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Circular Economy and Industrial Packaging Material Waste in EU

Case study

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ABSTRACT:

Current linear economy is based on take-make-use-dispose model which is damaging the environment with unsustainable resource use and generated waste. Sustainable alternative to current linear model is circular economy (CE), which integrates the economic activities and wellbeing with efficient resource use. The purpose of this thesis is to examine the impacts of CE to the consumption of industrial packaging material and waste management in international manufacturing industry. The study focuses primarily on environmental demands that EU is increasingly setting for multinational companies (MNCs) and how they impact on CE transition. Implementing circular business model within the organization may enable diverse benefits, e.g. potential to save considerable resources, gain competitive advantage and create value from economic, social and environmental perspective. Thus, the contribution of CE in gaining competitive advantage and creating value in global business context is observed in this study from resource-based view (RBV). Furthermore, waste management is closely interconnected with CE and developing functioning waste management system is crucial for effective resource use, as well as packaging waste treatment.

This thesis includes a qualitative case study, which examines the research topic by conducting interviews for external and internal stakeholders of a case company operating in global manufacturing industry. The research investigated the background of the demands for packaging material in EU, as well as identified the possibilities and challenges in terms of packaging material. It also mapped the current state of industrial packaging material waste treatment, monitoring and reporting. Current EU legislation and demands are not forcing companies to shift towards CE but are currently making the unsustainable actions and operations continuously more expensive and difficult. Reporting the inbound and outbound packaging material is mandatory for multinational companies in EU and currently very challenging. More reliable reporting would require extensive improvement in system data, requirements for suppliers about the packaging material, as well as more standardized packaging for products.

CE can enable various possibilities for companies by turning the inefficiencies of linear economy model into business value. However, various factors are hindering the transition towards circular model, such as legislation, complex global supply chains, challenging packaging materials, as well as missing system for circulating material. In order to overcome these challenges, comprehensive cooperation within the organization and throughout the global value chains is mandatory. Certain requirements for stakeholders are necessary for developing more circular processes and ensure that supply chain partners are willing to operate in more sustainable way. Furthermore, there is an urgent need for developing waste treatment methods and new systems for circulating packaging. The waste should be seen as a resource but current challenges in recycling and reusing the materials are decelerating companies to do any actual actions.

KEYWORDS: circular economy, waste management, packaging material, RBV

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List of Abbreviations and Terms

3R	Reduction, Reuse and Recycling
4R	Reduction, Reuse, Recycling and Recovery
B2B	Business to Business
C2C	Cradle to Cradle
C2G	Cradle to Grave
CE	Circular Economy
CEAP	Circular Economy Action Plan
EC	European Commission
EGD	European Green Deal
EMAS	Eco-Management and Audit Scheme
EPR	Extended Producer Responsibility
ETV	EU Environmental Technology Verification
EU	European Union
GPP	EU Green Public Procurement
GRI	Global Reporting Standards
GSC	Global Supply Chain
GVC	Global Value Chain
HSE	Health, Safety and Environment
MNC	Multinational Company
LCA	Life Cycle Assessment
LCT	Life Cycle Thinking
PEF-OEF	Product Environmental Footprint and Organisation Environmental Footprint
RBV	Resource-Based View
SDG	Sustainable Development Goals
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The purpose of this thesis is to increase knowledge of the impacts of circular economy for packaging material consumption and waste management in manufacturing industry in the European Union. In this chapter, the background and justification for the study are described, and the research question and objectives are explained in detail. In addition, this chapter provides elaboration for delimitations and scope of the study, as well as determines the structure of the thesis.

1.1 Background of the study

The world is currently suffering from a sustainability crisis. Present linear economic model is primarily based on the extraction, manufacture, use and disposal of raw materials, which damages the natural environment (Ungerman & Dědková, 2019; Murray, Skene & Haynes, 2017). The economic growth and well-being cannot be reached by wasting natural resources or constant manufacturing and buying. Thus, sustained wealth generation requires a new industrial model which is not dependent only on primary material and energy inputs, but rather keeps resources on cycle (World Economic Forum, 2014). One solution for this issue is **circular economy** (CE), which offers a sustainable alternative for today´s *"take-make-use-dispose"* -model by integrating economic activities and environmental wellbeing with efficient resource use (Sitra, 2020b; Murray et al, 2015). **Circular business models** limit considerably the amount of waste and improve the resource quality by using materials and products in a loop even when the life-end is reached (Council regulation (EC) 2018/1999).

Circular economy is not a new phenomenon, the principles have existed for centuries, but recently the phenomenon have gained considerable interest due to the rapid technology development and increased focus on customer outcomes. (Sitra, 2020a). In addition, current trends, such as tightening legislation, increased consumption, new generation of consumers, as well as urbanization and employment have speeded up the transition towards CE (Antikainen & Valkokari, 2016). Furthermore, circular business models

have been defined as the only way to achieve the *United Nations Framework Convention on Climate Change´s* (UNFCCC) goal of *Paris Agreement* to limit global warming to 1.5°C above pre-industrial levels and thus the importance of the concept have been increasingly identified (Accenture, 2020; PACE, 2020). According to *Circularity Gap Report*, the agendas of CE and low-carbon future are complementary and mutually supportive. (PACE, 2020). Despite the attention the CE has received in the past years, the world economy was only 8,6% circular in 2019, meaning that circularity gap is still wide. In 2018 the circularity was 9,1%, meaning that the consumption of disposable materials is increasing (PACE, 2020). The reasons for this negative trend are for instance high level of extraction, continuous stock building, as well as low level of cycling and end-of-use processing. Fully circular economy has the potential to reduce global natural resource use by 28% and cut greenhouse gas emissions by 72% (PACE, 2020).

Manufacturing industry is one of the biggest greenhouse gas emission sources and *multinational companies (MNCs)* have the power to promote collaborative long-term solutions, which contribute in reducing emissions throughout the whole supply chain (Campos, Straube, Wutke & Cardoso, 2017). There is an increasing interest for integrating sustainability into business strategy and operations under sustainable development framework (Halati & He, 2017). However, according to Halati and He (2017), the coordination is currently inadequate between environmental and economic goals of sustainability. Additionally, there is a need for improvement in adjusting organizational policies and procedures to lower the environmental impact in businesses (Halati & He, 2017). Despite the targets and demands the organizations and businesses have committed to pursue in contributing CE, the background of these demands and guiding legislation remain often unclear and thus actions in MNCs have not been as strong as they should be. There are also significant differences between industries and even within industries. Furthermore, there seems to be a lack of knowledge, comprehension or interest of the effects CE may have in bigger picture.

One of the main principles in CE is to look *waste as a resource* (Ellen MacArthur Foundation, 2020). Nevertheless, a significant amount of waste is generated every single day, from which at least 33% is managed in a way that harms the environment (World Bank Group, 2019). Governments, organizations and other alliances in a high quarter have developed plans, guidelines and agendas to support tightening legislation for sustainable development, CE and more sustainable **waste management**. *The United Nation´s* (UN) goals for sustainable development are formed to be an important framework for building more sustainable future at global level, but in terms of transition towards CE, *the European Union* (EU) has taken a fundamental role. EU´s *Circular Economy Action Plan* is a future-oriented agenda with an objective to achieve clean and more competitive Europe in cooperation with citizens, consumers, economic actors and civil society organizations (EC, 2020a). According to *European Commission* (EC), local, regional and national authorities enable the transition. However, economic actors, such as MNCs with their supply chains are the keys in the process, by not only following the regulations and directives but also to creating new sustainable solutions and innovations by themselves (EC, 2015b). Moreover, a considerable share of current waste comes from packaging and as a part of the *Circular Economy Package*, the Commission has reviewed the *Directive 94/62/EC on packaging and packaging waste* and set a target that all packaging in the EU market should be reusable or recyclable in economically feasible way by 2030 (EC, 2019b).

International business (IB) research has developed in essence during the past decades by adapting new theoretical contributions and concerns. **Resource-Based View** (RBV) has become one dominant theoretical perspective for many scholars studying operations or decisions in IB (Ferreira, Reis, Serra & Costa, 2013:4). International scholars use RBV for understanding the heterogeneity of resources and how companies´ resources effect on competition, instead focusing solely on company´s position in the industry. Although resources in RBV comprise diversely tangible and intangible resources, the theory can also be utilized in determining the benefits that unused resources may provide. CE offers a possibility to make the resource usage more efficient by minimizing energy and raw material inputs, as well as reducing waste. Saving resources and utilizing waste as a

resource may enable considerable value creation and cost saving possibilities for MNCs and environment. Thus, the phenomenon in this study is considered primarily from resource-based view. In addition, RBV focus provides deeper knowledge for the reader from certain viewpoint, instead for looking the phenomenon from too broad perspective.

1.2 Justification for the study

Since CE have been identified as a key approach to more sustainable economic model, the topic has been lately a trend in research field. Yet, there is a research gap in terms of CE demands in the context of **industrial packaging material** waste in EU from resource-based view. There is also wide room for further research in terms of new CE business opportunities or concrete outcomes CE may provide in practice (Bebbington & Unerman, 2018; Antikainen & Valkokari, 2016). Previous CE studies focus primarily on conceptual insights that determine the definition, principles, limitations and barriers (e.g. Korhonen et al, 2017; Kirchherr et al, 2017; Zink & Geyer, 2017; Jesus & Mendonca, 2018; Niero & Hauschild, 2017). Other studies examine the concept´s relation with other concepts, e.g. sustainability, sustainable development or corporate social responsibility (Korhonen et al, 2018; Suarez-Eiroa et al, 2019; Antikainen & Valkokari, 2016; Bocken, et al., 2016; Jesus & Mendonca, 2018). According to Merli et al. (2018) and Murray et al (2017) there is a lack of shared framework on how firms adapt CE paradigm to their business models or how CE should be applied to business operations. (Merli et al, 2018; Murray et al, 2017; Pieroni et al, 2020). Geissdoefer et al. (2017) and Merli et al. (2018) claim that CE has received great attention from scholars, but according to studies of Murray et al. (2017), as well as Jesus and Mendonca, (2018) CE is much more largely emerged from legislation than from academia and the theoretical development has been weak (Murray et al, 2017; Jesus & Mendonca, 2018). Additionally, CE has primarily been considered as an overall strategic framework by entities such as the *World Economic Forum* (WEF) and *Ellen MacArthur Foundation* (EMF), as well as international organizations, such as United Nations and European Union. Overall, CE seems to be a concept which definition, principles, boundaries and other practices needs still to be stabilized, since the concept is still evolving.

Globally increasing amounts of packaging waste has also received attention within academia and there are various studies related to sustainable packaging (e.g. Kumar, 2020; Lindh, Williams, Olsson & Wiksröm, 2016; Niero & Hauschild, 2017). Nevertheless, the studies are related mainly on plastic, due to the increased attention the waste issue of plastic has received. There are also some studies focusing especially the material of sustainable packaging, but the focus has been mainly on consumer products. (Lindh, Olsson & Williams, 2016). In addition, previous studies regarding sustainability of packaging design (e.g. Herbes, Beuthner & Ramme, 2018; Radu, Chiriac, Deak, Pipirigeanu & Izhar, 2020; Svanes, Vold, Moller, Pettersen, Larsen & Hanssen, 2010) focus more on functional requirements for packaging systems or strategic role of packaging, instead of resources and perspective of CE. Furthermore, the previous studies have mainly taken a local or global approach to the issue, not EU level perspective in MNC, and the role or impacts of mandatory packaging waste reporting has been missing from the studies.

Waste management is essential part of CE and included commonly in CE related studies (Merli et al, 2017). However, according to Kirchherr, Reike and Hekkert (2017), most of the research do not interpret waste hierarchy, which is fundamental part of CE. Without waste management, CE may be misinterpreted, and organizations may claim to be part of CE e.g. by only increasing recycling, although recycling is not until third in the hierarchy. Waste and resource management in current linear production model do not follow a *holistic approach* that concerns the whole production chain from product design, raw material extraction, production, consumption, and disposal (Singh et al, 2014). Due to this inadequate understanding of waste management and circular possibilities, current products and materials are often replaced or disposed by losing their value, although they would still be usable (Paes, Bezerra, Deus, Jugend & Battistelle, 2019). Since this study clarifies the role of CE and waste management in the consumption of industrial packaging material, it can provide an insight to more sustainable operations in the scope of the study. In addition, the study aim concrete examples of managing packaging material waste in MNCs by saving resources.

This study contributes in examining field of **packaging material**, where the circular opportunities are currently unexploited and resources wasted. There are national and EU-level demands for **waste monitoring and reporting** the amounts of consumed packaging material, but the current level of accuracy and reliability of reporting is not sufficient. Therefore, this study aims to clarify the background of the demands and emphasize the importance of monitoring and reporting from the perspective of CE. In addition, the EU policies relevant for the manufacturing industry in *EU Member States* are included in this study, for clarifying the topic for the reader. Focusing solely on manufacturing industry may provide deeper understanding of the role of CE and waste management in terms of packaging consumption. Since the packaging types and materials, as well as consumption models are so different e.g. in common consumer products, limiting the scope to certain materials provides the most value for the reader.

1.3 Research question and objectives

The aim of this study is to examine the role of circular economy in international manufacturing industry with an empirical research for a case company. The scope is limited to *packaging material waste* and the focus is primarily on environmental demands EU has set for MNCs. The phenomenon is considered from resource-based view in order to identify the factors that influence on company´s possibilities to gain competitive advantage in global markets. Based on this, the research question of this study is following:

How circular economy model impact on consumption and waste management of industrial packaging material inside the European Union?

The purpose of this thesis is to find an answer to the research question in addition to additional objectives which aim to direct and give clarity for the reader. These objectives are:

1. To clarify the background of industry´s obligation to circular economy in EU

2. To examine what opportunities CE offers for industrial packaging material from resource-based view and what hinders the implementation
3. To find out how waste management in manufacturing industry is linked to circular economy
4. To find out the role of monitoring and reporting in packaging material consumption.

1.4 Delimitations and scope of the study

In order to find an answer to the research question and reach the research objectives, the thesis examines the theoretical framework from the perspective of CE in the context of case company which operates in global manufacturing industry. The demands for monitoring and reporting the consumed packaging material are continuously increasing due to tightened *EU regulations, Green Deal,* as well as *local laws* and *directives.* Thus, understanding the fundamental concepts and reasons behind the demands, as well as the impact of CE, are essential for comprehending the importance of the topic. In addition, it is important to follow the current state of waste management in order to identify root causes for conceivable issues and potential solutions for them.

The overall scope of the thesis is inbounding and outbounding industrial packaging material at MNCs in EU member countries. The phenomenon is examined from resource-based view and perspective of circular economy. The qualitative case study is conducted for a global manufacturing company by interviewing internal experts and close stakeholders in managerial positions, who have a comprehensive knowledge about the most relevant themes regarding this study, including *sustainability, circular economy, packaging materials* and *waste management.* Although the study is conducted for a case company and the results are not generalizable, the aim is to examine the phenomenon as an ensemble, which enables a study with findings that can be utilized in various international businesses. In this thesis, consumer products are excluded, and the focus is on most relevant packaging materials used in manufacturing industry and the case company, including wood, corrugated cardboard and plastic.

1.5 Structure of the thesis

Structure of this thesis is as follows: relevant theories regarding this study are covered in the literature review section, which is divided in three chapters: *2. Towards sustainable future in European Union, 3. Effective resource use and global value creation through Circular Economy* and *4. Circular Economy and managing packaging material waste.* The first theory chapter goes through the background of Circular Economy demands in EU. The second theory chapter defines the concept in more detail, in addition to determining how it may influence to MNCs and create value or competitive advantage from resource-based view. Furthermore, the third chapter determines the waste management in the context of manufacturing industry and scope of this study. After the literature review, the methodology of empirical study is explained in chapter *5. Research methodology* and results of the empirical research are gone through in detail in the chapter *6. Empirical findings and results.* After this the key findings are concluded and discussed in chapter *7. Key findings and discussion.* This chapter also includes the evaluation of trustworthiness and limitations of the study, as well as suggestions for future research related to the research topic. The last chapter *8. Conclusions* sums up the whole research.

2 Towards sustainable future in European Union

Current worldwide production and consumption is dependent of the use of the environment and natural resources in a way which will in process of time lead to attrition of the planet. In order to decelerate the destruction, governments and different organizations have developed universal *guidelines* and *goals* for promoting circular economy and building more sustainable future. Background of these guidelines, as well as *laws, directives* and *regulations* guiding the transition towards CE are determined in this chapter for enabling reader to understand the phenomenon more comprehensively.

2.1 Sustainable Development Goals of United Nations

In 2015, United Nations Member States adopted the *2030 Agenda for Sustainable Development*, which pursues sustainable development and the extraction of extreme poverty, by providing a global plan for peace, dignity and welfare for people and the planet, now and in the future (UN Association of Finland, 2020; UN, 2020a). The Agenda 2030 supports 17 *Sustainable Development Goals* (SDG´s) of UN (Picture 1.), which were published in 2015 and are now adopted in numerous organizations (UN, 2020a). The goals include 169 targets which have been built for decades by the UN member countries, civic society, private sector and academia and the progress of each goal is continuously monitored with various indicators (UN Association of Finland, 2020). Bebbington and Unerman (2018) claim that SDGs build the vital basis for understanding and achieving ambitions related to environment and human development by 2030 and beyond that (Bebbington and Unerman, 2018). Caprani (2016) describes SDGs as *"the next era of human that is transformational"* and according to Hajer et al (2015) *SDGs "have the potential to become the guiding vision for governmental, corporate and civil society action for a shared and lasting prosperity"* (Caprani, 2016, p.102; Hajer, Nilsson, Raworth, Bakker, Berkhout, de Boer, Rockström, Ludwig & Kok, 2015, p. 1657). The goals have also strong effect on CE by guiding EU policies and targets for sustainability.

Picture 1. Sustainable Development Goals of United Nations. (UN, 2020c)

According to Sala and Castellani (2019), assessing the environmental impact of consumption and production is fundamental step for achieving the SDGs (Sala & Castellani, 2019). Thus, the 12th goal of SDGs *"Responsible consumption and production patterns"* is the most substantial part of SDGs in terms of the scope of this study. For instance, sub-goals 12.2 *"By 2030, achieve the sustainable management and efficient use of natural resources*" and 12.5 *"by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse"* guide directly the fundamental principles of *A European Green Deal* or the concept of CE. In fact, CE can be considered as one of the biggest market opportunities for delivering the SDGs and 12th goal can be accelerated by the adoption of CE (UN, 2015; Accenture, 2020; Geissdoerfer et al, 2017). *Sustainable Consumption and Production (SCP)* minimize the use of natural resources and hazardous materials as well as emissions of waste and pollutants throughout the life cycle of the service or the product (UN, 2015).

Although SDGs have received considerable attention and have been adapted in various countries, organizations and companies, it has still received some criticism. For instance, SDGs and sustainable development maintain the *status quo* rather than pursue development for transformation in deeper structures and uneven power dynamics (Schleider et al, 2018). According to Pezzey and Toman (2002) and Barbier and Burgess (2017) *systems approach* in SDGs has practical limitations in terms of guidance and applicability, due to tradeoffs and lack of clear guidance how tradeoffs among the goals should be solved or how to prioritize choices (Pezzey & Toman, 2002; Barbier & Burgess, 2017). Although an individual goal would be considered as the intersection of the goals attributed to interlinked *environmental, economic and social systems*, tradeoffs are almost inevitable if all SDGs are tried to be achieved. According to Barbier (1987) sustainable development can only be reached if tradeoffs between goals of three systems (Figure 1.) are balanced (Barbier, 1987, p. 104). However, finding the balance can be considerably challenging, since some of the SDG targets are even paradoxical and for instance economic development may lead to deeper environmental problems instead of reducing them (Schleider et al, 2018).

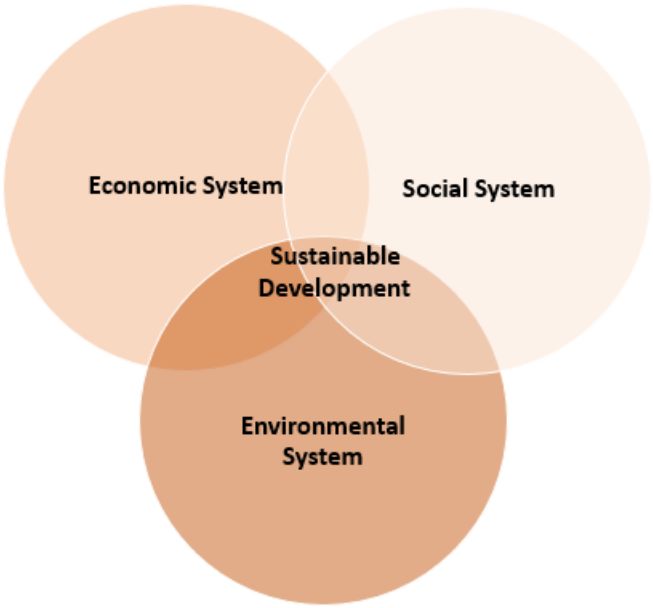


Figure 1. The systems approach to Sustainable Development. (Adapted from Barbier, 1987).

2.2 EU legislation and policies for Circular Economy and Waste Management

Environmental legislation in EU has been expanding considerably in the past decades and forms now the most comprehensive standards in the world. EU´s environmental law has changed from sectoral, technical policy to one of the most crucial factors affecting to legal and political decision making (Sikora, 2021). The EU´s ambitious target for being climate-neutral by 2050 requires fundamental changes in private and public sector, and these changes need to be guided by explicit legislation and regulations. Relevant EU policies and legislation related to topic of this study are introduced in this chapter.

2.2.1 The European Green Deal

The European Green Deal (EGD) is a framework and strategy for a climate-neutral, resource-efficient and competitive European Union, launched by European Commission in 2019. The goal is to foster climate-neutrality by reducing carbon emissions at least 50% by 2030 and transform EU to carbon-neutral economy by 2050 (Kumar, 2020; Sikora, 2021; EC, 2019b). Additionally, the aim of EGD is to protect, maintain and improve the natural capital of EU, as well as protect the citizens´ well-being and health from environmental impacts and risks (EC, 2019b). EU aims to succeed in transforming the economy for a sustainable future with elements illustrated in Figure 2. In order to reach the objectives, EU needs to accelerate the transition towards regeneration, limit the resource consumption within planetary boundaries and thus reduce consumption and increase circular material use rate, with e.g. new technologies, innovations and sustainable solutions (EU, 2020a). Transforming the ambitious agenda for climate into effective legal and economic instruments "*in a fair way, leaving no one behind*" will be a big challenge for EU (Sikora, 2021). Reaching the ambition set by EGD requires also significant investments sustained over time.

Figure 2. The European Green Deal (EC, 2019b).

The European Green Deal is crucial part of implementing the UN´s 2030 Agenda and UN Sustainable Development Goals (Sikora, 2021; EC, 2019b). According to Sikora (2021) EGD is synonym of *"the enhanced solidarity of the green transition towards climate neutrality"* but the phenomenon should be assessed from broad perspective in order to receive better impact from it (Sikora, 2021, p.695). For instance, from constitutional EU law perspective EGD is an innovative tool, which distributes environmental ambitions to EU legal order and requires global, constitutional approach, whereas at the implementation level, EGD must promote climate effect affecting the EU policies by taking also financial aspects into consideration (Sikora, 2021). Additionally, EU has a crucial role in promoting sustainability at global level and the EGD has an entire section "*The EU as a Global Leader",* where the EU promises to continue promoting and implementing ambitious policies for environment, climate and energy across the world (EC, 2019).

The EGD includes measures and targets in various sectors, including industry and packaging waste. For instance, it suggests renewed legislation and new legal requirements to boost the secondary raw material market with mandatory recycled packaging material

(EC, 2019b). In addition, the Commission ensures in the EGD that all packaging material will be reusable or recyclable in economically feasible way in the EU market by 2030 (EC, 2019b). This promise is ambitious since current situation is far away the targets and EU needs to succeed in getting numerous actors to adapt the goals of EGD. Furthermore, the European Green Deal is an instrument of the EU soft law, meaning that it is not a binding law for individuals, albeit it follows a case law and can may cause legal effects (Sikora, 2021). Thus, stronger legal obligations and sanctions are mandatory for accelerating the transition towards greener Europe.

Circular Economy Action Plan

Circular Economy Action Plan (CEAP) provides a future-oriented agenda for achieving cleaner and more competitive Europe. The plan aims to expedite the transformational change to circular model and is therefore an essential part of the EGD (EC, 2020a). The European Commission adopted the first Circular Economy Action Plan in 2015, which contains measures and objectives that aim to stimulate Europe´s transition towards CE, foster sustainable economic growth, accelerate global competitiveness and provide new jobs. In 2018, the European Commission adopted the *Circular Economy Package,* which includes various additional initiatives for CE, especially regarding plastics. In 2020, the European Commission approved *a New Circular Economy Action Plan,* where the aim is to present initiatives along the whole product life cycle, related for instance to product design, normalizing sustainable business models, as well as changing the consumption behaviour towards no-waste generation. (EC, 2020a). The plan establishes policy framework which pursues production of sustainable products, services and business models as the norm, and rebuilds the consumption patterns in a way where no waste is produced. (EC, 2020a; Kumar, 2020).

EU legislation and initiatives indicate a certain level of sustainability aspects of products. For instance, *Eco-design Directive* (2009/125/EC) successfully regulates energy efficiency and circularity for energy-related products and *EU Ecolabel regulation* (2010/66/EC) as

well as *EU Green Public Procurement* (GPP) criteria are regulations for larger scope. Other tools and instruments for facilitating the implantation of CE in EU are e.g. *Product Environmental Footprint and Organisation Environmental Footprint* (PEF-OEF), *Eco-Management and Audit Scheme* (EMAS), *Level(s)*, as well as *EU Environmental Technology Verification* (ETV). (EC, 2020b). Nevertheless, there is no integrated requirements to ensure that all products in EU markets are sustainable or the life cycle of products circular. Therefore, European Commission aims to propose a sustainable product policy legislative initiative, which pursues to widen the Eco-design Directive beyond energy-related products applicable to widest possible scale of products and promote the circularity. (EC, 2020a).

In addition to EU level initiatives and legislation, European Commission has also active global cooperation related to CEAP targets. *European Plastic Strategy* will be promoted from international to global level as *"global agreement of plastics"* and *Free Trade Agreements* reflect increasingly on CE objectives (EC, 2020a: 7). In addition, one of the EU´s key international initiatives is the *Global Alliance on Circular Economy and Resource Efficiency*, which maps policies and regulations in third countries, as well as identifies barriers hampering the global transition to CE and advise solutions for overcoming them (EC, 2020c). In addition, the CEAP pursues systematic promotion of the transition to CE at global level through multilateral, bilateral and regional policy dialogues, as well as free trade and environmental agreements. Examples of these are e.g. G7, G20, UN conventions on biological diversity and climate change, as well as *Ten-Year Framework Programme on Sustainable Consumption and Production.* (EC; 2020c).

Circularity in production processes is a crucial part of industry´s transformation towards sustainable operations and climate-neutrality. It may enable considerable material savings, provide additional value and open economic opportunities throughout production processes and value chains. (EU, 2020a). In addition to production processes, CEAP includes six key product value chains, including electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, as well as food, water and

nutrients, which all pose a considerable sustainability challenge and require urgent actions (EC, 2020a: 3). In terms of this study, value chain of packaging is substantial, due to the increasing consumption of packaging material and EU 2030 targets for *package recyclability and reusability*. The plan is supported by *EC Directive on Packaging Waste* (94/62/EC), which strengthens the mandatory requirements for packaging in EU market and focuses on

- *reducing packaging waste and overpackaging,* including waste prevention measures and setting targets
- *promote design for packaging re-use and recyclability,* including considering restrictions for some packaging materials for certain use or applications
- *reducing the complexity of packaging materials,* including the number of polymers and materials used. (EU, 2020a: 11).

European Commission have discovered that developing sustainable product policy and turning it into legislation will be one of the keys to prevent waste and the waste laws need to be modernized and tailored to fit in increasingly digitized world and circular economy. (EC, 2020a) The section *"Less Waste, More Value"* in CEAP emphasizes waste avoidance and reduction, focusing mainly on issues, such as better waste segregation, secondary raw material usage, as well as waste exports from the EU (EC, 2020a: 4). According to Kumar (2020), the EGD targets are rather postponed to a future time, than developed further in CEAP, and the message only repeats what has been already stated in existing directives of EU (Kumar, 2020). Furthermore, the CEAP does not provide any concrete solutions e.g. for reducing certain types of packaging waste. Although it mentions the focus on product design for reusable packaging, there is no further details on the subject and thus the plan is left vague.

European Climate Law

European Climate Law will propose the political commitment of the Green Deal to a legal obligation, which supports the EU´s goal to be climate neutral in 2050. In order to achieve the climate-neutrality, the EU countries should contribute in achieving zero greenhouse gas emissions by cutting emissions, protecting the natural environment and investing in new green technologies. The objectives of the law are to set create a system for monitoring, provide foreseeability for economic actors and investors, as well as ensure that climate neutrality will be reached. Action from all sectors, including energy, buildings, industry and mobility, is required for reaching the target. (Council Regulation (EC) 2018/1999). Urgency in discussion about climate change is always emphasized, yet the EU is behind from the schedule of publishing the European Climate Law. Since the final law has not reached its final form and is not formal yet, further details are not included in this study. Currently, the European Climate Law is expected to be ready during the summer 2021.

2.2.2 The Waste Management policy of EU

The environment policy of EU has evolved considerably during the past decades through various environmental action plans and proposals for legislation that aim to reduce negative environmental impacts and promote more energy and resource- efficient economy. Since the number of policies and directives regarding waste is comprehensive, only relevant directives for the scope of this study are included in this chapter.

Waste Framework Directive

In 2018, the European Parliament and the council published *Directive 2018/851 amending the Waste Framework Directive 2008/98/EC* as a part *of The Waste Package Legislative acts.* The update was part of a Circular Economy Action Package from 2015 where legislative proposals on waste were revised. The proposals consider revisions for following directives:

- *Directive 94/62/EC on packaging and packaging waste*

- *Directive 1999/31/EC on the landfill of waste*
- *Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC*
- *Directive 2000/53/EC on end-of life vehicles*
- *Directive 2012/19/EU on waste electrical and electronic equipment* (WEEE)

The Waste Framework Directive provides measures to prevent waste and reduce overall impacts of resource use and thus protect the environment and human health. It comprises the basic concepts of waste management, such as definitions of waste, recycling operations and secondary raw material. Additionally, it provides long-term targets for reducing waste disposal to landfills and facilitating reuse and recycling of waste. (Commission Directive 2008/98/EC on waste).

One of the most essential parts of Waste Framework Directive is the **Waste Hierarchy** (Figure 3.), which indicates the priority order in waste management and prevention legislation and policy. The aim of waste hierarchy is to promote prevention of waste and encourage options with best environmental outcomes by emphasizing *lifecycle thinking*. The most favourable option in the hierarchy is to reduce the amount of produced waste with **reduction** of raw material inputs or reduction of waste outputs (Van Ewjik, Stegemann, 2014). The ultimate goal would be to generate *zero waste*, yet this is reasonable challenging in terms of packaging material. If reduction is not possible, the second option is to use materials repeatedly. Material **reuse** is essential for circular recycling and it prevents further damage to the environment by providing value with new recycled products and additionally, reusing the packages have a significant impact on preventing waste production (CNE, 2014). The third option in waste hierarchy is **recycling**, meaning the material use for making new products. However, two different recycling types, *closed-loop recycling* and *open-loop recycling,* are not separated in the waste hierarchy although they have different kind of impact on environment (Van Ewjik & Stegemann, 2014; Pires & Martinho, 2019). In closed-loop recycling, the product is remade various

times and virgin material is only needed for compensating process inefficiencies. In open-loop recycling the materials move from one product life- cycle to another, which may cause environmental impacts beyond the original product life cycle (Van Ewjik & Stegemann, 2014). The second last option in waste treatment is **recovery**, where energy is recovered from waste for example through incineration. In this case the energy recovered can be only used once and the material circularity is reduced (Pires & Martinho, 2019). The least favourable option is **disposing** waste to landfill and this should be avoided to the last.

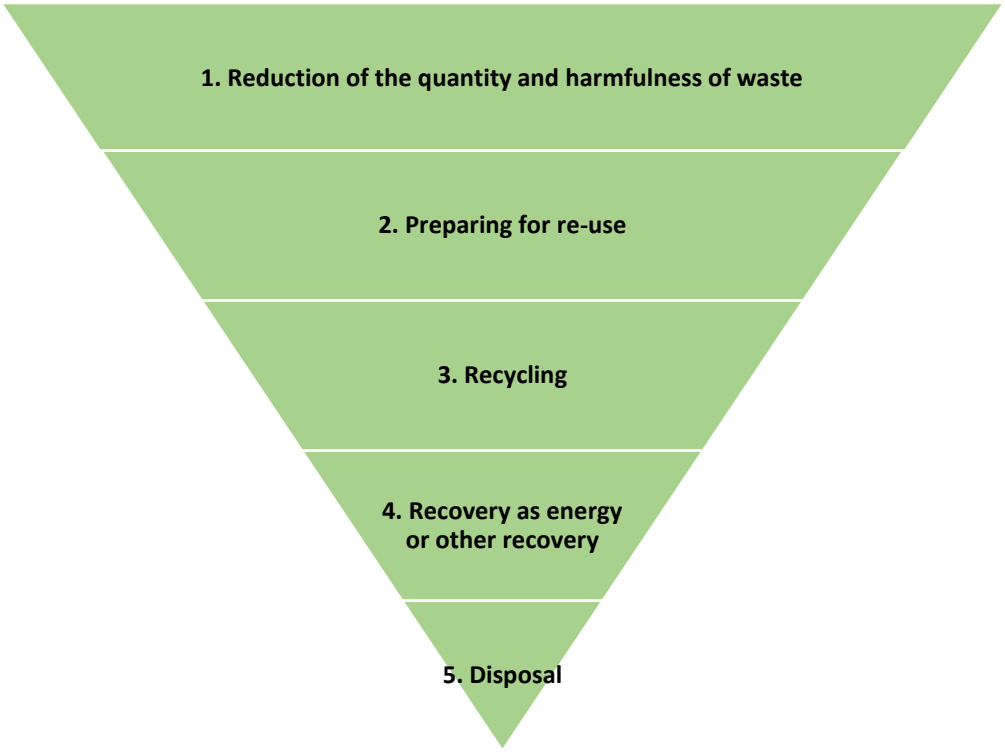


Figure 3. Waste Hierarchy (modified from European Union´s Waste Framework Directive)

Directive on Packaging Waste

In terms of this study, the most relevant part of Waste Framework Directive is the *Directive 94/62/EC on packaging and packaging waste.* Increased amount of packaging waste has forced governments to take measures for policy improvement, focusing on e.g. reducing unnecessary packaging, promoting packaging reuse and using alternative

materials for packaging (Radu et al, 2020). Directive on packaging and packaging waste aims to set long-term objectives for waste management in EU and offers environmental protection within internal European market for packaging (Radu et al, 2020). As a part of the directive, EU has set recycling rate targets for packaging material (Table 1.) and by the end of the year 2030, at least 70% by weight of all packing material should be recycled. According to European Commission, the introduction of recycling targets has increased the level of recycled packaging material and there is a big potential for further increase, which provide environmental and economic benefits (EC, 2015a). The directive incorporates all packaging sited in the European market and all generated waste.

	Current targets	**By 2025**	**By 2030**
All packaging	55 %	65 %	70 %
Plastic	23 %	50 %	55 %
Wood	15 %	25 %	30 %
Ferrous metals	50% (including aluminium)	70 %	80 %
Aluminium		50 %	60 %
Glass	60 %	70 %	75 %
Paper and cardboard	60 %	75 %	85 %

Table 1. Recycling targets for packaging waste (Amended from Directive 94/62/EC, 2015b)

According to European Commission, the most effective way to improve resource efficiency and decrease the environmental impact of waste is the *waste prevention*, which ensures that EU Member Countries take actions and measures for increasing the share of reusable packaging on the market (European Parliament and Council Directive 94/62/EC, 2015b). The actions and measures may include incentives, such as quantitative targets for recycling, as well as financial contributions for reusable packaging. The

EU member countries are required to ensure that the packaging materials set in the markets fulfil at least the following requirements based on Directive 94/62/EC:

- the size and weight of packaging is limited as small as possible in a way, which ensures the product safety, hygiene and approvability level for consumer
- concentration of hazardous substances in packaging materials are minimized
- the packaging is designed for reuse. This comprises the recycling, organic recycling and energy recovery design. (EC, 2015c: Annex 2)
-

Since the producer makes generally the decision about the type and amount of packaging, *Extended Producer Responsibility* (EPR) scheme is mandatory for improving the sustainability in packaging decisions. Directive 2018/852 amends Directive 94/62/EC to make clear that EPR schemes must be established for all packaging. Effective scheme may reduce the generation of packaging waste and increase its separate collection and recycling and thus have a positive environmental impact. Additionally, it is critical that manufacturer provides adequate markings about the product qualities, use or reuse, waste management or producer responsibility for the end-user. Although most of the Member States already have EPR schemes, there are still considerable differences in practical implementation, efficiency and scope of responsibility of producers (EC, 2015a). For instance, charging different fees based on packaging material weight and type placed on the market, has been identified to have a potential to increase environmental benefits. Currently 26 Member States have EPR schemes with fee modulation but only six states have more advanced modulation, with numerous fee levels within each material type or certain design features with penalty or bonus fees. Rest of the states have only low level of specific fee categories for certain types of packaging (Hogg, Sherrington, Papineschi, Hilton, Massie & Jones, 2020). Therefore, there is a certain need for more coherent scheme between the EU member countries.

3 Effective resource use and global value creation through Circular Economy

The transition to CE may require significant resources from a global company. However, it simultaneously offers a considerable possibility to save resources. In this chapter, the concept of CE and its differences to traditional linear model are described in more detail. In addition, the possibilities of gaining competitive advantage and creating value through CE is also considered from resource-based view. Moreover, the most common challenges of changing to circular business model in global markets are determined.

3.1 From linear to circular economy

Linear production and consumption model have been reigning the industrial revolution for the last 150 years. Companies use raw materials to manufacture a product, which they sell to consumer who discards it as a waste when it no longer serves its purpose. This take-make-dispose energy and material flow (Figure 4.) is unsustainable, and linear consumption is reaching its limits (World Economic Forum, 2014; Radu et al, 2020). The production of waste has negative impacts for the environment since it removes natural resources from the environment and reduces the value of natural capital caused by the pollution, and thus does not exploit the whole potential of **value-chain**. (Korhonen et al, 2018; Meadows, Randers & Meadows, 2004). Therefore, linear manufacturing industry needs to be rethought by moving towards CE, which is an endless cycle that maximizes the time products, components and materials are kept in use. (Sitra, 2020a).

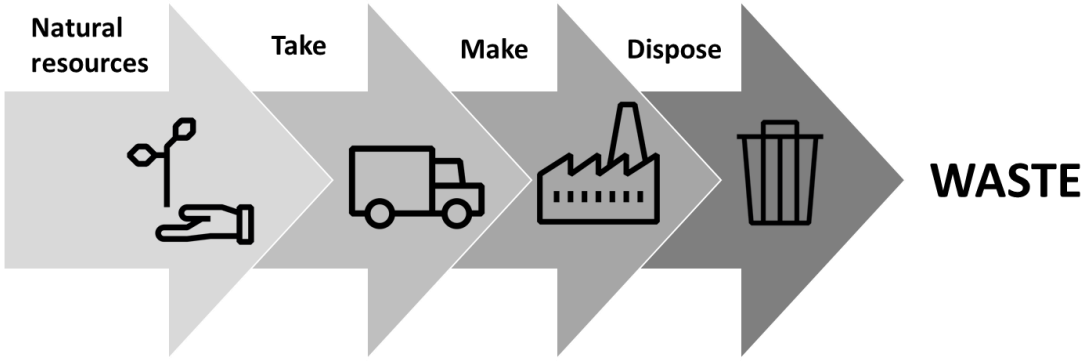


Figure 4. Linear Economy Model. (Adapted from EC, Circular Economy Action Plan 2016.)

Due to the increasing interest towards CE, various descriptions have been defined for the concept, yet there is no one commonly accepted definition. This study focuses primarily on resource-based view but there are also common definitions from economical perspective (e.g. Kirchherr et al, 2017; Merli et al, 2018). In order to understand CE in the context of this study, some common definitions for CE are listed in Table 2:

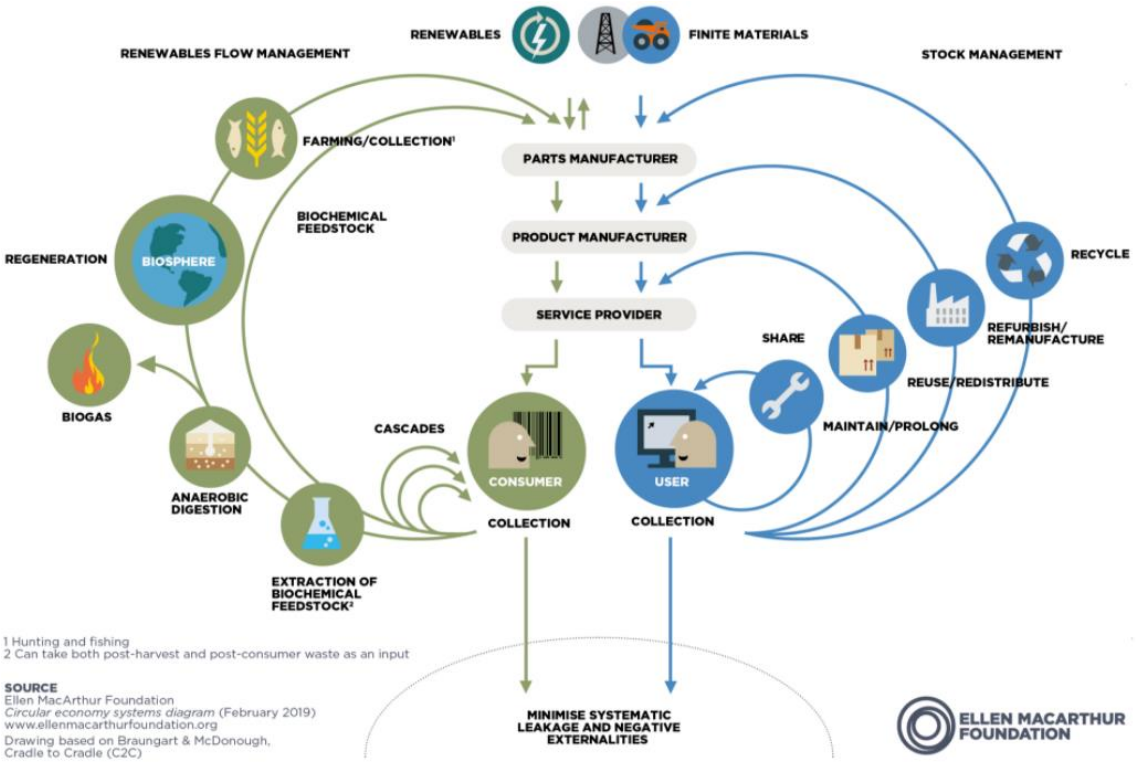
Organization / Author	**Definition for Circular Economy**
The European Commission	*"A circular economy aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste".* (EC, 2015).
Sitra	*"Circular Economy is an economic model which does not focus on producing more and more goods, but in which consumption is based on using services – sharing, renting and recycling – instead of owning. Materials are not destroyed in the end but are used to make new products, over and over again."* (Sitra, 2020b).
Ellen MacArthur Foundation	*"Circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems."* (Ellen MacArthur Foundation, 2020)
Murray, Skene & Hayes (2017)	*"Circular Economy is an economic model wherein planning, resourcing,*

	procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being". (Murray et al, 2017)
Hislop and Hill (2011)	*"The circular economy represents a development strategy that maximizes resource efficiency and minimizes waste production, within the context of sustainable economic and social development".* (Hislop & Hill, 2011).
Geissdoerfer, Savaget, Bocken and Hultink (2017)	*"Circular economy is a generative system in which resource input and waste, emission and energy leakage are minimized by slowing, closing and narrowing material and energy loops. This can be achieved through long lasting design, maintenance, repair, reuse, remanufacturing, refurbishing and recycling"* (Geissdoerfer, et al. 2017)

Table 2. Definitions for Circular Economy.

According to Ellen McArthur foundation report (2020), circular economy is a restorative or regenerative system which should be included in all phases of **product life cycle** (Ellen McArthur foundation, 2020). *The system diagram* (Picture 2.) by Ellen MacArthur foundation illustrates the continuous flow of technical and biological materials in value circle. (Ellen MacArthur foundation, 2017a). The principles of CE are designing out waste and pollution by seeing waste as a resource, keeping materials and products in use, as well as regenerating natural systems (Prieto-Sandroval, Jaca and Ormazabal, 2017; Ellen

McArthur foundation, 2020). A *"Cradle-to-cradle"* -model (C2C) is commonly associated to CE since it provides a new perspective for the design of products and services and can act as a conceptual substitute for *"cradle-to-grave"* (C2G) -model linked to linear economy (Drabe & Herstatt, 2016). In C2C strategy, the materials are used in safe, profitable and regenerative way by simultaneously creating value from economic, environmental and social perspective (NL Agency, 2011; Jaeger & Upadhyay, 2020). C2C design does not focus only on product´s features, but also on the reduction of energy and resource consumption in the manufacturing process (Ellen MacArthur, 2017a). However, understanding materials and processes in C2C design, such as how to replace certain components without compromising product characteristics, may be complex and require considerable resources (Drabe & Herstatt, 2016).



Picture 2. Circular Economy model (Ellen MacArthur, 2020).

CE arises often in the literature through three actions, **3R´s principles** meaning *reduction, reuse* and *recycling* which are also straight related to waste hierarchy. The first principle *"reduction"* means minimizing the share of primary energy and raw materials through

new technologies, simplified packaging and more energy-efficient machines (Su, Heshmati, Geng & Yu, 2013). For consumers reduction refers to more economical way of consumption. Second principle *"reuse"* emphasizes the utilization of by-products and waste as a resource for other use, as well as the use of products to the top capacity with maintenance for extending the resistance. (Su et al, 2013). The third principle *"recycling"* involves the reuse of products as resources when they reach the end of their lifecycle by processing the products into materials for new products (Ungerman & Dědková, 2019). Furthermore, Kirchherr et al (2017) have identified a fourth principle *"recover",* which is also adapted as **4R framework** in the literature. Recovering means the transform of waste materials into energy by reduction into gas or incineration (Kirchherr et al, 2017). In addition, there is another perspective of fourth principle, which is *"maintaining"* (Jaeger and Upadhyay, 2020). Maintaining the products in use endlessly would be a desirable solution but it may be challenging in practice, at least with some material types.

The environmental impact of products is usually associated primarily with manufacturing, logistics and service activities. However, the real challenge in minimizing environmental impact is reducing the negative impact throughout the whole value chain, including material selection through production, operation and end-of-life treatment. **Life Cycle Thinking** (LCT) can help to understand better the environmental impacts of a product in different phases of product life cycle (EC-JRC, 2016). LCT is essential in supporting decisions towards sustainable production and consumption patterns and is additionally an essential part of EU environmental policies (Pennington, Wolf, Bersani & Pretato, 2007). Operational mode of LCT is **Life Cycle Assessment** (LCA), which European Commission claims to provide the best framework for evaluating the potential environmental impact of products, since it can evaluate systemically the environmental performance of production and consumption patterns on many different levels (EC-JCR, 2016). In terms of packaging, LCA may focus on raw material supply of all packaging components, manufacturing, distribution and all required transportation processes, the use of packaging, as well as its recycling or disposal after the end user has receive the product (Figure 5.) (Pullman & Sauter, 2012). Environmental impacts of packaging should be taken into

consideration already in the design phase of packaging, since e.g. the dexterity, lightness and easy disposal effect on the environment. The content and context of packaging determine the material choice and amount of material. Packaging produces various types of waste during its life cycle and reliable assessment of the packaging waste requires observation of whole product life cycle (Lindh, Williams, Olsson & Wikström 2016).

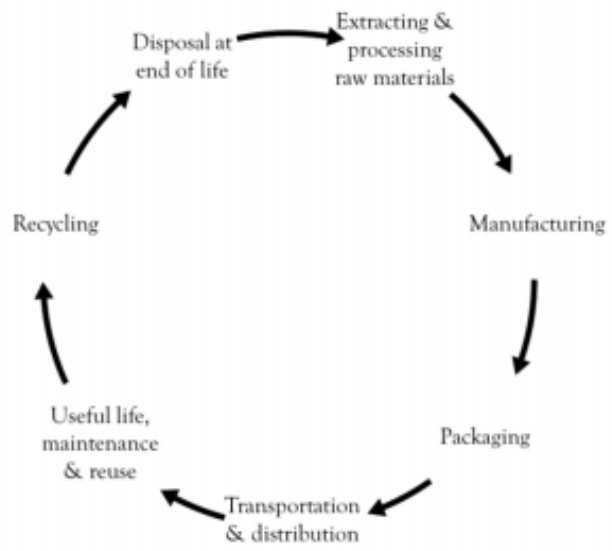


Figure 5. LCA scope. (Pullman & Sauter, 2012: 69.)

The goal of CE is to provide **decoupling**, which means the economic growth that can be reached by using less natural resources and causing less negative impacts on environment. The possibilities of CE vary depending on the *business model*, industry and various other actors but relevant fields for manufacturing industry where circular solutions can be implemented are illustrated in Figure 6. Adopting systemic approach in design process, as well as using the right materials for extended lifetime and optimal recovery of the product, promote circularity and may delivery positive customer outcomes. Circularity requires internal and external cooperation throughout the supply chain in order to create *shared value*. Furthermore, utilizing waste and sourcing recycled and recyclable materials are the keys in reclaiming the materials according to CE. In addition, continuously developing technologies provide considerable potential in helping companies to

optimize and track resource use, as well as maintain and build connections in supply chains e.g. in digital online platforms and technologies.

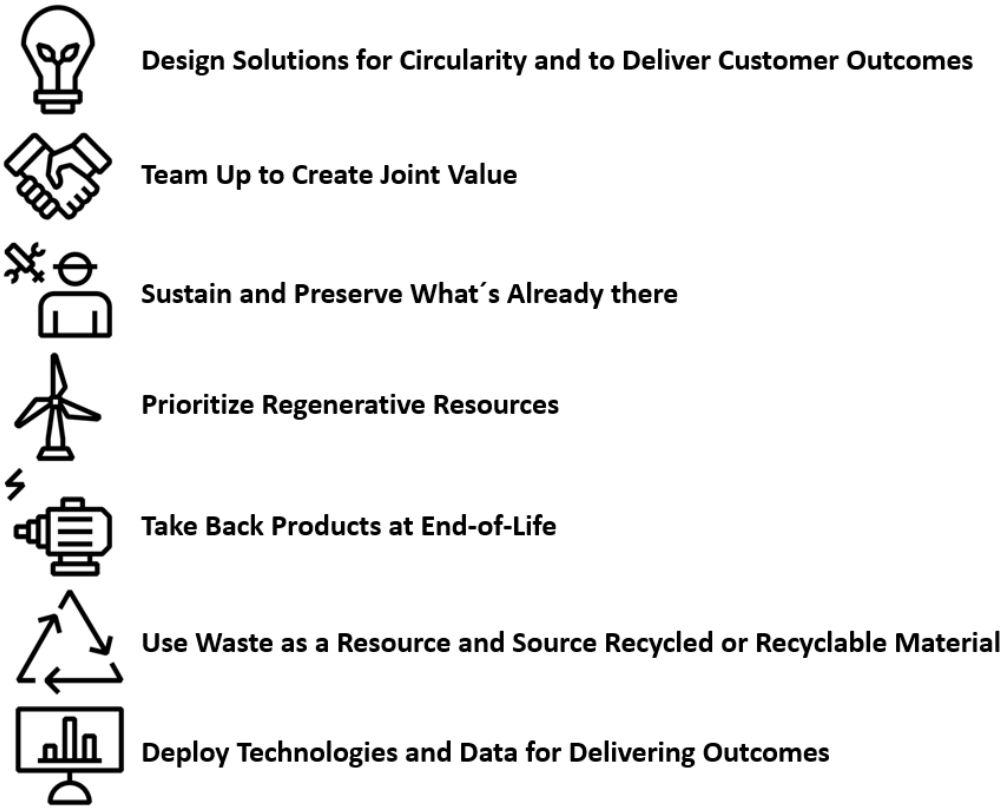


Figure 6. Circular possibilities in manufacturing industry. (Adapted from Circularity Gap Report (2020) & Sitra (2020a))

CE requires collaboration between all value-chain segments and a single industry is not able to achieve circular business model alone. Implementing the circular business model requires a fundamental change through the whole organization, as well as co-evolving capabilities and roles of different stakeholders (Ritzen & Sandström, 2017; Wheeler, et al 2003:4). CE transition require change of mindset in the ecosystem and adaptation of CE in strategy, business model, values, product design and processes (Sitra 2020a). The implementation requires communication, cooperation and coordination within net-works of interdependent and independent stakeholders (Accenture, 2020; Antikainen & Valkokari, 2016). CE may cause challenges for *B2B* cooperation in MNCs due to the delays and large transaction costs in international negotiations, as well as the requirements for

companies to adjust their daily operations (Preston, 2012). According to Gupta et al. (2019), all stakeholders in the ecosystem need to determine common goals and interests that drive making collective strategic actions (Gupta et al, 2019: 3). MNCs need also to make sure that the global suppliers invest on reuse and remanufacturing, in addition to incentives for more sustainable material use, durability and reparability (Preston 2012; Jaeger & Upadhyay, 2020). Furthermore, in businesses with linear model, historical data can be utilized for planning and predicting the future, but in circular business models there is limited value of relevancy with previous data (Lahti et al, 2018). In addition to networks and supply chains, the upper management needs to get familiar with significance and urgency of CE implementation. According to Lahti et al. (2018), top manager´s creativity, commitment and capacity are fundamental factors in the shift towards circular business models, since structural alignment decisions are mostly made by top management (Lahti et al, 2018).

Although CE has diverse opportunities, the practical implementation may have considerable challenges. In manufacturing industry, shift to circular economy requires redesign of products suitable for remanufacturing, which does not necessarily serve the purpose of optimization of the manufacturing process (De los Rios & Charnley, 2016). For example, products may be designed for agile assembly without considering disassembly. (Lahti et al, 2018). In addition, recovering increasingly complex products may be challenging and recycling materials may be more expensive than new raw materials. According to Jaeger and Upadhyay (2020) the high start-up costs are also one of the main barriers of CE. In addition, the certainty of high quality of recycled material is seen unreliable and the networks do not want necessarily to prioritize environmental aspects over performance quality (Jaeger & Upadhyay, 2020). MNCs also face a range of technological challenges and cultural barriers and for manufacturing industry it is vital to anticipate these challenges in order to take appropriate action (Jaeger & Upadhyay, 2020). Furthermore, CE loops require various building blocks, such as material flows, infrastructure, for handling the material flows, technology evolution and economics associated with these factors, which all involve some uncertainties (Accenture, 2020). All of these challenges consider

also the packaging material, since innovating new use for packaging waste or building a system for circulating packaging require considerable actions from different partners in value chain. Moreover, although these challenges concern all types of companies changing to circular business model, the challenges are especially significant in MNCs which outsource or have production facilities abroad.

3.2 Global competitive advantage with resource-based view

MNCs have clearly become increasingly aware of the need to provide more sustainable and socially responsible actions by simultaneously gaining competitive advantage. Achieving sustainability requires societal transformation, including institutional, cultural, organizational and technological change and thus transformation process, system innovation for sustainability, may still be seen complex and time-consuming process (Halati & He, 2018; Gaziulusoy et al, 2012). MNCs receive increasing external pressure for sustainability, yet the economic viability of being green can also be a reason why companies adopt sustainable business practices. Therefore, the **resource-based view** (RBV) is often used in research related to environmental business practices. The aim of RBV is to learn to control, integrate and utilize effectively the resource base of the company and thus gain **competitive advantage** (Hitt, Ireland & Hoskisson, 2001: 105; Barney, 1991). In RBV all MNCs need to focus on protecting the existing resources and simultaneously gain new, complementary resources which help in reaching the strategic goals (Hitt et al, 2001). Resources themselves do not necessarily ensure the advantage but combining the resources and utilizing them cogently enable the competitive edge. Thus, CE offers a whole new scale of opportunities for gaining competitive advantage. CE enables possibility to save considerable amount of existing resources and also to create new resources from new innovations and e.g. utilizing the production side flows.

According to Barney (1991), resources consider the capital, competence, processes and all characteristics that enable effective planning and implementation for business (Barney, 1991: 101). In RBV, sustainable competitive advantage is primarily built on the company resources, which can be intangible, tangible or human resources. There are parallel

theories, whereas some scholars combine capabilities and resources and other scholars discuss the concepts separately. For example, Grant (1991) claims that resources are the basis for production processes, as well as basic units for analysing and capabilities are the capacity to perform tasks (Grant, 1991). Nevertheless, one of the most common perspectives is Barney´s (1991) theory where resources and capabilities are combined. According to this theory the resources are divided to physical resources, human capital resources and organizational capital resources (Figure 7.) (Barney, 1991).

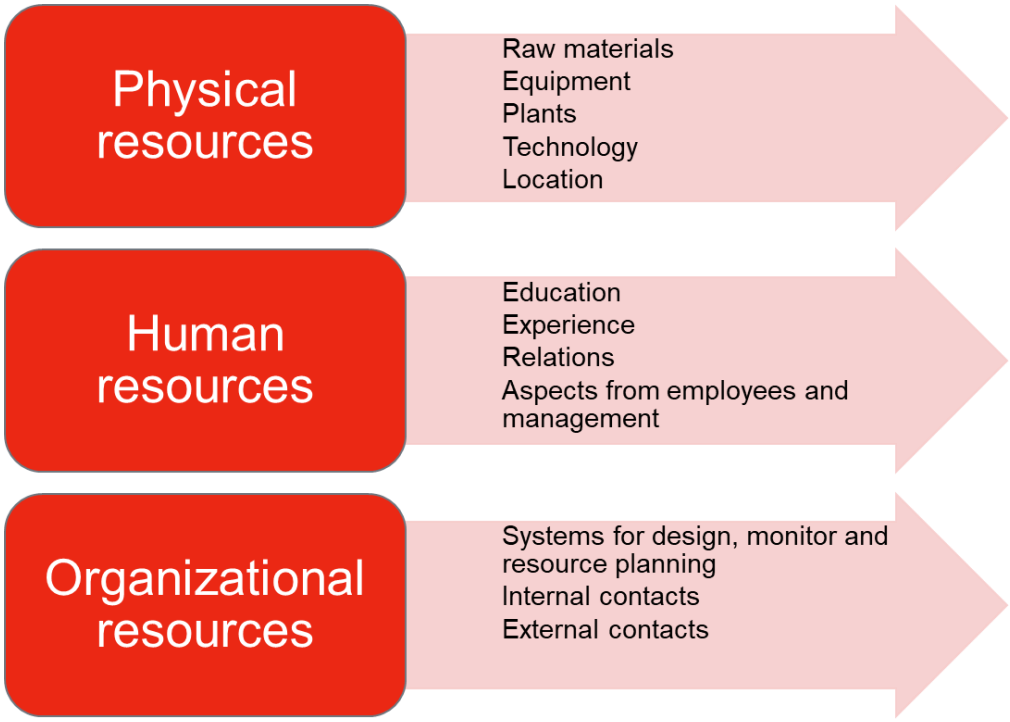


Figure 7. RBV company resources. (Adapted from Barney, 1991).

The aim of RBV in research is to identify the source of competitive advantage in differences and capacity of company resources (Na & Kang, 2018). Implementing CE model within an organization would impact on resources regarding all resource categories. For instance, finding new use for waste in or production side flows may be used as new sources of raw material. New circular systems and processes would also require new equipment or technologies, which could be utilized for processing the materials (Su, Heshmati, Geng & Yu, 2013). In addition, the impact of successful circular business model implementation to organization would be significant also related to human

resources. For example, changing the employees´ and managers´ mindsets would require e.g. comprehensive training for gaining knowledge, changed procedures and even new job positions within the organization (Sitra, 2020a). Moreover, organizational resources would change significantly due to the structural change of global value chains and new network partners in circular business model system (Gupta et al, 2019; Bocken et al, 2016).

Competence, education and continuous learning are essential enablers for CE. Finding solutions for slowing global warming, technology development and circular business models require innovation, competence and new skills. **Core competences** are capabilities that are the source of competitive advantage. Developing the core competences is integrative process where the organization learns to use the resources and competences in an effective way by gaining competitive advantage (Hitt et al, 2001: 113). Innovating new CE solutions require the adaptation of the concept within the organization and genuine willingness to develop new core competences throughout the organization. Differentiation from competitors is the only way to get head start. According to Barney (1991), the core of gaining competitive advantage in RBV is to create strong, unique resources which the competitors are not able to provide. The distinctive value in differentiation increases also the customer loyalty (Na & Kang, 2018). Since circular solutions for saving or gaining new resources is still highly underutilized in global manufacturing industry, there is a big potential differentiation in terms of CE. Although in process of time the competitors would also innovate new solutions for extending the product life cycle or saving resources, the MNCs are still singular and currently the room for new circular innovations is considerable. Additionally, developing core competences through differentiation may increase economic profit and added value for the customer(Na & Kang, 2018). Nevertheless, there are certain challenges in global business context. For instance, location, currencies, taxation, lack of knowledge, weak networks and various other factors may hinder significantly gaining competitive advantage. In addition, the ability to adapt and react to changes in market environment in real time requires continuous change and development, which may be complex in global market area. (Barney, 1991)

3.3 Creating value in global value chains

Globalization is causing a structural change in the modern world. The increasing interdependence between countries is uniting and standardizing the conditions and factors of development in individual countries (Glushkova, Lomakina & Sakulyeva, 2019). The growth of globalization has affected to supply chains of businesses that have expanded considerably into international locations in the last decades and increased the academic and practical interest in global supply chain management. (Sroufe & Melnyk, 2017). MNCs receive significant pressure to rethink, restructure and redesign how and where their products are produced, inputs are sourced, and customer needs and demands are fulfilled (Cohen & Lee, 2020).

Value chain provides systematic approach for examining how activities contribute to customer value and company competitiveness (Porter, 1985). Value chain is not exactly the same as supply chain, although the concepts are closely related together. In value chains the aim is to create value throughout the chain and to the consumer, whereas in traditional supply chain management, the focus is more on cost reduction and efficiency throughout the chain (Wahl & Bull, 2014: 586). The value chains of companies have changed increasingly more global in the past decades and the company activities are relocated across geographical and organizational limits. **Global value chains** (GVSs) consist of different stages of production process in different geographical locations around the world. Usually the GVCs are formed by large focal companies that distribute across various countries and locate facilities for production abroad or use outsourcing (Cohen & Lee, 2020; Koberg & Longoni, 2019). At industry level, GVCs demonstrate the input-output systems of commodity chains that create value (Gereffi et al, 2005).

Relocating organizational activities to new foreign locations increases complexity and coordination challenges for MNCs when coordination is done in international networks across cultures and various institutional systems (Pedersen et al, 2017; Kumar et al, 2009). De Marchi (2021) claims that the production fragmentation and integrated trade in long value chains pose one key challenge of CE (De Marchi, 2021). According to

Hofstetter (2021), CE requires new way of thinking how resources can move in different cycles and what is the role of different stakeholders in value chain. (Hofstetter, 2021). Furthermore, various governmental policies impact on local processes and trade across the country borders and the distance between suppliers and buyers pose challenges in managing sustainability. (Cohen & Lee, 2020). The frequent evaluation of environmental and social outcomes needs to be done in production site but assessment and auditing may be challenging due to long geographical distances and usually the focal companies do not have the visibility to any other suppliers than the first tier of suppliers (Koberg & Longoni, 2019). Moreover, cultural elements and values may cause differing expectations regarding sustainability which is considerable challenge for focal companies (De Marchi, 2021).

GVCs are closely related to CE which offers new opportunities for value-creation and CE transition would require a complete restructure of global value chain. The whole idea of CE is to find new way to create value by designing for durability, reuse, recycling and remanufacturing and keep resources circulating in the economy (Ellen MacArthur Foundation, 2019). The GVCs concern also packaging material since typically in MNCs considerable amount of packaging material is produced and transported between the countries by forming its own value chain. The use and type of packaging materials may be different in GVCs due to e.g. differing transportation modes and conditions and setting certain requirements for packaging material is more complex when the suppliers are located in different countries. Additionally, the quality, type and amount of packaging material received from suppliers in more unmanageable when the partners are following local procedures and do not identify the role of packaging in GVC. This may cause also issues if the received packaging is not for instance recyclable or reusable and material needs to be disposed by losing its value.

Business model of a company is the core of circular economy implementation and also determines how a company creates, delivers and captures value (Osterwalder, Pigneur & Tucci, 2005; Antikainen & Valkokari, 2016). It includes the customer value proposition,

pricing mechanisms, organization, as well as supply chain structure (Lahti et al, 2018). Circular business models are designed to create, deliver and capture value with ideal state of resource usage. Based on this, the goal of business model is to make profits through the flow of materials, resources and products over time, instead of selling products (Lahti et al, 2018). Circular Economy business models can improve resource utilization, facilitate to meet better customer expectations and deliver customer outcomes, enable new levels of efficiency and outcome-oriented solutions, as well as mitigate risk for pressure from investors and society (Sitra, 2020a). According to Sitra, CE is the solution for meeting the customer expectations and deliver customer outcomes, developing progressive solutions through digitalization and technology, as well as for improving resource utilization (Sitra, 2020a). According to Bocken et al (2016) engagement with end customers and other stakeholders, e.g. collaboration with local governmental organizations for improving integration into community, may be an efficient way to understand how to create value for broader set of stakeholders (Bocken et al, 2016).

CE provides an opportunity to turn inefficiencies of linear value chains into business value, by looking beyond production waste and focusing on unexploited capacities, untimely product lives, unsustainable materials and untapped customer engagements (Sitra, 2020a; Lahti et al, 2018). For example, in recycling the value is added by upcycling where the material does not lose its value. The upcycling can be compared to linear model´s downcycling which uses the non-renewable secondary materials and thus provides lower material value. Furthermore, reorganized production and consumption processes in CE models provide new sources of value. The value can be related to developments in product design, sales, management of operations, as well as new technologies and materials (Hofstetter, 2021). According to Stahel (2008) and *performance economy* perspective, the optimization of time is also essential for creating value. The objective is to create the best possible use value for the longest possible time by consuming as little energy and resources as possible (Stahel, 2008: 128). In performance economy, value is typically created through a service and maintenance, which extend the product life cycle and save more resources than producing new products. Additionally, the stakeholders

within GVC ecosystem may provide additional value by utilizing the competence, technology, side flows or services of each other.

From economic value perspective, World Economic Forum (2020) claims that circular business model that promotes the elimination of waste and safe resource use, offers an opportunity up to 4,5$ trillion in economic benefits by 2030 (World Economic Forum, 2020). In addition to economic value, the aim of CE is to provide value for customer by creating sustainable customer-centric solutions with new technologies (Sitra, 2020a). Creating value requires decisions where potential value for customer is first identified and then implemented into action and real value. With CE the value creation changes and instead of separating manufacturing and services, customers expect value co-creation, sustainable operations and connectivity with new solutions (Jaeger & Upadhyay, 2020). Furthermore, there is clearly an increased interest from investors and companies towards Corporate Social Responsibility (CSR) and ESG (Environment, Society and Government) matters, which may be one of the most fundamental KPI indicators in future business life.

4 Circular Economy and managing packaging material waste

CE has a crucial role in waste management since it emphasizes recycling of energy and materials, by turning them into other valuable resources (Paes et al, 2019). According to Pålsson, Finnsgård and Wänström (2012), packaging is closely related to marketing, manufacturing, logistics and information systems and thus affects the whole supply chain. (Pålsson, Finnsgård and Wänström, 2012). Packaging is part of a bigger ecosystem which consists of various stakeholders involved in different services or segments. In addition to packaging provider, the packaging ecosystem includes the customers, waste collectors, incineration plants where waste is processed, the government and regulations, as well as employees who make the strategic decisions. In this chapter, the purpose of packaging material, as well as waste management and resource processing in manufacturing industry are described in more detail. The chosen method to manage the waste and resources depend on the material type and source of waste. However, the scope in this study is especially the industrial packaging material including wood, corrugated cardboard and plastic.

4.1 Packaging material in manufacturing industry

In the context of this study, manufacturing industry means the industries that produce products from raw materials and components by using manual labour or machinery, by also utilizing digital instruments that facilitate the production process. Manufacturing industry is vital for world´s economy and essential to sustainable economic growth, but in manufacturing industries the change is also costly and slow (Liedr & Rashid, 2016; Jaeger & Upadhyay, 2020). For instance, changing the production processes according to CE principles would require throughout research and examination, significant financial investments, renewed internal and external processes, new supply chain networks, new working methods and other changes, which are not simple to implement in practice (Sitra, 2020a).

Packaging material has various definitions but according to Radu et al. (2020) two types of packaging material exist: *permanen*t and *non-permanent.* Permanent material can be reused or recycled repeatedly by keeping the features of material during the use. Unlike permanent materials, the properties are of non-permanent materials are modified during the use and the recycling process. (Radu et al, 2020). The choice of packaging system effects on economy and the environment throughout the whole life cycle of a product (Pålsson et al, 2012). Therefore, it is essential to understand the environmental impacts caused in all stages of lifecycle of packaging, including production, handling and disposal or recycling. There is a considerable potential for time and cost savings if the packaging system is adjusted to assembly lines or dispatch departments where material and assembly systems is integrated physically (Pålsson et al, 2012). Cost savings can also come for example from lighter packaging which has lower transportation costs, from more protective packaging which reduce damage or more compact packaging which helps to optimize the space use in warehousing and transportation. In addition, optimized packaging with minimal packaging material would save considerably resources.

Packaging has several integral functionalities throughout the whole supply chain and any material used to protect, contain, handle, present or deliver goods can be considered as a packaging. According to CNE (2014), packaging conserves and protects the product from external constraints, as well as preserves the environment from the product inside. Additionally, packaging provides general and legal information which facilitates handling, storing and transporting the product, such as various package markings, e.g. logo, content, brand, bar-code, weight, quantity and handling instructions. (CNE, 2014) Furthermore, Pålsson et al. (2012) determine six main functions for packaging: *containment, protection, apportionment, unitization, convenience* and *communication*, which all should be considered from a systems perspective (Pålsson et al, 2012: 290). The packaging can also be divided in three types. Packaging that contacts the product directly is called *primary packaging*. If packaging comprises several primary packages, it is considered as *secondary packaging*, and a pallet or other type of packaging where several primary and secondary packages are assembled is called *tertiary packaging*. (Pålsson et al,

2012). The appearance and material of packaging differs between consumer products and industrial goods, since the functionalities in consumer products focus mainly on the brand image, user experience and visual appearance (CNE, 2014). Since the scope of this study is industrial packaging material, packaging for consumer products are excluded.

The role of CE in packaging material is much more than just a recycling, although packaging circularity it is vital in ensuring good recycling of packaging waste and that packaging does not end up to landfill or to the environment (Radu et al, 2020). CE is involved to all stages of product lifecycle, including design, production, distribution, and use, as well as the recovery. In CE the resources are used economically, packaging and product waste are prevented, recyclability is improved, and materials are reused for optimizing the material flows. The legislation of EU includes recycling targets for different types of waste where all categories have a significant potential to increase the material collected for recycling, but technical, economic and social issues may hinder moving towards more ambitious levels. According to Radu et al (2020), following strategic objectives regarding packaging material are relevant in terms of CE: packaging material recycling rates should be grown, sustainable packaging solutions should be developed further and decoupling of packaging waste quantities from economic growth should be increased (Radu et al, 2020). Although all of these actions are important, the ultimate goal from RBV is to reduce the material as much as possible by optimizing the resource use.

In terms of reducing environmental impact of packaging, the focus is usually on recycling and material use minimization, and packaging is not seen as a complete system of packaging features (Lindh, Olsson & Williams 2016). Most environmental-friendly packaging solution would be a packaging which is not needed at all. However, usually the packaging is needed, and the most realistic sustainable solution is a packaging, which can be utilized in the distribution process without further processing. New technical innovations for packaging require a deep cooperation with all parties in the distribution supply chain. (Inkiläinen, 2009). Furthermore, there are couple of essential things which company should take into consideration when choosing a packaging material. First, the packaging

needs to be tested and fulfil certain standards. Secondly, the packaging should be compared to optional packaging materials in order to make sure that the best possible material is chosen. Thirdly, the reusability of packaging should be investigated and lastly the company should make sure that produced waste is the lowest possible. (Logistiikan maailma, 2021).

Corrugated cardboard packaging

Corrugated cardboard is customizable and cost-effective packaging material, made from multiple layers of arched paper and one of the most common-used packaging materials in various industries. The most typical corrugated cardboard is composed of three sheet layers, including the inner cover, the core and the outer cover (Ferreira, Camargo & Araujo, 2020). The difference with regular cardboard is that regular cardboard carton is made only from a single sheet and used rather for consumer products than protect heavy objects until it is received by the end-customer. Corrugated cardboard packaging works as a cushion for products and keeps the item safe during handling, shipping and transportation. It has several functional benefits: it is light-weighted, has good sealing performance, has certain anti-vibration ability and is easy to assemble and disassemble (Chen, Zhang & Sun, 2011). However, ensuring appropriate strength of packaging requires various of tests which determine a construction of the box and behaviour of material in different circumstances (Garbowski, Gajewski & Grabski, 2021). For instance, bending, compressive or bursting strength tests, as well as humidity tests are commonly implemented tests in packaging industry.

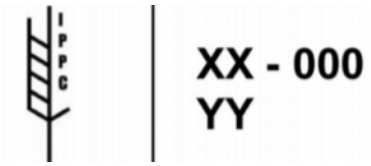
Corrugated cardboard stands out in reusable and recyclable packaging material context, since it reduces costs, is complimentary with environmental laws, optimizes the space usage and does not risk health or products (Ferreira et al, 2020). In terms of waste treatment, corrugated packaging is easy to recover and thus can be considered as sustainable packaging material. EU´s recycling target for paper and cardboard packaging waste is 85% by 2030, which is not impossible target, since it is actually already reached. According to Logistiikan Maailma (2021) already now over 85% of fiber waste, e.g. corrugated

cardboard, liquid packaging board and carton is recycled (Logistiikan Maailma, 2021). In order to reduce the amount of packaging material the corrugated cardboard packaging should be designed by following the reducing principle, meaning optimal combination of raw materials and overall design of packaging, as well as the cost control (Chen et al, 2011).

Wood

Significant share of global shipping is supported, protected or carried by wood packaging, including manufacturing industry, which utilizes various types of wood and plywood packaging solutions. Typical wood packages are e.g. pallets, cushions, frames and reels. According to Deviatkin, Khan, Ernst & Horttanainen (2019), increasing global trade have made especially the role of wooden pallets significant, since pallets are used for most of the international transportations, at least with industrial material (Deviatkin, Khan, Ernst & Horttanainen, 2019). Pallets can be considered as diverse handling equipment, used as a base for assembling, handling, loading, storing, stacking, transporting, or viewing goods or cargo (Chen et al, 2011). Pallets can be made of various materials, in various forms and dimensions. Currently, producers consider almost all wooden pallets as reusable several times (Logistiikan Maailma, 2021; CNE, 2014). However, this often requires standardized pallets which are designed to last for several trips. The management of wooden pallet waste depends on the pallet management strategy, which can be e.g. single- use, buy/sell or pooled (Deviakin et al, 2019).

The EU has certain *phytosanitary requirements* for wood packaging entering the EU. The wood packaging material coming from third countries, excluding Switzerland, need to be made of debarked wood, go through one of the approved phytosanitary treatments, as well as be officially marked with *ISPM15 mark*. The ISPM15 mark (Picture 3.) consists of 3 codes, including country, producer as well as measure, and it allows easy verification for wood, since it is universally recognized and non-language specific. These requirements do not apply to plywood or other fully processed wood or wood packaging material traded within the EU. (EC, 2018b.)



Picture 3. ISPM15 mark for wood packaging material. (EC, 2018b)

Plastics

Plastics are synthetic or semi-synthetic materials made from raw materials such as oil, cellulose, natural gas, coal and salt (PlasticsEurope, 2021). Plastics can be divided roughly to three categories: commodity plastics, technical plastics and special plastics. Plastics can also be classified to thermosetting plastics and thermoplastics. (FIPIF, 2021). Plastics is commonly used packaging material due to its thermal and mechanical features and several benefits. For instance, it protects the products well, since it functions as a thermal insulator which is also resistant against corrosion and humidity (Horodytska et al, 2018). According to PlasticsEurope, plastic is ideal as packaging material due to its combination flexibility, lightness, durability, ease of sterilization, as well as other beneficial features for packaging (PlasticsEurope, 2021). From economic perspective, plastic packaging is beneficial choice, since its light weight may reduce transportation costs and the plastic is also adequate inexpensive material (Matthews, Moran & Jaiswal, 2021). However, significant economic value is wasted since plastic is single-used material with low level of recycling.

Plastics have received a lot of attention in global environmental discussion due to its significant negative impacts on ecosystem, human health and environment. According to EC (2019), growing use of plastic which is not designed for reuse or recycling, increases the inefficiency and linear model in production and consumption (EC, 2019c). EU has set a directive for *single-use plastic*, which includes also many types of plastic packaging. Additionally, EU has started actions for banning *oxo-degradable plastic*, which are plastics that lead to splitting the material into micro-fragments or to chemical decomposition (EC, 2019c). The usage process of plastic as a packaging material is very short causing

considerable demand for collecting and recycling. Almost all plastics require fossil fuels and none of the polymers is entirely biodegradable nor recyclable (Mahalik & Nambiar, 2010). Furthermore, plastic´s breakage to macroplastics and microplastics is one of the main issues of plastics, since it is extremely difficult to collect from nature and it can cause significant harm, especially for oceans and animals.

4.2 Waste Management in manufacturing industry

According to World Bank 2019 report, at global level approximately 37% of waste is disposed in landfill, 33% is dumped openly, 19% is recycled or composted and 11% is incinerated (World Bank Group, 2019). Increasing **waste generation** is a real challenge and finding the root causes how waste generation is linked to consumption and production requires more focused strategy (Singh, Laurenti, Sinha & Frostell, 2014). Adequate waste management is critical in contributing to sustainable development and CE and there is a certain need for systematic approach to assess the emissions caused in waste treatment processes (Fan, Klemes & Chin, 2019). Waste issue is often associated first to its environmental impact, but the economic and social factors of waste are also considerable. The increasing demand of packaging waste indicates that waste flow over human health and environment caused by inappropriate disposal methods and technologies is an actual issue (Radu et al, 2020). The European Green Deal remarks that if waste cannot be avoided, its economic value must be recovered and its negative impact on the environment avoided or minimized and this requires a new legislation, which includes targets and measures for giving up over-packaging and waste generation. (EC, 2019a; Kumar, 2020). According to Pires and Martinho (2019) waste management is the way to achieve the best overall environmental outcome and get materials back to the economy (Pires & Martinho, 2019).

EU defines the waste management as the collection, transport, recovery and disposal of waste, comprising the supervision of these operations. (Council directive 2008/98/EC). The aim of waste management is to prevent the danger caused by waste, harm for health and safety, as well as reduce the amount and hazardousness of waste. Additionally,

waste management is closely linked to CE, but understanding the interconnection requires the understanding what waste is and what is the ultimate purpose of waste management. Waste can be defined in various ways, but EC sees waste *"as any substance of object which the holder discards or intends to or is required to discard"* (Commission Directive 2008/98/EC). The EC confirms that waste prevention should be the primary option of waste management. (Commission Directive 2008/98/EC) According to OECD (2003) all materials that are not prime products, have no further use in production, transformation or consumption and are disposed, can be considered as a **waste**. Singh et al (2014) describe waste as residue, by-products or end products which come in production processes and consumption (Singh et al, 2014). According to the European Commission, in order to reduce the environmental impacts of waste generation, measures of waste prevention need to be strengthen and further approach that takes the whole life-cycle of products into consideration needs to be adapted (2008/98/EC). The relative benefit of waste prevention for businesses is that unlike recycling, it eliminates time and effort spent on transportation, handling, and sorting the material which will be discarded. In CE, waste incineration and landfill need to be avoided to the last while recycling and reuse are the backbone of the economy. (Ewjik & Stegemann, 2014).

The responsibility of packaging waste management is generally on industry and local governments, although the company would be globally operating MNC. Actors responsible of waste management receive considerable pressure to follow the waste hierarchy but in fact, waste managers are not able to influence on waste prevention almost at all, except for the collection of waste. (Ewjik & Stegemann, 2014). Nevertheless, companies and organizations generating the waste are responsible of waste management process, which consists of various phases. Firstly, companies need to be aware of the amount of generated waste and how it is treated, which requires throughout monitoring and support from certain experts. Sorting and collecting of waste need also to be facilitated with adequate waste containers with clear markings, taking the special requirements for *hazardous waste* into consideration. The waste also needs appropriate places for warehousing and pick up, as well as adequate preparation for transportation, including required

documents, packaging and markings. Adequate recycling enables various benefits for companies, such as reduced waste management costs, better competitive advantage, meeting up better the customer expectations, as well as better possibility to follow the official regulations. Additionally, effective waste management may save considerable resources and secondary resources can fulfil the purpose of raw material partly or completely. High-quality sorting of waste material can produce free raw material which can be utilized in the internal processes or sold outside.

Recycling is the most widespread strategy to achieve CE and a critical part of waste management due to its several environmental benefits, such as greenhouse gas reduction, as well as energy and material savings (World Bank Group, 2019). Recycling can be defined as recovery operation where end-of-life waste is reprocessed into materials, products or substances for original or other use (2008/98/EC). The value chain of recycling starts with the separate collection of waste materials for a single group of waste materials and recycling can be divided in two different categories; material recycling, which means reprocessing the original material, and other forms of recycling, containing the reprocessing other purposes (EC, 2017). Although recycling is critical in minimizing waste, recycling rate alone is not adequate measure for overall quality, sustainability and efficiency of waste management. (Pires & Martinho, 2019). In addition, recycling does not always lead to effective decrease of material use. For example, high energy requirements and low quality of secondary material can end in increased demand of virgin material or even drive the production of new products with lower quality and price. (Haas, Krausmann, Wiefenhofer & Heinz, 2015). Therefore, applicable CE strategy should be considered based on both, specific improvements and measures, as well as contributions to closing material loops and ecological material cycles. (Haas, Krausmann, Wiefenhofer & Heinz, 2015).

EU Member States are obligated to *report* annually the amount and recycling rates of produced waste and reporting should be precise and comprehensive in order to ensure that the assessment for reaching targets is reliable. However, currently the compilation

of statistics on waste differ between the Member States and reliable comparison of recycling rates are not possible, since in many countries the data is collected straight from producers and is counterpointed from other sources. (Jokinen, Paavola, Tanskanen, 2015). Therefore, *Integrated Reporting Council* has started a project, which aims to increase the coherence, conformity and generalization of reporting frameworks, standards and demands. (Sitra, 2020a). Reporting should be executed according to *Global Reporting Initiative* (GRI) -standards, which are global rules for consistent and credible sustainability reporting, enabling better transparency and accountability (GRI, 2021). According to European Commission, reliable reporting and data of waste management is critical for efficient implementation and ensuring that the data is comparable between the Member States. Thus, reporting the packaging waste quantities requires the use of most recent EU rules and methodologies of respective national competent authorities. (94/62/EC: 24).

Companies' and organizations' obligation to handle the waste of manufactured or imported products when the products are disposed is an essential part of **producer responsibility**. Additionally, all economic operators setting packaging on the markets, are responsible of the waste management and recovery. However, the responsibility of disposing packaging material waste is usually on end user of the product. EU laws and regulations direct how each material must be disposed but the manufacturer cannot always affect in the way the waste is managed after the product has been received. This pose a significant issue, since for recycling of certain materials, such as wood, is expensive which leads inadequate disposal of packaging material. Therefore, close cooperation and monitoring of the treatment of packaging material waste, as well as tighter legislation concerning the whole EU is mandatory. Fortunately, the Circular Economy Package and other recent targets of EU pressurise the countries, companies, organizations, consumers and other actors to take more responsibility and start thinking sustainability beyond self-interest.

5 Research methodology

The research methodology is described in this chapter. Whereas the first chapter of this study introduces the research limitations, objectives and research question, this chapter provides more detailed definition of how the empirical part of the study is conducted. First, the case company and the significance of this study in the context of company is introduced. After this, the chosen research design and strategy are elaborated and data collection, as well as data analysis procedures are explained. Furthermore, the validity and reliability regarding the thesis are justified.

5.1 Case company

Case company is a global technology leader which manufactures diverse products and solutions for various applications and industries by employing over 100 000 people in over 100 countries. The case company is divided to four divisions which focus on *robotics and automation, process automation, motion* and *electrification*. It has promised to adapt sustainability in all operations and focus especially on reducing carbon emissions, promoting social progress and saving natural resources, by also contributing to SDGs of United Nations. The sustainability targets will be achieved by reduced energy consumption and increasing energy-efficiency, circular economy solutions by valuing durability, reusability and recyclability, as well as ensuring healthy and safe working environment for diverse people. In terms of circular economy, the company has promised to focus on greater eco-design, sustainable material use and better material efficiency. The company has also engaged to prevent waste generation, extend the lifecycle of products by new digital solutions, as well as develop different circular solutions for material recycle, such as taking back the end-of-life products.

This study is conducted for a business unit which manufactures energy-efficient low voltage motors in all different industries and applications globally. The most suitable packaging materials for the motors are corrugated cardboard, which increases the product durability. The second most used packaging material is wood, which is utilized in pallets

and sea freight packaging to protect products better in challenging transportation circumstances. This thesis focuses on identifying and determining all demands and effects of circular economy regarding the packaging material, by not focusing on a particular function, but rather approaching the phenomenon from a perspective which can be utilized in the whole supply chain network. Although the study focuses on the case company, the phenomenon is contemplated from various perspectives with interviews of stakeholders who work in different organisations and have extensive knowledge about the topic. This enables the possibility to apply the findings in different contexts and makes the study beneficial also for larger audience.

As introduced in theory review of this study, the case company operates in technology industry and is obligated to follow various demands, laws and regulations related to CE, waste management as well as sustainable consumption and production. In addition, several EU targets and demands guide the use of packaging material in the industry. Furthermore, the increasing demands from customers and other stakeholders cause pressure for more responsible material use which can be seen as e.g. requirements for the company to provide annual reports of the amounts of each type of despatched packaging material to each country. The current stage of reporting seems to be unreliable and the informed amounts are based on estimations instead of reliable data based on systematic monitoring. In order to develop this process, the demands for packaging material consumption, as well as challenges and root causes for current issues need to be identified. In addition, the interconnection between CE and generating packaging material waste need to be identified in order to understand the consequences of neglected responsibilities. Currently, CE as a concept have gained attention primarily in departments which are responsible of **HSE** (health, safety and environment) -issues, not throughout the company. Therefore, the goal of this study is to examine from larger perspective how CE affects to packaging material consumption and identify factors which need to be improved in order to implement circular solutions and shift towards CE.

5.2 Research strategy and design

The chosen research method in this study is *qualitative research,* which is suitable method for a study which focuses on small sample and non-numeric data. Since the study is conducted for a case company, it can be considered as a *case study.* Case study seeks evidence from different sources to single or multiple cases and offers a novel way to understand the phenomenon by defining, analysing and providing a solution for it in a specific context (Gillham 2010; Kananen, 2017). In qualitative case study, the theory can support to make interpretations from the gathered data or by contrast it can be the target if the aim is to create new theory or develop an existing one (Gillham, 2010). In this particular case study, qualitative method enables e.g. to view the study case from the perspective of people involved and receive the informal reality which is possible to be conceived form the inside.

Induction can be defined as a general approach that draws conclusions from observations and findings, whereas *deduction* is built on theory review and existing literature sources. (Eriksson & Kovalainen, 2008). The chosen approach in this study is an *abduction*, which means the combination of deductive and inductive approach. In abductive study, the analysis of the gathered data is not based straight to the theory, but there is a clear connection. In abductive approach explanations or confirmations for interpretations based on data are searched from the theory. Qualitative method is chosen to this study since unlike quantitative research methods, qualitative methods are not limited to a standardized methods or predetermined answer categories and thus may provide deeper understanding for the researcher. (Patton, 1990)

Research design can be defined as *"the general plan of how research question(s) will be answered"* (Saunders, Lewis & Thornhill, 2009). The research question of this thesis is "*How circular economy trend impacts on consumption and waste management of industrial packaging material inside the European Union?"*, and the purpose is to find an answer to this question with case study research design. The aim of case study is to focus on particular issue or phenomenon in a specific context or environment by using various

sources of evidence (Saunders et al, 2009). Case studies may provide detailed information, which can be utilized in larger context, by analysing one case or several linked cases (Hirsjärvi, Remes, Sajavaara, 2007). Although the results of case study should be possible to be utilized in broader context, the aim of this study is only to recognize elements of investigated phenomenon. The elements should be observable from general perspective, but the aim is not to make generalizations in its statistical meaning. Generally, the case study considers a phenomenon of a real life and tries to find answers to *"what", "why"* and *"how"* questions. (Saunders et al, 2009; Yin, 1994). The phenomenon in this study is demands and impacts of CE to industrial packaging material consumption in manufacturing industry. In addition, the goal is to find answers to the research objectives, which clarify the background of industry´s obligation to CE in EU, examining the role of CE in industrial packaging material consumption, examining the possibilities and challenges of CE, find out the role of waste management in CE and manufacturing industry, as well as clarify the role of monitoring and reporting in packaging material consumption. The theory review supports strongly these objectives and provide answers to some of the issues, but the aim of empirical research is to provide more comprehensive and practical understanding. Although the aim of case study is to study a single or multiple individual cases, it can be reflected also in larger perspective and provide results which can be utilized in more comprehensive examination or further action.

5.3 Data collection and analysis

The data in case studies is usually collected via *observations* or *interviews* (Hirsjärvi et al, 2007). The data collection in this research was implemented with two distinct methods. *Semi-structured interviews* from chosen experts in the field of this study provide the *primary data.* Semi-structured interview is a method where themes and possible questions are predetermined but the order of themes and questions may change during the interview, depending on the interviewee. (Saunders & Lewis, 2018). According to Gillham, semi-structured interviews are the best possible interviewing form in a case study research (Gillham, 2010). Discussion about undetermined questions may provide more details of the topic and discussion about areas that are not considered in the study but may

turn out to be vital for getting in-depth understanding of the topic. (Saunders et al, 2009). In addition to primary data, *secondary data* was gathered in this research through *observation* inside the company, as well as through internal web pages and other data sources in order to gather more comprehensive understanding of the topic and help the researcher to limit the scope before actual writing. The structure of the study is presented in Figure 8.

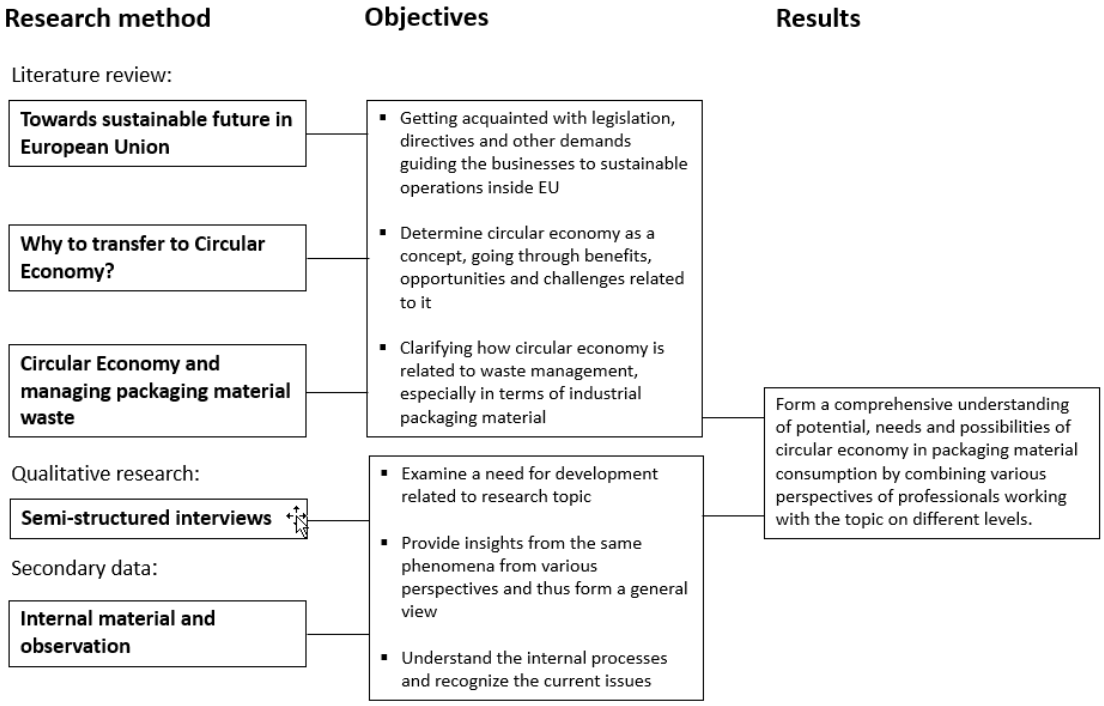


Figure 8. Structure of the research.

Firstly, company´s internal materials were explored for reviewing if some of the material could be exploited directly or indirectly in the research. After this, the packaging processes and used packaging materials were investigated more closely by visiting the dispatch and packaging department in the case company´s production plant and making observations. Thereafter the individuals for interviews were selected and semi-structured interviews conducted for data collection. The *discretionary sample* selected to the research were chosen with internal *Country HSE and Security Manager* of the case company, in order to find interviewees with the most relevant knowledge and expertise of

the study topic. Preliminary *sample* to the research was eight people. The aim of internally conducted interviews was to gather global, European and local -level knowledge and perspectives from representatives from different business units in the case company. In addition to internal experts, the aim was to interview external representatives from service provider who arranges the recycling points and collects the packaging registration and reporting, as well as representative from organization which collects the waste. CE is closely related to job positions of external interviewees and these perspectives can be considered very advantageous for finding answer to the research question. Additionally, including internal and external experts to the interviews enable more comprehensive understanding of the topic. Moreover, having interviewees from different countries provides the possibility to international perspective, instead of examining phenomenon locally.

The interviewees were approached by e-mail invitations (Appendix 1), where the background and objectives of the study, as well as interview themes and questions were included. The interviews consisted of four themes which have 18 questions (Appendix 2) but since this the research method is semi-structured interviews, the aim was to discuss about the question topics and different themes, rather than seek separately answer to single questions. In the beginning of the interviews, the interviewees were asked to explain further how their jobs are related to circular economy or the research topic, in order to understand better what kind of perspective they represent. The definitions in interviewees´ own words can be found from Table 3.

Respondent	**Title**	**Organization**	**Job relation to circular economy**	**Duration of the interview**	**Date of the interview**
Interviewee A	Country HSE and Security Manager	Case company	Product design and management, material compliance, various issues at sustainability side, waste and resources, waste legislation	30 min	16.4.2021

Interviewee B	Local Sustainability Officer	Case company	LSO and packaging material reporting, demands and legislation related to EU directives and practice	50 min	21.4.2021
Interviewee C	CEO	Packaging recycling organization	Managing a circular economy organization	30min	26.4.2021
Interviewee D	Global Motion Sustainability Manager	Case company	Sustainability strategy, KPI´s, frameworks and targets, circular economy in products and services	30min	26.4.2021
Interviewee E	Major Customer Manager	Environmental management service provider	Waste management sales, developing waste management and new solutions for major companies	50 min	18.4.2021
Interviewee F	HSE Specialist	Case company	LSO and packaging material reporting and patterns	25 min	29.4.2021
Interviewee G	HSE Specialist	Case company	Environmental specialist, circular economy increasingly within strategy	20 min	4.5.2021
Interviewee H	HSE & Sustainability Manager Belgium	Case company	HSE issues and sustainability, increasingly circular economy themes	25 min	5.5.2021

Table 3. Interviewees.

Qualitative analysis includes reduction of observations, as well as solving the research problem. The qualitative analysis is not based on quantitative law of averages, but rather focuses on contemplating relevant things for theoretical framework and research question (Alasuutari, 2011, 30-39). The actual interviews were conducted in Finnish and English via Microsoft Teams due to long geographical distances and COVID-19 pandemic. All interviews were recorded since the recording enables the interviewer to focus entirely on the interviews, instead of taking notes. Furthermore, the records make the data more reliable since it is not possible to make notes of everything the interviewees say or

consistently remember the content. After each interview was conducted, the recordings were listened carefully through and converted into text format. Literal transcript in spoken language was done first and after this modified to written language, which only includes the core messages of each sentences. After this, the referred sentences from interviews conducted in Finnish were translated as carefully as possible by making sure that the message will come across correctly.

5.4 Evaluation of research methods and data

Naturalistic case study aims to understand a particular phenomenon or situation from various perspectives and naturalistic researchers can be considered as observers who need to recognize their role in what they find. In order to do good research, it is essential to understand that the research investigation, where someone asks questions and collects data, has its own dynamic which will affect to the results (Gillham, 2010). In this study, the findings are focusing solely on issues that are the most relevant from the researcher´s point of view, although the aim is to provide research from objective perspective. Moreover, the interviews were conducted in Microsoft Teams which could affect to the situation and interviewees´ answers, since six of respondents did not know the researcher beforehand. Trust is harder to build when face-to-face communication is not possible and the respondent´s schedules were reasonable tight leaving no room for small talk and getting acquainted with each other.

The quality of the research can be determined by its reliability and validity, although in case studies the traditional reliability and validity are not necessarily the most accurate criteria for assessment due to the uniqueness and subjectivity of case company (Hirsjärvi, Remes & Sajavaara 2009). Traditionally the reliability means the repeatability of the research and ability to provide non-coincidental results (Saunders et al, 2009; Hirsjärvi et al, 2009). Additionally, reliable research should have correctly chosen research methods, which are executed well and in honest way (Seale, Gobo, Gubrium & Silverman, 2004: 378). The reliability in this study is based on choosing the correct theories connected with the observations and mapping of the topic before starting the actual writing. The

chosen theories support in understanding the research problem more comprehensively and recognize the combination of concepts. If assessing reliability further, this same study could be repeated to another case company as well, but the results would not be exactly the same since the empirical research depend heavily on perspectives of case company and the interviewees.

Validity means the capability of the research to measure what it was intended to measure with accurate data and truthful results. For instance, the methods and measures do not always respond to the vision of the researcher and the respondents in empirical study may misunderstand the questions. (Hirsjärvi et al, 2009). Although this research is not repeatable, it can be considered reasonable valid since it reaches the objectives by examining chosen perspectives in the single case company. The semi-structured interview questions in this study are founded on the theory review and approved by internal supervisor of the research. Although the questions are listed as separate interview questions, the aim was not to ask them one by one, but rather to limit the scope for clarifying relevant issues in the interview themes. Additionally, the interview questions were sent to respondents beforehand, in order to clarify the direction the for interviews, as well as make sure that the respondents did have time to prepare their answers.

6 Empirical findings and results

Findings of empirical research will be presented in this chapter. The interview data consist of eight responses from chosen individuals in managerial job positions who have a comprehensive experience and knowledge about sustainability related issues and circular economy. The interviewees from case company are from different business units in different European countries. Details of the interviews and interviewees are defined in Table 3. The interviews consisted of four main themes, including (1) Circular Economy demands behind packaging material consumption in EU, (2) Possibilities and challenges of Circular Economy in packaging material consumption, (3) Waste management of packaging material in EU, as well as (4) Monitoring and reporting of generated packaging waste in EU. The aim was to receive knowledge from versatile perspectives in order to approach the phenomenon from various perspectives instead of focusing solely on issues in certain plant or country.

6.1 Circular Economy demands behind packaging material consumption in EU

Guidelines, directives and legislation of EU should guide and support the circular economy transition in all MNC´s inside Europe. However, the sufficiency of these demands divides opinions among the interviewees, and everyone find areas for improvement. According to interviewee A the legislation is not currently adequate, and the biggest defects are missing certified management systems or categories, no infrastructure that supports the recycling and wasted raw materials. By contrast, Interviewee C feels that the current legislation is too detailed from packaging recycling organization´s point of view. Rest of the participants see the legislation sufficient but occasionally too demanding.

> *"Legislation is mostly enough, yet it has an issue for being too detailed and it takes too much time and resources from actually important things."* -Interviewee C

In order to truly implement CE within the organization, following certain EU demands should not be optional for companies. Additionally, almost all of the interviewed people feel that current reason for doing certain actions for CE and environment are mostly guided by image, cost savings and competitive advantage, rather than legislation which is not felt pressuring at this point.

> *"When talking about manufacturing industry, legislation is important but not the major factor… rather costs and other businesses in industry drive the change."* - Interviewee E

> *"Packaging material legislation is not yet compelling… imago is on bigger role."* - Interviewee B

In addition, economic losses and costs are still reasonable small in packaging material. Thus, more strict taxes and fees required in law would be needed for motivating companies to seek more circular solutions in packaging. Furthermore, some interviewees feel that differences between the EU countries and local laws are causing challenges.

> *"We are a global company, it is hard to get things done because there is so much interpretation between the countries in these regulations… *case company* don´t feel the urgency on that because in their country, there is another interpretation of packaging and they don´t see the need why they have to report on different way in Belgium for example."* -Interviewee H

Most of interviewed people feel that the legislation needs more clarity, in order to get the best benefits and avoiding unnecessary and demanding bureaucracy. The focus in EU legislation seems to be currently partially on wrong things. Interviewee E and interviewee H underline the importance of focusing rather on reducing packaging material instead of recycling and reuse. According to Interviewee C, the 2030 recycling targets are very high, yet the waste hierarchy of EU is very vague and focus is on political decisions

which leads to ignoring the practical perspective. Additionally, most all interviewed people feel that the focus is too much on reporting and any actual progress or actions on circular economy are not made and ultimate reasons for increasing reporting demands remain unclear.

> *"We don´t even come to the other part where it is meant to reduce packaging material because we spend all energy on the first part, reporting on a good way, and this is wrong."* -Interviewee H

Furthermore, Interviewee D emphasizes that from global perspective every country should operate in more structured and harmonized way, also in terms of possible fees and taxes. According to Interviewee D, harmonized guidelines would help to avoid unnecessary bureaucracy but the actions should be done first at European level.

> "*Europe is just faster. I think that others will follow but I don´t think we can see a global agreement on this, since it seems to be so difficult to find an agreement even on CO2 emission target levels."* -Interviewee D

Despite the defects of packaging material legislation, interviewees feel mostly that current legislation has still affected to consumption of packaging material and EU seems to be going to the right direction. According to Interviewee A the transition in Europe starts from Green Deal implementation and action plan, which will be very comprehensive once it is ready. In addition, Interviewee E finds that the new legislation will enable more comprehensive and universal approach to waste management in EU, instead of focusing solely on local laws.

6.2 Possibilities and challenges of Circular Economy in packaging material consumption

Circular economy has recently been very topical subject in various multinational companies but actual actions for transition have still been quite small. Thus, the interviewed

people were requested to clarify what kind of possibilities and challenges may drive or hinder the shift to circular economy in terms of packaging material. Based on interviews, there is clearly a lack of strong motivation or knowledge of how to take circular economy into account in the packaging material decisions in companies. All interviewees recognize the potential in developing packaging to sustainable and additionally emphasize the importance of circular economy. However, the interviewees did not mention many actual possibilities of circular economy and focused mostly on challenges.

Interviewee A suggests that packaging should be more simplified, which would make it easier to recycle, reuse or fix. He also emphasizes the need for better markings and guidelines for packing the products. Many of the participants stress the possibility to develop system for circulating packaging better, especially with the materials that are already partly reused, such as pallets and frames. Interviewee D sees the possibility in return packaging, which requires functioning partnerships.

> *"Circulating packaging, which may be working already locally, should be also utilized further in bigger picture and between the countries. Ideal for circular economy could be plastic, boxes, wood, pallets, frames or whatever what can be returned to the supplier."* -Interviewee E

> *"Pallets could be returned back, and the material could be utilized."* -Interviewee B

> *"One thing that has not received a lot of attention is surely a return packaging… I mean suppliers should provide that and companies like us should provide that as well, or at least ask suppliers eventually to do that."* -Interviewee D

On the other hand, Interviewee D finds that the feasibility of circulating packaging between the countries may be complicated in practice, especially with global suppliers from e.g. China or Russia, where the customs and bureaucracy may be complex.

Interviewee G sees the issue in continuously growing usage of global suppliers, especially from Asia. Although the raw materials, parts and components are more cost-efficient, quality of wooden packaging material and pallets is significantly poor causing a harm for the receiving site. In addition, interviewee B stresses that developing circular system for returning packaging material, such as reels and pallets, is possible only with countries with short geographical distance.

All participants, excluding Interviewee C, find various challenges in utilizing circularity in packaging material consumption but the focus in answers deviated quite a lot. Almost all interviewees find that current way of packaging is too complex and too many different materials are used in one packaging, which makes the material separation and recycling complex. Especially the challenges with plastics were emphasized by many interviewees. According to interviewee C plastic is the most challenging material but the packaging material is overall already recycled very well and current targets are too high.

> *"Complete recycling level is certainly not the best option for environment…packaging should be designed by prioritizing its function as a protection for the product, instead of looking the recyclability and reusability of the product."* -Interviewee C

All interviewed people agree that packaging material has not received very broadly attention in circular economy discussion and it should be emphasized more. According to interviewee A, only plastics have received attention, especially micro plastics which have turned out to be very harmful for the environment. Only person who do not agree is the Interviewee C, who finds that packaging is too emphasized compared to actual environmental impacts and in big picture the percentage of packaging materials in overall waste is very small.

> *"It is a threat that packaging materials are not resistant enough, but packaging material waste will never be as big threat for environment as the products which do not have adequate packaging."* -Interviewee C

In order to overcome the challenges and shift towards circular economy, significant actions are required from various actors. According to the interviewees, legislation, overall company strategy and adaptation, as well as customer demands are drivers for making actions. Some interviewees feel that legislation would have an impact, but it should take different industries into account and not be too strict which would make it too difficult to implement. In addition, taxes and fees set by EU or local legislation for using non-recyclable material would affect to the packaging material decisions.

> *"For global company the global policy of sustainability and also on the other hand the customer side do affect. Of course, we have the third player, authorities, and if they are putting laws and regulations, that also helps. So, I think the all three will help us together."* -Interviewee H

> *"If I look the value chain of *case company*, we have the suppliers pushing and we can have the consumers asking but if we don´t actually take action of the products and services we produce and start having more responsible impact, nothing will move. Policies are fundamental enablers, also awareness from consumers, so it comes from two ways and for sure there is a big role on company as well."* -Interviewee D

According to Interviewee B, increased customer demands would motivate in adapting circular economy in companies. However, it would also be a challenge if packaging solutions should serve separate needs of the customers and could not be simplified and harmonized. Interviewee F identifies the same issue and pointed out that there are also customers who demand virgin material also in packaging, instead of well-thumbed and used materials. In these cases, packaging material which has been used several times would not necessarily meet the customer requirements and occur as an issue.

Drive for shifting to circular economy in companies comes from supply chains. Sourcing and procurement have a big possibility to impact on circular economy, since they are choosing the material suppliers. According to interviewee G, the case company should set certain demands for packaging providers and would motivate the material producers to offer more sustainable innovations for packaging. Additionally, interviewee D emphasizes the importance of partnerships since no company is able to change to circular business model without committed partners in the value cycle. According the interviewee D, partnerships are essential but also challenging since they may make things complicated if the partners are not ready to adapt new circular way of doing business.

> *"Challenges are not related to packaging, they are rather broader challenges of circular economy which means it requires a change of mindset, complete change of mindset… One thing we need to realise that it is not only about you and whatever actions we take, we need to involve and partner up with other actors… In terms of recycled material, you need to start discussing with suppliers and raw material suppliers about the actual possibilities and same with packaging, recycling and end of use. You need to partner up either with same suppliers or recycling firms."*
> -Interviewee D

6.3 Waste management of packaging material in EU

Overall, every interviewee feel that current waste management in EU is reasonably adequate but there is still a room for further improvement. Many of the respondents emphasize the considerable differences between the EU member countries. Interviewee C feels that this question cannot be answered since no one can know what is the optimal recycling rate from environmental perspective. He also stresses that the targets are only political decisions which are not based on scientific data. Interviewee H thinks that the waste streams and recycling is functioning well in Europe, but the more important goal of reducing waste is forgotten. Additionally, the Interviewee E highlights that waste management is not yet seen mandatory and improvements are not truly adopted in companies.

"We are doing what we have to there but this is not the goal, the goal is to reduce material and we are not there yet." -Interviewee H

"Internal issue in companies is that waste management related issues seem to be voluntary and some demands and laws are actually good… Resistance of change among employees is a problem… If new material or process comes to the house, it should be more like announcement than suggestion, but of course feedback must be listened." -Interviewee E

According to Interviewee A, waste management contains the collection, decontamination and treatment of material but there is no operator who would make products from the waste or utilize it in new product life cycle. Interviewee G points out also the same issue that there is no waste actor who could manufacture new products or packaging from waste. According to Interviewee C, reason for this is that waste is not valuable raw material.

"One´s waste is not other´s raw material, if we talk about Euros." -Interviewee C

"We do not even have to wait the legislation to set that, we can actually proactively look and make partner with waste treatment providers and try to understand… There is a possibility to higher sort and that sorting could lead to higher recycling rates and even potentially cash back, so there could be some value there." -Interviewee D

The ultimate goal of circular economy is to reuse or recycle 100% of packaging waste and most of the interviewees think that it is possible, at least in theory. Only respondent who disagrees is Interviewee C who thinks that all packaging material waste can never be recycled.

"In theory I think it is possible but in practice it seems very distance at the moment. However, current trends and environmental pressure may lead to this." -Interviewee B

"I think if technology evolves, as it will evolve, it is possible. Completely zero I am not sure but if focusing on what is relevant for us, it might actually be possible. If you think about the plastic, pallets, wooden pallets, wooden boxes and cardboard, in the end it is already recycled." -Interviewee D

"From certain part it is possible, at least at local markets. Maybe also more broadly between the countries but then there would be need for duty reliefs." -Interviewee E

"It would never be possible, never ever. Incinerated waste that is used as an energy cannot be considered as recycled so it is technically impossible to recycle 100%." -Interviewee C

The packaging materials in the scope of this study are wood, cardboard and plastic. All interviewees think that the main issues occur with wood and plastic since the recycling rate of cardboard is already very high. The most common waste treatment method for wood is incineration and although the heat can be used to generate energy, incineration cannot be considered very sustainable. Most of the interviewees find that in manufacturing industry, the wooden reels and non-standard pallets are the biggest issue, since they do not have a functioning system for returning. Additionally, Interviewee C and Interviewee G find problematic that some countries do not have adequate facilities for wood incineration and therefore the material needs to be exported to Middle Europe. Interviewee E sees that broader standardized packaging types, such as FIN and EUR pallets would extend comprehensively the life cycle of packaging.

Almost all interviewees emphasize that the biggest issue in managing plastics as a packaging waste is the diverse plastic types used in one packaging. Some respondents also think that for the present plastic is mandatory for packaging certain type of products.

> *"The biggest issue is various plastic types which seem to be used very arbitrarily. In some of *case company´s* packaging there may be even 3-5 different plastic types mixed up which hinders the sorting for receiver or in production."* -Interviewee E

> *"Plastic recycling has been discussed topic but the practical implementation has been weak… Problem is also different plastic types, colourful and bright."* -Interviewee A

> *"Currently there are too many different kinds of plastics… Recycling would be easier if only one type of plastic would be inbounded to *case company*."* -Interviewee B

Most of the respondents see that one solution for utilizing circular economy better in waste management is simply to avoid unnecessary packaging. Many respondents also feel that focus should be more on design phase and R&D where circular packaging innovations could be developed. Some of the interviewees also emphasized that certain plastic types and unsustainable materials for cushioning could be replaced with more sustainable materials.

> *"One solution could be replacing plastics with materials that can be easier recycled, such as cardboard and carton-based materials or at least focusing on certain plastics or circular recycled packaging."* -Interviewee E

6.4 Monitoring and reporting of generated packaging waste in EU

Monitoring and reporting of generated waste and packaging waste is mandatory for MNCs within EU, but all interviewees agree that current reporting and provided data is not reliable. However, most of the respondents feel that the accuracy of numbers is adequate at least at some level, since exact numbers are not relevant for reporting. Interviewee E points out that current reporting from waste management perspective can be considered quite reliable but considerable amount of packaging waste is recycled as an energy waste which makes the amounts more unreliable. Furthermore, various member countries are currently requiring reports of imported inbound material separately from material bought from local markets which is seen as a challenge. Especially the interviewees who are responsible of reporting see this separation currently almost impossible.

> *"The amounts are not comparable between the member countries… EU level reporting is not reliable since different types of data is collected… Recycling percentages do not make sense in many countries which indicates how unreliable the reporting is."* -Interviewee C

> *"The waste amounts and outbound material are easy to figure out, but the inbound material bought inside and outside of EU is the issue."* -Interviewee B

> *"It is not reasonable to separate imported material… Imported packaging material is not always related to the product… but other usage is still included in total amounts of packaging waste and the sources cannot be separated."* -Interviewee F

> *"Reporting we have to do about for instance imported or inbound packaging is based on own estimations… Our SAP data is not that reliable that reports could be taken straight from there… There is a big need for improvement."* -Interviewee G

The differing legislations and methods for calculating the waste amounts is seen as the biggest issue in reporting. Since EU countries do not have universal guidelines, the waste amounts and reports between the member countries cannot be compared. Additionally, the differing reporting methods make the international reporting between countries complicated. The possibility to provide reports which meet the demands of other countries can require considerable resources and is not sometimes possible at all. Uniformity and common criteria for reporting and comparing the numbers are seen as the best way to develop reporting. Thus, the dispatching units should be able to find solutions for providing the exact data requested in receiving countries. In addition, more standardized packaging solutions is seen as one potential solution for facilitating the reporting.

> *"Currently the reporting needs to be done, in the worst case, 26 times because the guidelines are not universal."* -Interviewee A

> *"Reporting is very challenging, especially now when imported packaging material should be separated… we do not separate material which is imported from abroad and which has come from domestic markets or suppliers, so the idea is good but in practice very challenging."* -Interviewee D

> *"I would start from determining already beforehand what type of packaging is used and that the information could be found from the system."* -Interviewee G

> *"We don´t receive any data from other factories which I should report to local authorities, but the data we receive is only calculations… Authorities in Netherlands could not understand why we are not capable to report what they ask and it took months to explain them… Also when the product is sent from other country straight to the end customer, the *case company* unit in receiving country don´t see the product and packaging and there is no data available, so it is impossible to report in correct way."* -Interviewee H

Interviewee C highlights that new instructions and guidelines provided by EU are not enough, but it is also important to follow how guidelines are understood and implemented in practice, which is a significant job. Many interviewees also find that reporting is getting continuously more complicated, which requires considerable resources from companies and does not provide any advantage for companies.

> *"The more complicated and difficult the reporting is made for companies, the less reliable the reporting will be."* -Interviewee C

> *"Right now, reporting is not making things better because you need to report and pay but that is not driving any big action. It is just a long amount of time trying to fulfil the requirements, understand that and make some estimations… But you get lost in numbers or in reporting processes rather than putting action on the packaging."* -Interviewee D

> *"Reporting is important to measure progress but at this moment we do not measure progress because no one is asking for this and the only goal is reporting… It takes so much time and energy to get the numbers into system and at the end what do we win with it… There is no point to spend too much energy there and we have to change the focus on how much we purchase the packaging material… It is connected also in the design of the product and packaging and I think that is the only place we have the full control on."* -Interviewee H

> *"Recycled wooden pallets are very difficult… How to determine how many times the wooden pallets have been returned and these numbers should also be seen in reporting."* -Interviewee F

More reliable reporting and monitoring would have several benefits for the company. Better data would help to follow better the material flows, company success, as well as recycling and material utilization. Additionally, Interviewee G emphasizes that EU level

demands and reliable reporting would enhance better transparency, enable economic savings and in broader context compare own environmental success to other companies. However, Interviewee D sees that economic savings do not drive major actions and companies would take the reporting seriously only if it would risk sales. Interviewee H also highlights the money as a motivation and also thinks that implementing company policy for sustainability is depending on managers.

> *"We are proactively addressing that even if we are not yet at that point where sales are at risk, we recognize some responsibility and opportunity to cost savings or something called to be competitive advantage, not for packaging but broader perspective of sustainability."* -Interviewee D

> *"Only thing that motivates today is if you have to pay for it… You can also play with your company policy on sustainability but it will take years to change company from that perspective… It also depends on the mind of the manager, if it is focusing on sustainability and if he really wants it for his company, then it will happen."* -Interviewee H

7 Key findings and discussion

The purpose of this study was to examine the impacts of circular economy in international manufacturing industry with an empirical research for a case company. The scope was limited to *packaging material waste* and the aim was to focus primarily on reporting and other environmental demands EU is increasingly setting for MNCs. Based on this, the research question of this study was formed as follows:

How circular economy impacts on consumption and waste management of industrial packaging material inside the European Union?

The phenomenon was considered primarily from resource-based view in order to identify the factors that influence on company´s possibilities to gain competitive advantage and create value in global markets. According to existing literature and material published by EU or other authorizations, circular economy as a phenomenon should impact on packaging material consumption and waste management in various ways. The affecting factors consist of mandatory requirements set for multinational companies in EU, as well as optional factors driven by various things, such as company sustainability strategy, image, customer expectations and competition. Based on the theory review and findings of empirical study, circular economy has affected to current consumption of packaging material, as well as the whole waste management process. Currently there are no significant compelling things that force companies to shift to circular economy, yet the continuously developing legislation is making environmental loading and unsustainable operations increasingly difficult and expensive. In addition, accelerating global warming and environmental issues as megatrends are encouraging companies take more responsibility and have also affected considerably to customer demands. Due to these trends, the circular economy is attracting increasingly attention and is one of the most crucial things for gaining competitive advantage in the future.

Objective 1: *To clarify the background of industry´s obligation to circular economy in EU*

Various EU laws, directives and regulations, as well as industry-specific guidelines affect to all MNC´s in Europe. The legislation and frameworks are influenced by UN´s Sustainable Development Goals which are frequently base for company sustainability strategies and adapted in various countries, industries and businesses. EU legislation and policies that affect straight to packaging material in manufacturing industries are illustrated in Figure 9. Although there are various statutes, the empirical research showed that EU legislation is not completely sufficient and practical feasibility is not taken enough into consideration. Certain statutes related to waste and packaging material are mandatory for companies but according to empirical findings, growing demands considering e.g. reporting, are not completely viable or yield an actual advantage. Nevertheless, legislation does not have peremptory provisions for circular economy and the actions are mainly optional for companies. Yet, in order to boost the transition towards more circular world, some demands should be mandatory. The costs for packaging material waste treatment or taxes and fees for consumed packaging material are currently reasonable low and cost savings are not actual incentives on a large scale.

Figure 9. EU legislation and policies affecting on circular economy.

Although the EU legislation and policies consider all EU countries, there are various local laws and applications of EU level laws which hinder the uniformity between countries. There is also a possibility for diverse interpretations about legislation which makes harmonization of goals and actions between the member countries occasionally challenging. Nevertheless, the disadvantages of current linear economy model are common for all member countries and direction towards more circular economy would provide advantage for everyone. Thus, the transition should be guided by common guidelines and actions done together, instead of focusing solely on local demands.

Objective 2: *To examine what opportunities CE offers for industrial packaging material from resource-based view and what hinders the implementation*

Circular economy is now more topical than ever before, and MNCs should at the latest now to start to observe CE opportunities in their own business field. CE is not only a preventative approach reducing pollution, but it also aims to repair previous damage by designing better systems within the entity of the industry. Unlike in linear business models, CE aims to restore damage caused in resource acquisition and minimize the generated waste throughout the production process (Murray et al, 2017). According to earlier studies, circular economy enables diverse opportunities for companies from environmental, economic and social perspectives of sustainability. Circular economy integrates economic activities and environmental wellbeing with effective resource use by enabling considerable cost savings and waste reduction (Sitra, 2020b; World Economic Forum, 2020). However, the coordination between environmental and economic goals is currently inadequate. Therefore, it would be crucial to identify the potential for competitive advantage that sustainable and environmental-friendly operations could enable and thus bring also economic benefits for the company.

Previous studies have discovered that circular economy can turn inefficiencies of linear economy into business value, including unsustainable materials, underutilized capabilities, wasted end-of-life and unexploited customer commitments. There is also considerable potential for time and cost savings if the packaging system is adjusted to assembly lines or dispatch departments where material and assembly systems are integrated physically (Pålsson et al, 2012). The packaging has not received considerable attention in circular economy discussion and there is a strong potential for new circular solutions. However, it is important to focus on packaging systems on a bigger scale, instead of focusing only on finding more recyclable materials.

The aim of RBV is to learn to control, integrate and utilize effectively the resource base of the company and thus gain competitive advantage (Hitt, Ireland & Hoskisson, 2001: 105; Barney, 1991). Linear chains are clearly unsustainable in terms of RBV since the resources are wasted and unexploited, which does not help to reach the strategic goals of company (Hitt et al, 2001). Additionally, in linear models, the value of natural capital is reduced and the whole potential of value-chain is not exploited (Korhonen et al, 2018; Meadows, Randers & Meadows, 2004). In RBV, sustainable competitive advantage is primarily built on company resources and implementing circular business model within an organization would impact on intangible, tangible and human resources. In CE the waste is seen as a resource which may enable economic savings for the company, simultaneously with environmental protection. Implementing CE within an organization may enable new core competences and competitive advantage if resources are utilized effectively. Nevertheless, it is essential to be able to differentiate from competitors. Since circular solutions for saving or gaining new resources in terms of packaging material is still highly underutilized in global manufacturing industry, there are great opportunities for differentiation.

The empirical research did not provide wide perspectives about specific opportunities of circular economy. All participants in interviews agreed that companies in manufacturing industry should pursue new circular business models and one mentioned any

disadvantages circular economy could cause. However, the issue seems to be that need for actions are seen in the future, not in the present. This may cause challenges from competitive perspective since it offers an opportunity to competitors to gain competitive advantage while leaving the case company behind. Gaining competitive advantage with CE and effective resource use requires innovativeness and being a forerunner. Notable interest towards circular economy is reasonable new in manufacturing industry and there is not much data and proof about the exact numbers or concrete outcomes the circular economy may provide in long term (Lahti et al, 2018). Although CE would enable considerable resource savings, it would also require new type of resources. For instance, building a system for circulating packaging would possibly require considerable time, economic resources, efforts and cooperation with various actors. In addition, it is important to scrutinize the circulating packaging system as an entity, where emissions are caused in several phases, e.g. in transportation or handling phase. Thus, life cycle thinking (LCT) is an effective way to understand more deeply the entity of packaging value chain.

Changing the production processes from linear model to circular model would require extensive research and examination, significant financial investments, renewed internal and external processes, new supply chain networks and various other changes which would not be necessarily simple to implement. As the empirical research and theory review proofed, there are also various challenges that prevent companies from utilizing circular economy opportunities in packaging material. Possibility to influence on legislative decisions made at EU level may be challenging for companies but based on the empirical research and earlier studies, there are also many different challenges which companies can overcome and impact with their own actions. In this study, the challenges are identified and divided to three different categories: packaging features, processes and systems, as well as people. Challenges that stood out in the research and potential solutions for them are illustrated in Figure 10.

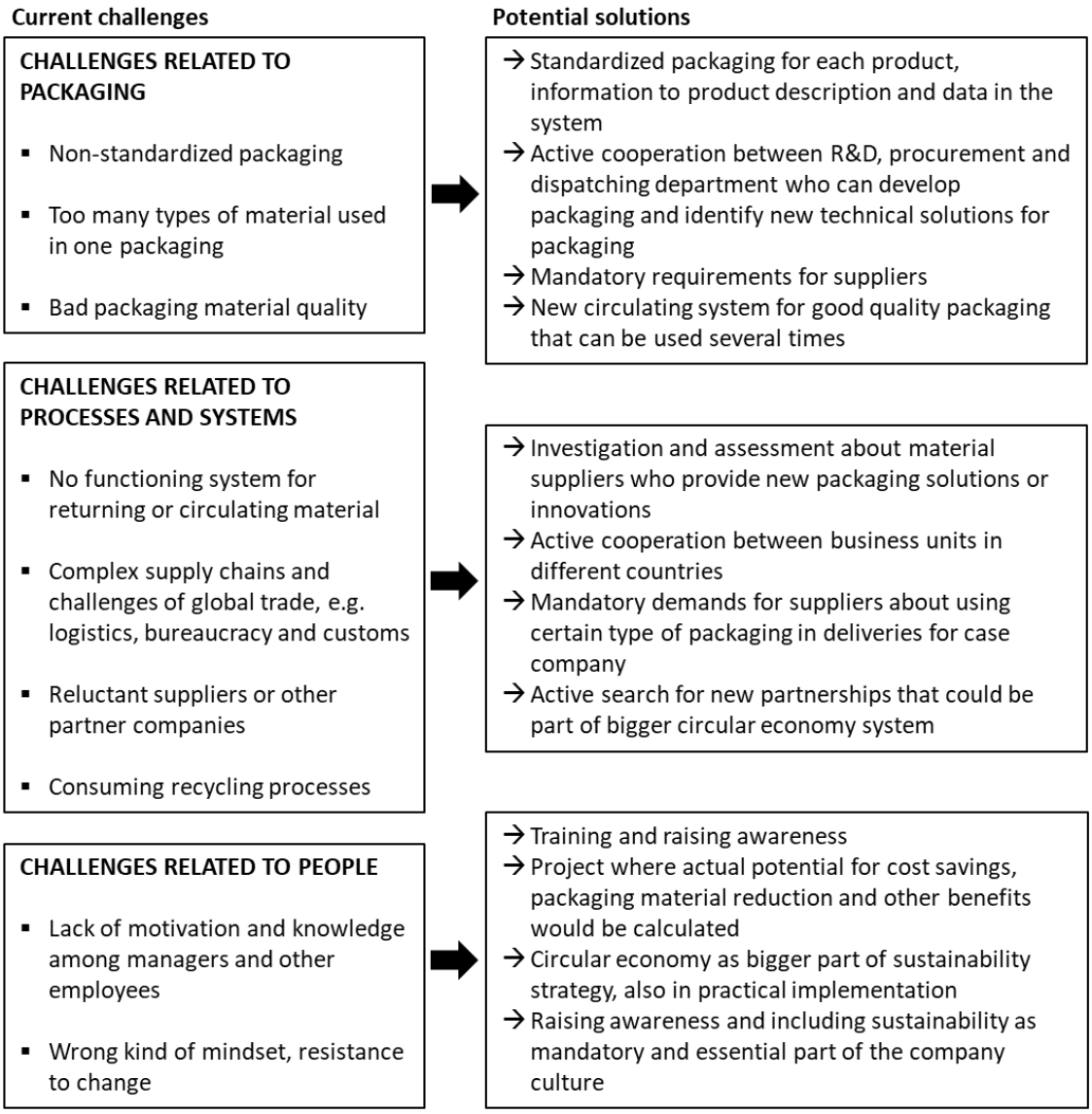


Figure 10. The main challenges and potential solutions for circular economy in terms of packaging material.

Packaging material recycling may be occasionally complicated due to too many material types used in one packaging. This causes difficulties in separating different materials for recycling and wastes resources. Thus, standardised and simplified packaging would be beneficiary for all products. This would not only simplify the recycling process and reduce packaging material usage, but it would also facilitate monitoring of consumed packaging material. If standardised packaging would be used in products, information about material amounts used in packaging could be included in product description and data

could be fed into the system, which would lead to better feasibility of outbound material reporting. In addition, the resource consumption would be easier to follow and develop with harmonized standard packaging.

For case company of this study, the packaging material received with inbound deliveries cause bigger challenges than outbound material. It seems that the only way to get recyclable or reusable packaging material with inbound products is to set some mandatory requirements for suppliers. There should be only certain type of materials that case company should approve. If supplier would not be able to provide packaging material with satisfactory quality, the possibility of developing system for circulating packaging should be mapped, or sanctions to be set to suppliers or vendors that provide packaging material that does not fulfil the requirements. Succeeding in developing simpler packaging for products would require an active cooperation between R&D, procurement and dispatching department who would together provide comprehensive knowledge from practical, technical and supply chain point of view. Before taking the packaging into use, it should be tested and compared to optional packaging materials for making sure that certain quality standards are fulfilled. In addition, reusability of packaging should be investigated in order to make sure that the life cycle of packaging would be as long as possible by maximizing the resource utilization. Furthermore, packaging should always be seen as important part of circular economy, as the other factors in product value cycle.

Circular economy requires systemic approach and the challenges related to packaging material are also part of bigger entities and systems, rather than just consequences of individual factors. Currently one of the most essential goals of packaging material consumption is to develop functioning systems where the material could flow in endless cycle and not end to landfill or incineration before it has reached its life-end. Building functioning partnerships and searching actively new packaging providers is essential in order to build a system for circular packaging. Since the supply chains may be complex and global trade has various challenges based on formal details, the cooperation between countries is mandatory. Additionally, internal people in different business units

and countries should assist with local bureaucracy and clarifications. This may not be necessarily simple but building partnerships and making processes more functioning for common good are in the core of circular economy.

According to Sitra (2020), manufacturing companies need to change the whole mindset and collaboration by adapting CE in strategy, values, business model, product design and processes (Sitra, 2020a). Since people make all decisions related to these issues, changing the people´s mindset within the company is crucial for succeeding in changing business gradually towards circular economy. However, all people do not find circular economy or packaging material development as urgent issues. Lack of motivation and knowledge among employees could be fixed with suitable training and awareness raising for all functions within the company. The change of mindset must start from managerial level, yet they may require concrete proof about the benefits circularity in packaging material can provide. In addition, people in operational functions, such as people who pack and dispatch the products, should not be diminished since their practical knowledge and perspectives can be very valuable for developing new circular solutions. New technical innovations for packaging require a deep cooperation with all parties in the distribution supply chain and the cooperation is essential for finding the best possible solutions for all functions (Inkiläinen, 2009). Furthermore, circular economy should not be only part of strategy on company websites, but it should be implemented in the organizations and in supply chains also in practice by investing resources for research and development.

Objective 3: *To find out how waste management in manufacturing industry is linked to circular economy*

Waste management is closely linked to circular economy, since energy and material recycling and turning the materials into valuable resources is essential part of circular economy. However, unlike waste management circular economy is involved to all stages of product lifecycle and waste management can be considered as one part of wider

circular economy system. According to EU, waste management is the collection, transport, recovery and disposal of waste, comprising the supervision of these operations (Council directive 2008/98). The empirical research indicated that the waste management in Europe is overall quite good but there are considerable differences between member countries. Recycling is critical part of waste management and also the most widespread strategy for circular economy, although circular economy is much more than just a recycling (World Bank Group, 2019). Nevertheless, EU has set high recycling targets by 2025 and 2030 which may have an impact on waste treatment but are simultaneously partly contradictory with EU´s waste hierarchy, where the primary option is to focus on preventing waste. Preventing waste is also the most effective way to save resources

According to Ellen MacArthur Foundation, one of the main principles in CE is to look waste as a resource and the ultimate goal of would be generate zero waste (Ellen MacArthur Foundation, 2020). In terms of packaging material, generating zero waste is possible at theorical level but practical implementation is more complex. One reason for this is the lack of facilities for waste treatment, as well as actor who would utilize and produce new material from waste. Overall, all guidelines, frameworks and legislation have ambitious targets which would certainly be beneficial at least for the environment, but the practical specifications and directions remain vague which hinders the companies from doing significant actions to reach these goals.

Different types of products require different types of packaging, but in terms of this study, mostly used industrial packaging materials are wood, cardboard and plastics. Although all of these materials would not be used in packaging of company´s own final products, it is currently almost impossible not to receive these materials from suppliers. Therefore, the waste treatment for these materials is common problem for all companies operating in manufacturing industry. As empirical part of this study indicated, the biggest challenges of waste management is the unclarity of packaging material amounts and inadequate waste treatment systems for certain materials, such as wood or too many types of plastics, which may end up to energy waste and incineration, although the waste could

be processed in more sustainable ways. As the case company is not able to achieve the change alone, partnerships are in essential role also in developing waste management. Of course, the company is mainly responsible of recycling the inbound waste in plants and cannot always impact on the later treatment or final disposal of waste. However, company can take more comprehensive producer responsibility and start to demand certain things from suppliers, as well as actively look for opportunities how packaging material could be reused or treated more effectively. Building whole new systems for utilizing the waste may be complex and time-consuming but anything will not change if companies do not take actions by themselves. Based on existing studies and legislation, it is clear that circular economy is continuously increasing its importance. Thus, companies would benefit more by starting the actions as soon as possible and starting to cooperate with waste management providers, instead of waiting that the amount of waste increases further by causing considerable harm for environment and spend economical resources to fees and costs that could be avoided.

Objective 4: *To find out the role of monitoring and reporting in packaging material consumption.*

Currently all international companies in EU are obligated to report annually the amounts of inbound and outbound packaging material. This reporting requires comprehensive monitoring and data maintenance but currently the follow up is not reliable and the numbers are mainly based on estimations. According to the results of empirical research, reliable reporting would benefit the case company in various ways. Better data could be utilized in following the material flows, company success, as well as recycling and material utilization. It would also help in identifying potential for cost savings, comparing company to other competitors and enhancing transparency, which could strengthen the customer relationships. Although it is not simple to determine what is the exact adequate accuracy in reporting numbers, it is still clear that there is still much room for improvement in reliability. In addition, there is high potential for collecting more reliable data and developing better monitoring system for outbound material, but challenges with

inbound material are much more extensive. Inbound packaging material is currently estimated from overall waste amounts in the case company plants, but the accuracy of these amounts is not actually enough since large amount of different packaging materials are recycled as energy waste, although it would belong to recycling bin of some certain material. In addition, it is very difficult to separate the packaging material imported from other countries and packaging material from local markets since the supply chains in global companies can be very complex. Additionally, recycling separately the imported packaging material and material from local markets would require a lot of effort and would probably not bring value to anyone. This can be considered again as an example how demands and legislation have not considered the actual feasibility of the requirements.

Based on the empirical research, one of the key issues in reporting are the differences between EU countries. Although certain EU level laws consider all member countries, the interpretations of laws and methods for calculating and assessing the waste amounts differ considerably between countries. Due to the current unreliable monitoring, the case company is not able to provide certain reports or fulfill requirements of some EU countries. This reduces the competitive advantage of company and does not promote international collaboration. In global companies the cooperation between different countries´ business units is so fundamental part of business, that putting effort on fulfilling the requirements should not be impossible. Developing uniform calculating methods and comparability to all member countries depends on EU policy- makers. Therefore, individual companies are not necessarily able to impact on current inconsistency on large scale. However, the case company as a global leader in technology industry has big possibilities to create harmonized reporting methods within the organization. Significant time and resources would be saved if one report would provide appropriate information for case company business units in all countries, although the numbers would not been comparable e.g. with competitors. The case company should show the way and strengthen the international cooperation instead of focusing on obstacles that may occur.

7.1 Trustworthiness and limitations of the study

According to Brink (1993), the trustworthiness of a qualitative study consists of credibility, transferability, confirmability, as well as dependability. (Brink, 1993). There are various factors that may affect to the trustworthiness of the study, but most common factors are the researcher, the subject error, the context and situation, as well as the data collection methods and analysis (Brink, 1993). The researcher of this study has been working at the case company for several years which could normally affect to the objectivity or preconceptions about the topic. However, the researcher was not familiar with the study area or the departments and functions the study was conducted and therefore she did not have any presumptions or opinions of the topic beforehand.

A subject error concerns the truthfulness and honesty in interviewees´ responses, where the interviewees may want to make things seem better or worse than what they actually think (Brink, 1993). Furthermore, selected individuals and sample to represent in empirical study affects to validity of the research (Saunders & Lewis, 2018). In this study, the interviewees knew that they would stay anonymous in order to guarantee honest responses. In addition, the chosen sample to interviews were specifically suggested by internal person in the case company who has tens of years long experience from the HSE field and knows the most suitable people, whose perspectives brought the best value for this study. However, the interviewees were only from three different European countries and in order to get more comprehensive perspectives, it would have been beneficial to interview people from more diverse country selection. On the other hand, focusing solely on certain countries would have limited the research better and enabled more detailed results from a specific area. Nevertheless, the aim of this study was to examine the phenomenon inside the whole Europe and the conducted interviews provided comprehensive information enough from the perspective of the case company.

Data collection and analysis methods may affect to the validity and reliability of the study if the researcher is not able to choose valid method for studying the phenomenon (Brink, 1993). All the interviews in this study were recorded and afterwards written down

carefully, in order to make sure that nothing was missed. The most relevant comments and perspectives regarding the research question and objectives were formed as a logical aggregation after all interviews were conducted. However, since the chosen comments and findings of the topic were based on the judgement of the researcher, there is a possibility that interpretations have not been made completely correctly or something is missing. In addition, the interviews were conducted in Finnish and English, which means that the translations of some interviewees´ comments are not exact word for word.

The empirical research was conducted as a case study which means that the study has various limitations that reduce the generalizability. The empirical research focused explicitly on a single case company which has own processes and ways to work and the results in other case company would probably been different. Therefore, the study cannot be generalized directly to other companies although they would operate in the same industry. Furthermore, the insights and perspectives in the empirical study are almost solely from managerial point of view since all internal and external interviewees are working in managerial positions. The chosen interviewees were able to provide inclusive insights about the topic and saturation in interviews from certain perspective was reached. However, if data would have been collected also from employees working in more operative positions, the findings would have been more comprehensive. Furthermore, although this study considers the most common EU laws, directives and regulations impacting on packaging material and waste management in manufacturing industry, the legislation is continuously changing. For instance, EU will release the new environmental law in summer 2021 which is likely to impact on the case company as well, and the background of demands determined in this study are not necessarily up to date.

7.2 Future research

There are various potential topics which could be investigated as continuation of this research. Based on the topics covered in this study, future research could focus on examining more profoundly single areas, such as specific waste flows, potential

alternatives for packaging materials or identifying circular economy solutions in practice, since there is clearly a lack of functioning system for circulating certain packaging materials and waste. Additionally, the actual potential in long term cost savings, cost reductions and other benefits should be determined and calculate estimations. Implementing circular economy in business requires functioning partnerships and supply chains, where all have the same agenda and goals. Therefore, mapping potential partners, packaging material or service providers or other alternative suppliers would be good next step. Determining certain requirements for suppliers and developing current sustainability assessment criteria would be also important thing to proceed with.

It would also be interesting to examine if it was possible to limit the amounts of packaging material without compromising the protection of the product in different transportation conditions. In addition, it is essential to investigate further how to get more reliable and updated data in the system, which would facilitate the packaging material reporting considerably. This would require examination how packaging could be changed more standardized to each product type, how this information could be included as a necessity in product description and how this data could be put in the system and utilized. Furthermore, the impacts of new European Climate Law in practice or assessing how case company is reaching the recycling targets of EU would be important things to investigate.

8 Conclusions

This research was a case study commissioned by global technology company. The purpose of the research was to examine how circular economy impacts on packaging material consumption and waste management in manufacturing industry. The aim was also to examine the phenomenon from resource-based view by focusing on competitive advantage and value creation. The scope in this study was limited exclusive to industrial packaging material waste, including wood, cardboard and plastics. The aim was to inspect the demands that EU has set for companies operating in this particular industry and focus especially on reporting obligations and other demands related to packaging waste. The literature review of this study focused on existing literature about most relevant theories regarding the study topic. It included the current EU legislation and demands related to circular economy and packaging material waste, as well as concept of circular economy and how it may bring competitive advantage and value for the company. Moreover, potential challenges and opportunities which may occur in adapting or implementing the concept within company were included in study. In addition, the theory contained the concept of waste management, and defined the most relevant packaging materials in manufacturing industry and scope of this study.

The main contribution of this study was to increase the understanding of circular economy as a concept, as well as clarify how it affects to bigger entity regarding packaging material usage and processes within an MNC. The resource-based view focused on identifying how circular economy may bring competitive advantage for a company and create value on a larger scale. The theory review formed an ensemble which may facilitate the reader to understand the legal requirements and the close role of packaging waste management to circular economy. The findings of the thesis supported the existing literature that circular economy is increasing its importance and the potential to new circular solutions in terms of packaging is considerable. The underlying reasons for current challenges and slow implementation of circular economy throughout the organization were also examined. The findings of the study showed that it is crucial to adapt the concept throughout the whole global value chain instead of focusing on separate functions,

which was justified by existing literature. Furthermore, the findings indicated that the need for doing actual actions for changing towards more circular models is identified but not seen very urgent. Thus, this study may provide motivation at least for the case company to start to take actions and accelerate the transition.

EU has various laws and policies that are related to circular economy, packaging material and waste management. All of these demands increasingly affecting to all companies operating in international manufacturing industry. The most relevant policies in terms of this study are The European Green Deal, Circular Economy Action Plan, Directive on Packaging Waste, Waste Framework Directive, EU Plastics Strategy and SUP Directive, as well as European Climate Law that is expected to be published during 2021. According to the findings of empirical study, the legislation is not completely sufficient and does not consider the practical feasibility enough. Additionally, the EU requirements for packaging material waste reporting are currently demanding and the reported amounts from each member country cannot be considered reliable. Another issue with reporting is the different interpretations about legislation in different countries, as well as diverse calculating methods for waste amounts which makes the comparability between the member countries impossible. The findings of the research show that current EU legislation and demands affect to packaging material consumption and reporting in many ways, but it is not the main driver for companies to transit towards circular economy. The reasons for possible implementation and adaptation of circular economy are rather related to company sustainability strategy, image, customer expectations and competition. The continuously developing EU legislation is hindering the environmental loading and unsustainable operation, yet there are no compelling things that force companies to shift to circular economy. Additionally, the circular economy is increasing its importance, since accelerating global warming and environmental concerns as megatrends affect considerably on customer demands and also encourage companies operate in more responsible way.

According to previous studies, circular economy enables diverse opportunities for companies by turning the inefficiencies of linear economy model into business value. Circular

economy offers also a great opportunity to gain competitive advantage with effective resource use. Additionally, the potential for cost savings and significant benefits for environment cannot be ignored, yet there is a lack of data and proof of exact numbers or concrete outcomes that circular economy may provide in long term. As the theory review and empirical research indicated, there are various challenges that prevent companies from utilizing circular economy opportunities in packaging material. In order to overcome these challenges, comprehensive cooperation within the company and global value chains is required. There may be a lack of understanding about circular economy and environmental issues in all departments of organization. Therefore, departments with experts and knowledge of these issues need to take the responsibility and raise awareness of environmental issues throughout the organization. In supply chains, certain demands need to be set for global suppliers in order to get the whole value chain of packaging more circular. Furthermore, developing more circulating packaging for products would require better waste treatment methods and systems. The waste should be seen as a resource but there are currently various challenges in reusing or recycling some of the industrial packaging materials, such as mixed plastics and wood. Nevertheless, now when the issues and challenges are clearly identified, it is time to do actions.

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Appendices

Appendix 1. Interview Cover Letter

Hello,

My name is Hilda Vähäsöyrinki, I´m a MIB student from University of Vaasa (Finland) and currently writing a Master´s thesis as an assignment for ***case company***, where I´ve also been working the past 3,5 years. The topic of the study is ***Circular Economy in Packaging Material Consumption and Waste Management in the European Union*** and the aim is to examine background of the demands for packaging material in EU, as well as identify possibilities and challenges of circular economy in terms of packaging material. Additionally, objective is to recognize current state of industrial packaging material waste treatment, as well as monitoring and reporting the generated waste amounts.

For this study, I need to interview people who have the most suitable knowledge about the topic. *Case company* Country HSE and Security Manager suggested to interview you, since you have a comprehensive experience and knowledge about sustainability and circular economy. Therefore, I would like to ask you to an interview and would really appreciate your participation. The findings of this study would provide vital information for *case company* and would help to develop important processes and thus expedite the transition towards circular economy.

Please find all interview themes and questions attached to this invitation. Since circular economy is such a comprehensive phenomenon, the scope of the study and interview has been limited to **industrial packaging material**, excluding the consumer products. Additionally, the aim is to examine the topic especially from **EU level perspective**, not locally.

If you have any questions or concerns about participating to this study, don´t hesitate to contact me via e-mail. Thank you in advance!

Appendix 2. Interview questions

Circular Economy in Industrial Packaging material Consumption and Waste Management in the European Union

Interview themes and questions

Background information

- Date and place:
- Name of the company or organization:
- Name of the interviewee:
- Job position:
- Job description or relation to circular economy:

Circular Economy demands behind packaging material consumption in EU

1. Is the current EU legislation adequate regarding circular economy?
2. Is the current EU legislation adequate regarding packaging material?
3. How would you improve current legislation (at global, international or local level)?
4. Has EU legislation and guidelines affected to consumption of packaging material? How?

Possibilities and challenges of Circular Economy in packaging material consumption

5. What circular economy possibilities or solutions you see in terms of packaging material?
6. What circular economy challenges you see in terms of packaging material?
7. Do you think that packaging material has received enough attention in circular economy discussion?
8. Which level/actor has the biggest possibility to impact in circular economy transition?

Waste management of packaging material in EU

9. How do you see the current state of packaging material waste treatment?
10. How circular economy could be utilized better in packaging material waste management?
11. Do you think it is possible to generate zero packaging material waste?
12. What are the biggest challenges of managing wooden packaging waste? Do you recognize any potential solutions for reducing wood waste?

13. What are the biggest challenges of managing corrugated cardboard packaging waste? Do you recognize any potential solutions for reducing cardboard waste?
14. What are the biggest challenges of managing plastic packaging waste? Do you recognize any potential solutions for reducing plastic waste?

Monitoring and reporting of generated packaging waste in EU

15. Is the monitoring and reporting of packaging material waste currently reliable?
16. How the monitoring could be improved?
17. How the reporting could be improved?
18. What benefits reliable reporting can bring to a company or organization?