



# Sustainability from project logistics perspective

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## **Tiivistelmä**

Opinnäytetyö toteutettiin kaivos- ja teknologiateollisuuden alalla globaalisti operoivan eurooppalaisen yrityksen toimesta. Tehtävä oli kehittää käytännön ehdotukset kestäväen kehityksen edistämiseen ekologisesta näkökulmasta projektilogistiikan toimintojen kautta. Tavoitteena oli edistää yrityksen kestäväen kehityksen tavoitteiden saavuttamista konkreettisten toimenpiteiden avulla.

Opinnäytetyön tutkimusmenetelminä käytettiin sekä kvalitatiivista että kvantitatiivista lähestymistapaa. Kvalitatiivinen menetelmä käytettiin päämenetelmänä hyödyntäen vapaamuotoisia yksilöhaastatteluja sekä laajaa kirjallisuuskatsausta. Kvantitatiivista menetelmää käytettiin tukevana lisämenetelmänä yrityksen sisäistä dataa ja analyysityökalua hyödyntäen.

Opinnäytetyön tuloksena saatiin käytännön ratkaisuja ajallisesti kolmena eri lähestymistapana eli lyhyenä, keskipitkänä sekä pitkänä. Nopeimmin toteutettavaksi todettiin kestäväen pakkaukseen liittyviä ratkaisuja, enemmän aikaa vieväksi todettiin intermodaalikuljetusten hyödyntämistä pitkissä toimituksissa sekä eniten aikaa vieväksi todettiin kokonaisvaltaisempaa ratkaisua kiertotalouden logistiikkaketjun muodossa.

Opinnäytetyön tulosten pohjalta syntyi useita jatkotutkimusten kohteita. Ensimmäiseksi ehdotukseksi muodostui vastaavanlaisen tutkimuksen uudelleentoteutus tulevaisuudessa. Lisäksi ehdotuksiksi muodostuivat kestäväen pakkauksen ohjeiden laatiminen sekä intermodaalikuljetusten ja kiertotalouden logistiikkaketjun käyttöönotto mahdollisuuksien kartoittaminen yrityksen projektilogistiikan operaatioissa.

## **Avainsanat (asiasanat)**

Kestävä kehitys, Ympäristöllinen kestävyys, Päästövähennys, Logistiikka, Projektilogistiikka, Toimitusketju

## **Muut tiedot (salassa pidettävät liitteet)**

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### **Abstract**

The thesis was carried out for a globally operating European company in the field of mining and technology industry. The task was to develop practical proposals for promoting sustainable development from an environmental point of view through project logistics activities. The aim was to promote the achievement of the company's sustainable development goals through concrete measures.

As a research method of the thesis both qualitative and quantitative approaches were utilized. The qualitative method was used as the main method, utilizing unstructured individual interviews and extensive literature review. The quantitative method was used as a supportive additional method utilizing the company's internal data and analysis tool.

As a result of the thesis, practical solutions were obtained in three different time approaches or short, medium, and long. The fastest implementation was found to be solutions related to sustainable packaging, more time-consuming was found to be intermodal transportation solution in terms of long deliveries, and the most time-consuming was found to be a more comprehensive solution in the form of a circular logistics chain.

Based on the results of the thesis, several directions of further research were created. The first proposal was the future implementation of a similar study. In addition, suggestions were made regarding the preparation of sustainable packaging guidelines and a mapping of deployment options of intermodal transport and circular logistics chain in the company's project logistics operations.

### **Keywords/tags (subjects)**

Sustainability, Environmental sustainability, Emissions reduction, Logistics, Project logistics, Supply chain

### **Miscellaneous (confidential information)**

No confidential information

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# 1 Introduction

Human activities have long had a negative impact on the surrounding environment. Already today, each of us notices the consequences of climate change, through the increase of average temperature, and in the form of extreme weather phenomena all over the world. At the global level, it has been shown that the high amount of greenhouse gases in the atmosphere causes the climate change. Now, in order to turn the situation radically in the other direction, measures must be taken. Due to that, sustainability has become one of today's megatrends and therefore the most talked about topics around the world, both at the individual and corporate level.

Several significant historical measures toward problem solving have already been taken on a global scale. One of the most well-known ones happened in December 2015, when the universal call called the Paris Agreement was held in terms of combating climate change. (The Paris Agreement N.d.) In the same year, an important call for the promotion of sustainability was also held, resulting in the 17 Sustainable Development Goals. (The 17 Goals N.d.) From a European Union level point of view, plenty of directives and policies related to the topic have also recently been introduced. In addition, new regulations and supplements to the existing ones are constantly being developed. As laws and requirements become stricter, large companies in particular change their strategies and goals to promote sustainability development in their processes, regardless of industry. Furthermore, the transparency of corporate responsibility matters is becoming a requirement, which in turn leads to pressure regarding sustainability reporting.

Despite the huge importance and topicality of the subject and the availability of a great amount of information, real measures towards sustainable development have not necessarily been implemented on a practical level. Due to this, actions must be taken to identify ills, solutions have to be proposed and presented and the most important put into force on a practical level to optimize various processes from a sustainability point of view. Measures must be implemented as soon as possible, as the next years will be crucial, especially in terms of the climate change slowdown and the elimination of its consequences.

## 1.1 Goal of research

This research is carried out for a globally operating European company in the field of mining and technology industry, whose intention and promise are to achieve the sustainability goals set by both the legislation and the organization's own level in the upcoming years. These targets are especially related to limiting global warming to 1.5 °C aligned with the Paris Agreement and achieving net zero emission by 2030 by reducing CO<sub>2</sub> emissions through operations.

**The main goal of the research is to develop concrete action proposals for the company to promote sustainability from the perspective of project logistics operations.** The main research question, in turn, can be defined as follows: “What are currently the most suitable practical measures from the point of view of project logistics operations towards achieving the goals of sustainable development?”. It should be noted that the main research question will be approached through multiple specified sub- and additional questions in the next sections of the work.

The purpose of the research is to find the best practices considered in the current situation to reduce carbon dioxide emissions through project logistics activities. It is noteworthy that the end results of the work are intended to help not only the company to which this research is carried out to rethink their own processes and thereby move towards set sustainability goals, but also other operators, inter alia, in the logistics sector or those working closely with project deliveries on a global scale regardless of location. In addition, with help of study based further development proposals there will be created space for new ideas to take end results to a new level in the future.

## 1.2 Limitations of research

There have been several limitation factors set for the research as the sustainability topic itself is highly extensive. In the first place the work will focus on sustainability theme specifically from the logistics, precisely on project logistics point of view, due to the author's degree to be completed and accumulated work experience directly related to the field. In the second place the research will thoroughly focus only on sustainability's environmental point of view instead of all its three perspectives i.e., environmental, social, and economic one. As a justification for above mentioned limitation is the company's sustainability strategic approach based especially on environmental goals, such as a significant reduction of carbon dioxide emissions in its supply chain processes. The

third research limitation is related to legislation. The work will only briefly focus on the main legislative paragraphs related to the subject, but there will be no more approach on them due to the purpose of the research to create concrete action proposals toward sustainability in project logistics operations and not to look at the effects of legislation on actions to be taken.

## **2 Theoretical basis**

The purpose of the theoretical basis section of the research is to focus on the most important definitions of subject related terms. The advancement of determination has been considered in a logical order so that first introduction to the subject of sustainability occurs through the environment and emissions directly related to climate change terms. These are followed by a brief opening of the logistics terms and the most significant related legislation abbreviations.

### **2.1 What is Sustainability?**

The definition of sustainability may vary depending on the individual or organization. Often the word is associated with "greenery", which is only part of the truth. In fact, in October 1987, the Brundtland Report was released by The World Commission on Environment and Development, in which the concept was given an official definition of satisfying the needs of existing generations without endangering the ability of the following generations to respond to their own needs (Report of the World Commission on Environment and Development: Our Common Future 1987). Despite the strong linking of sustainability into the environment, it is not the only part of its area, as many often think. In reality, sustainability consists of three different dimensions, all of which guarantee a long-term and uniform lasting result. These three pillars are environmental, social, and economic sustainability, all of which are dependent on each other. Thus, one can think that the economy is dependent on society again these are both dependent on the environment. (What is Sustainability? N.d.) From a corporate point of view, sustainability can also be thought of as three of the above groups. According to Mohsen (2022) it requires the company to minimize waste, optimization of process and resources, and reduce costs from the operator. The benefit of this, in turn, will result in an increase in profitability, improved competitiveness and ensuring business continuity (Mohsen 2022).

## **2.2 Environmental sustainability**

The unfortunate fact is that humanity will not have a healthy future without care of the environment. Even nowadays, nature disasters are starting to be an ordinary sight. It has been researched that with the current greenhouse gases producing, global warming reaches 5.4 °C by year 2100 when the target is to keep it below 1.5 °C. This thus means that without changing operating methods, emissions from industry and fossil fuels will pollute air, water, and soil quality unprecedentedly quickly. (Environmental Sustainability: Importance, Issues and Benefits 2022.) In addition, caring for ecological sustainability is not just a key role in combating climate change but also in the preservation of biological diversity which is one of the basic components of the ecosystem. Due to the dependency of the availability of natural resources and ecological services to biological diversity, it also plays an important role in the economic wellbeing of societies (Surampalli, Zhang, Goyal, Brar & Tyagi 2020).

### **2.2.1 Ecological footprint vs handprint**

Ecological footprint measures the funds that, for example, a particular product requires to produce the natural resources it consumes. In other words, it counts the demand and supply of nature, through how quickly we consume natural resources and produce waste relatively how quickly nature absorbs the resulting waste and generates new resources. The ecological footprint is particularly monitored by the following natural resources producing areas: carbon and built-up lands, forest products, fishing grounds, grazing land, and cropland. Some of them are also characterized by waste absorption, such as carbon dioxide emissions, which is also considered in the measurement of the footprint. (Ecological Footprint N.d.)

The ecological handprint focuses on determining, measuring, and evaluating sustainability effects from a positive perspective, unlike the ecological footprint. The handprint has a holistic approach to counting the sustainability effects of products from all three perspectives, i.e., environmental, social, and economical. In addition, it considers the life cycle of the entire product. The approach is able to support economic actors to meet the demands of society, due to the transparency of the sustainability of products. The handprint is therefore in a key role in communication of the sustainability performance. (Handprint N.d.)

### 2.2.2 Greenhouse gases

Greenhouse gases are gases that bind the sun's heat radiating from the earth's surface into the atmosphere, preventing it from escaping into space. Due to phenomenon, the greenhouse effect occurs. Greenhouse gases are usually divided into the following types covered, inter alia, by the Paris Agreement: carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide, and different types of fluorinated gases. Of all the gases, the attention is usually paid to CO<sub>2</sub> emissions in particular, as it is the most important greenhouse gas produced by human activity. It is released into the atmosphere especially as a result of industrial processes and burning of fossil fuels, as well as through trees and chemical reactions. Although CO<sub>2</sub> emissions occur naturally as part of the carbon cycle, human-caused emissions are the main reason for their increase in the atmosphere. (Overview of Greenhouse Gases 2023.)

Some of greenhouse gases make the climate warmer more efficiently than others. Each of these gases can also remain in the atmosphere for different periods of time, from a few to thousands of years. For example, methane and fluorinated gases stay in the atmosphere for less time than CO<sub>2</sub>, but they absorb the heat of the sun much more efficiently which makes them equally dangerous compared to CO<sub>2</sub>. (Climate change: the greenhouse gases causing global warming 2023.) However, all gases stay in the atmosphere long enough to mix well, so the values obtained as a result of emission measurements remain the same in every part of the world, regardless of the location of the emission source (Overview of Greenhouse Gases 2023). And since each gas has its own warming potential, the impact they cause is used to convert into a CO<sub>2</sub> equivalent to facilitate comparison (Climate change: the greenhouse gases causing global warming 2023).

### 2.2.3 Net zero

The definition of net zero is the balance between the number of greenhouse gas produced and removed from the atmosphere. The simple idea is to cut greenhouse emissions as much as possible and let the remaining amount reabsorb from the atmosphere for example by forests and oceans. In any case changing the world to meet the net zero goal is one of humanity's biggest challenges at the moment. Due to the fact that global warming is directly dependent on the amount of CO<sub>2</sub> emissions production, it is not possible to stop the heating as long as net zero goal has not yet been reached. This, in turn, means a complete transformation of how humanity should start to

produce, consume, and also act as a whole. (For a livable climate: Net-zero commitments must be backed by credible action N.d.)

It is a global effort to reach the net zero by 2050 when the transition must be fully complete. In the Paris Agreement it was agreed to cut emissions by 45% by 2030 and achieve the goal by 2050 to keep global warming below 1.5°C. (For a livable climate: Net-zero commitments must be backed by credible action N.d.) That remains a requirement to preserve a livable planet. As the energy sector is currently the largest existing producing greenhouse emissions, even replacing traditional non-renewable energy sources with renewable ones would significantly reduce CO<sub>2</sub> emissions.

#### **2.2.4 Scope 1, 2 and 3 carbon emissions**

Companies in particular are seen to play a key role in climate action. Thus, in order to achieve the net zero goal, they must understand and identify where their greenhouse emissions come from to make it possible to measure and assess them in the right way. Due to this, scope 1, 2 and 3 have been developed to classify CO<sub>2</sub> emissions into different categories and thereby help companies to better understand the origin of emissions caused by their entire value chain. It is also noteworthy that the concept of scopes refers to the whole process and the completion of it, so they do not, for example, apply to measure the number of emissions produced on a particular life cycle phase of a single product. (Energy explained. N.d.)

In the globally used Greenhouse Gas Protocol, which was first published in 1998 with the aim of providing a common scheme for calculating and managing greenhouse gas emissions, there is a definition for all three scopes. In its simplicity in the protocol, scope 1 is defined to include emissions under the company's direct control, while scope 2 and 3 are defined to include emissions caused by its operations which are not under its direct control. The significant difference between scope 2 and 3 is that the second one contains only emissions from the value chain activities for which the company has no direct impact. More specifically, for example, scope 1 includes on-site energy and emissions from company's transport units. Again scope 2 include emissions from energy purchased from outside, such as electricity, heat, or cooling. Scope 3, in turn, includes all produced indirect emissions from company's entire value chain. (The complete guide to understanding scope 1, 2, and 3 emissions N.d.) Emissions from scope 3 are also divided into upstream and downstream categories. In this way, the upstream emissions come from the production of another

company's products or services, which the other company then purchases or uses, such as business traveling. Downstream emissions, in turn, come from the use or disposal of those products or services, such as an investment. (Farbstein 2023.)

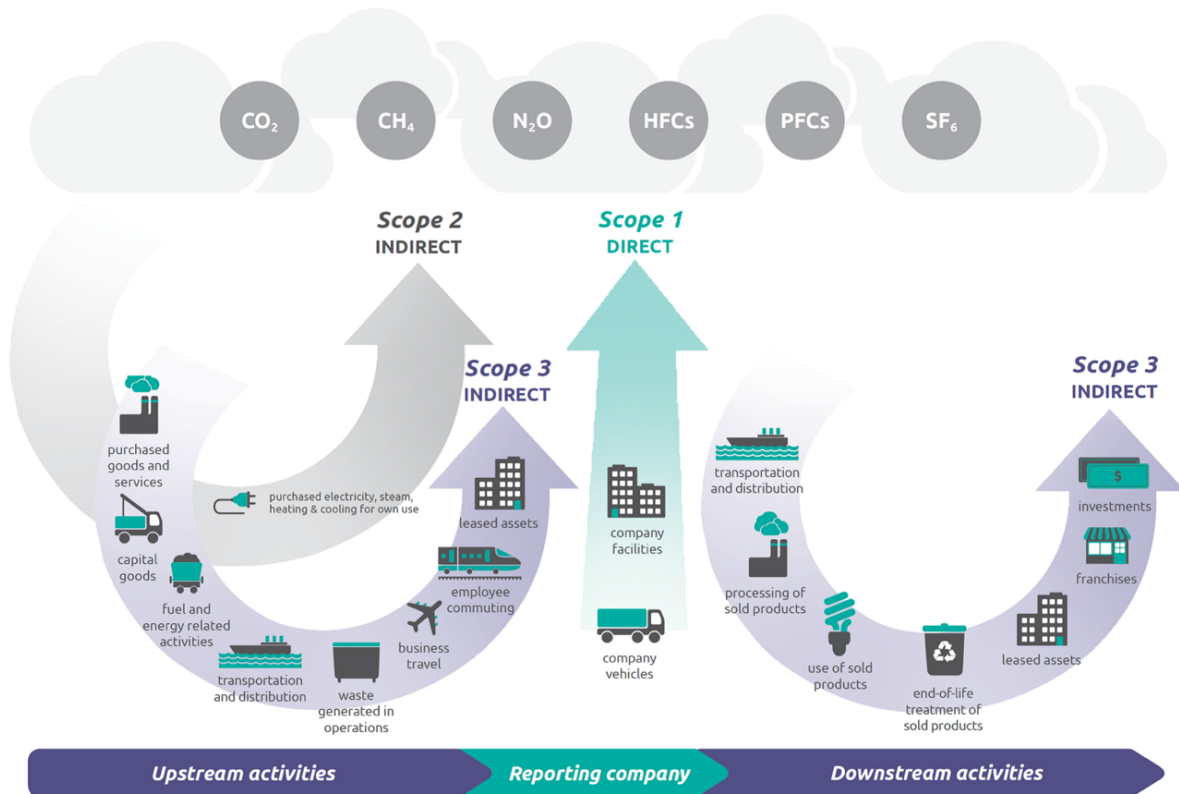


Figure 1. Scope 1, 2 and 3 emissions illustrated (Scope 1 and Scope 2 Inventory Guidance 2023).

### 2.2.5 Carbon offsetting vs insetting

Again, to reach the net zero goal by the set deadline, methods called carbon offsetting and insetting have been invented to compensate as time as the economy and the ambition gaps. In this context, offsetting refers to the reduction of greenhouse gas emissions or by increasing their removal with help of external auxiliary functions, for example, through carbon credits purchases (What Is Net Zero? N.d.). Those credits are often related to various environmentally friendly projects, such as providing renewable electricity or protecting forests ones (Fleming 2019). Carbon insetting refers again to the reduction of greenhouse gas emissions or by increasing their removal through scope 1, 2 or 3 carbon emissions (What Is Net Zero? N.d.). The difference between offsetting and insetting is its direct connection to implementing nature-based solutions, for example through reforestation or regenerative agriculture. Bhatia (2022) states that it is even possible to

influence the improvement of the livelihood of indigenous peoples through inseting activities. Although carbon offsetting is one of the most important tools to compensate produced carbon emissions is understandable that without the carbon inseting tool, the company's direct carbon emissions cannot be reduced. As a result, the use of both methods in emission reductions must be considered.

### **2.2.6 Greenwashing**

Greenwashing is defined as an intentional act of providing misleading or completely wrong information about the environmental benefits of a product or practice related to its environmental benefits. According to Lindwall (2023) it is often used by companies to hide activities that cause environmental pollution, which enables business continuity by giving its consumers, investors, and the public a false impression of the activity's compatibility with the sustainability principles. Thus, greenwashing phenomenon is a significant setback on the way towards the goals in combating climate change. To prevent greenwashing, United Nations Climate Change released a Recognition and Accountability Framework and Draft Implementation Plan in order to promote transparency and improve credibility regarding the implementation of companies' promises and plans toward combating climate change (Greenwashing – the deceptive tactics behind environmental claims N.d.). At the European Union level, the parliament has also approved legislation on sustainable investments in June 2020 to prevent companies from falsely claiming about compliance with the sustainability in their operations (Green Deal: key to a climate-neutral and sustainable EU 2023).

## **2.3 Logistics**

In its simplicity, logistics term refers to a process that combines, among other things, transportation, storage, and material handling functions. According to Mohsen (2022) effective logistics and exact planning can directly influence the success of business by providing the goods with quality and quantity as agreed to the right place at the right time at a low cost. Logistics also strongly includes, for example, planning of cash flow and contracts, as well as reviewing the environmental impact of its operations (Logistics N.d.). As a result, the role of logistics is growing significantly, as it is the basis of good economic success from a corporate point of view (Mohsen 2022).

In short logistics can be divided into the first, second, third, fourth and even fifth parties, depending on the participation of parties in customer's supply chain. First-party logistics refers to the so-called traditional logistics, whereby the product producer delivers the goods to its customer. The logistics of the second party refers to when the importer, for example, does a logistical performance to the first party. Third-party logistics is talked about when a third-party is responsible for logistical services that produce them to the second- or first-party. Again, fourth-party logistics means a service provider between the manufacturer and a third-party, whose job is to centrally manage a specific supply chain, for example at the company level. Fifth-party logistics refers to when the provider is responsible for developing the customer's supply chain network as optimal as possible with the help of innovative logistics solutions. (Ciemcioch 2018.)

### **Project logistics**

Project logistics could be called as management of logistics related to a specific project. In project logistics, the services of third-party logistics companies are almost always used. Depending on the contract, a third party can execute part of the project logistics process or even the entire project process. (What Is Project Logistics? A Simple Guide 2022.) Project logistics is often connected to large-scale unique projects, the site locations of which may be located in extremely harsh environmental conditions. Due to this, it especially requires the combination of project and transportation planning skills with traditional forwarding and transportation expertise. It also requires constant communication with both suppliers and logistics service providers around the world. The responsibility of project logistics also includes, for example, providing customs clearance for goods being exported from and imported into the country. In addition to all above mentioned responsibilities, in project logistics, careful attention needs to be paid to procurement, management of suppliers and contracts, and operational matters. (What is project logistics? N.d.)

## **2.4 Corporate sustainability**

Corporate sustainability can be defined as a business strategy to ensure the supply of goods and services in an environmentally friendly and supportive manner. In this way, short-term economic benefits are replaced by prioritizing long-term growth, using sustainable methods. In order to

meet the strategy of a sustainability, the business must commit to considering all three perspectives, i.e., environmental, social, and economic one, and take practical steps to ensure them. (What is corporate sustainability and why is it important? 2021.)

### **Corporate Social Responsibility (CSR)**

The actions of companies have a major impact on people's lives around the world, for example through products and services, jobs and working conditions, as well as the environment and health. Due to this, companies are expected to understand both positive and negative effects on the environment and society. Based on that need, the Corporate Social Responsibility (CSR) business model has been developed, the aim of which is to help companies practice being socially responsible for themselves, their stakeholders, and the public. CSR is often divided into four categories, i.e., economic, ethical, philanthropic, and environmental responsibility. The environmental category mainly focuses on the maintenance of natural resources, the philanthropic one focuses on donating to important causes, the ethical category guarantees honest business, and the economic one enables supporting the above goals. (Fernando 2023.) CSR does not only apply to companies, but also, for example, the public sector can use the same operating models in public procurement as well (Corporate social responsibility (CSR) N.d.).

### **Corporate Sustainability Reporting Directive (CSRD)**

Ever since responsibility has become the norm in today's society, the legislation related to sustainability has also developed. Nowadays European Union legislation requires all large companies to publish information on what kind of risks and opportunities they see in social and environmental problems, as well as the effects on the environment and people through their activities. With the help of this required provided information investors, customers and other stakeholders are able to evaluate the organization's sustainability performance from the point of view of the European Green Deal the goals of which are especially includes the prevention of environmental pollution and the promotion of a circular economy. (Corporate sustainability reporting N.d.)

In April 2021, the European Commission proposed a new directive on corporate sustainability reporting. It had already entered into force in January 2023, which means that around 11 700 large

companies, including the company for which this work is carried out, will have to implement the new rules starting from the 2024 financial year. (Corporate sustainability reporting N.d.) According to Spinaci (2022) the purpose of the directive is to confirm the recently introduced rules regarding sustainability reporting in the European Union. In addition, it will standardize and expand the Non-Financial Reporting Directive that is already in use (Spinaci 2022).

### **Carbon Border Adjustment Mechanism (CBAM)**

To support the European Union's efforts towards the European Green Deal goal in reducing the carbon footprint, in July 2021 it was proposed to introduce the Carbon Border Adjustment Mechanism (CBAM), which takes into account the risk related to transferring the production of the most polluting sectors to countries with looser greenhouse gas emission restrictions in order to avoid stricter standards. The phenomenon is also known as carbon leakage. On a practical level, CBAM means applying fees to imported goods from countries with less ambitious emission reducing goals. The mechanism will apply to ware from high energy consuming industries such as iron, steel, aluminum, and hydrogen. In the beginning, only direct emissions will be considered, but in the future, indirect emissions will also be considered. (Carbon leakage: preventing firms from avoiding emissions rules 2023.)

The importers of the goods will be responsible for the payment of fees. In addition, they will be required to report the direct and indirect emissions caused by the ware imported during the previous quarter and the CO<sub>2</sub> prices paid overseas on a quarterly basis. The money received with the help of the mechanism will be directed, inter alia, to developed countries to promote the reduction of the CO<sub>2</sub> emissions of their manufacturing industry. (Carbon leakage: preventing firms from avoiding emissions rules 2023.)

In April 2023, the Parliament had approved CBAM, and it entered into force in May 2023 (Carbon leakage: preventing firms from avoiding emissions rules 2023). It will be applied from 2026 to 2034, and the allowance of the mechanism will happen gradually in a fast schedule (Reducing carbon emissions: EU targets and policies 2023).

### 3 Methodology

In order to obtain relevant answers to the main research question, the most appropriate research and data collection methods must be defined. The methodology section of the work provides definitions to selected methods with justification and reliability assessment of the choices. In addition, the section sets out the field of the sub- and additional questions mentioned at the beginning of the research and describes the steps to occur in the following sections.

The research term can be defined in various ways. According to Kothari (2004, 1) it refers to the scientific and systematic way of searching for relevant information on a specific subject. The term itself refers to the method, which consists of verifying the problem, the formation of hypothesis, the collection and analysis of data, and drawing conclusions based on results. Kothari (2004, 1) also states that research is often associated with academic activity and thus the term is commonly used in a technical sense. Using scientific methods to get answers to questions that have not yet been found or presented in a clear form can be defined as the main purpose of the research. It has been observed that the role of investigation has grown considerably in modern times as it is used to solve operational problems increasingly. Kothari (2004, 6) points out that decision-making is not necessarily a part of it, but research itself certainly facilitates decision-making. Thus, it can be thought of as an important source of information and guidelines for solving various arising problems. In addition, investigation creates an opportunity to better understand new developments in the field. (Kothari 2004, 1-7.)

There are several types of research with two basic approaches, viz., qualitative, and quantitative. Research with a qualitative approach always involves a subjective evaluation of opinions. In work with such kind of methodology, for example, interviews or surveys in various forms are often implemented. The conclusions of this type of research are often based on insights and impressions. Again, quantitative approach is about collecting and analyzing data in numerical form through inferential, experimental and simulation methods. (Kothari 2004, 5.) Surveys, among other things are also used in work with that kind of methodology. Research with quantitative approach creates the possibility to perform various statistical analyses, the end result of which can be, for example, demonstrated relationships among the data (What is Quantitative Research? 2023).

Once the research approaches are selected, the task of collecting appropriate data begins. The information itself can be divided into primary and secondary. The primary one refers to data collected afresh for the first time whereas secondary data refers to information already collected and analyzed by some other person. (Kothari 2004, 95.) There are several ways to collect both types. According to Kothari (2004, 96) the most common methods for collecting primary one is through observations, interviews, and questionnaires. Again, publications, books, and reports, both published and unpublished, are used as sources of information to collect secondary data (Kothari 2004, 111). It should be noted that both primary and secondary data are relevant and there is no single perfect method to collect information as pros and cons are included in each one.

### **3.1 Selected research and data collection methods**

For this research, the use of both qualitative and quantitative approach was considered reasonable. Such investigation with both methods used simultaneously, can also be called as mixed. The availability of data to solve the problem in both written and numerical form acts as a justification for choosing mixed approach. In addition, using qualitative and quantitative methods together most often produces the results in the most appropriate way, due to the ability to support different approaches by nature, and thereby reduce the characteristic inaccuracies in each of the results. The aim of the mixed method is therefore to give a deeper understanding and a clearer picture of the situation under investigation.

In this research, the qualitative part has been implemented using two different ways, i.e., through interviews and a literature review. At the very beginning of the research, the individual interview had been held with a logistics sustainability management related title person working in the company to which the research is carried out. The interview questions can be found in Appendix 1 of this study. The aim of the interview was to get a clearer picture of the current situation, future goals, and real needs in terms of sustainability of company's logistics operations. The interview turned out to be unstructured and dealt with a number of rising ideas related to the topic outside the interview body. Another individual interview had also been held at a later stage of the research with one of the largest logistics service providers of the company. As an interviewee was a person with the background and knowledge of the sustainability, which was appropriately told about their company's future sustainability solutions. The interview questions were not prepared in advance as it was agreed to keep the interview also unstructured.

In addition to the individual interviews, the literature review based on both openly and internally available sources proved to be an important way of research on a qualitative approach. To find the answer to the main question of the research, first, the company's internally available material covered sustainability in general and logistics was investigated in order to get a more comprehensive picture of the current situation at the entire company level. After internal research, the subject has begun to be explored using openly available materials, mainly in the form of books, articles, and legislative texts. A considerable amount of relevant information was found in the wide literature review and as a result finding the answers to each presented question in this research was successfully completed.

As a support for a qualitative approach, the quantitative way was seen as a useful addition. In this research, the quantitative part has been implemented through investigating the company's internally available numerical data related to logistics sustainability through CO2 emissions calculations. With the help of internal analysis tools, the intention was to use the available information to support the assumptions and conclusions of the study. On the basis of the relevant seen information, the illustrative figures have later been built to support the qualitative part of the text. The use of other qualitative ways was not considered necessary for this research and therefore they are not included.

Based on the research approaches selected for this work presented above, utilization of both primary and secondary data collection methods was seen as needful. The primary data of this research is regarded to information obtained through individual interviews. In turn, the secondary data is the information collected through the literature review utilizing mainly subject strongly related books and the most current articles available both published and unpublished. In addition, the completed statistics used in this work from a company's internally available data analysis tool is also counted into secondary data.

### 3.2 Reliability assessment

Table 1. Summary of selected research and data collection methods

<b>Data collection method</b>	<b>Type of data</b>	<b>Research approach</b>
Individual interviews	Primary	Qualitative
Books	Secondary	Qualitative
Articles	Secondary	Qualitative
Legislative texts	Secondary	Qualitative
Numerical data from company's internal analysis tools	Secondary	Quantitative

The choice of mixed research approach brings with it both the advantages and the disadvantages. The possibility of supporting qualitative part of the work on a quantitative part can be seen as a positive side. On the other hand, the recommended work length does not allow fully concentration on both approaches compared to when only one in use. In this research, the focus is on a qualitative approach, and as stated several times, the use of qualitative approach is only seen as a way to support the observations and conclusions made while utilizing of qualitative way.

Interviews in particular unstructured are considered to be one of the best suited methods to collect primary data. In addition to in advance prepared interview frame, the freedom to ask directly subject related questions arising, enable a tremendous amount of flexibility to collect appropriate information. However, the number of interviews conducted in this research is limited when only two individual interviews have been completed. More likely, a wider number of interviews would have created more broad-based data collection.

With the collection and utilization of secondary data in research, there is a need to caution due to the significant decrease in the information reliability and precision compared to the personally accumulated primary data. In addition, for identifying secondary data sources for unsuitable or inadequate in the context of problem-solving information, knowledge on the subject and critical thinking are required. However, the benefit of using secondary data can be considered by avoiding

problems arising by primary data collection, such as the minor number of answers or the provision of incomplete information.

### 3.3 Following steps of research

The research itself began by dividing the following main research question (RQ) “What are currently the most suitable practical measures from the point of view of project logistics operations towards achieving the goals of sustainable development?” into three subquestions listed below in logical order:

- (RQ1) What measures have already been implemented in company’s project logistics operations?
- (RQ2) What are the ways to reduce the carbon emissions through project logistics operations?
- (RQ3) Which concrete measures are best suited to the current situation?

In addition, an important additional question for above ones turned out to be the following:

- (RQ1;1) What are the company’s goals towards environmental sustainability?

By primarily answering that particular additional question, it was possible to find relevant answers to all other ones arising as well. A thorough analysis of all the above questions presented will be provided in the following section of the research.

On a practical level, finding the answers to the main research question began by getting to know the company's environmental sustainability goals throughout the organization level. Information was collected through investigating the topic related internally available sources, mainly in the form of articles and through internally held individual interview. Next, the measures already introduced in project logistics were explored through the previously mentioned same individual interview and also through internally available written and numerical data. After receiving the answer to the questions regarding sustainability at the company level, research of potential solutions to the main question using external sources and holding another individual interview with external sustainability expert was seen as necessary approaches. Finally, as the result based on the findings, the three best suited proposals with different time approaches from short to long one has been selected and justified.

## 4 Sustainability from project logistics perspective

Sustainability from project logistics perspective section returns to issues related to the climate change previously raised in both introduction and theoretical basis chapters. In addition, it provides a thorough analysis of all questions introduced in former sections as well as the outcomes based on them. The proposals considered to be the most suitable for the main question of the research are also presented in a clear form along with justifications in this section closer to the end.

From the company's point of view, the fight against climate change is at the top of the agenda. Through logistics activities, it is possible to directly influence the reduction of CO<sub>2</sub> emissions, energy consumption and waste, and thus play an important role in combating climate change. However, it should be borne in mind that turning the effects of climate change into the opposite takes time and therefore measures must be taken in advance to see these positive consequences within the time limit.

### 4.1 Analysis

Before moving on to presenting the answers to the defined additional and subquestions of the research, it is valuable to look at the available information related to the company's logistics operations from the past year, in order to better understand the overall picture of both used transportation modes and the number of CO<sub>2</sub> emissions caused by each. It should be noted that the data in the figure presented next provides information of the logistics activities of the entire company on a global level instead of only the project logistics department activities. This is due to the fact that the collection and reporting of such information has started during the fourth quarter of 2022 and therefore data analysis methods and tools are yet under development. In addition, it should be noted that the data presented below is based entirely on the reports provided by the company's third-party logistics service providers. This, in turn, means that it may have flaws on different scales, as during the investigation it has been established that the company is still on its journey to engage all logistics service providers to report the actual CO<sub>2</sub> emissions on shipment level. Despite all the above shortcomings, the quantitative data utilized in the study has been seen as a relevant supplement to support questions in the analysis section and to determine the end results on the basis of answers.

The figure 2 shown below describes the modes of transport used based on volumes (kg in %) of shipments during the period from December 2022 to December 2023. While looking at the circle, it can be noted that almost half, or 49,96 %, of the total mass (kg) of all shipments has been shipped via ocean transportation mode. Right after it, considerably more than a quarter, or 36,45 %, of shipments have been transported via road option. The courier and air transportation modes, on the other hand, have a significantly smaller number of shipments based on mass (kg) compared to the ones mentioned above, only 8,73 % for courier and 4,86 % for the air. In addition, the multi-modal option has only been used in single cases during a year, and thus it is shown as 0 % in the figure.

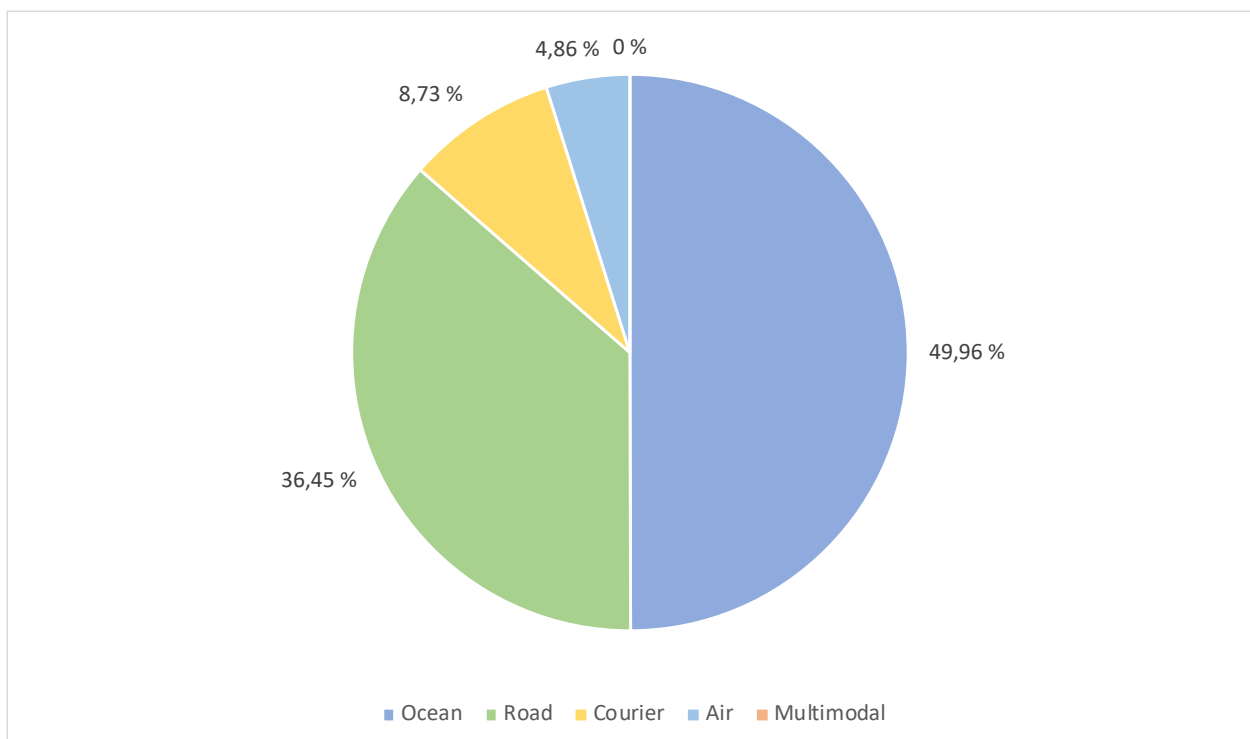


Figure 2. Volume (kg in %) of shipments by transportation mode from December 2022 to December 2023.

The following figure 3 under helps to visualize the number of tons (kg) of CO<sub>2</sub> caused by each transportation mode, considering scope 1, 2, and 3 carbon emissions from the past year. It should be noted that the weight and distance of the shipment with emission coefficient of a particular transport mode are taken into account when calculating the CO<sub>2</sub> emissions of transportation. However, it is noteworthy that the information displayed in December 2023 is not relevant, as at

the moment of the research, the monthly part of the data was not yet available. In addition, the number of multimodal option CO2 emissions appears as zero due to the lack of its use.

While looking at the figure 3 below to the significant variance between certain months especially in the instance of air, the almost steady decrease in CO2 emission volumes in all four transportation options excluding multimodal one, i.e., air, courier, ocean, and road can be noted. Also, as a noteworthy point can be considered a fact that the most CO2 emissions have been caused through the ocean mode of transportation, the second highest number through air, and the least and almost as much through courier and road options.

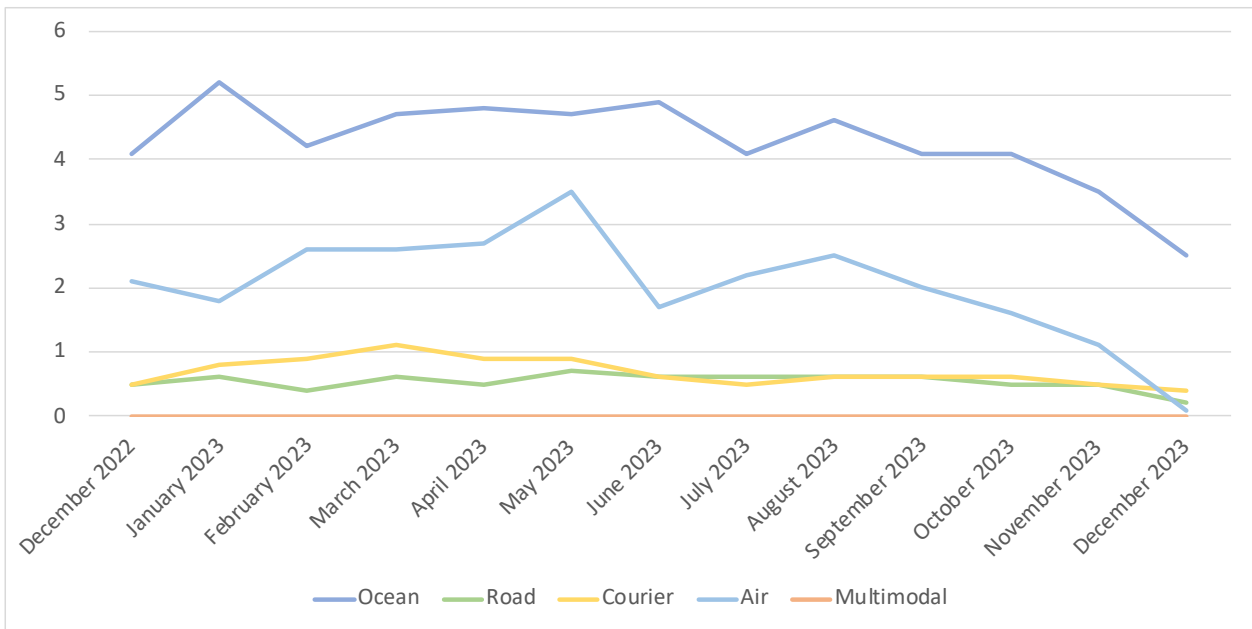


Figure 3. Amount of tons (kg) of CO2 by transportation mode (Scope 1, 2 and 3 emissions included).

The figure 4 under shows the distribution of the amount of CO2 emissions described above into upstream and downstream categories, including scope 1, 2 and 3 carbon emissions. The definitions of terms have been better opened in the theoretical basis of research. While looking at figure 4, it can be noticed that three quarters, or 75,25 %, of the circle takes upstream, and the quarter, or 24,75 %, takes downstream emissions. However, the exact description of the content included in the upstream and downstream data was not available and therefore cannot be opened in more detail.

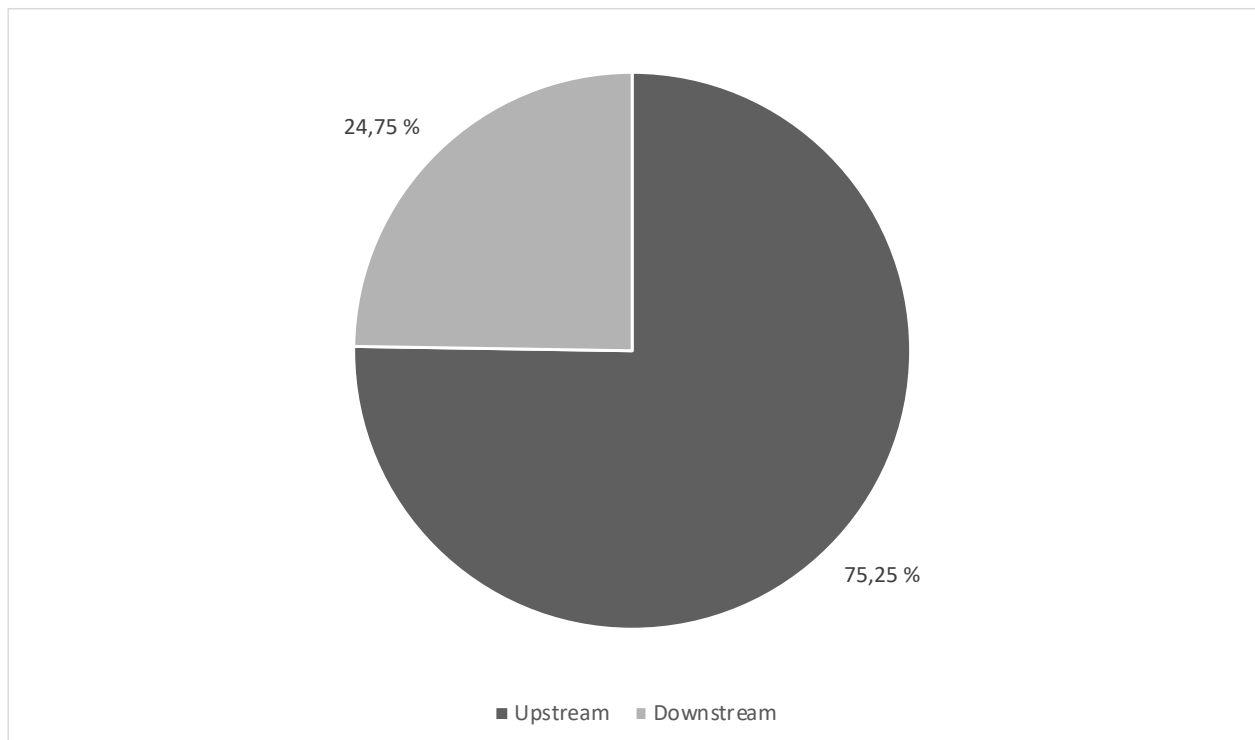


Figure 4. Amount of CO2 divided into downstream and upstream (Scope 1, 2 and 3 emissions included).

By looking at the figures 2, 3 and 4 above, it has been noted that based on the volume (kg in %) of shipments the most popular transportation mode turned out to be via ocean. Again, the most environmentally friendly option among those in use, i.e., multimodal was hardly used. Another important consideration when analyzing the data turned out to be the fact that one of the most environmentally friendly existing forms of transport, i.e., the rail option, was not included in the reported data at all.

By looking at the number of CO2 emissions based on the mode of transportation, it has been observed that air option produced the second highest number of CO2 emissions together with the ocean one, although the difference in the volume (kg in %) turned out to be huge between the two modes. By reviewing the distribution of upstream and downstream emissions, it has been noted that in particular, scope 3 downstream carbon emissions have been considered at a good level in the company's supply chain as they took a significant part of total emissions of CO2. This, in turn, raises the reliability of the data to a higher level as otherwise the percentage share of

downstream carbon emissions would be lower. However, as previously had stated, the accurate information regarding the content of both upstream and downstream emissions are unknown.

#### **4.1.1 The company's goals towards environmental sustainability**

RQ1;1: What are the company's goals towards environmental sustainability?

By investigating internally available materials, it has been discovered that the company has defined environmental sustainability goals at the level of the entire organization, focusing especially on climate change limiting global warming to 1.5°C aligned with the Paris Agreement. At the same time, it has committed to achieve the globally set goal of net zero emission by 2030. The company has also adapted the action plan, considering the Sustainable Development Goals mentioned in introduction phase of the research. In addition to the functions described above, it has defined several targets based on the Science Based Targets tool, which helps companies define a clear path for reducing greenhouse gas emissions aligned with the Paris Agreement goals in order to support its ambitious goals related to environmental sustainability. From the point of view of this research, the most important target has proven to be to reduce CO<sub>2</sub> emissions in logistics -20% by year 2025 compared to 2019 level.

The company's environmental sustainability goals also proved to include several ways to minimize footprint and maximize handprint. In order to minimize the footprint, the organization aim is to reduce environmental impact, especially through its operations, logistics and procurement. Again, to maximize the handprint, the company has committed to develop innovative solutions towards environmental sustainability, not only through the product range but also through the entire supply chain, including logistics.

The direct goals related to the company's project logistics activities proved to be following ones: collaborations with logistics service providers in order to find sustainable solutions to mitigate CO<sub>2</sub> emissions; collaborations with 3PL warehouses in order to get the reports regarding energy, water, and waste; development of circular logistics; optimizing of supply chain and optimization of next generation warehouse footprint.

#### **4.1.2 Implemented measures in project logistics operations**

RQ1: What measures have already been implemented in company's project logistics operations?

Based on an individual interview with logistics sustainability management related title person working in the company, and on internally available materials, it has been found that several measures regarding to the transition of logistics towards environmental sustainability are either under development or recently introduced. During the research it has been observed that, up to year 2022, environmental sustainability measures have mainly been related to the definition of clear goals and the rethinking of strategies. It has turned out that the most important actions of past years have been particularly connected to centralization of warehouse locations and reviewing of logistics service providers goals and strategies alignment with the company's own ones.

However, based on research, during the year 2023, the company has begun to take actions towards implementing of practical measures from environmental sustainability point of view. Among other things, alternatives to more environmentally friendly packaging have begun to be searched, and some of the solutions already found have begun to be tested in the real weather conditions. Also packaging sizes, itself have been started to optimize together with container payloads. In addition to the above, more attention has started to be paid to limitation of the number of shipments via air transportation mode in order to achieve a faster reduction in CO2 emissions.

As a statement, therefore, it is the fact that no actual comprehensive practical measures have been taken in the project logistics department so far. Currently, the company is working on the development of various measures to reduce CO2 emissions, after which it intends to integrate the measures into the processes with a greater impact in the near future. Due to that, the outcomes of this study can be considered significant, as based on them, the company can start building its future strategy towards sustainable development.

#### **4.1.3 Ways to reduce carbon emissions through project logistics operations**

RQ2: What are the ways to reduce the carbon emissions through project logistics operations?

During an unstructured interview with a sustainability expert from logistics service provider company the following practices to change activities towards environmental sustainability has risen:

- Greener transport options;
- Routes optimization;
- Utilization of renewable energy in transportation;
- Waste reduction and sustainable packaging.

During the research based on externally available sources it has been found out that there are actually a considerable number of ways existing besides ones already mentioned above. As an example, Testi (2020) has named the following noteworthy ways to reduce CO2 emissions:

- Optimization of warehouses;
- Reverse logistics.
- Sharing economy applied to logistics processes;
- Use of combined and intermodal transport solutions;

Below is a more detailed definition of intermodal transportation and a circular logistics chain, which strongly related to concept of a circular economy in order to provide better understanding of how they can be integrated into project logistics functions.

### **Intermodal transportation**

Before moving on to the definition of intermodal option of transportation, it is worth noting that the term is often confused with combined and multimodal methods. For the sake of clarity, it should be noted that combined transport is referred to a form of intermodal transportation, when more than one mode of transport is used to moving goods, but where the final distribution takes place using road option. Multimodal transport, on the other hand, is also an intermodal transportation extension, when goods are delivered door-to-door using at least two modes of transport, regardless of order, but with the possibility of reloading of goods while changing modes, unlike in the intermodal option. (Intermodal, multimodal, and combined transport N.d.) Both combined and multimodal methods of transportation are highly common options of moving goods and are already largely used in the company.

Intermodal transportation itself is defined as a cargo movement process using at least two forms of transport, including trucks, trains, ships, and airplanes options, and most importantly, using only one load unit throughout the whole journey. This is made possible by the use of large, standardized intermodal containers, which allows easy transfer between modes of transport. (Larsen 2023.) The main point of the transportation is that the longest part of the total distance is carried by the most environmentally friendly forms of transport or by sea or rail. It is worth noting that there are two types of intermodal shipping methods when using the rail option or Container-On-Flatcar (COFC) and Trailer-On-Flatcar (TOFC) (The Complete Guide to Intermodal Transportation N.d.). COFC type refers to a way in which four intermodal containers are placed at the same time on the well-car, or double-stack car, so that two of containers always overlap. Again, the TOFC type refers to a way where the Over-The-Road (OTR) trailer is placed directly on the well-car. (Mathey 2022.) Both options have strengths and weaknesses, such as lower or higher total cost, thus the choice needs be considered on a case-by-case basis.

As a simple example, intermodal transportation can proceed as follows: At first, the goods located in the production facility are loaded into an intermodal container attached to an intermodal chassis. When that stage is complete, the container is operated to the railway slope using a dry motor carrier. Upon arrival at the intermodal slope, it is lifted off the platform and planted into a well-car. Then, along the railroad, the goods are transported for the longest part of the total distance. Upon appearance at the next intermodal slope, the container is moved onto a platform to later be placed on a truck. As the last step, the goods are delivered to the final destination by road. (The Complete Guide to Intermodal Transportation N.d.)

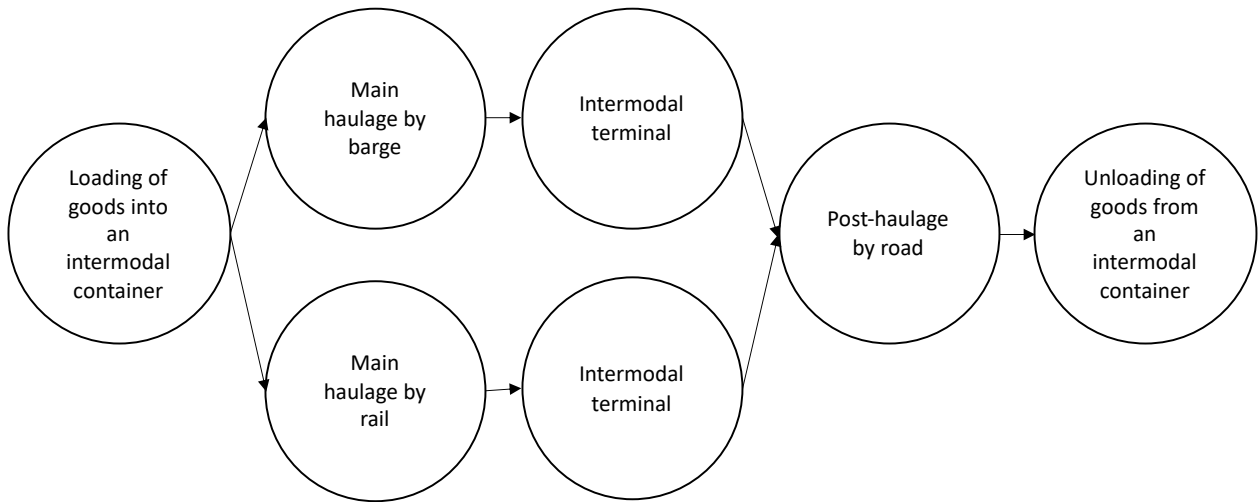


Figure 5. A simple example of intermodal transport logistics chain.

### Circular logistics chain

Before defining the circular logistics chain, it is good to get a clearer picture of what the comprehensive circular economy means. Namely, it refers to a model where the supply chain is based on a closed-loop system based on the following principles: reuse, sharing, repair, refurbishment, re-manufacturing, and recycling. The primary goal of the circular economy is to reduce waste production to a minimum. In addition, it redesigns products and services so that they are less resource intensive. With this improved use of resources and thus reduced need for virgin materials, it creates an opportunity to radically reduce greenhouse gas emissions. (Hofman 2023.)

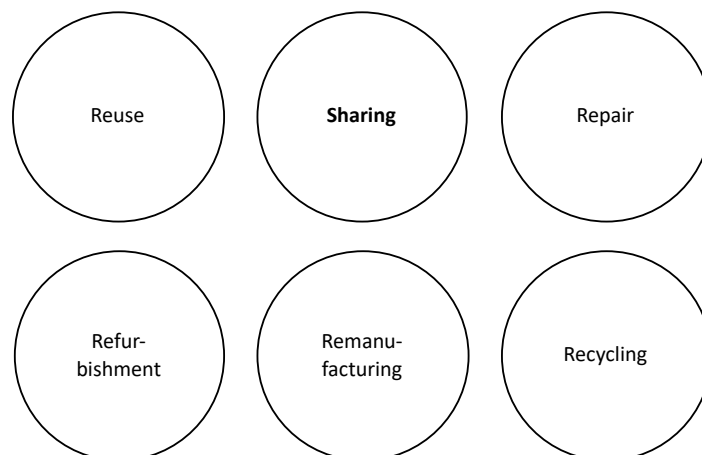


Figure 6. The principles of the circular economy.

Circular supply chains are unable to function at full capacity without a change in logistics. The linear logistics model needs to be rethought and modified towards new operating methods such as reverse logistics. The term itself refers to a chain that works in the opposite way compared to the usual model, in other words, it means transportation the goods from the customer back to the manufacturer or retailer. The objective of reverse logistics is therefore to recover the value of the returned product. (Hofman 2023.) For example, in the construction industry, reverse logistics is used to move the remaining materials to the next construction sites and thereby create new value for goods that would otherwise end up as waste.

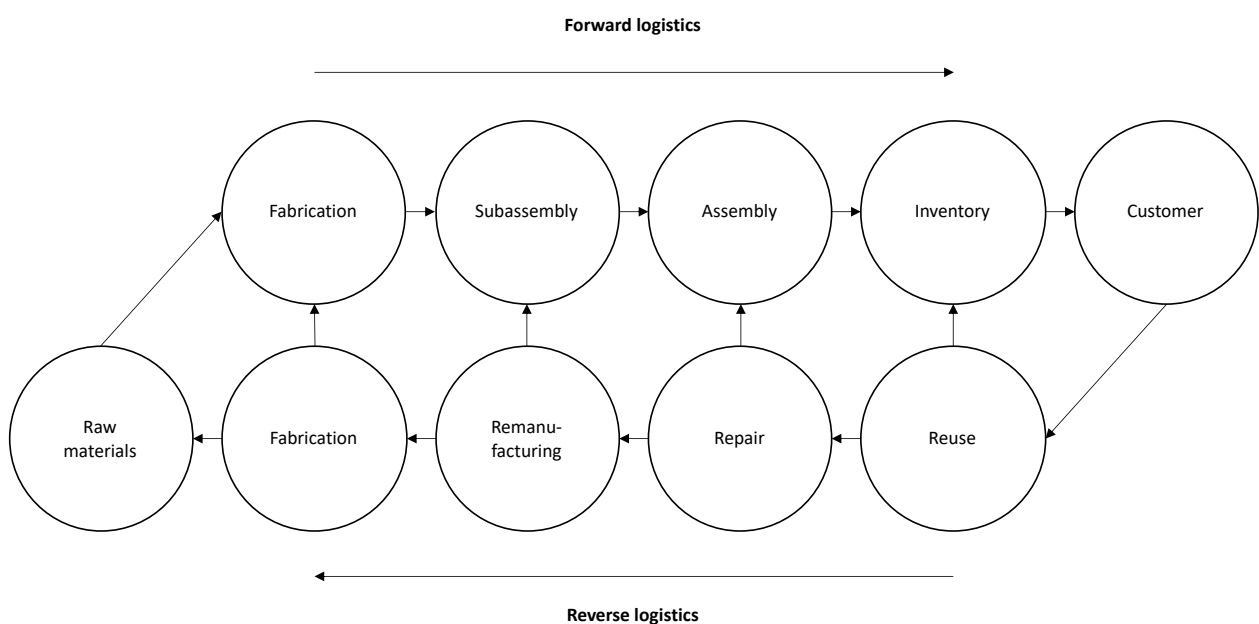


Figure 7. The flow of a reverse logistics (What Is Reverse Logistics? N.d.).

## 4.2 Results

As the next step the best suited measures selected with different time approaches will be opened up and presented through practical implementation proposals together with reasonable advantages. At the same time, the answer to the last additional question of the research will be provided. It is noteworthy that after the completed analysis, the session with representatives of the company had been considered necessary in order to receive feedback on how relevant they saw the end results described next. This, in turn, means that the outcomes are not just the author's own view, but in a certain way the whole of both parties created as a result of consensus.

The intention was to find solutions with three different time approaches or short, middle, and long. Thus, the order of presentation of the end results is progressing in time from the fastest available to the most time-consuming one. It should also be noted that all outcomes in a certain way is related to each other, and thus a logical order of progress helps to perceive their connectivity.

#### **4.2.1 The most suitable measures towards sustainability for the current situation**

RQ3: Which concrete measures are best suited to the current situation?

Based on the answers found to additional and other supportive questions of this research, the best appropriate measures to the current situation are considered as following three:

- Sustainable packaging;
- Intermodal transportation;
- Circular logistics chain.

The justification for choices acts the alignment with the company's goals, as well as the opportunity to introduce actions in different periods of time, considering the fact that the measure in order is always dependent on the previous one. As it has been stated in the same way several times during the literature review of this research, the management of logistics sustainability begins with the design of a packaging and ends with the comprehensive circular logistics solutions.

#### **Sustainable packaging as a short-time approach**

In order to ensure safe transport, the goods must be appropriately protected, i.e., packed. However, the problem is that the packaging itself often ends up as waste after delivery, which causes a negative effect on the environment. In reality, it can be utilized in many different ways, both in its original form and as a raw material. Since the company has already taken certain steps towards sustainable packaging, as mentioned in the analysis section, it is seen as a short-term approach towards achieving the organization's sustainability goals in significantly reducing CO2 emissions. It should be noted that sustainable packaging includes not only the reuse and recycling of packaging, but also the selection of more environment-friendly materials and, most importantly, the choice of the proper packaging dimensions.

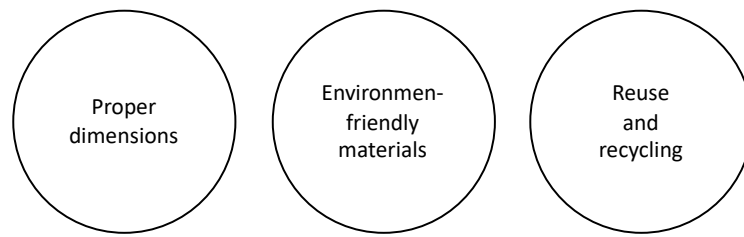


Figure 8. The three pillars of sustainable packaging.

As it was also mentioned at the beginning of this analysis section, the company has already started to make optimizations regarding container payloads, so the consideration of the right package sizes would serve as a distinctive addition to the procedure by enabling an even more optimal filling ratio. On a practical level, this means determining the correct packaging dimensions of the goods right at the beginning of the projects with help of relevant experts, in order to avoid the transportation of “air”. Depending on the case, it would also be reasonable to consider combining goods into the same package so that the space of both the package itself and the transport unit would be utilized as optimally as possible. Therefore, due to, among other things, the reduced overall weight, the significant benefits of the measures described above are both in terms of environmental sustainability through a reduction in CO<sub>2</sub> emissions and by reducing transport costs.

Choosing the right packaging material is another factor that can substantially influence the achievement of sustainable development goals. Consideration of the use of alternative materials, especially replacement of plastic-containing fillings with environmentally friendly alternatives, and a high rate of use of recyclable packaging are ways to positively influence the reduction of CO<sub>2</sub> emissions. A notable challenge from the company's point of view is that the majority of its product range consists of heavy units, which require packaging material options distant from environmentally friendly ones, such as the plywood boxes to ensure safe transportation. As a practical measure to the challenge, at least the procurement of responsibly produced materials can be proposed. As an addition, whenever possible, it is also reasonable to use packaging materials that are produced locally or close to the place of use.

Reuse of packaging and recycling at the end of their life cycle are the most important practical measures in terms of environmental sustainability. In addition, reusing packaging materials not

only reduces the amount of waste generated, but also saves on packaging costs. Again, by recycling materials that would otherwise end up as waste, the need for primary natural resources can be reduced while creating secondary raw materials for a new type of market.

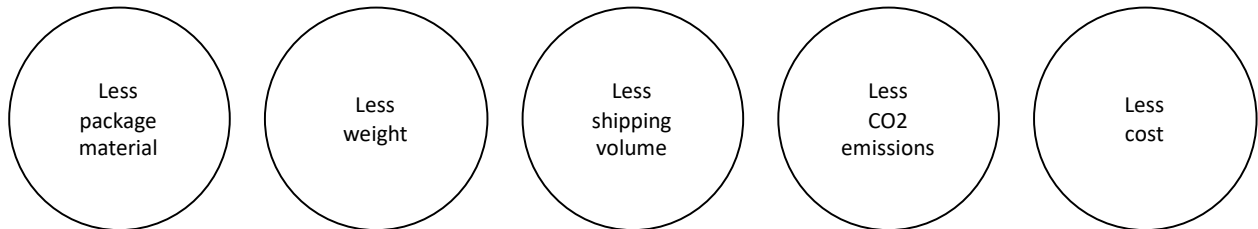


Figure 9. The advantages of a sustainable packaging.

### **Intermodal transportation as a middle-time approach**

Container transport is by far the most important factor in terms of international trade. In project logistics, especially in the case of larger projects, most of the goods are moved by utilizing shipping containers. As has been mentioned several times before, the company has already taken measures regarding container payloads. Thus, in order to reduce CO<sub>2</sub> emissions even more effectively, it has been started to look for a more environmentally friendly transport method for goods moving especially in containers. For that reason, intermodal transportation has been chosen as a middle-time approach also as a continuation of the short-time one described above, which focused, among other things, on the optimization of package dimensions.

Intermodal transportation has many advantages such as transportation efficiency, delivery time reduction and cost saving. These are especially due to the use of standardized containers, so that no extra time is spent on loading and unloading. In addition, in this case, the need to remove goods from containers along the way disappears, bringing a reduction in handling costs and the possibility of speeding up customs processes, since only one inspection is then required. Safety improvement is also one of the advantages of intermodal transport. Using intermodal cargo units protects the goods during the transportation period, reducing the risks of theft and damage, due to increased visibility through the tracking protocol, which recalls the tracking of regular packages. This feature gives companies a competitive advantage, due to the possibility of managing ship-

ments with higher on-time delivery and pick-up percentages. Sustainability aspect through emission reduction is the most significant advantage of such mode of transport. (The Complete Guide to Intermodal Transportation N.d.) Utilizing the most environmentally friendly transport option for a large part of the journey and only the most polluting one at the end, in terms of flexibility, enables the optimization of the supply chain and thus the reduction of CO<sub>2</sub> emissions.

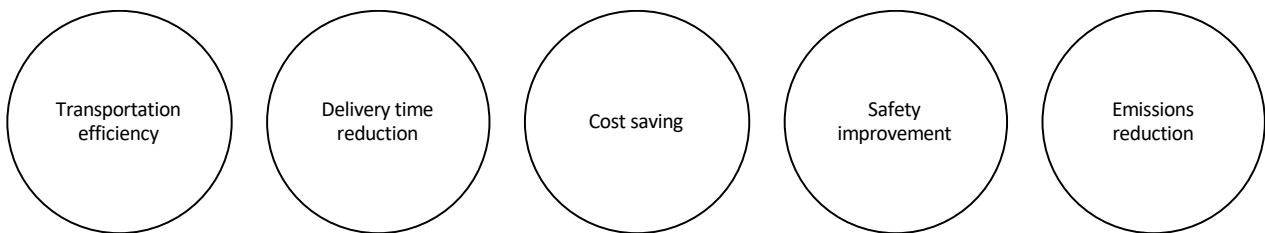


Figure 10. The advantages of an intermodal transportation.

It should be noted that intermodal transport has limitations. The efficiency and other advantages of the transport method only come into play in long journeys, i.e., when the distance from the original point to the destination one is equal to or more than about 965 km. It is also worth noting that intermodal transportation is competitive with, for example, the road option when the distance is equal to or more than about 725 km and when container transfers can be performed near to the intermodal departure and destination ramps. (The Complete Guide to Intermodal Transportation N.d.)

It is a common misconception that intermodal transportation is inherently operationally complicated when there are several steps involved. Today, however, the processes have been significantly enhanced and facilitated when the intermodal service providers (IMC) have entered the market, whose task is to be responsible for origin, linehaul, and the destination transfers of goods. In this case, the process becomes as easy for the customer as in the case of truckload. Based on the analysis section, it has been noticed that the rail is not even included in the transportation options in project logistics for some reason. Hence, the practical proposal for the company is therefore not only to consider entering into long-term contracts with IMC, but also to take into account the utilization of the rail mode of transport for long deliveries.

### **Circular logistics chain as a long-time approach**

Until today, the majority of companies have had the practice of keeping their supply chains linear, which means a direct chain from product manufacturing to delivery and later to disposal at the end of its life cycle. A similar model is also largely still in use at the company for which this study is carried out. However, more and more such supply chains are considered to be expensive, inefficient and, especially in terms of greenhouse gas emissions, highly productive. Due to of this, the linear supply chain model needs to be rethought in order to move towards achieving the goals of sustainable development. Now, when the short-time approach, i.e., the packaging, and the middle-time, i.e., the mode of transport, have been considered from a sustainability point of view, it is reasonable to move to a more holistic and at the same time long-time approach solution proposal, i.e., the circular logistics chain.

With a circular economy supply chain processes are thought to be more streamlined and efficient, which also naturally leads to cost reductions in all areas of the system. For example, from the point of view of project logistics, a product designed from the beginning to follow circular economy principles can reduce transport costs, inter alia, through efficient packaging. It is also worth noting that the circular economy as a whole is completely based on the circular logistics chain and its sub-areas such as reverse logistics, which enable a smooth flow of different types of resources. (Hofman 2023.)

Reverse logistics optimization of the company's processes can provide beneficial outcomes for both the organization itself and the environment, when product manufacturing, delivery, possible returns related to repairs and disposal remain in a continuous circular motion. This type of model not only reduces the company's costs, but also prevents, among other things, waste from ending up in landfills and thus in the soil. (A key part of the circular economy N.d.) The challenge of reverse logistics is that the flow must work smoothly in both directions. This requires advanced software that allows to monitor every step that takes place. In addition, to ensure efficiency, the functions must be monitored and evaluated regularly. In any case, by developing and implementing a

reverse logistics system as part of the organization's operating model, it is possible to create added value from the customers' point of view through the provision of a green supply chain.

Another useful way to significantly reduce CO2 emissions through the circular economy is with the help of the sharing economy in logistics. The term refers to the use of collaborative logistics solutions to enable transportation and supply chain optimization. Collaborative logistics itself primarily means sharing transportation units, but also, for example, warehousing resources with other companies. Such kind of solution helps both in saving costs and improving efficiency, as well as in promoting sustainability goals. For example, a company can share a truckload with another one with a similar destination to reduce the number of trucks and empty runs. This approach not only saves transportation costs, but also helps reduce greenhouse gas emissions by requiring fewer transport units to move the same amount of goods. (Wolff 2023.) One other way of collaborative logistics is warehousing space sharing, which reduces the need to build more new ones. However, this approach has been in use in the company for which this work is carried out for a long time, so it does not require a more detailed definition and highlighting of the benefits.

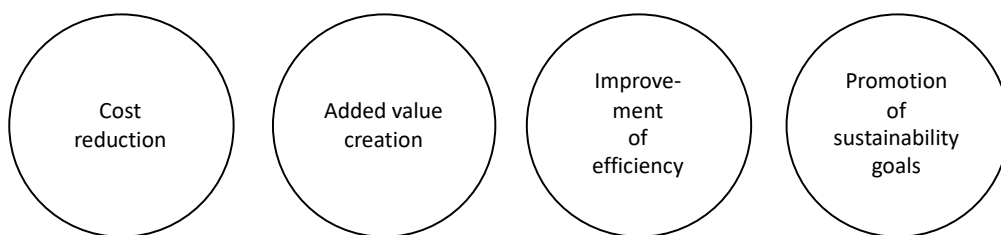


Figure 11. The advantages of the circular logistics chain.

All in all, an organization whose goal is to move towards a circular economy must ensure that the focus remains not only on product development, but also on the circular logistics chain, including packaging design, environmental friendliness of transportation, and reverse logistics. With such a whole, sustainable development aspects are filled, bringing other significant advantages to business. The practical proposal of a long-time approach is to implement the reverse logistics and sharing economy practices in company's project logistics operations over time as part of the circular logistics chain.

## 5 Discussion

The discussion section returns to the most important points presented in the research in a logical order to get a more comprehensive picture of the entire work. In addition, it clarifies the importance of the results achieved based on the analysis, both from the point of view of the company for which this research was carried out, and from a wider perspective. The section also highlights aspects related to the reliability and ethics of the research and finally presents further proposals arising from the study.

Undoubtedly, there is no healthy future without practical action towards combating climate change. Regardless of the industry, companies have priority in reducing greenhouse gas emissions through their own activities, and at the same time they are responsible for achieving the globally set sustainable development goals. The theme of sustainability was chosen as the subject of this study due to its great topicality. As mentioned in the research introduction section, rapidly advancing laws, and other types of rules, both at the local and global level, mainly forcing large companies to change their operating models for a more sustainable direction to achieve the goals set on a global scale from all three perspectives, i.e., ecological, social economic ones. In particular, corporate sustainability reporting related new directive, forces companies to rethink their processes to ensure their consistency with the required criteria. Therefore, the purpose of the research was to help the company renew project logistics operating methods in a more environmentally friendly direction due to the high greenhouse gas productivity of the logistics department and the target to significantly reduce the total amount of CO<sub>2</sub> emissions.

The work began by familiarizing with the main concepts of the topic in order to get a better understanding of their connectivity. Due to the fact that environmental sustainability contains a large number of different but seemingly similar terms, their opening in a clear form and in logical order through the theoretical basis section of the research seemed necessary. The next step was to determine the methodology used to perform the research itself. The outcome of the work was intended to be common in a way, consequently surveys, structured interviews or precise analysis of numerical data were not intended to be used in this study. Due to the reason, unstructured interviews and extensive literature review proved to be the right ways to carry out the research in order to obtain the desired results from the perspective of both parties. The purpose of the work analysis section was to give a more comprehensive picture of the current situation of sustainability

at the level of the company's entire logistics department, inter alia, through the topic related sub- and additional questions. The results of the study were later based on the answers found through the questions in the forms of three different time approaches.

The purpose of this research was to find the best practices of the current situation from the perspective of a project logistics, particularly related to the environmental sustainability in order to reduce CO<sub>2</sub> emissions to a minimum. It should be noted that the intention of the research was to get other logistics and project delivery providers also benefit from the results of the study. Thus, the research can be considered equally important for both the company itself and more broadly for other actors. In addition, the advantage of the study can be seen as increasing awareness of sustainable development, especially through the theoretical basis section, where the concepts of environmental sustainability are opened in a clear and understandable form. From the point of view of society, this work may potentially promote reduction in CO<sub>2</sub> emissions and thus help in combating climate change.

## **5.1 Reliability assessment and ethical review of research**

The entire work has been done in accordance with good scientific practice with honesty, care, and accuracy. The reliability of the study is supported by the logical progress order of the methodology section and the descriptions of the methods used with sufficient accuracy. It should be noted that, for example, the amount of utilized source materials is not defined by numbers, such as five books, due to the fact that the idea of adding information was only born when the section was already complete. Thus, it was impossible anymore to calculate precisely. Naturally, not all materials used during the literature review were included in the research as the purpose was to collect data from different comparable sources to ensure the transmission of reliable information in the study.

The validity of the research, in turn, is demonstrated in the selection of appropriate methods through which it was able to reach the main goal of the study or to find the most suitable ways to reduce CO<sub>2</sub> emission through project logistics operations. The source material for the research consisted mainly of international and timely sources published in the last five years to avoid the use of outdated and incorrect information. Literature over than 15 years old was also used in the research, but the reliability and remaining topicality of the information were confirmed before uti-

lizing the information. Generally, care and accuracy were considered in the collection and maintaining of the materials, respecting the matters agreed with the parties. In addition, the works produced by members of the scientific community were respected by referring to them in the appropriate way. After the study was completed, the list of references was revised to ensure the accuracy of the information provided. JAMK University of Applied Sciences reporting instructions were carefully followed in research reporting. In addition, the assessment criteria of the thesis had been used along with the work to ensure that the requirements were met.

As a whole, the research was gingerly planned and logically structured to progress from the beginning. In addition, the aim was to describe the events of it in a clear and consistent way, giving the reader the correct understanding of them. Already in the introduction section, a clear research goal was defined and otherwise the extensive topic was limited. It also has been possible to stay within the limits throughout the entire work. The terms of the theoretical basis section were expressed informatively, clearly and in logical order. The properly selected methods described in the methodology section eventually achieved the implementable credible results, while reaching the main goal of the research.

This work as a whole has been carried out in accordance with JAMK University of Applied Sciences ethical principles and regulations. Before the start of the work, the company for which this research was carried out, was informed about the public nature of the study. Due to that, a non-disclosure agreement had been drawn up between the parties. The points agreed in the agreement were strictly followed throughout the work by ensuring that sensitive information did not end up in the study. Based on the joint decision of the research author and the company, confidential attachments were not intended to include in the work. Due to that, there were not used research methods that produce or require sensitive material in the work. In addition to information security issues, care has been taken to ensure that the materials used in the research in their various forms are properly disposed of so that they do not end up in the wrong hands.

## **5.2 Future directions of research**

Based on the results obtained through the study, numerous proposals for further research were created. First of all, due to the public nature of the work, there was no possibility to use the infor-

mation available internally within the company in the research. Consequently, it was also not possible to carry out the study on a more detailed level by delving into the operating methods of the project logistics department in relation to sustainable development from an environmental perspective. In addition, since the calculation of CO<sub>2</sub> emissions from the operations of the logistics department turned out to be a recent phenomenon, the information deemed necessary for the analysis was not available so far. Therefore, one proposal for further research would be to repeat similar study, but using higher quality data and, where possible, utilizing research methods that produce more detailed outcomes.

Further research proposals have also been created for each of the three final results. Regarding sustainable packaging, it would be reasonable to start developing packaging guidelines in order to promote sustainability on a practical level through that. In the case of intermodal transport, it is advisable to carry out investigation on opportunities that optimally applies to the rail option for long-distance deliveries. In addition, it would be reasonable to make a comparison with other transport options in order to find out the benefits that rail mode of transport might bring. In terms of circular logistics chain, it would be reasonable again to perform a more detailed study, for example, on the number of returns for a variety of reasons and based on them start to map the possibilities of making the logistic supply chain run in circular form.

## **6 Conclusion**

Today, companies around the world have begun to understand the importance of integrating sustainable practices through the many benefits they produce. Reduction of CO<sub>2</sub> emissions, cost savings, more efficient supply chain, and also the requirement to adapt to local and global goals and commitments, make organizations rethink their entire processes that have been in use for a long time. From the point of view of logistics, as it is one of the most productive sectors of carbon emissions, with the right actions it is possible to significantly influence the fight against climate change.

After clarifying the targets set at company level regarding environmental sustainability, several similarities with the goals set at the global level have been observed. As an example, limiting global warming to 1.5 °C and achieving net zero emission by 2030. In order to reach the goals, the company has started considering measures not only through offsetting but also by mapping and implementing more comprehensive solutions that promote sustainable development. In order to

help the company achieve its goals, especially in terms of reducing CO<sub>2</sub> emissions, the operational model of the project logistics department had to be reviewed and areas for improvement had to be found.

After successfully identifying the shortcomings, different solutions were developed with three time-different approaches. Sustainable packaging proved to be the fastest to implement, as certain measures towards it had already been started in the company. However, in the form of several proposed solutions, it was possible to bring new perspectives to problem solving. Intermodal transport turned out to be the second fastest feasible solution, as its less complex forms have been in use in the company for a long time. The complete absence of rail option from the CO<sub>2</sub> emission reports and the very low use of multimodal option caused confusion, but at the same time showed a development direction to find a solution. Redeveloping a forward logistics chain in accordance with the circular turned out to be the most time-consuming approach and at the same time a prerequisite for sustainable development. Although the proposed “circular logistics chain” solution seemed unclear and complicated at first, it can be famously stated that problems cannot be solved with the same thinking with which they were originally created.

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## Appendices

### Appendix 1. Interview questions

1. *Job description?*
2. *Generally, about current situation and own view of where actually company are nowadays from sustainability point of view?*
3. *What are actual sustainable targets in which company would like to develop?*
4. *Should the focus be mainly on environmental point of view or is it better to also consider social and economic point of views?*
5. *How to correctly read the CO2 emissions related data from company's analysis tool?*
6. *What kind of research outcome would benefit the company best right now?*
7. *Any ideas how to integrate sustainability into everyday work of logistics department in future?*
8. *Useful materials / sources?*