators and third countries to reduce their emissions (Tulli, 2023b).

The reporting will start with a two year transitional period during from October 2023 to December 2025 during which the importers have to report quarterly the emissions from their imports. After 2026 the definitive regime will enter into force, which means that the importers have to declare the quantity of imported goods in the previous year as well as their embedded emissions to the European Commission once a year. The reporting during the transitional period does not require verification or any financial payments. (European Commission, 2023a.) The transitional period is important both for the EU and for the companies, because it helps in reducing carbon leakage, as well as in reducing GHG emissions. The first reports give important information about the functionality of the system and the European Commission can use the reports to define default emission values for the products. These values can later be used for calculations. As the reporting requires new actions and cooperation between importers, suppliers, and the authorities, it is important that the transition to the definitive regime is flexible. This gives the stakeholders time to get used to the new system, as well as to create a functioning reporting mechanism before 2026. (Tulli, 2023b.)

3.4.1 Requirements for transitional period (2023-2025)

During the transitional period an importer of goods or their representative has to report the quantity of imported goods, the direct and indirect emissions embedded in the imports, the possible carbon price paid in the country of origin and the compensations received. The

Commission Implementing Regulation (EU) 2023/1773 (2023) lays down rules for implementing the CBAM regulation during the transitional period. It also presents the calculation methods for the transitional period. The Annex I of the implementing regulation presents the information that needs to be included in the quarterly reports. During the transitional period the report is submitted to the European Commission through the CBAM Transitional Registry. The reporting is done quarterly, and the deadlines for the reports are 31.1., 30.4., 31.7., and 31.10. The importer is responsible for collecting the emission data from the suppliers, but it is also possible to submit the CBAM report with insufficient information. However, if the report is not completed before the deadline or if it is missing completely, there is a chance for penalties and it might be more difficult to get the status of an authorised CBAM declarant in the future. (Tulli, 2023b.)

3.4.2 Requirements for the definitive regime (2026-)

The definitive regime includes certain changes compared to the transitional period. According to article 4 in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023), once the definitive regime enters to force, only an authorised CBAM declarant is allowed to import CBAM goods to the EU. Any importer of CBAM goods must apply for the authorised CBAM declarant status before importing goods into the EU customs territory, as stated in Article 5. Article 5 also states the requirements for the CBAM declarant application. The application shall include for example the name, address and contact information of the applicant, the company's main business activity in the EU, and the EORI number of the applicant. An economic operators registration and identification number (EORI) is an identification number for companies originating in the EU. All importers and suppliers who trade with non-EU countries, as well as transport companies need an EORI number for all customs declarations. (Tulli, 2023a.) The application also requires a declaration of honour regarding infringements of customs legislation, taxation rules or market abuse rules, necessary information to prove that the applicant is capable to fulfil its obligations under the regulation, an approximation of the monetary value and volume of imported goods of the ongoing and following year, a certification that the applicant is not subject to an outstanding recovery order for national tax debts and if the applicant is not acting for themselves, the names and contact information of the persons to whom the application is addressed.

In the definitive regime also the CBAM declaration is done only once a year, instead of the quarterly reporting. Article 6 in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) states that the CBAM declaration is to be reported each year by May 31st, the first time being in 2027 for the previous year's imports. The report is submitted to the CBAM registry by each authorised CBAM declarant. Article 6 also states that the report shall include the following information:

- (a) *The total quantity of each type of goods imported during the preceding calendar year, expressed in megawatt-hours for electricity and in tonnes for other goods.*
- (b) *The total embedded emissions in the goods referred to in point (a) of this paragraph, expressed in tonnes of CO₂e emissions per megawatt-hour of electricity or, for other goods, in tonnes of CO₂e emissions per tonne of each type of goods, calculated in accordance with Article 7 and verified in accordance with Article 8.*
- (c) *The total number of CBAM certificates to be surrendered, corresponding to the total embedded emissions referred to in point (b) of this paragraph after the reduction that is due on the account of the carbon price paid in a country of origin in accordance with Article 9 and the adjustment necessary to reflect the extent to which EU ETS allowances are allocated free of charge in accordance with Article 31.*
- (d) *Copies of verification reports, issued by accredited verifiers, under Article 8 and Annex VI.*

As mentioned above in item (c), the CBAM declarant has to acquire enough CBAM certificates to account for all emissions embedded in their imports in the preceding year. One CBAM certificate accounts for 1 ton of emissions, and the price is formed according to the current weekly auctioning price of the EU ETS allowances. The Commission will create a CBAM account for each CBAM declarant, to store the bought CBAM certificates. The Member States will sell the certificates, and there is no limit to the number of certificates allowed to be bought. The CBAM account has to hold minimum of 80 % of the needed certificates quarterly, and the remaining certificates have to be bought by the deadline of the annual report. (Tulli, 2023b.)

4 A general framework for CBAM reporting

The reporting requirements for importers of goods into the EU and installation operators outside the EU are written into law in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023). The regulation introduces the main target of CBAM, as well as states how the reporting should be carried out, and what information should be included in the report. It also introduces the other requirements for the process, and provides information about the involved parties and their roles in the reporting process.

The European Commission has prepared IT tools to help importers and installation operators to calculate the related emissions, as well as developed guidance documents, training materials and tutorials to support companies in the adaptation to the new system. The Commission also published an Excel template to help installation operators to report their embedded emissions in the correct way. (European Commission, 2023a.) The Commission has published two guidance documents for the implementation of CBAM, the other one for the importers of goods into the EU, and the other one for the installation operators outside the EU. The documents are written in a non-legislative language, and the aim of the documents is to provide assistance and support companies in the implementation of CBAM during the transitional period. (Directorate-general Taxation and Customs Union, 2023a; Directorate-general Taxation and Customs Union, 2023b.) The documents are based on the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) and the Commission Implementing Regulation (EU) 2023/1773 (2023). As mentioned in the scope of this thesis, this study introduces the reporting principles both for importers of goods into the EU and for installation operators outside the EU. This section gives an overview of the contents of the regulation and analyses the results from the benchmarking. Finally, by using the collected information and the previously mentioned guidance documents, a general CBAM reporting process is drafted. This section introduces the CBAM regulation as well as the requirements and guidance documents for installation operators and importers.

4.1 Scope of the regulation

The CBAM regulation will first apply to those imports originating in a third country, of which the manufacturing has the highest risk of carbon leakage. These products are fertilisers, electricity, cement, iron and steel, aluminium and hydrogen. The precise products affected by the CBAM regulation are identified in the Annex I of the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023). Article 2 in the regulation states that the CBAM goods that are processed into products in an inward processing procedure are only included in the scope of the regulation, if they are imported into the EU customs territory after the inward processing. This includes any area or structure locating in the exclusive

economic zone of a Member State that is bordering the EU customs territory. In addition, article 3 in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) defines importation as follows: “‘importation’ means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013”. This means that products that go through the inward processing procedure and are not released for free circulation or supplied to a customer inside the EU, are excluded from the scope of the regulation and do not have to be included in the CBAM report. The scope is presented in figure 1 below.

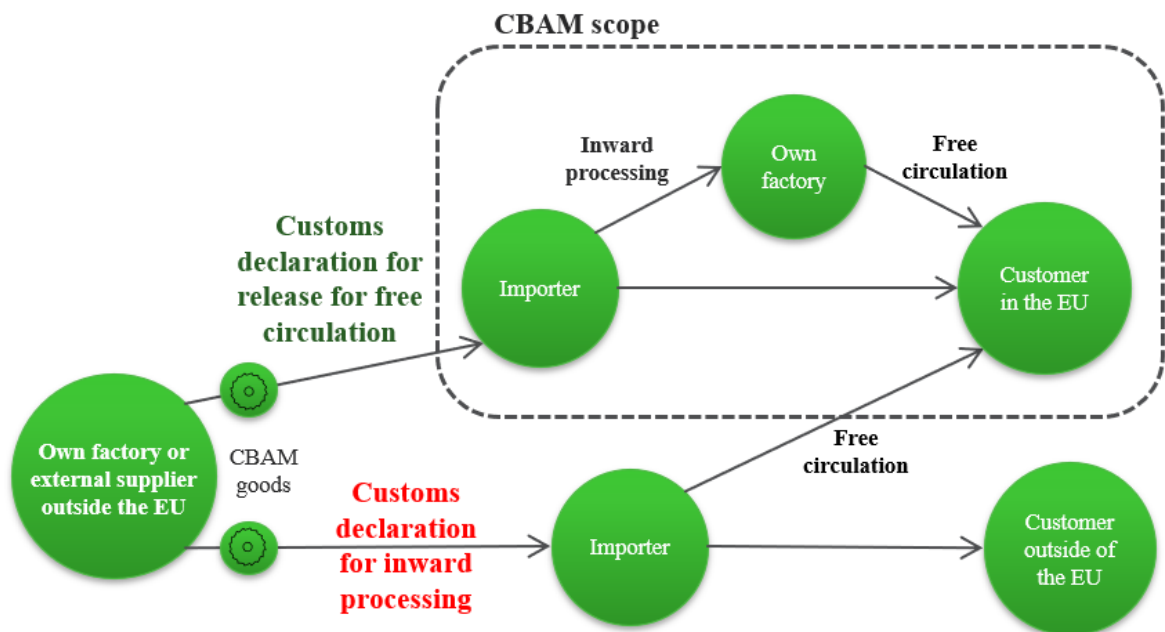


Figure 1: Illustration of CBAM scope.

The scope introduced in the regulation also states that the regulation does not apply to all products in the previously mentioned categories. The regulation states that if the imported goods have negligible value, they do not have to be reported for CBAM. The article 23 in the Council Regulation (EC) 1186/2009 (2009) states that an import is considered negligible if it has a maximum value of 150 €. The goods imported in the personal luggage of travellers are also not considered by the CBAM regulation if they are of negligible value. The regulation states that it does not apply to goods used for military purposes, or to goods that are originating in Iceland, Liechtenstein, Norway and Switzerland, or in territories of Büsingen, Heligoland, Livigno, Ceuta and Melilla.

4.2 Requirements for importers of goods into the EU

The reporting guidelines for importers of goods are introduced in the Guidance Document on CBAM Implementation for Importers of Goods into the EU by the Directorate-general Taxation and Customs Union (2023a). The document is targeted for the transitional period, and gives guidance to the implementation of CBAM. It states that the first step in starting the

CBAM reporting process is to clarify if the imported products are CBAM goods or not. This is done by comparing the combined nomenclature codes (CN) of the products against the list given in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023). The CN code is an 8-digit code used for classifying goods. If the CN codes of the imported goods correspond to the codes included in the current list of CBAM goods, the importer has to follow the rules of the CBAM regulation. (Directorate-general Taxation and Customs Union, 2023a.)

According to the Commission Implementing Regulation (EU) 2023/1773 (2023) the next step is to determine if, and how much of a carbon price for the goods or precursors has already been paid in the sub-national region, or country of origin. If a carbon price has already been paid, it allows a reduction in the CBAM obligation after the beginning of the definitive regime in 2026. Information about a paid carbon price however needs to be included in the report in the transitional period. If the precursors originate from an area where a carbon price is paid, the importer also needs to collect information for each purchased precursor. If information about the carbon price is not provided, it is assumed to be zero.

The guidance document states that an importer of CBAM goods needs to request certain information from the installation operator in order to follow with the CBAM requirements. The report has to include information about direct and indirect emissions, precursors (optional), and additional qualifying parameters that depend on the goods in question. This information is collected from the installation operators. The data monitoring is explained better in section 4.3, and the emission calculations in section 4.4. Regarding the indirect emissions, the importer needs to report how much electricity is consumed per imported product, and calculate the emissions by multiplying with the emission factor of electricity. The data related to precursors does not have to be reported, but they have to be included in the emission calculations for CBAM goods. Thus, it is good practise to provide relevant emission data on the precursors to ease the process of checking the reported emissions. In addition, depending on the type of goods produced, some additional qualifying parameters listed in Annex IV of the Commission Implementing Regulation (EU) 2023/1773 (2023) need to be reported.

The last steps the importer has to take are to understand the reporting period used by the operator, and to collect information about the embedded emissions using provided methods. Collecting information from the installation operator is recommended to be done by using the template provided by the European Commission. This is to make the communication between the importer and the operator as efficient and simple as possible. In the end of each reporting period the operator calculates the specific embedded emissions of each good, which are the main parameter to be obtained for the report from the installation operators. (Directorate-general Taxation and Customs Union, 2023a.)

4.3 Requirements for installation operators outside the EU

The reporting guidelines for installation operators are introduced in the Guidance Document on CBAM Implementation for Installation Operators Outside the EU by the Directorate-general Taxation and Customs Union (2023b). The document states that as well as the importers, also the installation operators have to determine if the produced products are CBAM goods. This is done by comparing the CN codes of the imported goods to the product codes listed in Annex I of the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023).

The operator also has to note that in addition to the goods being imported straight to the EU, there are other ways in which the goods fall under the regulation. If the products are used in inward processing by the customers, they might act as precursors for CBAM goods, which are then imported to the EU, or if the products are sold to a trader who sells them to the EU, they fall under the CBAM. In these cases the operator is responsible for providing information about the embedded emissions of the goods. (Directorate-general Taxation and Customs Union, 2023b.)

To be able to provide the correct information about embedded emissions according to CBAM, the operator first needs to define the installation boundaries, production processes and production routes. Defining the system boundaries is necessary for attributing emissions to specific products. In the CBAM regulation each product or good is classified to an “aggregated goods category”, which means that the goods involved in the same category are, for the purpose of monitoring, assumed to go through the same joint “production processes”. Thus, the installation operator can assume that certain products go through the same production process, which makes the emission calculations more simple. (Directorate-general Taxation and Customs Union, 2023b.) In addition, the operator has to define the reporting period they are going to use. The reporting period might differ between the importer and the installation operation due to many reasons, for example the location of the installation. With a reasonable argument, other calendars can be used. Suitable periods can include for example periods of a carbon pricing scheme or the fiscal year in the country of the installation. In some cases it is reasonable to use these alternative reporting periods, as they might increase the confidence of the data used for CBAM reporting. (Directorate-general Taxation and Customs Union, 2023a.)

The operator has to provide certain basic information to the importer, as well as information about the monitored parameters in an installation, which need to include direct emissions of the installation, direct emissions related to heat flows, indirect emissions, and emissions from precursors. The Regulation (EU) 2023/956 of the European Parliament and of the Council

(2023) states direct and indirect emissions as follows:

- (a) *‘direct emissions’ means emissions from the production processes of goods, including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling*
- (b) *‘indirect emissions’ means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity*

The direct emissions of the installation can be either calculated or measured. The calculation-based approach is based on the quantities of fuels and materials used in the production, and the corresponding factors used for calculations, such as the emission factor of the fuel or material. The measurement-based approach is used to measure the concentration of the GHGs and the fuel gas flows for each emission source. The installation operators also need to monitor the emissions related to heat flows, which means that the emissions from heat consumption need to be attributed to production processes. If the heat is recovered or produced within production processes, the emissions attributed to the produced products can be deducted. (Directorate-general Taxation and Customs Union, 2023b.)

For indirect emissions there are different options for performing the calculations depending on the situation. A default emission factor by the European Commission or another country-specific emission factor can be used if the electricity comes from the grid. If the installation produces electricity, the emissions need to be monitored similarly to other direct emissions from the installation, and follow specific rules for calculating the emission factor for the fuel mix. If the used electricity is bought from an installation under a “power purchase agreement”, the operator can use the provided actual emission factor of the electricity. (Directorate-general Taxation and Customs Union, 2023b.)

Precursors are the input materials that are exclusively used for the manufacturing of goods. The calculation of emissions from precursors is needed by the operator, if the precursors are produced at the operator’s installation. If the precursors are bought, the operator needs to request the embedded emissions from the producer. For bought precursors the information needed is the identification of the producing installation, direct and indirect emissions of the precursor, production route and additional parameters, reporting period used by the producer, and information about the possible carbon price paid. The quantity of the precursors needs to be monitored in both cases. (Directorate-general Taxation and Customs Union, 2023b.) In addition, some additional qualifying parameters need to be monitored, and they can be found from Annex IV of the Commission Implementing Regulation (EU) 2023/1773 (2023).

In order to perform the emission calculations, the operator needs to determine a methodology for monitoring each parameter. The methodology needs to be defined for quantities of fuels and materials, and calculation factors or instruments for continuous emission measurements. The installation operator also has to provide information about if they are obliged to pay a carbon price in their own jurisdiction. This information is also needed of all precursors bought. (Directorate-general Taxation and Customs Union, 2023b.)

The installation operator is required to put all the collected information together in a written documentation, so the used methodology is transparent and can be followed consistently in the coming years. The documentation is also important so it can be ensured that the treatment is similar between the installations affected by the EU ETS regulation and the installations outside the EU. The documentation is called monitoring methodology documentation (MMD). The principle is that an independent person with knowledge of GHG monitoring is able to understand the given methodology. The documentation should be detailed enough so it can be followed by the installation's personnel calculating the embedded emissions. The calculation methods and steps should thus also be included in the documentation. In addition, the MMD has to include control measures from primary data to final emissions, for example a frequent checking by an independent person, comparing data from different sources, and checking the consistency of time series. The preparation to the CBAM has to be done in the beginning of the reporting obligation to be able to monitor the installation, but the monitoring must be performed throughout the reporting period. The relevant data needs to be collected, emissions need to be calculated, and all relevant quality control measurements defined in the MMD need to be performed. The MMD also needs to be reviewed once per reporting period. (Directorate-general Taxation and Customs Union, 2023b.)

To be able to submit the report, the installation operator has to collect the necessary data from the whole reporting period, determine the emissions from each production process, and divide them by the corresponding "activity level" to calculate the specific embedded emissions of the goods. The activity level means the total amount of CBAM products produced at the installation during the reporting period. The specific embedded emissions are the main parameter the importers needs to obtain from the operator, and the installation operators have to communicate the requested information about the embedded emissions to the importers. (Directorate-general Taxation and Customs Union, 2023a.) The calculations methods are introduced in section 4.4

4.4 Emission calculations

As mentioned previously, the implementation of the CBAM regulation has a transitional period from October 2023 to December 2025. During the transitional period the companies

can choose between three different methods for calculating the emissions embedded in their imports. The first option is to use the EU method, which means that the reporting is done fully in accordance to the new methodology. Starting from the 1st of January 2025, the EU method will be the only accepted method for reporting emissions. Until the end of 2024 the companies can, instead of the EU method, choose one of the three methods equivalent to the EU method to calculate their emissions. As stated in Article 4 of the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023), the alternative methods are as follows:

- (a) *a carbon pricing scheme where the installation is located; or*
- (b) *a compulsory emission monitoring scheme where the installation is located; or*
- (c) *an emission monitoring scheme at the installation which can include verification by an accredited verifier.*

It is also accepted to do the reporting based on default values, which the Commission published in the end of 2023. These values can be used during the transitional period until the end of July 2024, but also later with the EU method in specified cases. The default values and estimates are accepted in the calculations if the goods are complex and the default values are accounting for a maximum share of 20 % of total embedded emissions. (European Commission, 2023a.)

The embedded emissions in the CBAM are based on the carbon footprint of products (CFP) (Directorate-general Taxation and Customs Union, 2023b). The CFP is a system where the environmental footprint of a product is calculated from throughout its whole life cycle, and then displayed on the package of the product in supermarkets. The calculation in CFP is done using life cycle assessment (LCA) method, which takes into account all life cycle stages from the product life cycle. (Inaba et al., 2016.) LCA is a widely used tool for environmental management, which started to grow interest two decades ago due to increased application and implementation both in private and public decision-making. (Finkbeiner, 2016.) Where the CFP considers the whole life cycle of the product, in CBAM the scope is limited to covering the same emissions as the EU ETS. This means that the emissions from use and end-of-life are left out in the embedded emissions of CBAM products. Transportation of products between sites and from processes further upstream are also excluded from the scope. (Directorate-general Taxation and Customs Union, 2023b.) The Guidance Document for Installation Operators Outside the EU by the Directorate-general Taxation and Customs Union (2023b) presents the precise system boundaries and value chain for each covered sector and each aggregated goods category. The document also provides case studies on the application of the mass balance method used in the calculations. A simplified system

boundary for the processes included in the scope of CBAM is presented in figure 2 below.

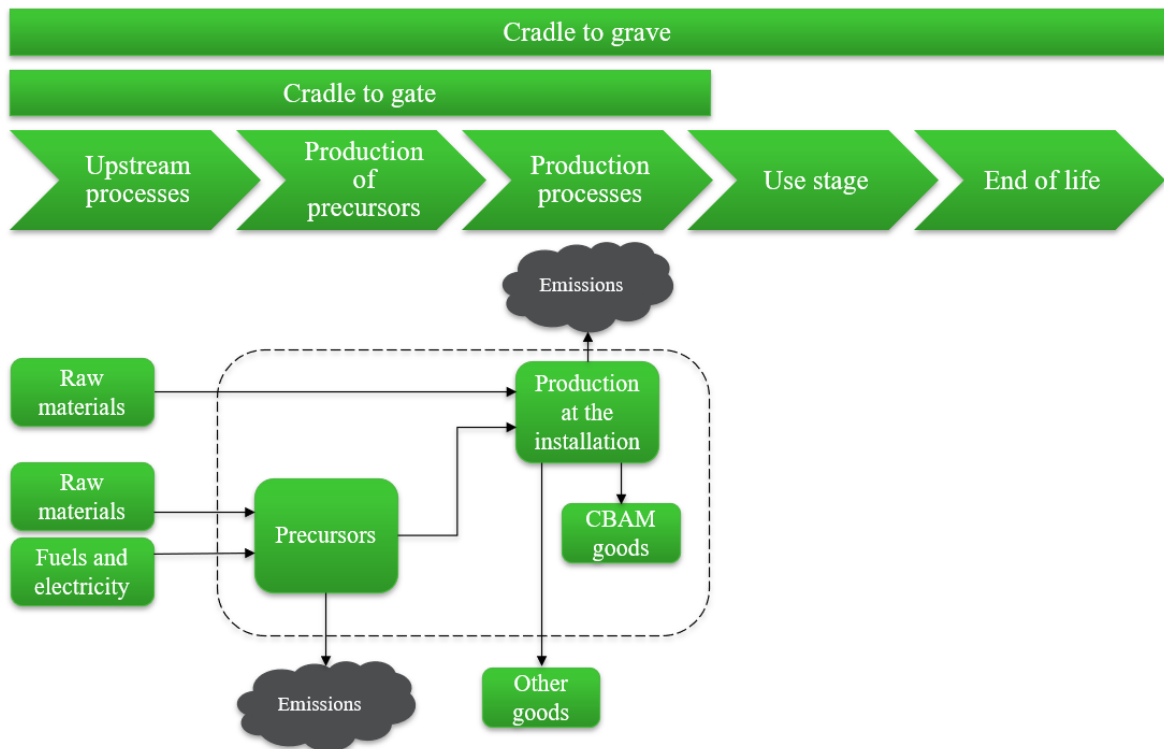


Figure 2: A simplified system boundary for calculating embedded emissions of CBAM goods (Directorate-general Taxation and Customs Union, 2023b).

As mentioned in the previous sections 4.3 and 4.2, the calculation responsibility lies with the supplier. To calculate the specific embedded emissions, information about all used production processes and equipment, all fuel, energy and material flows, and direct and indirect sources of GHGs is needed. The supplier can use a calculation-based or a measurement-based method for data collection.

Annex IV in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) introduces the calculation methods for embedded emissions for simple goods and complex goods. The annex defines simple goods as *goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions* and complex goods as *goods other than simple goods*. The emission calculations for CBAM are performed as follows. First, the installation's emissions are calculated from during the reporting period and attributed to the production processes which result in goods g . The attributed emissions for goods g ($AttrEm_g$) can be calculated by adding up the direct emissions ($DirEm$) from the production process and the indirect emissions ($IndirEm$) from used electricity, as shown in equation 1 below.

$$AttrEm_g = DirEm + IndirEm \quad (1)$$

To find out the specific embedded emissions for goods g (SEE_g), the attributed emissions are divided by the activity level (AL_g), which represents the quantity of goods g produced during the reporting period. When calculating the specific embedded emissions for simple goods, the emissions from precursors is not taken into account. This is shown in equation 2 below.

$$SEE_g = \frac{AttrEm_g}{AL_g} \quad (2)$$

For complex goods the embedded emissions of input materials (EE_{InpMat}) are taken into account. The embedded emissions of input materials, or precursors, can be calculated as shown in equation 3 below. In the equation the mass of the input material (M_i) is multiplied with the specific embedded emissions (SEE_i) of the representing input material. This is done for all of the input materials, and then summed up together to get the embedded emissions of the precursors.

$$EE_{InpMat} = \sum_{i=1}^n M_i \cdot SEE_i \quad (3)$$

To find out the specific embedded emissions of complex goods g , the sum of attributed emissions of the goods g and the embedded emissions of the input materials are divided by the activity level. This is shown in the equation 4 below.

$$SEE_g = \frac{AttrEm_g + EE_{InpMat}}{AL_g} \quad (4)$$

Simply put, the installation operators have to first define the reporting period and calculate the sum of the direct and indirect emissions, with the information stated in section 4.3. In the case of complex goods the sum should also include embedded emissions of the precursors. The sum is then divided with the number of goods g produced during the reporting period, which gives as a result the specific embedded emissions of the CBAM good.

4.5 Summary of the CBAM reporting process

The Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) sets the requirements for CBAM reporting for installation operators and importers of CBAM goods. The European Commission has provided a various set of guidance documents, IT tools and templates to help the involved parties to follow the rules of the regulation. The transitioning to CBAM will start with a two-year transitional period, which works as a learning period for operators and importers to adjust to the regulation. The regulation first applies to the manufacturing of carbon-intensive goods, but the scope will enlarge in the future.

The main requirement for importers is to report the embedded emissions to the European Commission quarterly during the transitional period and annually in the definitive regime. The step-by-step instructions for importers are summarised below:

1. Combine the CN codes of the imported goods to the list given in Annex I of the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) to ensure that CBAM requirements apply to the imported goods.
2. Determine if, and how much of a carbon price has been paid for the goods or precursors in the sub-national region, or country of origin.
3. Understand the reporting period used by the operator.
4. Request information about the direct and indirect emissions, precursors and additional parameters from the installation operator by using the provided methods.
5. Submit the report including the quantity of goods, the embedded direct and indirect emissions, the possible carbon price paid, and the information about compensations to the CBAM Transitional Registry during the transitional period, and the CBAM declaration including the quantity of imported goods, the total embedded emissions in the goods, the total number of CBAM certificates to be surrendered and the copies of verification reports to the CBAM Registry during the definitive regime.

The emission calculations in CBAM are performed by the installation operator and they should be carried out by a cradle-to-gate LCA. The approach takes into account the upstream processes, production of precursors, and the actual production processes of the CBAM goods. Use stage and end of life are left out from the scope of the analysis. The main requirement for installation operators is to provide the embedded emissions of their products to the importer of CBAM goods. The step-by-step instructions for installation operators are summarised below:

1. Combine the CN codes of the goods produced at the installation to the list given in Annex I of the Regulation (EU) 2023/956 of the European Parliament and of the Council

(2023) to ensure that CBAM requirements apply to the produced goods.

2. Define installation boundaries, production processes and production routes to enable the attributing of emissions to specific products.
3. Define a reporting period to be used.
4. Use a calculation-based or a measurement-based approach to find out the direct and indirect emissions embedded in the products.
5. Define the emissions embedded in the precursors.
6. Determine a methodology for monitoring each of the parameters, and create a written document providing all above mentioned information.
7. During each reporting period, provide the importer with the embedded emissions of their imports.

By following these instructions and the supplementary information given in the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) and the guidance documents, the importers and installation operators should be able to provide the needed information for reporting according to the CBAM requirements.

5 Case Valmet

The goal of this thesis is to find out the main principles guiding the implementation and optimisation of the CBAM reporting process and use them to plan a CBAM reporting process for Valmet. This section shortly introduces Valmet and gives an insight of Valmet's need for CBAM reporting. The first subsection gives a short introduction to Valmet's business lines, organisational structure and legal entities. The second subsection introduces the supply chain and procurement, especially the sustainable supply chain policy and supplier sustainability management process. The last subsection presents the CBAM products at Valmet.

5.1 Introduction to Valmet

Valmet is a globally operating manufacturing company providing automation systems, process technologies and services for different industries. The main customers are in pulp, paper and energy sectors. Valmet operates under five business lines; Pulp and Energy, Services, Flow Control, Automation Systems, and Paper, and five geographical areas; North-America, South-America, EMEA (Europe, Middle-East and Africa), China and Asia-Pacific. The head office is located in Finland, in addition to which the EMEA area has in total 206 R&D centers, service centers, production units and sales offices. For China, Asia-Pacific, South America and North America the figures are 20, 48, 14, and 60, respectively. Valmet has over 17 000 employees, and in 2022 Valmet's net sales were around 5,1 billion euros. (Valmet, 2023d.)

Valmet is a matrix organisation, which means that instead of some managers reporting to one boss, they report to two. Matrix organisation is usually used if the companies have to be responsible for two sectors simultaneously, if the operation requires very high information processing, and if there are strong constraints on financial or human resources. A matrix organisation includes three critical roles. The top manager is responsible for balancing the dual chains in the matrix, the matrix bosses share the subordinates, and the managers are responsible for reporting to the matrix bosses. (Davis & Lawrence, 1978.) The operating model at Valmet consists of five business lines, five geographical areas and four support functions. These are shown in the matrix in figure 3 below. (Valmet, 2023e.)



Figure 3: The matrix management system at Valmet (Valmet, 2023e).

From Valmet's business lines, Pulp and Energy, Paper, and Flow Control provide mainly technology solutions, while Automation Systems and Services focus on automation and service solutions. Flow Control delivers technologies for various industries, focusing on improving the environmental efficiency and performance of their processes. The technologies are also designed to ensure the safe flow of materials. Pulp and Energy offers technologies for pulp and energy production, biomass conversion and emission control. The technologies are designed to maximize production with renewable materials, with keeping focus on increasing efficiency and minimising environmental impacts. Paper business line offers technologies for board, tissue and paper production, such as complete production lines, rebuilds, and process components. The focus is again kept on environmental and process efficiency, flexibility, safety and reliability. The machines are designed to have a modular structure, which increases cost-effectiveness, possibility for repairs, and ease of use. Services business line provides services throughout the whole life cycle of the technologies and automation systems. The services are designed to improve the performance of processes. Lastly, Automation business line provides a wide range of automation solutions which are designed to maximize profitability and sustainability. The systems aim at improving performance, quality management, cost-effectiveness and efficiency of the processes. (Valmet, 2023d.)

Valmet has around 30 legal entities in the EU, and all of them have their own EORI-number. The largest legal entities in Finland are Valmet Oyj, Valmet Automation Oy, Valmet Flow Control Oy and Valmet Technologies Oy. Valmet Oyj includes the corporate level actions. Valmet Automation Oy is in charge of the automation business line in Finland, and Valmet Flow Control Oy of the flow control business line. Valmet Technologies Oy includes pulp & energy, services, and paper business lines. In Sweden, Valmet has two legal entities; Valmet AB and Valmet Flow Control AB.

5.2 Sustainable supply chain

As mentioned in the introduction of this thesis, the supply chain network at Valmet is large and operates in more than 25 countries. Valmet has over 30 000 suppliers globally, but around 40 % of annual procurement is coming from 600 strategically important main suppliers. Valmet is developing the transparency and traceability of its value chain throughout the whole life cycle of its products. The estimate is that 4 % of the environmental impacts from the product's value chain originates from supply chain. (Valmet, 2023a; Valmet, 2023b.)

Deriving from the supplier's purchasing category or the country of origin, the suppliers have different sustainability risk levels. To identify, evaluate and manage the sustainability risks, Valmet has established a global four-step supplier sustainability management process, which is shown in figure 4 below. The global supplier sustainability management process is a tool that is used in decision-making for supplier approvals. The process includes methods to ensure that the suppliers share the same ideology and ethical principles of responsible business practices, and is mandatory before beginning cooperation with new suppliers. The sustainability practices are also reviewed in the case of contract renewal in order to ensure that the practices line up with Valmet's Sustainable Supply Chain Policy. The Sustainable Supply Chain Policy sets the principles of a sustainable supply chain, which the suppliers have to comply with. The rules were updated in 2022, after which it is expected that the suppliers monitor, report and try to reduce CO₂ emissions from their operations and value chain. (Valmet, 2023b.)

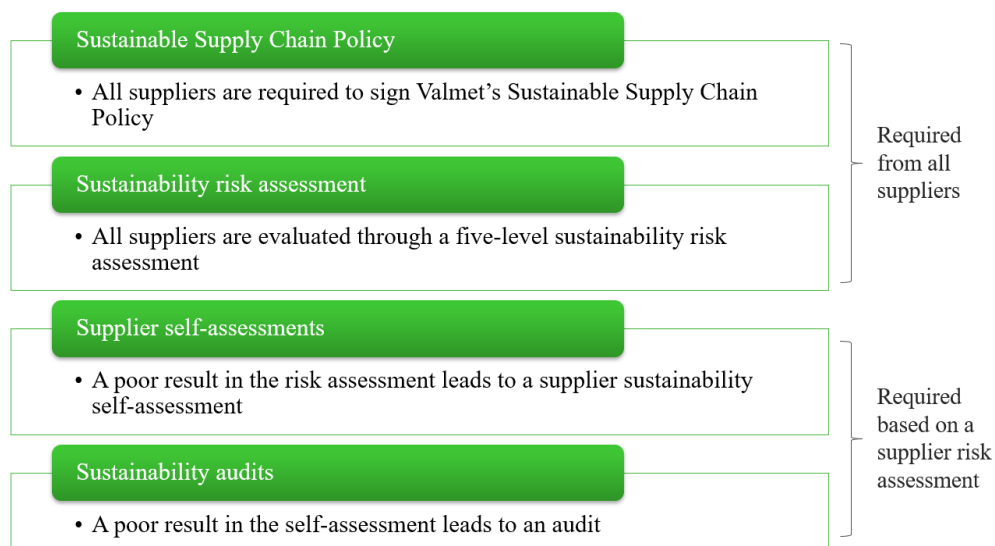


Figure 4: Valmet's global supplier sustainability management process (Valmet, 2023b).

Valmet has established a Sustainable Supply Chain Policy which covers all sectors of sustainability and sets the basic themes and requirements to which all suppliers need to comply with. The policy acts as the foundation for supplier sustainability risk assessments, supplier

self-assessments, and sustainability audits, which are a part of the global supplier sustainability management process as shown in the figure 4. The policy was last updated in 2022 due to changes in regulations, export control, and trade sanction laws. The requirements related to climate, services and products were also strengthened, and suppliers are for example required to report the emissions from their operations and value chain. (Valmet, 2023b.)

5.3 CBAM products at Valmet

According to the Annex I of the Regulation (EU) 2023/956 of the European Parliament and of the Council (2023) and the Guidance Document on CBAM Implementation for Installation Operators Outside the EU by the Directorate-general Taxation and Customs Union (2023b), the CBAM products that belong to the aggregated goods category of iron and steel products, include products that have a CN code beginning with 7205, 7208-7217, 7219-7223, 7225-7229, 7301-7311, 7318 and 7326. Currently the list of CBAM goods is relatively short, and does not include products with high added value. Thus, the share of CBAM imports in Valmet's total imports is not significant.

This section studies the customs import reports of Valmet Technologies Oy, Valmet Automation Oy, and Valmet Flow Control Oy during October and November 2023. The reports were requested from the Finnish customs. During October and November Valmet Technologies Oy had 438 different imports, of which 18 were CBAM goods. Out of these 10 were over 150 €, which makes them belong to the scope of CBAM. For Valmet Automation the numbers were 244 imports in total, 4 imports including CBAM goods, of which 3 were over 150 €. From the three studied legal entities Valmet Flow Control Oy had the most imports during the two month period. The total number of imports was 783, of which 143 were CBAM goods, and 68 priced over 150 €.

Most of Valmet Flow Control Oy's imports are valve parts, which have a CN code beginning with 8481. 283 of the imports were valve parts, which is 36 % of the total number of imports. For Valmet Technologies Oy the single most imported category were pulp and paper machine parts that have a CN-code beginning with 8439. 139 of the total number of imports declared by Valmet Technologies Oy were pulp and paper machine parts, which is around 32 % of all imports. The following figure 5 illustrates the share of CBAM products of total imports.

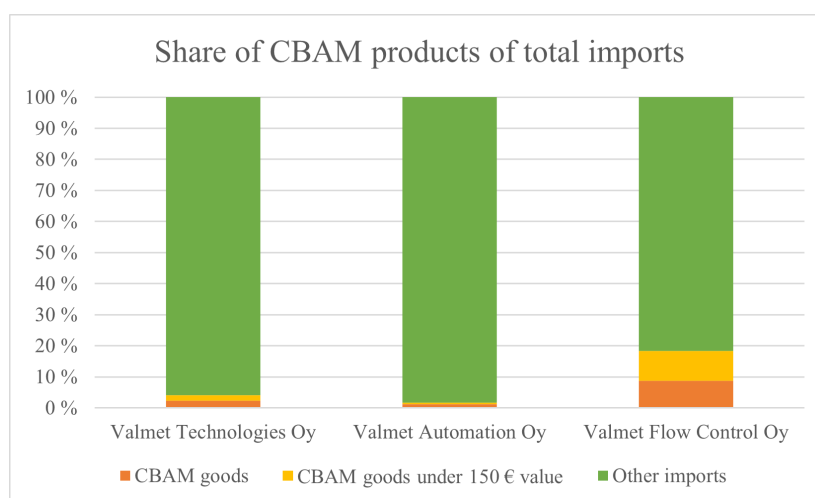


Figure 5: Illustration of the share of CBAM products of total imports.

As the goods belonging under the CBAM regulation are currently of low added value, Valmet does not itself act as a manufacturer of CBAM products. However, there are cases where a Valmet unit has to be able to provide emissions to another Valmet unit, or another actor in the EU. In these situations, Valmet acts as the supplier and has to be able to provide emissions from the manufacturing of these products. Currently, as Valmet does not manufacture these low added value products, the entities have to request the information from the manufacturer. In the future it is however possible and expected that the scope of CBAM will increase and more products will be added to the scope. These will most definitely include the higher value added products manufactured from the same materials, such as pulp and paper machine parts and valve parts.

Valmet is declaring only a small share of its imports using the inward processing customs procedure, mostly due to its high price. In these cases it is made sure that the customer is outside the EU, which makes it a very rare case at Valmet that an import originally declared for inward processing would later be imported into the EU and thus fall under the requirements of CBAM reporting. The declaration for inward processing is a multi-phase process, which is also a reason why it is preferred to declare the products for release for free circulation. Most of the imports are declared for release for free circulation, which also makes most of the imports with CBAM goods included in CBAM reporting.

6 Results

In the previous sections a framework for CBAM reporting was created by using information from legislation and guidance documents, after which the case company Valmet was introduced shortly. The collected information is used as a framework for the questions used in both internal and external benchmarking.

This section first presents the results from the internal benchmarking. The aim of the internal benchmarking was to figure out the challenges occurred with CBAM reporting at the legal entities during the first reporting period, and use the information as framework for the external benchmarking. The external benchmarking then focused on finding out what kind of challenges have occurred at similar companies, and if they correspond to the challenges found in the internal benchmarking. It was then researched if the companies had addressed the challenges, and by which means. The information from both benchmarks is later used to find out the main principles guiding the optimisation of a CBAM reporting process in a globally operating manufacturing company located in the EU.

Both benchmarks are divided into two parts, where the first one focuses on the challenges in the current situation with CBAM reporting, and the second one seeks answers to how the company representatives see the future of CBAM reporting and CBAM in general. The questions in the first part focus on finding out what were the main process steps in the reporting process during the first reporting period, what challenges were found internally and externally, and how the challenges were addressed, or could be addressed in the future. The second part aims at finding out how the representatives see the future of CBAM reporting, and how they think the regulation will affect businesses and their operations in the future.

Finally, the main findings are introduced, the suitability of the best practices for Valmet are discussed, and the outcomes are utilised in planning an optimal CBAM reporting process. The results from benchmarking are used to create an optimal process initially for the transitional period and finally to the definitive regime. The latter subsections go through the process steps, trying to find out the best available practice for each one. The section 6.3.2 includes an additional internal interview involving representatives responsible for internal data development. The interview aims at finding out how the solutions could be implemented and if there are any challenges slowing down the process. The second to last section summarises the main principles guiding the implementation and optimisation of the reporting process. In the last section a suggestion for a centralised and automated CBAM system is presented.

6.1 Internal benchmarking

This section presents the results from the internal benchmarking. The internal benchmarking included four of Valmet's legal entities located in Finland and Sweden. The entities were chosen as most of Valmet's manufacturing takes place in Finland and Sweden, and are managed by the legal entities based in these countries. The people chosen to the internal benchmarking are currently responsible for the CBAM reporting process at the legal entities, which is why they have relevant information about the actions done for CBAM reporting by now. Thus, they were considered as good representatives for the purpose of this research. In this section the entities are referred to anonymously as legal entity 1, 2, 3, and 4.

In addition to the benchmarked legal entities, Valmet also has some smaller legal entities in other EU locations, such as Poland, Germany and France, who are also doing smaller-scale manufacturing and thus might be obliged to do the reporting for CBAM. The people responsible for CBAM reporting at these locations were also briefly interviewed about their imports during the first reporting period of CBAM. Based on these short interviews, it was found out that not many of the legal entities are importing CBAM products. If there were CBAM imports, the number was very low, only a few items per quarter. The biggest problem seemed to be that the interviewees were having problems with understanding the regulation correctly. It was unclear which products were categorised as CBAM products. In addition, some of the interviewees had not understood that the emissions of the imports have to be reported, and only reporting the general information of the imports is not enough. Another factor causing problems was also related to the complexity of the regulation, as the interviewees had not understood how should they deal with products transferred internally within the EU. It seemed to be unclear that only the legal entity who is the importer of the product and responsible for the import customs declaration is obligated to include the product in their CBAM report.

The actual internal benchmarking began with finding out the current status of the reporting process. It was established that the approach to the reporting process has been quite similar in all legal entities and that similar methods were used for collecting information. It also seemed that all legal entities faced similar problems during the reporting. The first step was to define roles and responsibilities, which was done similarly in each legal entity. In each legal entity there is one person who is responsible for the reporting and collecting the required data, and procurement function is responsible for communicating with the supplier. According to the representative of legal entity 2, their plan is to get the finance team involved latest for the definitive regime, as then money will play a role in CBAM reporting.

It was found out in the benchmarking that the reporting process started with collecting the

data of imports. The data was collected by requesting it from the local customs; in Sweden through a commercial system connected to the customs services, and in Finland by requesting a report of imports by EORI number. According to the representative of legal entity 2, they also had imports to Germany, but there it was not possible to request the information from the local customs. Thus, the import data was collected manually from purchase orders and own data systems. The data was then analysed and CBAM imports were identified based on the defining factors such as the CN-code, country of origin, and the price and weight of the import. After that the CBAM suppliers were identified and their ID's were collected, and they were contacted by email with the Excel template for reporting emissions attached. The emission reports were returned to a shared mailbox dedicated for CBAM reports. Each legal entity had a mutual company external person to validate the emission reports which were returned to the email address. Once the data had been collected and the emission reports requested from the suppliers, the reports were submitted in the CBAM Transitional Registry. Due to a low number of received emission reports, all legal entities used the provided default emission values for submitting the first CBAM report.

After finding out about how the first reporting was carried out, the focus was moved to the occurred challenges and positive factors about the reporting. The results from the questions regarding the current situation are introduced in table 1 below.

Table 1: Results from internal benchmarking; challenges in the current situation.

	Legal entity 1	Legal entity 2	Legal entity 3	Legal entity 4
Which ERP system do you use?	LN, Baan	M3	LN	LN
What kind of problems or challenges within CBAM have you encountered by now?	<ul style="list-style-type: none"> • Emission reports were not received. • Long supply chains and problems with traceability cause problems. • Communication with suppliers is difficult, they are not aware of the regulation. • Unclear or complex instructions. • Item data quality in ERP systems is insufficient and data ownership is missing. 	<ul style="list-style-type: none"> • Some products declared with a wrong CN-code. • Long supply chains are difficult to trace. • Difficulties in getting emission reports. • As own databases are not helpful, difficulties with getting the customs report in central Europe are a problem. • Excel is complicated. • Fast schedule in the transition. 	<ul style="list-style-type: none"> • No received emission reports. • Excel template was seen as complicated and massive. • Engaging suppliers is difficult. • Long supply chains cause trouble as the manufacturer is not known by the importer. • Item data in ERP systems insufficient. • EU regulations are not simple and easy to understand. 	<ul style="list-style-type: none"> • Bugs in the reporting registry made things confusing. • Collecting emission reports is difficult and according to suppliers the Excel is complicated and they do not have enough resources.
Have you found, or do you have any solutions to the challenges?	<ul style="list-style-type: none"> • Ownership must be defined to fix data related issues. • Supplier communication needs to be done on a different approach. • The person on the supplier's end must be someone who understands something about sustainability topics. • Giving advice and good instructions to suppliers could help in receiving emission reports. 	<ul style="list-style-type: none"> • Legal entity in Germany starts keeping a record of their CBAM imports. • It must be emphasised to the suppliers that in order to keep supplying to the EU, they must be able to provide the emission reports. • Suppliers can be noted that reporting does not require the complex Excel template. 	-	<ul style="list-style-type: none"> • Language used in the regulation and supporting documents more down-to-earth. • Default values could be allowed to use for a longer time. • Informing suppliers about the benefits of reporting.
What did you consider easy or good with CBAM reporting?	-	<ul style="list-style-type: none"> • The process was simple overall, and in Finland the data was easily collected from the customs. 	<ul style="list-style-type: none"> • Only a few CBAM imports. • Instruction document by the Swedish customs for reporting with default values helped a lot. 	<ul style="list-style-type: none"> • Data collection was easy through Swedish customs systems. • Instruction document for reporting made by the Swedish customs was helpful. • Number of imports was low.

From the results it can be seen that the legal entities use different enterprise resource planning (ERP) systems. It was also noted that all systems have insufficiencies in data quality, which is why the item data from ERP systems alone is not adequate for CBAM reporting, and other data sources are required. The first challenge with data is that the information from customs declarations is not saved efficiently and in a unified way to the data bases. As CBAM imports are determined by their date of import, the lack of customs declaration data is a challenge. Also, it seems that some products that are actually of a higher added value and therefore excluded from the CBAM scope, have been falsely declared with a CN-code that is in the scope of CBAM. From the results it can be seen that the data related problems might be the biggest concern with CBAM reporting currently, and the existing data in own ERP systems cannot in its current state cover all data requirements of CBAM reporting. According to the

representative of legal entity 1, the problems with data quality are due to many reasons. For example, if some commercial parts are missing weight data, the weight of own design items also cannot be calculated. This causes that the products remain without weight information. The old item data is also not updated even if necessary, which is due to the fact that the role is not designated to anyone. Based on the interviews, defining ownership to data management could help as then there is at least one person who is responsible for data quality.

From the results it can be seen that also communication with suppliers and especially receiving the emission reports has turned out to be difficult. In addition, the interviewed people think that the language used in the regulation and supportive documents is difficult to understand. Also, the Excel template provided for suppliers for reporting emissions is seen as complex by both the people responsible for CBAM reporting and the involved suppliers. Based on the results, the challenges in acquiring emission reports could be solved by giving more information and assistance to the suppliers about the benefits of CBAM reporting, as well as by doing the communication on a different approach. Currently, the communication to suppliers is done by procurement, as they are already in touch with the suppliers regarding other matters. The representative of legal entity 1 suggested that the approach could be more sustainability-based, and the person in the receiving end also must be aware of sustainability issues. In the current measures it might be that the sent emails are not noted in the way they should be as there might be a person in the receiving end who does not understand the reasons.

The representatives were also asked about what they think is good or easy with CBAM reporting. It seems that the small CBAM scope is the main reason each entity thought that reporting was not difficult. The data was easily requested from the customs, the few imported products did not take a long time to report, and reporting with default values was easy. In the interviews it was found out that the Swedish customs had made a guidance document for reporting with default values in the CBAM Transitional Registry, which had helped a lot in submitting the report. To conclude the good views on the reporting process, it seems that to succeed with the reporting, a lot of additional information and help was needed. The reporting would have been a lot harder if the data had to be collected from own ERP systems, instead of requesting it from the customs, and if the correct reporting practices had to be learned solely on the basis of the EU regulation, provided guidance documents and the Excel template. Also, a larger scope of products would have made the reporting more difficult.

The enlargement in the product scope and other additions to the requirements might however be expected in the future. The following table 2 shows results for how the representatives see the future of CBAM reporting and the regulation in general. The questions tried to find

out how the reporting scheme could be improved, what are the opportunities and challenges, and how the regulation will affect business operations in the longer term.

Table 2: Results from internal benchmarking; views on the future.

	Legal entity 1	Legal entity 2	Legal entity 3	Legal entity 4
What are your views on a centralised CBAM reporting process?	Currently easier to do separately for each entity. Would require smooth communication with suppliers and access to other entities' data.	Would make reporting easier, but requires that data is similar or the parameters are provided to the reporting responsible. Everyone would need an assigned role and know their responsibilities.	Good if made easy and helps with reporting. If tries to serve everyone and things are made complicated, then not required.	Currently not possible due to low item data quality. Might be easier if control of CBAM reporting was within one team, but requires that the required data is available.
What are your views on automating CBAM reporting? Is there a plan to get it automated, and are there challenges?	Low amount of imports so currently no need to automate. The EU reporting registry could have more automated features.	Would help if the data of imports was available automatically.	Currently not necessary. Enough automation would be if the reporting registry saves previously reported information to be used also in the following reports.	Not possible to automate yet, because there can be various types of imports that need to be checked in detail. A category-based purchasing system needs to be developed.
Do you see any opportunities or threats in CBAM entering into force? What kind?	+ Will help in increasing sustainability. + Opportunity for suppliers to reduce emissions and cause global emission reduction.	+ Good opportunity to see how much emissions occur from these operations. + Drives sustainability agenda globally. + Suppliers more aware of their emissions. + EU customers can directly and indirectly get suppliers to reduce emissions. - Depending on costs, can drive manufacturing away from the EU. - Inflation increases and product prices go up. - Can make companies in the EU less competitive.	+ Possibility to increase local production and procurement. - Suppliers can end supplier contracts if they cannot provide the reports, especially if the effect on business is not significant.	+ Can increase local purchasing and reduce emissions. - Increase in scope could cause costs getting higher.
How do you see that the regulation will affect the business, and do you see upcoming changes in operations due to CBAM?	If significant financial effects are caused, changes in operations could happen. Production of net zero or fossil free iron and steel might increase. Can increase local production and procurement.	If the scope increases, companies must start thinking where to buy products from. Prices will increase. The correctness of CN-codes must be checked more carefully.	Smaller companies might localise procurement. Changes are highly price dependent. Depending on the significance of the EU customers, some suppliers might focus supplying to outside the EU.	Depends on how the scope will evolve. Changes will not happen immediately, also awareness of CBAM is not high.
What kind of questions or uncertainties do you have considering CBAM in general?	Who is responsible for verifying the emission reports in the future? Could a centralised platform help to solve this problem?	-	-	Who verifies the correctness of the emission reports? Who knows the emissions of products manufactured a long time ago and imported to the EU years later?

The first question tries to find out if the representatives think that centralising the reporting within the company would be a positive change, and if a centralised platform for CBAM reporting would make the process easier. Based on the answers it seems that with the current scope of CBAM products and the mentioned issues with item data, an internally centralised

reporting scheme was not seen as a crucial improvement to make the reporting process easier. It is seen as a problem because the data is located in different ERP systems and no one has access to all data. Also, collecting data from different external data sources would be difficult for one person. However, it seemed to be a prevalent opinion that having the control within one team would make reporting easier, as it could be carried out for multiple legal entities at the same time. But as mentioned, this is currently not possible.

On the other hand, a centralised reporting platform would be a desired feature, and also automation in the EU Transitional Registry is highly hoped for. For example, the data of imports could be automatically available in the Transitional Registry, or it could be provided to the importers automatically by other means. As the number of imports is low, and the reporting is not currently time-consuming, increasing automation internally does not seem to be an urgently needed enhancement.

After identifying areas for improvement, the focus was shifted to future prospects. The entities had quite similar expectations and hopes for the future, for what it comes to CBAM and its effects. The opportunities seen in the implementation of CBAM are related to increasing sustainability globally, and creating awareness of the emissions occurring from operations. The regulation is also seen as a way for EU companies to reduce emissions outside the EU, or alternatively move procurement and manufacturing to the EU. However, the increasing costs and the expected increase in products in the scope of CBAM are seen as a threat to companies in the EU. According to the representatives, the costs might also have an effect on business operations if a level is reached where the costs would be a major economic factor. In these situations it is assumed that the production of net zero or fossil free materials will increase, or if the process has already been started in some companies, CBAM might speed up the process. The regulation is also seen as increasing local manufacturing and procurement. The results also show that the future regarding CBAM has raised some concerns at the entities. A common question was related to verifying the reports, as there were uncertainties about who is responsible for verifying the emission documents, and what is the best way to do that.

6.2 External benchmarking

This section presents the results from the external benchmarking. The external benchmarking involved three companies, which were chosen due to the similarity of their business operations and organisational structure to Valmet's. Each company had chosen a representative to the interview, who was alone responsible for CBAM reporting, or who worked in the team responsible for CBAM reporting at the company. Each of the chosen people were relevant regarding this research, as they were familiar with the current situation of CBAM, the processes and taken steps, and the challenges within the process. In this section the companies

are referred to anonymously as company 1, 2, and 3. The results related to the challenges in the current situation are shown in table 3 below.

Table 3: Results from external benchmarking; challenges in the current situation.

	Company 1	Company 2	Company 3
What is the extent of imported CBAM products?	Around 70-90 imports per quarter	Around 37 imports, mostly ferro-nickel	Less than expected. Around 25 imports to Finland and Sweden + a few to other locations.
How have you distributed the roles and responsibilities in CBAM reporting?	Reporting done centralised for each legal entity. Initially from Corporate Sustainability and Procurement Analytics teams. In the future hopefully from finance function.	Global procurement function responsible for data collection and reporting for all served European legal units. Also handles the purchases for all legal entities.	Core team of three responsible for process development, providing guidance, and assisting in the validation of emission reports. Each legal entity has a reporting responsible. Team in Asia responsible for supplier communication and data collection.
How was the import data collected?	Data arranging and clean-up done manually through ERP system, logistics system and customs clearance documents. Low level of automation used in data collection and processing. Data verified through customs reports. Data collection is not complete, and the CBAM reports need updating.	Data collected from different sources, such as LSP provided CBAM feature, new ERP system, Excel, or manual collection depending on the country.	Customs data from Finnish and Swedish customs. Initial thought is that the team in Asia collects import data, and if not available, each legal entity has a customs coordinator who cooperates with the team in India to identify imports.
Which methods were used in collecting emission reports?	Vendor management system used for emissions data collection. Currently re-evaluating the suitability for CBAM reporting.	Category manager or a person from global procurement function contacted the suppliers via email.	Supplier info package under development. A centralised team in Asia collects the emission reports and provides them to the legal entities.
What kind of problems or challenges within CBAM have you encountered by now?	<ul style="list-style-type: none"> • Difficult to do reporting on behalf of legal entities in different countries as systems and guidance is different in each country. • Collecting import data is challenging as customs documents are not saved in a unified way. • Emissions data collection is seen as a challenge. Reports were not accurate. Long supply chains and precursor emission are a challenge. • Emission reporting is difficult and resource intensive for suppliers. • Excel is complicated and instructions are not given in a simple way. • Too many rules, exclusions and clarifications that most ERP systems do not easily bend to. 	<ul style="list-style-type: none"> • Default values are too low. The correctness of reports difficult to validate. • Emission reporting difficult and resource intensive for suppliers. • Some stakeholders are not cooperative. • Bugs in the system. • Long supply chains cause traceability issues. • Data quality issues due to changing ERP system, etc. No ownership for import procedures, and local handling. Data is scattered. • CBAM seminars all the same, not going below surface. 	<ul style="list-style-type: none"> • Proactive identification of suppliers at the time of the purchase transaction is not currently possible. • Suppliers vary between reporting periods. • Suppliers have no incentive to provide the reports. • Data problems; not all legal entities have the same ERP, same products declared with different CN-codes, day of the customs declaration not available, only delivery date. • Tight schedule and lots of improvements and development necessary, must prioritise. • Engaging people internally and externally is challenging. • No internal person who could build an XML-file.
Have you found, or do you have any solutions to the challenges?	<ul style="list-style-type: none"> • Global supplier meeting to be arranged, and suppliers informed about the requirements of CBAM. • Smaller Excel template sent to suppliers, complexity increased approaching 2025. Suppliers are trained. • A centralised way of collecting customs declarations is under development. Goal is to improve saving customs declarations. • External service in search for giving training to suppliers on emission calculations. 	<ul style="list-style-type: none"> • Improving traceability to define the manufacturers in long supply chains. • Default values used for one-time purchases. • CBAM requirement to be mentioned in supplier contracts. • Proactive approach desired. Reminder sent to supplier when placing a purchase order. • Separate field added for “goods producer” and its country. • Default values rather too high than too low to motivate suppliers. • EU CBAM system automated and centralised for all importers and suppliers. 	<ul style="list-style-type: none"> • Proactive supplier identification under development. • New supplier code of conduct, and development of purchase and framework agreements with CBAM reporting obligation included. • Step-by-step instructions and training to internal reporting responsible. • Increasing priority of supplier communication by involving supplier and category managers to the communication.
What did you consider easy or good with CBAM reporting?	<ul style="list-style-type: none"> • Cooperation with Finnish customs was proficient. Seminars were informative and answers were provided to questions. 	<ul style="list-style-type: none"> • Reporting registry was clear. • Finnish and Swedish customs authorities were helpful and data available. 	

From the results it can be seen that the share of CBAM products of total imports is comparable to Valmet's in all benchmarked companies. It was also found out that due to a low number of CBAM imports during the first reporting period, the reporting process was seen relatively easy. In addition, the use of the CBAM Transitional Registry was considered satisfactory, even though the system was seen to have bugs in the beginning. It was established that data collection in Finland and Sweden was easy through the local customs authorities or cooperative systems, but in other countries it was more challenging. According to the representatives, none of the benchmarked companies could collect all the needed information from own data sources, as the process requires data that is not currently stored in any internal data location. The available data is also scattered to multiple platforms and systems, and thus the data for CBAM needs to be collected from multiple different internal and external sources.

The roles and responsibilities were distributed differently in all benchmarked companies. In company 1 and 2 the reporting was done centralised, one function reporting for multiple European legal entities. At company 1 the CBAM team was responsible for all steps of the process, starting from data collection all the way to submitting the report. In the future it is hoped that finance function was involved in CBAM reporting as in the definitive regime the financial aspects are involved. This was also mentioned in the internal benchmarking by legal entity 2. According to the representative of company 1, the challenge in a centralised approach was that getting access to systems in different countries is challenging with a foreign personal identification number, and that guidance is given in different ways in each country. Also, the customs systems in the EU are not unified, and the working policies in each country are different. As at Valmet, the data from customs declarations is not saved to the systems in a unified way and the priority of saving them has not been high, which means that there might be gaps in import data in own data bases. The benchmarked company 1 used a vendor management system for collecting emission reports, but its suitability for CBAM reporting is currently being evaluated. Company 1 saw emission data collection and supplier engagement as a major challenge, especially regarding long supply chains and precursor emissions.

At company 2 the import data and emission report collection is handled by one centralised team from global procurement function. The company used different methods for collecting import data, depending on the country of each legal entity. In Finland the data was collected through a logistic service provider (LSP), that provides a CBAM service, in which the CBAM imports are filtered from total imports, and each quarter the CBAM base report is provided to the importer. In Sweden the legal entities use a newer ERP system, which has a transaction where the customs reports are entered and stored manually. The transaction has all imported

products with their CN-codes, so the CBAM imports can be filtered from the available ERP data. The company also has small non-regular imports to other EU countries, which are close to impossible to trace. Therefore, the company is trying to identify the locations and legal entities that have a possibility to have occasional imports, and get them to use the new ERP system and the transaction similarly to the legal entities in Sweden. To collect the emission reports, the suppliers were contacted via email by category managers or people from the global procurement function, similarly to the approach at Valmet. The representative of company 2 saw that the challenges in data collection were that some stakeholders, such as local customs, were not cooperative, long supply chains make traceability and engaging the original manufacturers challenging, and data in own ERP systems is scattered and the quality needs to be improved.

Company 3 had begun the process similarly to Valmet, and each legal entity had nominated a person who is responsible for submitting the report to the Transitional Registry. The company had introduced a core team from the Import Trade Compliance team, whose responsibility is to further the development of the reporting process on a higher level, provide guidance to the other stakeholders, and assist in verifying the emission reports. Whereas Valmet has decided that the responsibility for data collection is on each legal entity's reporting responsible, at company 3 a separate team in Asia had been nominated the responsibility for collecting the data of the imports, contacting the suppliers and collecting the emission reports. A centralised collection of import data and emission reports was seen as the better option, as different legal entities might use the same suppliers. Through a centralised function for emission report collection, the suppliers only have to provide the report once, and the team can then share the report to all legal entities who have purchased from the supplier in question. The team is working in cooperation with each legal entity's customs coordinator, who is able to help the team to identify CBAM imports. During the process company 3 identified that engaging stakeholders both internally and externally is challenging. Internally the reporting is seen as an additional task and the process requires time from each person involved. Externally the challenges were seen to be the varying of suppliers between reporting periods, as well as engaging each supplier to provide the requested emission reports on time. Data collection was also seen as a challenge as the quality of data varies between legal entities, and the date of the customs declaration is not stored in own data bases.

The companies had started to tackle the issues with collecting import data in different ways, depending on what was considered their biggest challenge. Company 1 is developing a centralised way for storing customs declarations and saving the information to their systems. One discovered option is to store the declarations to a certain transaction in the used ERP system. As mentioned, company 2 has this feature in use in Sweden, and they have ac-

knowledged the transaction as practical. Company 2 has previously started to identify the manufacturers of products to increase traceability in their supply chains. The company is planning to introduce a separate field to ERP item data for “goods producer”, which could be entered when a purchase order is placed. The data attribute would include information about the producer of the goods, such as the location of their installation, which is also the country of origin of the product, and thus helps in identifying CBAM imports. For improving supplier identification, companies 2 and 3 had also considered developing a more proactive approach, which would help in identifying suppliers already when placing a purchase order. One presented idea was that the supplier is automatically sent a reminder of CBAM requirements when a purchase order is placed. This would however require improvements in data quality.

Other than the issues with import data collection, the benchmarked companies seemed to have faced similar issues as the legal entities at Valmet. All companies thought that the main issues with getting emission data from suppliers is that suppliers are not prepared for calculating emissions, they lack resources and expertise, and precursor emissions are difficult to obtain. It is also challenging to train suppliers to emission calculations as the supply chains might be long and the original manufacturer of the product is not known. The Excel template for emission calculations is seen complicated and heavy. The representative of company 3 saw that as the obligation for providing emission information for CBAM is not mentioned in the purchase or framework agreements, the suppliers have no liability for submitting the report. Also, the representative of company 2 thinks that the provided default values are way too low compared to actual emission values, which does not encourage suppliers to calculate their actual emissions. It was seen that the default values should be rather too high than too low so the suppliers would have an incentive to calculate their emissions to get an advantage. The default values were also seen inconsistent with each other.

Company 1 has started to tackle the supplier engagement related issues by arranging a global supplier meeting, to which suppliers from all around the world are invited to hear about the current actions and strategies. CBAM will be one topic that is brought up and introduced to suppliers during the meeting. The company has also initially approached the emission data collection with a simplified Excel template, and as the suppliers get familiar with the requirements of emission reporting, the company will gradually move towards using the official EU Excel template when approaching 2025. Training of suppliers has been found as important in all companies, and company 1 has started a search for an external service to give training to suppliers about CBAM emission calculations. Companies 2 and 3 see it important to add a written obligation for providing CBAM emission reports to their framework and purchase agreements, and company 3 has already begun with renewing their supplier

code of conduct and developing their supplier agreements. As mentioned before, company 3 has a separate team in Asia to handle supplier engagement, but a challenge is that communication from the team might be seen as low priority. A focus is now on increasing priority in supplier communication, and involving a supplier manager and a category manager to the communication.

What comes to the general issues with the communication from the EU and the overall implementation of CBAM, it was seen that the time schedule was too fast for the improvements needed for proper reporting. CBAM requires information that is not stored in ERP systems, and many ERP systems do not bend to the requirements of CBAM. The CBAM Transitional Registry had bugs in the beginning, and the supporting seminars were seen as repeating each other and staying in explaining “what” instead of introducing “how”. However, company 1 also saw that the seminars provided by the Finnish customs were informative, and the authorities were helpful. In general the Finnish and Swedish customs were considered helpful and data collection through the customs was made easy. The reporting registry was also seen as functioning and easy to use, once the bugs were fixed in the system.

All companies thought that to address the issues, the EU CBAM registry should be automated and centralised for all importers and suppliers. It was seen as desired that the suppliers could provide their reports to the system, and each importer could retrieve the report from the system. The system could also be connected to the customs, so the data of imports, suppliers, and products would be available in the system for each EORI-number. This way the suppliers are not required to provide the emission reports to multiple importers, and the importers did not have to collect and combine data from various data sources. Verifying the documents would also be easier, as then verification is done by one authority, and the chance of each importer verifying the report differently would be minimised. A centralised CBAM register by the EU would ease the process for all parties. The representative of company 2 saw that the default values are too low, which can be addressed by the EU by increasing the values so suppliers would have an incentive to calculate actual emissions. It was also hoped that default values could be used for a longer period in the beginning, and that it was allowed to use them for non-regular purchases.

The companies were also asked about their opinions of centralising and automating the CBAM process internally and externally, as well as about the opportunities, threats and effects of CBAM. The views on the future are presented in table 4 below.

Table 4: Results from external benchmarking; views on the future.

	Company 1	Company 2	Company 3
What are your views on a centralised CBAM reporting process?	Desired, as the current EU way is too complex and laborious. Centralised system would ease the process for suppliers, if the report could be submitted to a centralised location.	Centralised reporting used in the company. EU CBAM register should be centralised.	An internally centralised reporting might not work as getting access to multiple foreign systems can be challenging. Easier to divide tasks to multiple people, rather than have only one person doing reporting for all entities.
What are your views on automating CBAM reporting? Is there a plan to get it automated, and are there challenges?	Semi-automated as base systems do not allow the changes required for a more clean data maintenance. We use AI to read customs declaration for data collection. ERP data is filtered and streamlined into a single Power BI dashboard for further use. More automated features required for the EU CBAM system.	Ideally automated by the EU and customs authorities.	Not there yet, but if automation would be under consideration, it would probably begin with getting some automation to the import and emission data collection to the team in Asia.
Do you see any opportunities or threats in CBAM entering into force? What kind?	<ul style="list-style-type: none"> + Helps to understand data volumes. + Drives good changes such as reducing emissions and educating suppliers - Iron and aluminum product prices face inflation within the EU. - With the current scope causes manufacturing to be moved away from the EU. - Increased bureaucracy and challenges in the system ruin the good intentions of the regulation. - Does not add value. 	<ul style="list-style-type: none"> + Hopefully protects the European market from dirty imports, but with low default values not possible. + Supports decarbonisation in the EU. - Some high carbon intensive substitute materials for stainless steel production are left out from the scope. Threat is that these materials are used for stainless steel to avoid CBAM regulation. 	<ul style="list-style-type: none"> + Forces importers to pay attention to customs measures and correct CN-codes. + Brings out imperfections and forces to improve own data and operations for the future. + Highlights the need for trade compliance function. - Direct financial effects seem to be going to additional reporting procedures rather than the certificates. - How CBAM can be complied with? How own processes can be handled? To which percentage are the suppliers engaged?
How do you see that the regulation will affect the business, and do you see upcoming changes in operations due to CBAM?	Makes businesses more aware of own supply chain and the lack of transparency in the supply chain. Will probably result in more and better supply data collection. Development in IT systems, improving data quality and saving customs declarations. CN-codes will be handled better. Hopefully leads to more unified customs processes and policies between EU countries.	Many end products are currently excluded from the scope, and the production of end products might be moved outside of the EU. This can cause major carbon leakage.	Different business areas have different procurement strategies that have stayed invariant, and strategies might not reflect to each other. Importers need to consider how to optimise and localise procurement. Must think the necessity of importing certain products. More attention has to be paid to CN-codes. IT development.

Similarly to the internal benchmarking, the first question about the views on the future was related to centralising the reporting process. As mentioned, all companies thought that centralising the EU CBAM Registry is desired. A commonly centralised system was thought to be the best solution, as therefore all required information for CBAM reporting, such as the data of both imports and emissions, would be available for all importers and suppliers by similarly reducing additional work from the stakeholders. An internally centralised reporting function was seen to work in companies 1 and 2, despite the fact that in company 1

there were challenges in getting access to some of the foreign systems. This was also seen as one of the reasons why company 3 did not approach reporting fully centralised, and now has a reporting responsible in each legal entity. However, according to the representative of company 3, they had introduced a centralised function for collecting emission reports. This was seen as the best practice, as multiple of their legal entities or business areas might be using the same suppliers, and in this approach the supplier needs to provide the report once to the company, and not separately to each stakeholder. With automation, the companies were also requesting actions from the EU Commission. The representative of company 1 mentioned that they used some automated features in their process, as they had stored the customs declarations to a certain transaction in their ERP system, from where the data is read by AI and saved in the system as data attributes. Automation was also used to filter and streamline ERP data to a Power BI dashboard.

Despite all the challenges in the reporting process, CBAM was seen to create some opportunities both internally and externally. One mentioned internal opportunity was that CBAM will make companies more aware of their data volumes, and supply chains. The regulation also brought up imperfections and forces importers to improve their data quality and operations for the future. It was also seen as an important change that from now on more attention must be paid to declaring products with the correct CN-code. On a more general level, CBAM was seen as a good way to drive emission reductions globally, as regulations and obligations were seen as the best way to work towards sustainability.

Based on the benchmarking, CBAM was seen to have more threats than opportunities. It was seen that product prices in the EU will increase, which will increase inflation in the EU. Also, as the scope currently includes only products with low added value, it was seen as the biggest threat that due to the requirements of CBAM the manufacturing of end products, or products with higher added value, is moved outside from the EU, to curve the CBAM requirements. At company 2 another challenge with the narrow scope of CBAM was identified, as according to the representative, there is a carbon intensive material for stainless steel production, that can be used instead of the materials in the scope of CBAM. The representative thinks that this might increase production of stainless steel by using the carbon intensive substitute material. The representative from company 3 saw that following the reporting requirements is a threat to companies, as the process has many uncertainties internally, and it is unsure to what extent the suppliers can be engaged.

In addition to the threats, CBAM was also seen to have direct positive effects on companies. It was seen that companies might develop their IT systems and improve data collection, as well as increase traceability in the supply chain. In addition, companies might start optimising their supply chains better, and localise procurement to some extent. They might also start

considering the advantages and disadvantages of importing certain products instead of buying them locally. As an external positive effect, it was hoped that in the future the customs procedures in EU countries would get more similar with each other and start working in a more unified way.

6.3 Suggestions for optimising the reporting process for Valmet

Now that the current situation and challenges with CBAM reporting process have been established internally at Valmet and externally at similar companies, the process needs to be optimised for the future. Currently the steps in the process can be roughly divided to defining roles and responsibilities, data collection, supplier engagement, and reporting in the Transitional Registry. Based on the internal interviews, there are problems to be solved in each process step. The following figure 6 shows the process steps and current methods, as well as the challenges to be addressed.

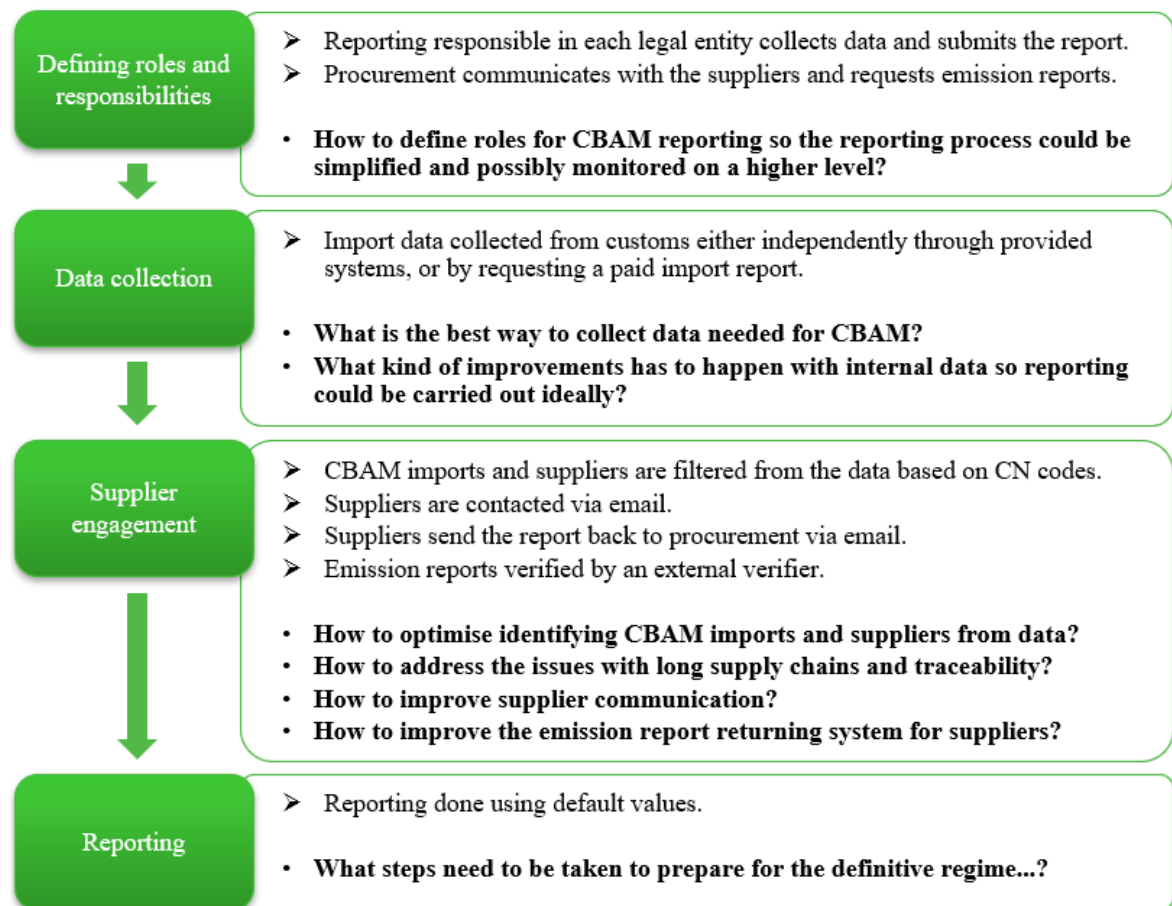


Figure 6: An illustration of the process steps, current measures, and issues to be solved for the future.

The figure above presents the current methods used in the reporting process, as well as the challenges, which are addressed in the following sections. The results from the internal and

external benchmarking are used to find ways to overcome the presented problems as well as to figure out the best practices for optimising the reporting process for the transitional period, and later for the definitive regime. The goal is to define optimised and unified methods for the whole company to use. The following sections until 6.3.4 present an optimal reporting process for the initial situation, using the best available practices. The initial solution is based on the current practices and takes into account the current situation with data and other factors. The initial solution is planned so that it only requires minor or inevitable improvements to the current situation. Later in section 6.3.5 a draft for a separate CBAM focused platform is created. The platform is a vision for the future, but in addition to the minor improvements and the inevitable changes in the current system, it requires, for example, product development and financial investments.

6.3.1 Defining roles and responsibilities

As found out in the internal interviews, currently the roles and responsibilities at Valmet have been defined so that one person from each legal entity has been appointed to the role of a reporting responsible whose responsibility is to collect the data of the imports, check from the data if they have imported CBAM goods and are therefore obliged to do the reporting, and finally submit the report to the Transitional Registry. Once the reporting responsible identifies imported CBAM goods from the reporting period, they inform the purchaser of each good to contact its supplier and inform them about the reporting requirement. Once the supplier returns a report to the shared mailbox, as mentioned in section 6.1, it is verified by an external verifier.

In the current situation one challenge is that the ownership of CBAM reporting has not been designated to anyone, and the process is not monitored from the center of functions. Each legal entity has named their reporting responsible, but there is no centralised core function ensuring that the required measures have been taken in the entities each reporting period. To better manage and support the CBAM reporting process and the related functions in the company as a whole, it would be required to define a centralised core function, or a core team, and from the function an owner for the reporting process. This would be a measure to make sure that no products are left out from the report, and that the reports are submitted on time with the correct information. It is currently not possible to centralise the whole process so that one function would be responsible for reporting for all legal entities, but it is desired that there would be a centralised function to manage and keep track of the process as well as to provide assistance to different stakeholders.

Another challenge with the current roles and responsibilities is that finance function is not in any way involved with CBAM reporting. As seen in the benchmarking, the representatives

from legal entity 2 and company 1 see it as a desired improvement that someone from finance function would be involved in the reporting, and take responsibility of the reporting in the transitional period, or at the latest in the definitive regime. In the definitive regime it would be desired that the responsible person from finance could have direct access to see the generated emissions regarding CBAM, as the definitive regime requires surrendering and paying for the certificates.

Based on the results from internal and external benchmarking, the roles and responsibilities can be optimised for the future. Due to the organisational structure, the scattered supply chain functions, and the data issues, it is not currently possible to fully centralise the reporting process, such as they have done at company 2, where global procurement function is responsible for reporting for all European legal entities. This is why currently it is optimal to have a reporting responsible in each legal unit. In the external benchmarking, the representative from company 1 had seen it as a challenge to get access to different systems in foreign countries, which created additional work and thus is not the desired way at Valmet. Also, collecting data from each EU country was seen as a challenge, which is why it is better to have a local contact collecting the required data for each country. Currently, the scope of CBAM does not include many products, so collecting the data is relatively easy, and does not create a lot of additional work for the people responsible for collecting the data. In the future when the scope gets larger, it has to be considered, if one person could be responsible for reporting and collecting the data centralised for all EU legal entities. This option depends on the share of CBAM products from total imports in the future.

As seen from table 3, company 3 had introduced a core team who operates as a centralised function, providing assistance for all legal entities, purchasers and suppliers and at the same time operates in the background aiming at developing the reporting process for the future. They also provide guidance and assist in validating the emission reports. For an optimal CBAM reporting process, a core team should also be introduced at Valmet. The centralised core team should work in the background of all functions similarly to company 3, but be available for suppliers, purchasers and reporting responsables when needed. They are also responsible for managing the process within the whole company and making sure that the data has been collected and the reports are done on time, if relevant. The core team would have an important role in the reporting process, as they would be in charge of the process and responsible for making sure that the requirements get fulfilled each reporting period.

The benchmarked company 3 had also introduced a company-wide centralised function for collecting emission data from suppliers. A centralised function or system would be important for optimising the communication with suppliers, as then suppliers would only have to provide the emission report once for all legal entities to use, and not to each purchaser sepa-

rately. This will reduce the time and resources required from the supplier, as well as from the purchasers. The centralised function or system will serve all business lines and legal entities, as the report is available for everyone at the company to use. Company 3 had introduced a separate team in Asia to handle the collection of emission reports, which might not be possible at Valmet. However, it is possible for the suppliers to submit information and documents, such as the emission reports, to Valmet through a supplier portal, from where they are automatically stored to a supplier relationship management (SRM) system. A centralised collection of emission reports by using the supplier portal and SRM application, could be used as a centralised way of collecting and storing emission reports at Valmet.

The roles and responsibilities in an optimised CBAM reporting scheme for the transitional period are so that there is a core team giving assistance to stakeholders, verifying emission reports, and ensuring that reporting is done according to the requirements in each importing legal entity. Initially, during the transitional period, the reporting responsible in each legal entity is responsible for collecting the data of imported products from the reporting period. The data can be collected through different methods, as currently the documentation of customs declarations and issues with data quality do not allow collecting the data from own databases. In the definitive regime it is desired that the import data could be collected through own ERP system, and for this to work, IT development and improvements in storing customs declarations is required. Once the import data is collected, the CBAM suppliers can be filtered out and the purchasers informed about their responsibility to contact the suppliers. Initially, the purchaser is responsible for communicating with the suppliers and asking them to provide the emission reports to SRM through the supplier portal. In the definitive regime the request to suppliers will be sent automatically from the SRM system, which will be explained in the following sections. In the definitive regime, the supplier will continue to upload the emission reports through the supplier portal to SRM, where it will be stored to the specific supplier's files. In the transitional period, the reporting responsible from each legal entity submits the report based on the emission reports in SRM and the collected import data. In the definitive regime, it would be optimal, if the responsibility for surrendering CBAM certificates would be on finance function. The optimal roles and responsibilities for transitional period and definitive regime are shown in figure 7 below.

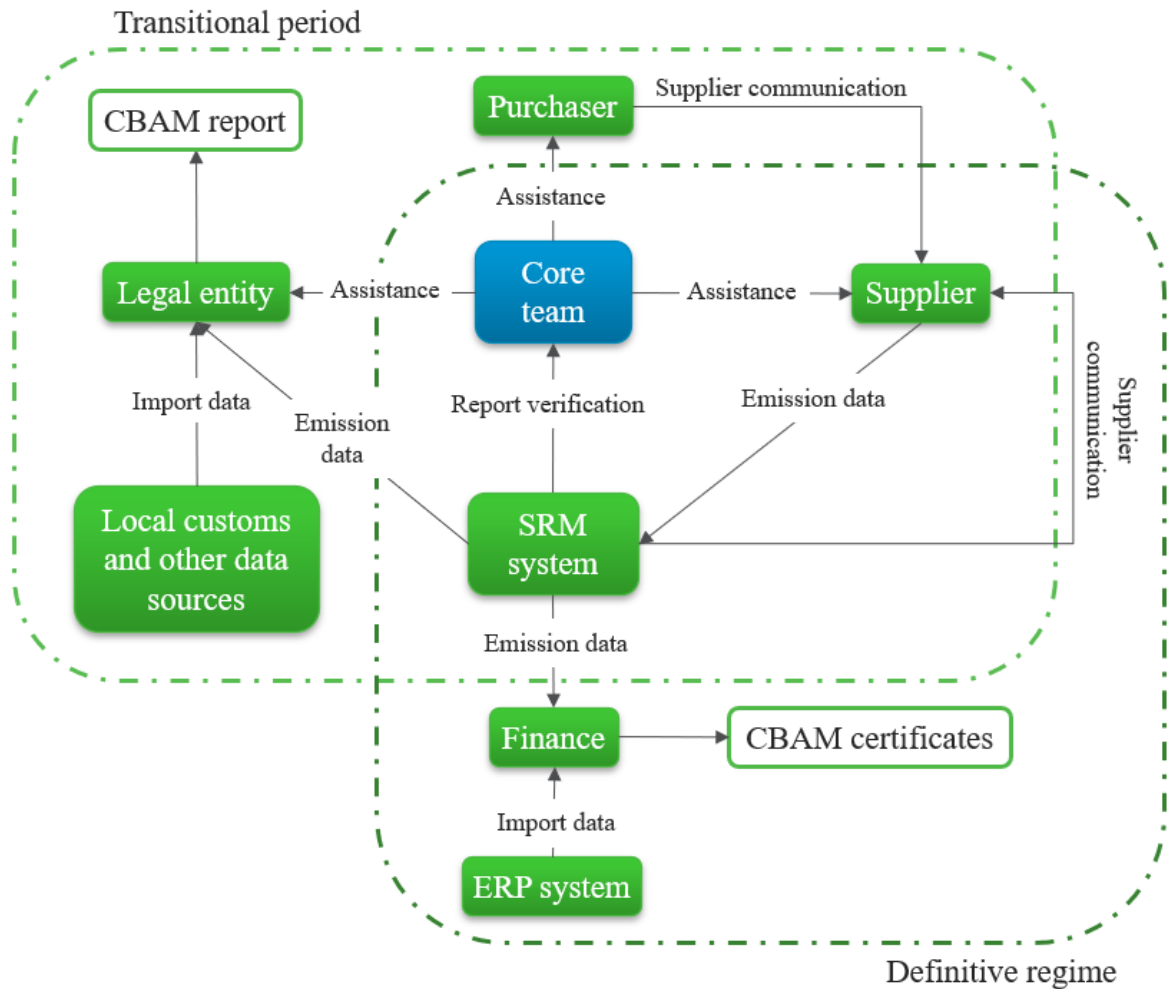


Figure 7: Optimal roles and responsibilities for transitional period and definitive regime.

6.3.2 Improving import data collection

As discovered in the internal benchmarking, data collection was done manually during the first reporting period. The import report was requested from the Finnish customs authorities, or acquired from the Swedish customs through a collaborative customs declaration archive. In other countries the data was collected manually.

The data in ERP systems was seen as insufficient and not helpful with CBAM reporting. Even if the data quality was better, the challenge is that relevant information about imports is not currently available in the ERP systems. For example, the date of the import is essential information when considering CBAM reporting, as the reporting follows certain reporting periods. Each CBAM product that is imported during a certain reporting period, is to be included in that period's CBAM report. Thus, it is necessary to store the information from the customs declaration documents. Saving customs declarations and commercial invoices does not currently have company-wide unified guidelines, and therefore the documents are stored in different methods and to different locations. The challenge is that the data locations

only serve as document archives, and the data needed for CBAM reporting is not saved anywhere as readable data attributes, and thus is not easily acquired from the internal systems. Impossibility of determining CBAM imports by date of importation is the main reason why CBAM reporting is impossible with the currently existing ERP data. This was also seen as a challenge in the external benchmarking.

There are several challenges in the current system and relying on collecting the reports from the local customs authorities. The first challenge is that by requesting a customs report from the customs authorities of a certain country, the report only includes the imports treated in the country in question. If import data would be collected this way, each EORI number would have to identify the countries to which they are declaring imports, and request the report from each country's customs separately. Also, another challenge is that not all customs authorities have the import reports available, which is due to multiple reasons. For example, based on the benchmarking, in some countries the customs system is scattered and they do not have a centralised customs authority, who could provide a report including all imports to that country. This is why it would be important to have the relevant data for CBAM stored internally.

To address the issues with data, three people working with internal data were interviewed. According to the interviewees, the current situation with internal data is reasonable, but there are challenges in data availability and scattered data sources. Currently there are more than one ERP system in use by business lines, and the challenge is that none of the systems include all the information. Thus, to collect data from all business lines, the user has to toggle between the systems. The reasons for using different ERP systems is because the business lines have their own needs and ways of operating. The company is also operating globally so the data requirements can be different in each business line. CBAM requires data that is not available in any ERP system, such as the date of the import. This information is available in the customs declarations, which are currently not stored in a unified way within the company. According to the interviewees, the date of the import is not a maintained attribute, which is why it is not added to the systems. It is also difficult to maintain information about the date of the import, as it is not tied to a supplier or to an item, but to a specific purchase. Other issues with data regarding CBAM are that supply chain traceability is currently in the need for improvements and the manufacturers of goods are not available in the data systems, as well as that the customs codes and weights are not available for all products. The following table 5 shows the sources of data needed for CBAM reporting.

Table 5: Sources of CBAM data.

	ERP	SRM	Customs declaration	Commercial invoice
Date of the import			X	
Customer purchase order number	X			X
CN-code	X		X	X
Item weight	X		X	X
Price of the purchase	X		X	X
Supplier information	X	X	X	X
Supplier contact information		X		
Country of origin	X		X	X
Customs document ID			X	X

From the table above it can be seen that the data needed for CBAM reporting has to be collected from various sources, and as mentioned, there are also lacks in data availability especially regarding the country of origin, weight and CN-codes of the items. According to the interviewees, the issues with data availability are currently being addressed, and a centralised data hub is under development to collect information and increase data availability for different stakeholders. The aim of the data hub is that the information would be easily available and retrieved from multiple systems. The existing data can also be used to form data products and entities that can be utilized by relevant people who are given access to the data. With current systems the problem is that not everyone has access to ERP and the data is not easily available to everyone. The data hub would act as a solution to this issue. The current state of the process is that the data needs are being mapped. Another ongoing development process is adding weight information to items, but defining ownership slows the progress. It has to be considered if CBAM could be added as part of the data hub.

CBAM reporting requires collecting data from different documents or transactions. To identify CBAM imports, information from customs declaration and commercial invoice documents is required. From these documents the order ID, supplier information, CN-code, weight, date, country of origin and price are required. With this information the CBAM import and its supplier can be identified. After that, the supplier information from ERP system is needed to be able to contact the supplier and request for the emission report. The last source of required information is the supplier's emission report, which includes the product emission data and the CN-code of the product to which the emissions are calculated. According to the interviewees, to address the issues with lacks in available data required for CBAM, it is required that the location and format of the customs declarations is known and that they are uploaded to the same database and in the same data format with each other. To get the information from the customs declarations is not necessarily an investment to tools, but in the simplest form a data vault where the date of the import, purchase order number, and other relevant information is defined as mandatory attributes. It must be defined care-

fully what information is needed from the customs declarations, and save that information as metadata, which is easily readable to other systems. Alternatively, the required information can be set as mandatory fields in the product data management system, so an item cannot be created without giving this information. However, due to various reasons, it might be a challenge to set country of origin, CN-code and weight as mandatory fields. A possibility to generate weight information using AI needs to be investigated.

Another data attribute that might need setting as mandatory, is the original manufacturer of the product. In CBAM it will be of high importance to increase traceability in supply chain, and identify the manufacturer of products, to provide assistance in emission calculations and other CBAM related themes. The benchmarked company 2 had introduced a “goods producer” data attribute. It could be added as a mandatory data attribute for the selected supplier an item combos.

According to the internal benchmarking, automating or centralising the reporting process with the current scope is not necessary, which was also mentioned in the interview with the people working with data. For example, automation and AI could be used to read customs declaration documents, but the economic profitability has to be considered, and with the current scope it is not seen as beneficial. According to the interviewees, the challenge in automating the CBAM reporting process is the need for verifying the emission reports. This is something that cannot be completed using automation alone, and thus the process can be automated to a certain point, but not fully. But as mentioned before, automating the process is not considered, before it is economically profitable.

Based on the current situation with data availability and scattered databases, and also considering the current data development processes, the narrow scope of CBAM, and the requirements of data for CBAM reporting, as well as the results from the internal and external benchmarking, it can be stated, that fixing the current data related issues must begin with creating a unified way to store customs declarations and commercial invoices, and collecting the required information as data attributes to the internal data bases. This considers all legal entities and business lines. As seen from table 5, CBAM reporting requires data that is currently scattered in multiple data locations, and thus there must be rational development in storing the data of weight, CN-code and country of origin of the items. Also, information about the manufacturer of the products is required for providing assistance in CBAM emission calculations. The required improvements in data are shown in figure 8 below.

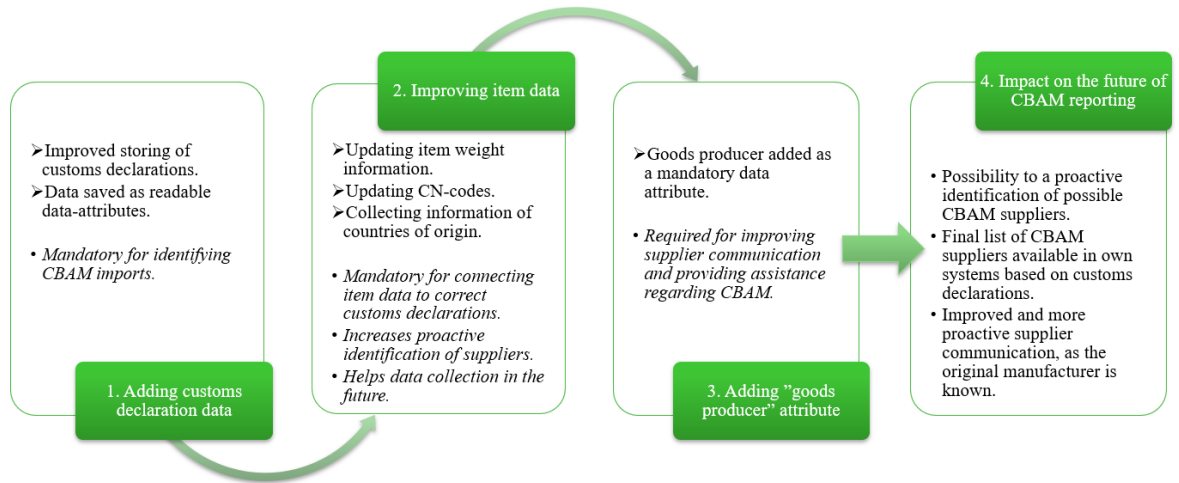


Figure 8: Illustration on required data improvements and their impact on CBAM reporting.

The roadmap to improving data quality and increasing the volume of available CBAM data in own data bases is shown in the figure above. Improving own data quality would be the desired option with data in regards to the future of CBAM reporting, as it would be important to have own data bases in shape so using data from external operators would not be necessary. However, improving data quality is time and resource consuming so also other options for improving data collection should be considered. One option is for example to use a centralised forwarding company, who offers a CBAM service, and collects the data on behalf of the company, such as has been done at the benchmarked company 2.

6.3.3 Identifying CBAM imports and improving supplier communication

As the date of the imports is not currently available in the systems, the data of imports has been collected from the local customs authorities. The CBAM imports were filtered out from the received data by CN-code, and the suppliers identified. After the suppliers had been identified from the data, the purchaser of a certain product contacted the supplier via email about the requirements of CBAM, with the EU emission calculation template attached. The suppliers were asked to fill in the required information to the emission template and to send the filled template to a shared mailbox dedicated for CBAM.

One challenge in the current method was that the suppliers were identified only after the data from the whole reporting period is available. This is often too late, as the suppliers do not have time to provide the emission report on time before the deadline. Another challenge was also that the number of received emission reports was low. Even though the main reason for this might be that the suppliers do not have enough resources, time or motivation to perform the calculations, improving supplier communication and providing better assistance for emission calculations might act as a solution to some challenges, and thus increase the

number of received emission reports.

First step in developing the supplier identification process is to create a proactive way of identifying suppliers, preferably already while placing the purchase order. This was also seen as a desired improvement by the representative of the benchmarked company 3. An option to improving identifying the suppliers proactively would be to add certain data attributes to the SRM and ERP systems. Initially, an attribute for “CBAM supplier” could be added to the systems, and the suppliers who have supplied CBAM products during the first reporting periods can be manually selected and identified as CBAM suppliers. After the suppliers are identified based on their previous imports, the purchaser could get a notification in the ERP system if they are purchasing from a recognised supplier of CBAM products. Later in the definitive regime, given that the previously mentioned desired data improvements have been implemented, new CBAM suppliers could be identified based on the product CN-codes, proactively while placing the purchase orders. As the purchase orders are made in the ERP system, the system could notify the purchaser similarly to the initial phase.

Another new data attribute could be added to the SRM system for sending CBAM template to suppliers. The “send CBAM template to supplier” transaction would include a ready-written message to suppliers with a request to provide the emission report back to a shared mailbox. The location to which the emission reports are requested should be centralised for all suppliers and all purchasers. Currently, the suppliers are able to provide documents to Valmet using a supplier portal, from which the documents are saved to the SRM system. SRM system can also function as an archive for the provided emission reports, and once an emission report has been received, it will be uploaded from the supplier portal to the supplier’s files in SRM. Once an emission report has been added to the supplier’s files, the purchaser can check another new data attribute “emission report received”. This way when ordering the same CN-coded product from the same supplier again, the purchaser is informed that the emission report has already been provided and the request does not have to be sent to the supplier again. As long as the “emission report received” box stays unchecked, the supplier will get a new request each time a CBAM product is ordered from them.

The supplier communication has been relatively unsuccessful, as based on the internal benchmarking, there were only a handful of emission reports received. The ready-made template for supplier communication could be improved by adding the supplier and category managers to the communication, as was also planned in the benchmarked company 3. Adding a sustainability contact’s information to the message would also be beneficial, as it would make it easier to find the right person to assist with the emission calculations. The following figure 9 shows the optimised way for identifying CBAM suppliers and improving supplier communication.

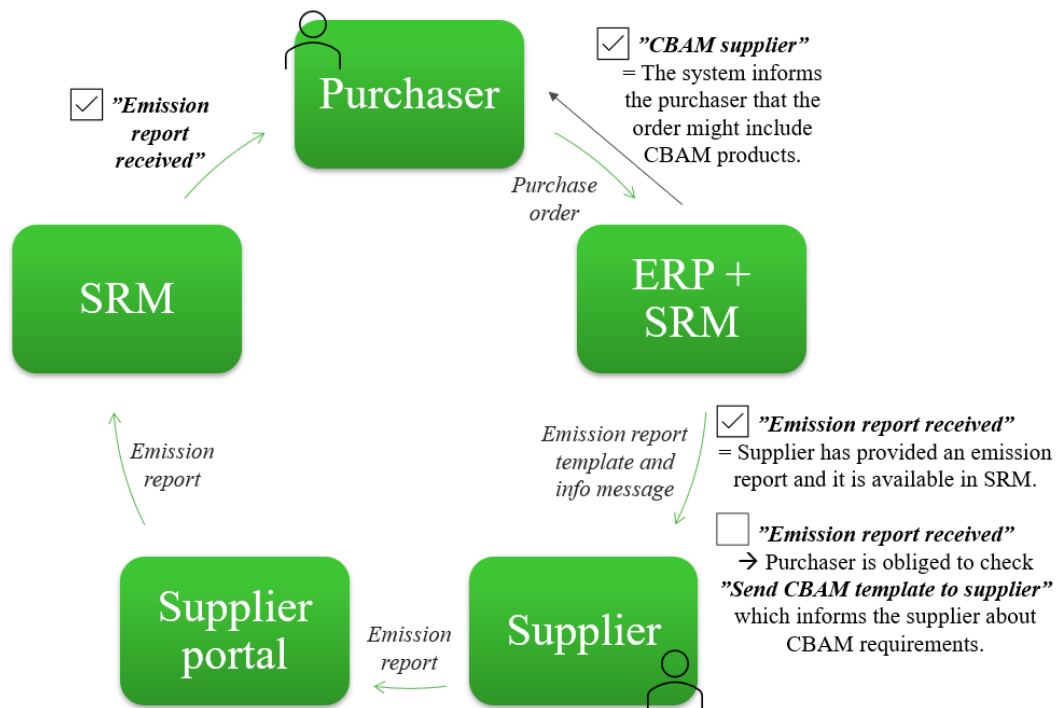


Figure 9: Improvements in supplier identification and communication.

The figure above presents the initial solutions for improving proactive supplier identification and communication. In the future, it is desired that a proactive approach to supplier identification and communication could be implemented, but this requires additional work and improvements in internal data quality.

6.3.4 Summary of the suggested functions in an optimised CBAM reporting scheme

The previous sections presented the issues to be solved with CBAM reporting, and gave insights on how to address the issues. The best available practises were analysed and the optimal process was created.

The optimal roles for CBAM reporting in the transitional period include a centralised core team whose responsibility is to manage the process, give assistance to stakeholders, and be in charge of the internal development of the process. Each legal entity has a reporting responsible who collects import data and submits the report. Purchasing communicates with the supplier and collects emission reports to a centralised data location. In the definitive regime the responsibility of collecting the data and surrendering CBAM certificates is moved to finance function.

To improve data quality and moving to a more internal data collection process, the optimal solution is to start storing customs declarations in a centralised and logical way. The necessary information from customs declarations should be added as mandatory data attributes,

so the date of the import, in addition to other relevant characteristics, are easily available for defining CBAM imports. Adding mandatory data attributes will also improve both data quality and supplier engagement. In the future it would be desired that a way to proactive CBAM supplier identification is introduced. This is important so the CBAM imports can be recognised already when placing a purchase order, so the purchaser can weigh the importance of the purchase, and consider changing the supplier to one located in the EU. A proactive supplier identification is also important so the suppliers can be informed about the requirement of providing the emission report already in an early stage. Additional mandatory data attributes are also needed to the ERP and SRM systems, so it is possible to identify the manufacturer of the goods and increase traceability, and to recognise if the supplier has already provided an emission template or not. The following figure 10 illustrates the process steps and the suggested functions to improving the current reporting process initially in the transitional period and for the future.

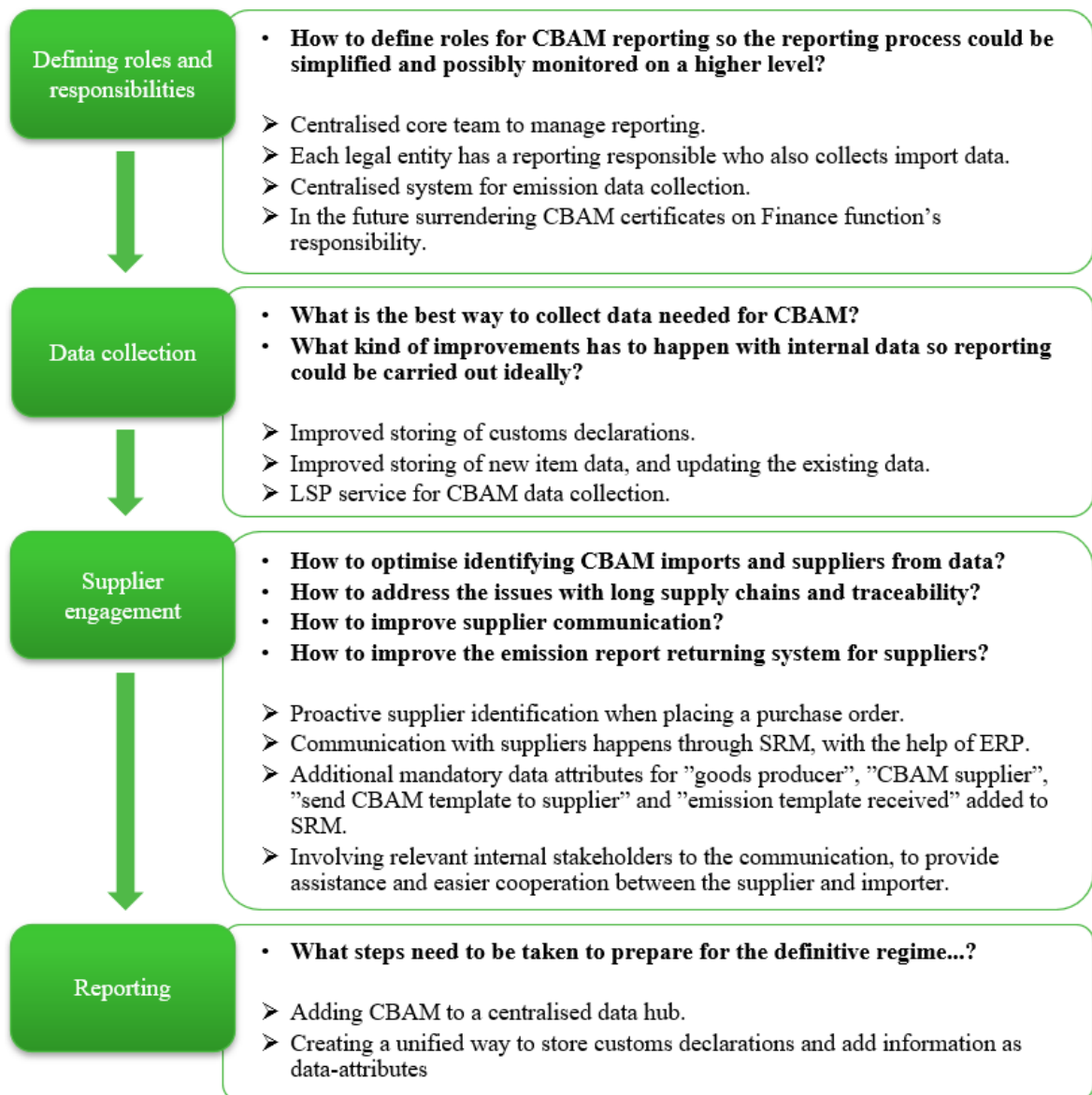


Figure 10: An illustration of the process steps and the suggested functions for the future.

6.3.5 Draft of a specific CBAM reporting platform for definitive regime

Based on the internal benchmarking, an automated and centralised CBAM reporting system is not seen necessary with the current scope. As the scope will increase in the future, possibly already before the definitive regime in 2026, there will be a need for simplifying the process and reducing the number of involved stakeholders. This section introduces a vision of a future CBAM reporting platform, and the improvements required for its implementation.

Preferably, an automated reporting platform should be able to collect information from different data sources. This would however require that the data is updated in the relevant data locations. The input data should include the necessary identifying information, so the CBAM suppliers can be identified and the emission reports requested from the suppliers. Identify-

ing input data is also required to connect the emission reports to the corresponding purchase orders, and calculate total emissions of each import. After that the platform should be able to provide the user with the total emissions generated during each reporting period, so the number of required CBAM certificates can be recognised. A draft of a centralised CBAM reporting platform, its main functions and their desired functioning order is presented in figure 11 below. Including the functions of this drafted platform to the centralised data hub, which was mentioned previously in section 6.3.2, should be considered. This draft or a similar system will be a welcome improvement at the latest when it is a more economically beneficial option than reporting as it is done in its current form.

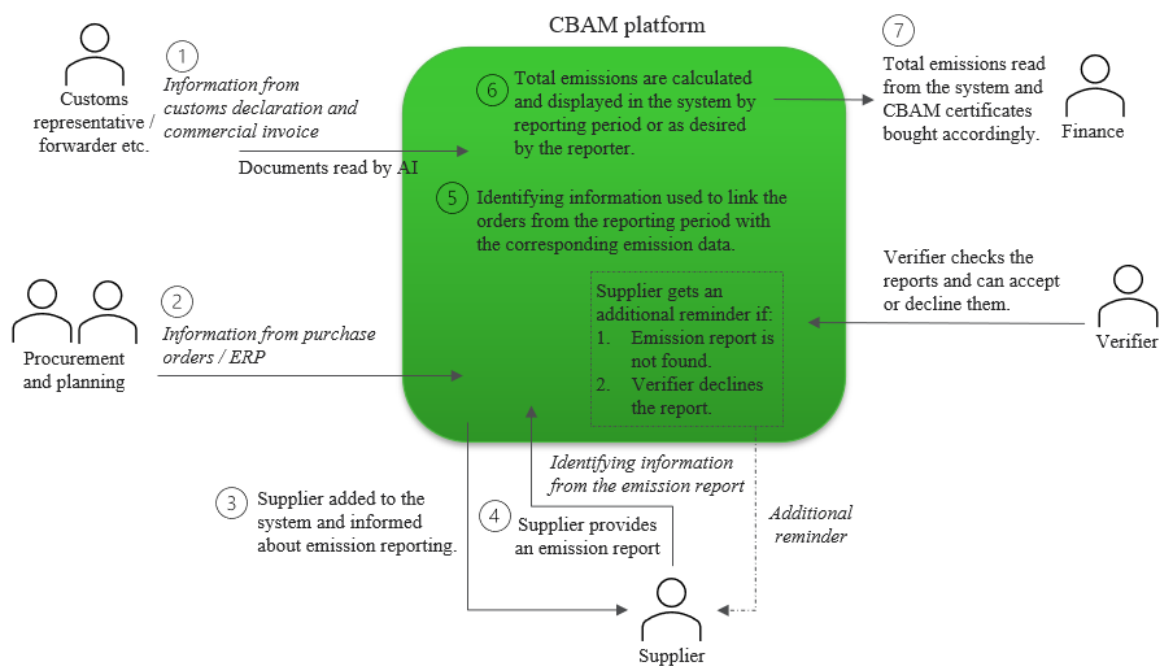


Figure 11: Illustration of the main functions of an automated and centralised CBAM platform.

The process begins with defining the reporting period. The platform functions one reporting period at a time, which means that the collected data from the current reporting period is active in the platform, and the data from previous reporting periods is archived per each reporting period.

The first step of the CBAM data collection process begins when an imported product goes through the customs procedures and the customs declaration document and commercial invoice are imported to the platform, or the information is read from an external database. Artificial intelligence (AI) is used for reading the documents and to collect the relevant information of the import, such as order ID, supplier information, CN-code, weight, date, country-of-origin and the price of the purchase. If the platform recognises that an imported product in the customs declaration belongs to the CBAM scope, it saves the supplier infor-

mation to the platform and in the second step collects the supplier's information from another database, such as ERP or SRM system.

Once a supplier is identified as an importer of a CBAM good with a certain CN-code and it has been recognised that the import has happened during a certain reporting period, the supplier and the product are added to the CBAM platform, and linked together with each other. The supplier and the products are only added to the platform on the first time when importing CBAM products during the reporting period. The contact information acquired from ERP and SRM systems is used to send the supplier a reminder, in which they are asked to provide the annual emission report of that specific CN-coded product. The supplier is given access to the CBAM platform, into which they are obligated to upload the report. The supplier gets reminded about their reporting responsibility each time it is recognised by the platform that they have imported a CBAM good with a CN-code that does not yet have an emission report provided and connected to the product in the platform. Thus, if an emission report for a product with a certain CN-code is already available in the platform, the reminder is not sent again.

The next step is that the supplier submits the emission report to the platform. After that the identifying information, such as supplier information, product emission data, and CN-code, are used to link the imports from the reporting period with the corresponding emission data. Once this happens, the emission report reminders will not be sent concerning the products that have the same CN-code as in the provided emission report. The platform has a function in which it calculates the total emissions of the imported products from the reporting period, based on the weight of the imports and the linked emission data. In the future finance function can read the total emissions from the platform and surrender the according number of CBAM certificates.

The platform also grants access to the report verifiers. The platform has a function in which it compares the sent emission values to the default values, and other emission reports provided for the same CN-code, and flags the emission reports that seem to have incorrect values. The verifier has access to the platform, so the emission reports can be verified. If the verifier declines the emission reports, the supplier is sent a notice that their report has been declined, and they have to provide a new one with some improvements. The verifier can also add comments to the notice.

7 Discussion

Sustainable business practices are becoming increasingly important, as the transition towards a more sustainable society and lower carbon emission is creating new business opportunities and affecting the costs of operations. Thus, it is necessary for the companies to increase sustainability in operations and involve it in business strategies. If the companies fail to increase sustainability or follow the rules of the sustainability regulations, they might become vulnerable to losing revenue and reputation as well as to facing regulatory penalties. (Brennan et al., 2024.)

Regulations are an important driver of sustainability, and in 2024 several key sustainability regulations are being finalised (Brennan et al., 2024). Even though the regulations aim at creating a sustainable future and encourage companies to increase sustainability in business operations, as seen during this research, it is not always straightforward for companies to adapt to the increasing amount of new regulations. This section reflects the findings of this study to the existing literature and discusses the challenges with CBAM and other sustainability regulations. The impacts of CBAM on the business operations and strategies of companies are also being discussed. This section includes short interviews with relevant representatives from different Valmet's functions to further discuss the internal opinions on the discussion points. The interviews were conducted for people in supply chain, procurement and sustainability functions.

7.1 Analysing the challenges and risks associated with sustainability regulations

In the end of 2023, a month after the beginning of the first reporting period, Reed Smith (2023) collected initial feedback from EU importers and non-EU producers about the risks associated with CBAM. Based on the feedback it was established that the importers are faced with obligations they are unable to meet. This research also addressed the risks and challenges associated with the CBAM regulation in general as well as its implementation to practice. Similarly to the feedback collected by Reed Smith, also the representatives from the benchmarked companies and legal entities saw it as a major challenge that the obligations seem very difficult to meet. According to the public policy challenges listed by Brennan et al. (2024) emissions accounting is a major challenge of the new sustainability regulations, and in this research it was also seen as one of the biggest challenges of CBAM reporting. Brennan et al. (2024) has also established that data accuracy and harmonisation is a significant issue in reaching the emission reduction targets. For example, companies in the technology sector have on average 7000 suppliers in the whole supply chain, out of which 125 are tier one

suppliers, and if the companies have global supply chains, the issue is even more complex. This challenge was also established in this research. As the aim of sustainability regulations is to reduce global emissions, Brennan et al. (2024) states that due to varying possibilities and limited access to sustainable alternative fuels or resources in developing countries, it is required from the importers to find ways to account for the generated emissions while at the same time work together with stakeholders to reduce them. However, it was found out in the benchmarking that due to the challenging and highly demanding requirements of the reporting process, there is a risk that the direct financial effects will go to additional reporting processes rather than addressing the actual issue and investing in sustainable practices. As the aim of CBAM is to reduce carbon leakage and encourage non-EU actors to reduce their emissions, it might be that the complexity and unreachable requirements of the regulation cause that the stakeholders invest resources to the reporting process and not in actual emission reductions. Thus, as the reporting does not directly add value to the companies, the increased bureaucracy might only ruin the good intentions of the regulation.

The feedback collected by Reed Smith (2023) shows that the involved parties see it as a risk that the CBAM reports submitted during the transitional period are retroactively reviewed, and the fines for incomplete or incorrect CBAM reports are higher than what the importers have to pay for their actual emissions. It was established that as the CBAM-based revenue is part of EU's own resources, there is an associated risk that if the emissions are incorrectly computed or missing, the authorities might require payment after the importation. A CBAM debt might also exist to the importers unbeknownst, for example due to giving wrong item information. According to the listing by Brennan et al. (2024), funding gaps are in fact one of the areas in need of further work by regulators, standard setters and the industry. It is estimated by the European Commission that to fund the EU's climate and energy security investments, 1.25 trillion euros will need to be spent by 2030. The estimate is an increase of over 65 % compared to the past decade, and is expected to come from the private sector. As it seems that the EU is in need for funding from the companies in the private sector, it can in fact be seen as a risk that there could be additional or unexpected payments required by the authorities.

Related to the previous topic, it was also found out in the initial feedback by Reed Smith (2023) that the fines are also based on emission calculations made with punitive default values. Making emission calculations with default values was also seen as a risk in the definitive regime, as the quarterly minimum of 80 % of CBAM certificates is based on default emission values, which creates a risk for systematic over-purchasing of certificates. However, it was seen that also under-purchasing the certificates in the definitive regime creates risks to the importers. It is not certain how accurately the importers can verify the emission data, which

can result in under-purchasing certificates. (Reed Smith, 2023.) It can be noted that the views on the regulation are partly contradictory, as in the initial feedback it was thought that the use of default values would result in over-purchasing of certificates. However, it was found out in the benchmarking that the default values are too low compared to the actual embedded emissions, which does not encourage the suppliers to calculate the actual emission values, and could cause difficulties with receiving actual emission data from suppliers. If the companies prepare for surrendering 80 % of the certificates in the beginning of the reporting period based on the default emission values, it might be that the number of surrendered certificates is actually rather too low than too high. This can instead lead to companies under-purchasing the certificates, as the actual emissions would be higher than expected. As the certificates start to play a role only in the definitive regime, it remains to be seen how correctly the companies manage to estimate the emissions from their CBAM imports. It also remains to be seen if there is a real risk for the estimates not corresponding to the actual embedded emissions, and if there will be a requirement for additional payments due mistakes.

In addition, it was found out in the benchmarking that depending on the additional costs caused by the regulation, there is a risk that the regulation might drive manufacturing of end products away from the EU. It was also seen as a threat of CBAM that the companies operating in the EU can become less competitive due to additional costs, product prices will go up and inflation in the EU might increase. This is because the current scope of CBAM does not include end products, and with the current scope the importer can avoid CBAM reporting by importing end products instead of the low added value CBAM products. It is expected that the scope of CBAM will expand to higher added value products rather soon, as the goal in the beginning was to get stakeholders familiar with the requirements of the regulation as well as force the importers to create a reporting process and the suppliers to learn how to calculate the embedded emissions of their products. However, it might be better that the expansion would happen rather too soon than too late, as with the current scope there is a threat that instead of reducing carbon leakage from the EU, the regulation will only increase it. However, expanding the scope on a fast schedule might be challenging, as the requirements are already demanding and resource intensive for the involved parties. It must be understood that there might not be a straightforward way to optimise the regulation so that it will serve for the purpose it was created for, and similarly require only few resources from the companies. After all, larger-scale improvements in reaching global sustainability targets do not happen without external pressure and obligations.

7.2 The impact of CBAM on business operations

In 2022 AFRY Management Consulting (2022) studied the effects of CBAM on the price of electricity. The analysis focused on the price of imported electricity from Russia, and it

was conducted before the Russian invasion of Ukraine. It was found out in the research that CBAM will increase the price of imported electricity by 3-4 euros per megawatt hour, and thus reduce the amount of imported electricity. Similarly, it was also a dominant opinion in the benchmarks that an increase in product prices caused by CBAM will be the main driver for reducing the amount of imported materials. However, based on the results of this research, the amount of products in the CBAM scope is currently low, and the impacts on operations remain minor. As the scope will increase, the increased prices start to concern also higher added value products, and eventually end products.

The representatives saw that as a result of the increased prices, CBAM encourages importers to localise production and procurement, which is in line with the findings from the study by AFRY. Thus, it can be expected that importing CBAM products will decrease and moving production inside the EU will increase in the future, depending on the significance and financial impacts caused by CBAM. However, considering the current scope of CBAM this is conflicting with the risk of manufacturing of end products moving away from the EU, which was mentioned in the previous section 7.1. According to the interviewees from Valmet's supply chain and procurement functions, there will be changes in operations, depending on how the scope will increase in the future. It is seen that the current scope is not enough to cause significant changes in operations, as the costs will remain minor, and the main driver of changes will be the increase in costs. Thus, as found out in the benchmarking, importers should begin to consider how to optimise and localise procurement for the future.

It was also found out in the benchmarking that the representatives saw localising and optimising the supply chains an important and probable change in operations in the future. As the scope of CBAM will increase and the costs start to be more significant to the economy of companies, it will become important to optimise the value chains. At least in globally operating large-scale manufacturing companies, where procurement is automated to a certain point, there might be a challenge with unreasonable supply chains. This is caused by the fact that each product has a first and second priority supplier, that does not depend on the location to which the product is supplied. For example, a product might have its first priority supplier in Asia and second priority supplier in the EU. Regardless if the product is purchased to a location in Asia or in the EU, the product will primarily be purchased from the supplier in Asia. It was also found out in the benchmarking that it would be desired that the supply chain was optimised and the production localised globally and not only in the EU. This challenge could be addressed for example by creating an automated process where the suppliers' locations are compared to the address of the delivery, and the closest supplier would be always chosen as the first priority. Thus, CBAM can have a significant impact on operations and for example reduce the transportation emission of purchases globally.

Related to the supply chain optimisation, during the first reporting period it was established that Valmet transmits products through own warehouses, from where they are further supplied to the EU. In these cases the warehouse acts as the first tier supplier, and is responsible for collecting the emission data and providing it to the legal entity who made the purchase. According to the interviewees from the supply chain and procurement function, this creates additional work for the warehouses. Thus, the interviewees hoped that transmitting CBAM products to the EU through an own warehouse outside of the EU would be terminated. Considering the requirements of CBAM and increasing sustainable supply chain operations, the companies must start thinking about the necessity of purchasing products from certain suppliers. This also confirms the opinions from the benchmarking that CBAM forces to improve own data quality and operations, as well as causes that businesses become more aware of their supply chains and lack of transparency.

According to Brennan et al. (2024), to address the requirements of different sustainability regulations, the companies should begin to reduce their carbon footprint in raw materials. CBAM will support in reaching this goal, which means that by following the rules of CBAM and changing ways of operating, the impacts will also be positive in regards to other sustainability regulations and their requirements. According to the interviewee from Valmet's sustainability function, CBAM is in line with Valmet's ambitious climate goals. CBAM supports Valmet's supplier engagement program, which engages suppliers to follow Valmet's climate goals and reduce emissions. At the moment the regulation only concerns one product sector, but gives acceleration to achieving internally set climate goals. It was established in the benchmarks that it is expected that CBAM will increase the production of low carbon products in and outside of the EU.

8 Conclusions

Conclusions present the key findings, and the implications of the research. The limitations of the research are discussed, and the opportunities for future research and development of the CBAM reporting process and the regulation in general are presented.

The study focused on implementing an optimal reporting process for CBAM to be used at a globally operating manufacturing company that imports CBAM products to the EU. CBAM requires actions from both the importers of goods and the installation operators, or suppliers, supplying CBAM products to the EU. In this research the scope was limited to consider the reporting process and actions required from the importers. The scope of this research was limited to CBAM products in the iron and steel sector, as the studied companies work mostly with such materials.

The research began with a literature review that focused on finding out the background and reasons for the implementation of the regulation. It was established in the literature review that the European Green Deal is an agreement that aims at making the EU's economy sustainable by providing actions that enhance the efficient use of resources by transitioning to cleaner and circular economy, mitigating climate change and cutting pollution, as well as recovering the lost biodiversity. To achieve the targets set in the European Green Deal, the EU introduced the "Fit for 55" package, which is a set of proposals aiming at achieving the 2030 target of reducing emissions by 55 %, as well as help in reaching the 2050 target of climate neutrality. The CBAM regulation is part of the "Fit for 55" package and it aims at supporting the global climate goals by tackling the EU ETS issue of carbon leakage. Carbon leakage occurs when emission intensive production is moved outside of the EU to avoid the EU ETS requirements.

After the background of the regulation was established, the focus was moved to the regulation itself. The requirements for importers and installation operators were introduced and a general framework for CBAM reporting was established. According to the rules of the regulation, during the transitional period the importers are required to submit a quarterly CBAM report to the European Commission and during the definitive regime surrender CBAM certificates in accordance to the amount of generated embedded emissions annually. The suppliers are required to calculate the actual embedded emissions of the products that fall under the CBAM scope, and provide the data to the importers.

The empirical study included a case study for Valmet, and the case company was introduced shortly. The empirical study included both internal and external benchmarking. The internal benchmarking focused on Valmet's legal entities located in the EU, and aimed at finding

out the current situation with the reporting, as well as the challenges occurred during the process. The external benchmarking, in turn, tried to find out if companies that are working with similar materials and have a similar organisational structure as the case company Valmet are struggling with the same challenges as found out in the internal benchmarking. The external benchmarking also investigated how the companies have tackled the challenges and what kind of measures have been taken to optimise the reporting process in each situation. The results were analysed and the suitability of the best practices for Valmet was evaluated. Based on the results, an optimised CBAM reporting process was developed. The optimised reporting process was initially targeted for the transitional period.

8.1 Key findings

The current situation with CBAM reporting process at Valmet is that each legal unit has a reporting responsible who collects the data of imports, contacts the purchasers of each CBAM import, collects the emission data if available, and submits the report to the CBAM Transitional Registry on behalf of the legal entity. The data was collected from the local customs in Finland and Sweden, and in various methods in other EU countries. The purchasers were in contact with the suppliers, and requested the emission reports with a ready-written request message. The suppliers were asked to provide the emission reports to a shared e-mail address, in where they would also be available for verification. The reporting was done using the provided default values, as the number of received emission reports was low.

The results from the internal benchmarking show that the legal entities faced some challenges in all stages of the reporting process. The data was seen easy to collect due to the cooperative customs authorities in Finland and Sweden. However, it was seen as a challenge that the data in own systems is scattered to different locations and that the customs declaration data is not stored in a unified way throughout the whole company. This will cause challenges as the aim is to be able to collect the import data from own data systems. Collecting emission data from suppliers and engaging them to the process were also seen as major challenges, such as were long supply chains, as currently the original manufacturer of the product is difficult to trace and traceability needs to be improved. In general, it was seen that the time schedule in the transition was too fast in contrast to the heavy requirements of the regulation, the Excel template was complicated and the language used in the regulation is unclear and complex.

Internally, it was seen that process ownership needs to be defined to fix the challenges with data quality. The data collection for CBAM must be done focusing on the relevant factors for CBAM reporting, and the data quality must be improved. Based on the internal benchmarking, the communication with suppliers needs to be done on a different approach, and the person on the supplier's end must be someone who understands the reasons and require-

ments behind emission reporting for CBAM. It was also seen necessary that the suppliers are provided with assistance to help with emission calculations to increase the number of received emission reports.

The results from the benchmarking showed that two of the companies had approached the reporting process through a centralised function. The third company had chosen a different approach and established a core team to be responsible for process development and providing assistance to stakeholders as well as a centralised function in Asia that is responsible for supplier communication and data collection. Similarly to Valmet, the company had named a reporting responsible from each legal entity to submit the report on behalf of the legal entity. In all companies the data collection was seen as a challenge, and each company had used external stakeholders, such as the local customs or an LSP provided CBAM feature, to collect the required import data. In two companies the suppliers were contacted by email or through a vendor management system. The third company had a supplier info package under development, and suppliers were not contacted during the first reporting period. The reporting was done with default values in each benchmarked company due to a low number and unreliable quality of received emission reports. However, it had been established in one of the benchmarked companies that the default emission values are too low, and thus do not motivate the suppliers to calculate the actual embedded emissions.

Based on the results of the external benchmarking, the representatives see a better and more unified storing of customs declarations as one solution to the challenge with import data collection. The representatives saw supplier engagement as an important challenge, and the results showed various approaches to the issue. One company had arranged a global supplier meeting where the regulation and its requirements are introduced and the suppliers are informed about their responsibilities. It was also seen as an important improvement that the reporting requirement would be mentioned shortly already in the purchase agreements. Improving traceability in the supply chain and decreasing complexity in communication were also seen as important improvements. For example, the Excel template was simplified before it was sent to suppliers, and the training of suppliers was improved. The companies had also thought about establishing a proactive approach to supplier communication.

Based on the findings from the benchmarks, the occurred challenges in the CBAM reporting process can be divided to four process steps; defining roles and responsibilities, data collection, supplier engagement, and reporting in the Transitional Registry. It was established that the roles and responsibilities should be defined so that each legal entity has a reporting responsible collecting data and submitting the report. The emission data is collected from suppliers proactively through a centralised system. In the future it is hoped that finance function was responsible for surrendering the CBAM certificates. Defining the roles this way is

the optimal way considering the organisational structure at Valmet.

For data collection the suggested actions are to improve the storing of customs declarations. This will need improvements and unification in the company as a whole. Also, the required data should be saved as mandatory data attributes to the systems. Other data attributes will also need updating. CBAM reporting requires that the weights, CN-codes, and other product related data is accurately presented in internal data. Before the data of imports is available in own systems, a suggestion is to use an LSP service that offers a CBAM service for data collection.

For supplier engagement the suggested improvements are that a proactive supplier identification process is established. This means that the CBAM suppliers are recognised already while placing the purchase order, so the suppliers can be informed about the regulation early enough, and the purchasers can rethink the necessity of their purchase and if needed, change the supplier and localise procurement. The proactive approach could be established by adding mandatory data attributes to the SRM and ERP systems. The data attributes help in identifying CBAM suppliers, and let the purchaser know if the emission report has already been submitted or not. The communication with suppliers is suggested to be done through the SRM and ERP systems, so the data is available for all users. This would be a way to centralise data collection, and make supplier engagement more practical. The communication with suppliers should be improved, so it is easier for the suppliers to get assistance to the calculations.

The last process step was reporting in the Transitional Registry, and the suggested functions have to do with the preparation to the definitive regime. The first reporting was done with the provided default values, and to address this challenge the suggested options are to first improve the storing of customs declaration documents and to improve the quality of internal data in general. Once the issues with data have been addressed and the data quality improved, it should be thought if CBAM reporting could be included to the centralized data hub which is currently under development.

The discussion focused on analysing the risks and challenges of sustainability regulations as well as their possible impacts on business operations. It was seen that the main risk of CBAM and other sustainability regulations is that the stakeholders are faced with obligations they are unable to meet. The scope of CBAM is currently narrow, and excludes end products, which can lead to moving manufacturing away from the EU. It is also seen that as the default values do not correspond to the actual embedded emissions, reporting with default values has its risks. The EU's funding gap creates a risk of additional and unexpected payments, and for example an incorrect number of surrendered CBAM certificates might lead to penalties.

It was established that the driving factor for changes in operations was the increase in the scope of CBAM. Depending on the improvements in scope, it is seen that the companies might optimise their supply chains and localise procurement. In general, CBAM is seen to support companies in reducing their emissions, and with the improvements also help in reaching the targets of other sustainability regulations.

8.2 Limitations

The research covers the case company Valmet, and three large-scale manufacturing companies that all have similar organisational structure and are all working with similar materials as Valmet. The studied companies focus on the iron and steel sector, and the imported materials were mainly iron and steel. In addition to iron and steel, the scope of CBAM includes cement, aluminium, fertilisers, electricity and hydrogen. Thus, the results from the internal and external benchmark do not necessarily reflect to all sectors covered by the regulation. It might be that the companies working in different sectors are facing different challenges compared to the ones working with iron and steel. Due to the scope of this thesis limiting to certain type of manufacturing companies and to one material sector, it must be noted that no case study that focuses on only one product category under CBAM can provide an optimal reporting scheme to be used by everyone affected by the regulation. This is especially when the optimisation does not include developing a fully new software and is done using only the best available practices. Each company also has different operations, systems, and data quality issues, and thus the optimised system created in this study is most likely not suitable for every importing company affected by CBAM. The suggested optimal functions for the reporting scheme might not be suitable for companies working with other CBAM materials, or with different functions in the organisation in general.

In addition, as all the studied companies are large-scale companies with similar organisational structures, the results are limited to similar businesses. The results from this study might not reflect to the situation faced in smaller companies and to companies working with different materials. The studied companies also had multiple legal entities in the EU, but some companies working with CBAM might not have additional legal entities at all, or in significantly lower numbers.

The studied companies had a low share of CBAM imports currently, mostly due to the currently narrow scope of CBAM products. However, there are companies, such as retail hardware stores, that are mostly importing small products with low added value. One limitation to this research is that no studied company had a large share of imported CBAM products, and all companies saw data collection and emission reporting relatively easy due to the low number of CBAM imports. The situation might not reflect to companies that have a larger

share of imported products. The suppliers were also not benchmarked to interview about the challenges they have faced. Even though the scope of this study is limited only to the importing companies, having the suppliers' point of view might create changes to the proposed process steps. Currently, the optimised reporting process does not consider the suppliers' opinions, and may only work for the benefit of the importer.

The study was conducted after the first ever report had been submitted, which creates some uncertainties to the results. The companies might not have had time to adjust to the requirements nor had time to think about helping the suppliers with their responsibilities. The short time-frame with updates to the regulation and the additions to the guidance and information limited the study as the knowledge of different factors increased daily. During the first reporting period it was also seen that different stakeholders have started the adaptation to the requirements on a different pace, and the level of knowledge about CBAM varies significantly between stakeholders.

The validity of the research could be increased by involving different sized companies from various fields to the benchmarking. It would also be required to involve all relevant stakeholders, such as the internal participants and suppliers, to the benchmarking and get their perspectives on the topic. To increase the validity of the research, it should be considered if the process was optimised again, when companies have had a bit more time to adapt to the rules of the regulation, and have established their optimal reporting process. The validity of the results could be increased if the benchmarked companies would have had more time to prepare themselves for the reporting and had optimised their reporting process with the best available practices. Currently, as the situation is undeveloped, the companies are each looking for their optimal practices.

8.3 Opportunities for further research

The regulation is relatively new, which is why there are no similar studies conducted about optimising the CBAM reporting process at importing companies. However, there are many reasons and different factors supporting the future research about the implementation process for CBAM. Based on the results of this study, the improvements in data should be considered on a higher level, taking into account the centralised data processes and better handling of documents. As the importance of sustainability is constantly increasing and different sustainability regulations and reporting schemes are introduced, developing a platform for bringing together data to form reports for different purposes should be considered. An opportunity for further research is to study the functions required for an automated CBAM platform, and to consider how the platform could be integrated to existing systems. An automated CBAM reporting platform will also help with the process later on when the list of CBAM products

increases and there is more products to report on.

Another suggestion for future research is to benchmark companies that work with different CBAM product sectors. As mentioned in the previous section, this study only considered iron and steel sector, and the companies importing such products, which creates an uncertainty to the results. It is unclear, how well the optimised system can be utilised in companies importing other CBAM products than iron and steel, which is why an opportunity for further research is to study how the process could be optimised in those companies. It would also be important to find out if companies in other sectors have faced similar challenges with CBAM as came up during this research, or if the challenges differ between sectors. Also, companies in other sectors might see different opportunities and threats with CBAM, in comparison to the companies benchmarked for this study.

In addition, it would be beneficial to conduct a study focusing on the suppliers' perspective, as this research only focuses on the importers responsibilities. It would be important to understand the challenges faced by the suppliers, to better understand their situation, and provide assistance for their specific needs. It is currently a remarkable challenge that the suppliers are unable to provide the emission reports correctly and on time, which is why it would be valuable knowledge to understand the suppliers' concerns.

As discussed previously in this study, the introduction and implementation of CBAM is most likely to cause some changes in operations, depending on the financial effects and the possible enlargement of the CBAM scope in the future. This study creates a good framework for further studying the impact of CBAM on business operations. The research could provide an insight on how the regulation will affect on the current practices, and which factors are the key drivers for changes. The research could also focus on finding out which operations are most affected by the regulation, and what kind of effects do the changes in operations have for the business and in general.

8.4 Conclusion statement

CBAM is a new regulation by the European Commission, which aims at tackling the issue of carbon leakage occurring due to the EU ETS regulation. The regulation entered into force in 2023, starting with a transitional period, and continuing after 2026 with a definitive regime. It is important for companies to optimise the reporting process for CBAM as it requires data that is previously not stored at companies, increases the need for improved supplier communication, and requires establishing new internal functions. The regulation is entering into force on a fast schedule and the obligations are changing and increasing throughout the transitional period, which means that the companies need to start adapting to the changes.

This study focused on finding out the optimised practises for establishing a CBAM reporting process at a globally operating manufacturing company located in the EU. The suggestion was created considering the solutions that would be the best fit for the current situation and the currently available methods and systems. The research was conducted with a literature review and the empirical study included internal and external benchmarking. The research questions of this study were as follows:

“What are the main challenges with CBAM reporting and how can they be addressed?”

“What are the main principles guiding the implementation and optimisation of the reporting process at the case company?”

It was found out in this study that the main challenges with CBAM reporting are currently in import data collection and the scattered and insufficient data availability, as well as in supplier engagement and communication. To address these challenges the roles and responsibilities need to be defined so that a centralised core team is established to manage the reporting process and provide assistance to stakeholders, and a reporting responsible is named from each legal entity to take responsibility for submitting the CBAM report to the Transitional Registry. In the future, surrendering the certificates is on the finance function’s responsibility. The emission reports are collected from the suppliers centralised via the used SRM system, so there is no need for the suppliers to provide the report to the company more than once. With data collection the main challenge was related to the insufficient and unavailable data, such as the lacks in storing import data from customs declarations. Thus, the main data improvement regarding CBAM is to establish a company-wide method for saving the data from customs declarations to the internal systems.

The main principles guiding the implementation and optimisation of the reporting process are centralised and resource efficient processes, as well as optimised data collection processes. It is important that the reporting is made resource and process efficient, so the reporting process does not require additional external resources, and that the process would be as simple as possible for both internal stakeholders and the suppliers. Thus, it is important to keep focus on the centralised emission data collection process for the suppliers, as well as on ensuring that the import data collection is made resource efficient and unified within the company.

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