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Circular Supply Chain Practices

A current Practice of Circular Supply Chains in Finnish Companies

School of Innovation and Technology

Master's thesis in Industrial Management

Master of Science in Economics and Business Administration

Vaasa 2025

UNIVERSITY OF VAASA

School of Innovation and Technology

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Title of the Thesis: Circular Supply Chain Practices: A current Practice of Circular Supply Chain in Finland

Degree: Master of Science in Economics and Business Administration

Programme: Industrial Management

Supervisor: Ines Simoes de Brito Peixoto

Year: 2025 Pages **:** 80

ABSTRACT

Circular economy is one of the strategic and core channels of resource efficiency, reduction of waste, and maintenance of long-term sustainability among firms. This thesis points out the major drivers, enablers, and obstacles that affect such a transition by exploring the current state of implementation of circular supply chain practices in Finland. This thesis examines various cases and data were gathered by way of semi-structured interviews that were analyzed to comprehend the interpretation, actualization and extent of circularity in industrial networks. The findings obtained were also explained using Triple Bottom Line (TBL) sustainability framework.

Their findings demonstrate that the motivation of circular economy in Finland is mainly the national and EU-level policy as well as organizational commitment to sustainability and collaborative regional ecosystems. The paper emphasizes that despite the general agreement on the importance of applying the CE principles in strategic planning and its integration with those of other strategic planning components, the implementation needs continuous capacity building and the structural conduciveness at the industries and policy levels.

This study also contributes to circular economy literature by demonstrating that circular economy cannot be established linearly or organization-specific shift rather requires an iterative, network-dependent process. This process requires to be shaped by institutional, technological, and cultural factors. However, the systemic challenges including high investment costs, gaps in recycling and material recovery infrastructure, scalability limitations of emerging technologies persists. Development of shared logistics systems, material recovery infrastructure and strengthening knowledge transfer mechanisms are essential steps for advancing Finland's circular transition.

KEYWORDS: Circular Economy, Circular Supply Chain, Sustainability, Supply Chain Management, Finland,

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Abbreviations

CE= Circular Economy

EU = European Union

SEMS = Small and Medium Enterprises

TBL = Triple Bottom Line

VASEK = Vaasanseudun Kehitys OY

EPS = Expanded polystyrene

H & M = Hennes & Mauritz

LNG/LBG = Liquefied Natural Gas

CO2 = Carbon Dioxide

PESTEL = Political, Economic, Social, Technological, Environmental and Legal

CLCS = Closed-Loop Supply Chains

1. Introduction

The global economy is transitioning from the linear approach (take-make-dispose) to a circular in which the resources are subjected to reuse, recycle, and regenerate. The CE is gaining momentum as it can reduce waste, enhance sustainability, and create economic opportunities (European Union, 2023). According to the Finnish Innovation Fund Sitra (2023), the disintegration of nature's carrying capacity is one of 2023's megatrends. In addition, VTT Technical Research Centre of Finland (2023) identifies deep sustainability as one of seven megatrends for 2023 globally. Active promotion of the CE has been conducted in Finland by national strategies and innovation programs. This thesis considers how the principles of CE can be applied most effectively in Finnish supply chains for increased efficiency and sustainability. This paper is especially applicable to Finnish manufacturing firms, which are also being pressured to reduce environmental impacts and comply with EU standards. CE is a venture concept to control scarce resources and minimize reliance on virgin material (Sitra, 2023). Finland has been a proponent of the circular economy by recognizing these pressures in the form of national strategies, legislation, and innovation.

This thesis aims at discussing the existing supply chain adoption of the Finnish of the CE practices, evaluating the challenges and barriers to the adoption, and providing practical recommendations. Through integrating different case studies on the theoretical frameworks, the study will create more practices to facilitate the application of the circular economy, as well as provide practical solutions to Finnish firms.

1.1 Background of the study

The focus on green and sustainable management of supply chains has become the biggest concern in the context of the world wide when climate change, global warming, and modern lifestyle pressures begin to increase. Saeed and Kersten (2019) note that businesses are being strained to implement green and sustainable supply chain management because of societal pressures, regulations and market pressures. One of the green concepts that has some weight in the environmental perspective is the circular economy (CE). It is not a new concept, but it has evolved over time. Already in

the 1960s, Boulding (1966) had called the Earth a closed circular system which alluded to subsequent controversy over CE, including Pearce and Turner (1989). Keeping of materials and products in use for as long as possible by reuse, recycling, and repair are the primary methods of the circular economy (Korhonen et al., 2018). The CE has been viewed as a measure to decrease wastes, minimize raw materials, and emissions into the environment in the past few years (Lahane et al., 2022; Sehnem et al., 2019). Finland has also been considered to be the role model of sustainability in the world and has been encouraging the circular economy policy practices, investing in innovation, and positioning itself as a collaborative state in circular economy practices between the corporations (VTT Technical Research Centre of Finland, 2023).

Yet, Finnish supply chains are not immune to the challenge of failing to make use of the principles of CE to their fullest. While the policies and technological innovations provide the necessary support, the majority of companies, particularly small and medium-sized enterprises (SMEs), are faced with high expenses, bad infrastructure, and even a lack of skilled human resources (Mehmood et al., 2021). Such practical limitations establish a disparity between desired CE policies and reality executed in supply chains. The present thesis examines the issue of applying CE to Finnish supply chains with a greater focus on risks and opportunities, along with challenges in carrying out such an application. It has further been observed that past studies have given a great deal of emphasis to the challenges of implementation but have addressed the drivers and enablers little (Korhonen et al., 2018; Wei, 2015).

The elements of barriers can be diverse, therefore it is prudent to research the industry in the Finnish market in general instead of trying to research the specified industry. Understanding these contributors can enable an organization to not only push the environmental agenda but also enhance competitiveness and overall success (Romm, 2016, pp. 32-34).

1.2 Research questions and aim of the study

The comprehensive research question that this thesis will be guided by will be the following: What is the best way to incorporate circular economy principles into Finnish

supply chains in a way that would make them more sustainable and efficient? The research question will assist in framing the study and establishing its purpose. It indicates the necessity of bridging practice and theory when discussing the use of sustainable supply chain management.

There are three broad goals to tackle the solution to this question. The first is to look at the initial point of the circular flows in Finnish supply chains. Second, it outlines the key challenges and barriers that hinder the wider uptake of CE. Third, the paper investigates strategies, tools, and policies that may enable and support circular change. These goals correspond with the national and the EU objectives of sustainable development (European Union, 2023).

The research question and objective are clearly established; therefore, the research will be actionable and focused as well, owing to the apparent purpose of the research. It allows the researcher to gain useful information and compare patterns, and present desired solutions that would be context-specific but general. The results should provide support to the Finnish companies, policymakers, and researchers who are willing to contribute to sustainability through the power of circular supply chain practices.

1.3 Conceptual Framework

The conceptual framework of this thesis aims at linking the substantial theories of a circular economy to the real-life implications of circularity principles in the supply chains. The model incorporates the existing principles of CE, i.e., the waste elimination, resource efficiency, and product life extension, and the identified barriers and enablers in the literature.

Three core pillars of the framework include the following items: environmental, economic, and social sustainability, which are matching the Triple Bottom Line strategy. They depend on both internal business drivers (commitment of the leadership, technology capability, and supply chain cooperation) and external factors (regulations, market trends, and stakeholder expectations) (Tura et al., 2019; Khan et al., 2022).

This framework is useful in describing the interaction between drivers, barriers, and enablers as dynamic in the context of the supply chains in Finland. The mapping of such relationships helps the study develop a systematized understanding of the way CE can be and is successfully implemented into the supply chains, and detects both the problems and opportunities of such integration within the specific situation in Finland.

1.4 Definitions of Key Concepts

In this section, it will define the key concepts employed in the thesis in order to be more precise and have a common ground. These definitions can prevent the creation of confusion and may provide the reader with a full picture of what the research is about and its areas of concern.

Circular Economy (CE) is the name of an economic system to reduce the waste of resources and aim to have the highest output of resources by reusing, recycling, remanufacturing, and restoring. CE does not diminish the need to use a linear (take-make-dispose) economy, but it promotes closed cycles of resources in which objects travel the longest possible way using resources (Korhonen et al., 2018).

Circular Supply Chain (CSC) - the redesign of the supply chains with the support of the CE principles. Product flow in CSCs is not only optimized towards producers and customers but with back flow as well, a consideration that includes reuse, returning, remanufacturing, and recycling actions (De Angelis et al., 2018).

The Supply Chain Management (SCM) is the management of associated businesses, processes and activities that support the production and delivery of goods or services. SCM incorporates product take-back, closed-loop product tracing, and material flows as well as collaborative sustainability in circular supply chains (Govindan & Hasanagic, 2018).

In this paper, sustainability will mean evenly balancing economic development with environmental concerns and social welfare, the said Triple Bottom Line. Sustainability, in the context of CE, focuses on lessening environmental impacts, maximizing the use

of resources, making products durable, and promoting social development that is inclusive (Sitra, 2023).

1.5 Limitations and Validity

This study contains some limitations. The companies selected for the data collection shall operate in Finland. The company shall operate in Finland but doesn't require to be Finnish. Therefore, in this case, the respondent is asked to answer through the lens of the Finnish context, not the parent company or concern. This choice ensures that data are collected from Finnish market from limited respondents, which is the part of research gap. Since circular economy is based on recycling and waste management, these companies fit the aim of the study.

The study is based largely on literature overview and qualitative study, academic articles and reports, as well as publicly presented company reports. Although the same comprehensive theoretical information can be obtained, this method might fail to cover all the developments in the industry or all the company-specific programs in regards to implementing CE.

In this research, both primary and secondary data sources are used. Primary data were collected through the interviews of professionals and experts from different companies and outside the companies who are involved in the Circular economy, Supply chain, and sustainability. Through the interview, we get the information regarding how things work in the industry, barriers present, and how to overcome them. The secondary information was obtained by using scholarly articles, company sustainability reports, as well as corporate websites, which introduced the real-life views and opinions. The relevance of the studies is also promoted by such established theoretical frameworks as Circular Economy principles and the Triple Bottom Line.

1.6 Research Methodology & Data Collection

In this study, the research methodology is the qualitative approach with both source of primary and secondary data. Within the study, it is examined how the principles of a

Circular Economy (CE) can be implemented in the Finnish supply chains, and which barriers, drivers, and enablers, as well as other practices, facilitate circularity.

The research is guided by the following research questions:

What is the best way to incorporate circular economy principles into Finnish supply chains in a way that would make them more sustainable and efficient?

To answer this question, the study sets out three specific research objectives:

- To assess the current implementation of circular practices in Finnish supply chains.
- To identify key challenges and barriers hindering circular economy adoption.
- To identify additional practices that enhances the adoption of the circular economy.

A set of primary data was gathered in the form of interviews with the representatives of CE and professionals of the Finnish industries. Those interviews offered real-world information about the present-day use of CE, challenges noticed, and the conclusions of professionals concerning its enhancement. Various insights on ongoing measures were collected by means of a structured literature review with keywords equal to the combination of circular economy and supply chain, sustainability, in the University of Vaasa Library Database. All the searches included the peer-reviewed articles published, yielded more than 500 articles; after the screening process, relevant articles were selected. Real-world perspectives of secondary data collection were drawn by obtaining additional data in terms of corporate sustainability reports, company online publications, and publications with regard to the industry.

The study will combine theoretical knowledge, professional views, and corporate policies to elaborate on extensive findings and real-life guidelines on the improvement of CE in Finnish supply chains.

1.7 Structure of the Study

This study is organized into several logical sections that make it easier and guide the reader through the research process and findings.

Chapter 1: Introduction describe the background of the study, research questions, objectives, and outlines the reasons for investigating circular economy practices within Finnish supply chains.

Chapter 2: Literature Review introduces such academic theories and frameworks as the ideas of the Ellen MacArthur Foundation (CE principles), and the Triple Bottom Line (people, planet, profit). It also summarizes any new research related to barriers, drivers, and enablers of CE implementation in supply chains.

Chapter 3: Research Methodology outlines the qualitative research process, methods of data collection, and will select both the primary (interview) and the secondary (literature/corporate reports) sources of data.

Chapter 4: Results and Analysis will summarize the interviews of experts and second-hand data, showing what a supply chain in Finland currently adopts CE, what are the most prominent barriers are, and other supporting practices.

Chapter 5: Discussion decodes the findings obtained from corporate reports, interviews and various literatures and relates them to the prevailing literature, and gives feasible recommendations on how to improve the adoption of CE in the Finnish supply chains.

Chapter 6: Conclusions, recommendations and Future Research concludes about the key results of the study, recalls the limitations of the study, and offers future research on the issue of CE and supply chain sustainability.

This framework allows presenting a consistent and full development of the research subject with an appropriate integration of theoretical knowledge, on-the-job knowledge, and recommendations in the implementation of circular economy in Finland.

2. Literature Review

The early roots of circular thinking can be traced in the Knenneth Boulding's (1996) famous metaphor of "Spaceship Earth", which framed the economy as a subsystem of a closed, finite planet rather than an endless cowboy economy. Yet these framings were largely normative and lacked operational guidance. Building on this, Pearce and Turner (1990) framed the economy as part of a closed ecological system, where materials and energy must be recirculated. The basis of these works supports that the circular economy is a development of historical arguments on resource scarcity and sustainability.

The definition of the circular economy has been extended with time. Geissdoerfer et al. (2017) define it as a regenerative system slowing, closing down and narrowing resource loops and Korhonen, Honkasalo and Seppala (2018) refer to production-consumption systems operating on renewable energy and cascading material flows. There is however a wide divergence of definitions. Nonetheless, neither of them speaks about equity and justice, which makes the circular economy rather a techno-economic initiative. According to Kirchherr, Reike, and Hekkert (2017), 114 different definitions were found, which demonstrates the abundance and vagueness of the concept. A few critics, such as Murray, Skene, and Haynes (2017), highlight that many definitions of sustainability prioritize environmental and economic benefits while marginalizing social equity. This implies that although the two notions are protecting natural resources and promoting economic development, the social aspects, including fairness, justice, and community welfare are not highlighted. These are usually ignored or they are considered as secondary issues. Most recently, Morseletto (2023) has suggested that the circular economy is to be viewed as a limited transition approach, rather than a pledge of complete circularity.

This thesis also emphasizes the fact that these origins draw attention to the fact that the circular economy is not a brand-new-model as it is, rather, a changing pattern of reaction to ancient issues surrounding the shortage of resources, environmental pollution, and system stability.

2.1. Circular Economy and Sustainability: Alignment Gaps

Circular economy is frequently presented as a pathway to sustainability, but the relationship is not straightforward. Elkington's (1997) Triple Bottom Line (TBL) framework, economic, environmental, and social pillars, is often used to evaluate circular economy outcomes. Yet Elkington himself later warned that the TBL has been misappropriated into a simplistic reporting tool rather than a genuine transformation agenda (Elkington, 2018). Critics like Murray et al. (2017) state that the literature on the circular economy has a tendency to overlook the problem of labor rights and equity. Empirically, Neves and Marques (2022) note that social awareness in the transition to the circular economy is significantly behind that of environmental awareness. Furthermore, Elkington (2018) has subsequently criticized the way the Triple Bottom Line has been distorted into a reporting checklist instead of a revolutionary framework.

There is a two-fold implication of this asymmetry. To begin with, the notion of a circular economy risks strengthening the concept of green growth, which holds that environmental gains are sought to the extent that they do not threaten the economic competitiveness and that justice is left on the fringes. Second, disregard of the social pillar makes policy objectives harder to meet. In Finland, the Finnish Circular Economy Roadmap (2023) by Sitra focuses on job creation, community benefits and educational programs but research on implementation shows that social benefits are difficult to quantify and are easily drowned out by environmental and economic metrics. This prompts to an even more significant question: is the circular economy appropriately aligned with sustainability, then one must explicitly take into account the social consequences not only in the study but also the practice.

Reverse logistics, waste valorization, and eco-design are capabilities that can be seen as strategic resources in a circular economy-context that will make the forms stand out beyond compliance, and hence be able to capture long-term value. In the same vein, the implementation is also relational as it is inherently developed under the circular economy within stakeholder networks of governments, non-governmental organizations, customers and communities. According to Meadows (2008), supply

chain functions are intricate adaptive systems which are defined by interdependencies, feedback loop and unintended consequences.

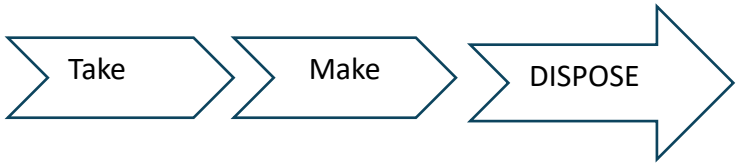

Figure 1. Linear Economy

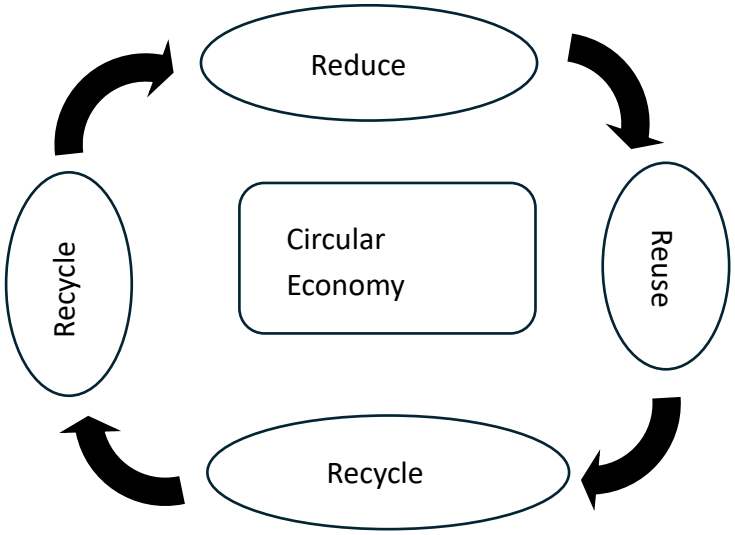

Figure 2. Circular Economy

Integration of these complementary lenses, therefore, does not confine the circular economy as an operational or environmental agenda, but as a strategic change, a process of stakeholder-based legitimacy, or a systemic socio-technical transformation. The theoretical plurality improves the ability to explain firm-level practices in the context of broad institutional and global sustainability processes. This paper therefore places the circular economy as a systemic framework of sustainability transitions, and the Triple Bottom Line (TBL) is another framework that can be used to assess its multidimensional outcomes. These perspectives can be combined to form a complete

perception of results. When combined, these viewpoints allow for a comprehensive understanding of how circular practices concurrently provide social, economic and environmental value, which are three sustainability pillars of the study.

2.2. Circular Supply Chains: Practices, Enablers, and Barriers

Supply chain management provides the operational backbone of the circular economy. Guide and Van Wassenhove (2002, 2009) define closed-loop supply chains (CLCs) as systems that integrate forward and reverse flows, enabling activities such as remanufacturing, reuse, and recycling. Industrial ecology-wise, a company can follow the example of natural systems; making waste streams an input of other processes (Korhnen et al., 2018).

Building on this, Bocken, de Pauw, Bakker, and van der Grinten (2016) identified four strategic mechanisms:

- Narrowing flows (efficiency, dematerialization),
- Slowing loops (durability, repairability, reuse),
- Closing loops (recycling, reverse logistics), and
- Regenerating systems (renewables, ecosystem restoration).

Nevertheless, there are still arguments on whether it is feasible. Guide and Van Wassenhove (2009) warn that reverse logistics can be very expensive particularly when using SEMs, because of the inconsistency in returns quality and lack of infrastructure. Some contend that digital products like blockchain and product passport may facilitate traceability and lower transaction expenses (Sarkis, 1999). Yet critics stress that technology cannot overcome structural barriers such as fragmented repair ecosystems, cultural resistance to reuse, and limited consumer acceptance (Hailemariam & Erdiaw-Kwasie, 2023).

2.3. Internal and External Drivers

The transition to a circular economy and circular supply chains is predetermined by both internal and external factors. Internal drivers are those reasons that are internal

to the organization. The reduction of costs and financial returns is one of the most striking benefits to the companies encouraging the development of circular strategies, as it leads to a decrease in waste and an increase in the effectiveness of resource use (Agyemang et al., 2019; Govindan & Hasanagic, 2018; Tura et al., 2019). Besides, circular techniques also provide new avenues of innovation since they promote the creation of new products and models of business (Calzolari et al., 2021; Tura et al., 2019). The involvement of the top management cannot be ignored, given that effective leadership makes sustainability practices part of the internal objectives of the company (Jia et al., 2020; Ostermann et al., 2021; Ouro-Salim et al., 2023).

Moreover, the in-house knowledge enables organizations to effectively adopt the circular practices (Ostermann et al., 2021). The use of the principles of a circular economy is also widely used in companies in order to support their competitive competencies and capture a larger market share (Agyemang et al., 2019; Calzolari et al., 2021; Jia et al., 2020; Sandvik & Stubbs, 2019). Other individuals and organizations strive to enhance their brand image through a sense of environmental responsibility (Sandvik & Stubbs, 2019). Lastly, a circular value proposition enables enterprises to support the sustainability aspect of products according to the demands of customers, making them more attractive in the market.

On the contrary, external drivers can be defined as the external pressures on the organization that lead to the implementation of circular practices. The government policies, regulations, and legal requirements remain important drivers that encourage businesses to implement the principles of a circular economy in operations (Calzolari et al., 2021; Govindan & Hasanagic, 2018; Jia et al., 2020; Mehmood et al., 2021; Ostermann et al., 2021). Moreover, the increasing environmental issues, in general, and climate change, in particular, make the companies implement more sustainable approaches (Govindan & Hasanagic, 2018; Mehmood et al., 2021; Moktadir et al., 2018; Tura et al., 2019).

Another important aspect, which is evident in the context of natural resources scarcity, is that the limited availability of raw materials forces business enterprises to demand

more circular and resource-efficient solutions (Tura et al., 2019). Lastly, the growing awareness of customers and their desire to consume nature-friendly and sustainable goods and services also contribute to the increased motivation of organizations to change their business model into the model of the circular economy (Jia et al., 2020; Tura et al., 2019)

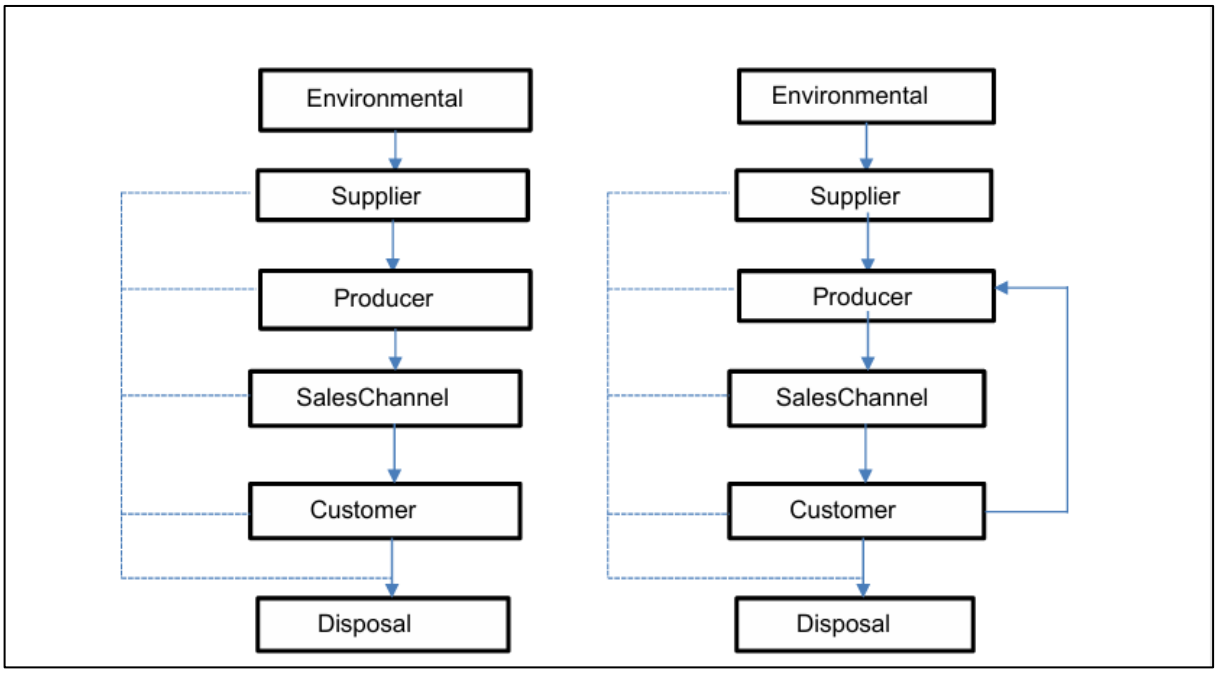

Figure 3. Linear and Closed Supply Chain (Adapted From Faroouqe et al)

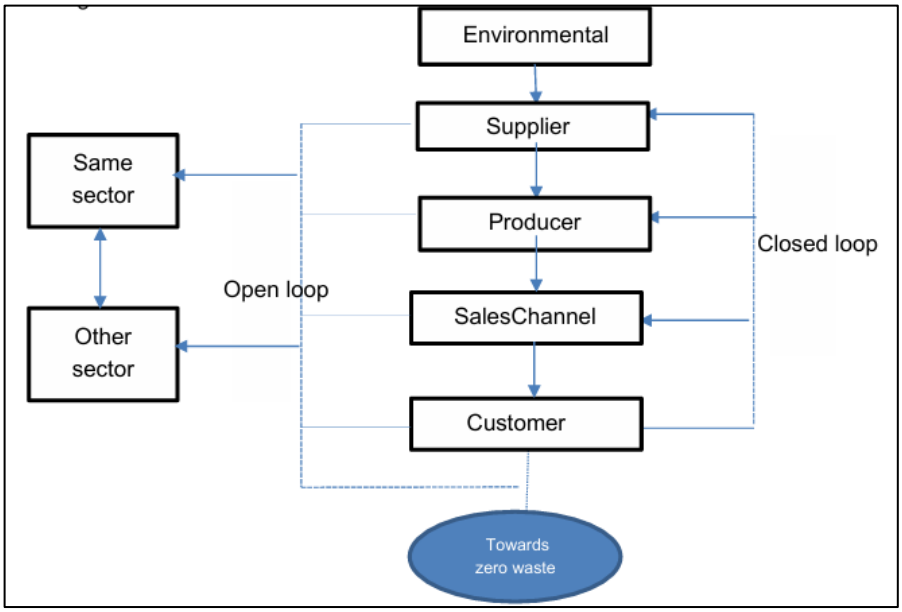

Figure 4. Circular Supply Chain (Adapted From Farooуqe et al)

In Figure 4, Circular Supply chain goes forward to other steps to recover from waste by co-operating with other organizations in the same as well as different sectors.

2.3.2 Enablers

Among the best-known facilitators of the circular supply chains, collaboration within the entire supply-chain network can be cited. The other major enabler is the application of technological and digital solutions. The attitudes of customers towards circular products, in particular, recycled ones, are crucial since Khan et al. (2023) examined the mediating role of these factors in driving circular supply chains. Customer acceptance will play a major role, as without the demand for circular products, it will be hard to establish a circular supply chain.

Commitment of the top management of an organization is another enabling factor that was emphasized by Khan et al. (2023), without which the organization cannot change. Other key enablers are legislation, regulation, and the creation of circular business models. Regulations are very important because they force businesses to do something, and a circular business model will be required to successfully establish the circular supply chains.

Sandvik and Stubbs (2019) stressed the role that digital solutions play in the process of facilitating circular supply chains and how digitalization and innovation are essential to the process. As specifically stated by Bressanelli et al. (2021), technologies related to Industry 4.0 (blockchain, 3D printing, and the Internet of Things (IoT)) are central to facilitating the purposes of the circular economy. (Khan et al., 2022) also stated that effective technological solutions, especially regarding waste management, are extremely needed.

Chen et al. (2022) did research on the way technology affects the adoption of circular supply chains and were interested in stressing the fact that circular supply chains could be adopted by technological improvements and automation of the process. Chaouni et al. (2023) pointed at insufficient experience in the usage of new technologies as the factor that might prevent further progress, emphasizing the necessity of well-educated and trained personnel. Supply chain cooperation has also been mentioned in several studies as a significant trigger of circular economy initiatives. Cardoso et al., (2023) identified collaboration as a key factor given that redesigning of supply chains is a very pertinent move towards realising circular economy endeavours (Hazen et al., 2021; Hussain & Malik, 2020; Govindan & Hasanagic, 2018). Larger partnerships, including industrial symbiosis (differing industries collaborating) have also been considered one of the most crucial facilitators (Khan et al., 2022).

Moreover, Chaouni et al. (2023) selected traceability as an extended consideration of circular supply chains. The ability to track and trace products and materials along the supply chain is essential to sustainable supply chain management and may be one of the hottest sustainability topics to be discussed.

The positive consumer attitude encourages high demand for circular products, and top management strategies support sustainable strategy and better utilization of resources. Legislation and regulation, traceability, supply chain collaboration force companies to be transparent, and a better foundation is made by the circular business model. Digital solutions and industry 4.0 technologies (e.g., IoT, 3D printing), technological solutions

for waste management, process automation, and process automation encourage innovation and efficiency.

2.3.3 Internal and External Barriers

High implementation costs, shortage of financial resources, and the absence of skilled workers are the most widespread obstacles of the internal type. In addition, the external obstacles are unawareness of customers, lack of cooperation with suppliers, and poor or inadequate laws. Though circular supply chains promise financial rewards in the long run, the investment needed to establish them could be considerable, and this is especially problematic when it comes to smaller companies (Tura et al., 2019).

According to Mehmood et al., the least of all wanted is financial limitations, which are known to be one of the biggest obstacles because the companies usually value profits rather than environmental responsibility (2021). Furthermore, Govindan and Hasanagic (2018) stressed that low government financing, coupled with high costs of implementation, worsens the problem of moving towards circularity of supply chains as well.

Another significant barrier is a failure to cooperate among stakeholders (Farooque et al., 2019). Although collaboration is known to be a major enabler of circular supply chains, the lack of it is a major inhibitor of the successful implementation of circular supply chains, as every actor in the supply chain needs to come into coordinated action so that the material can enter into a loop (Lehtonen, 2024). Another challenge is customers' willingness to pay higher prices. Circular products might become unprofitable in products whose industries that do not emphasize sustainability.

Poor environmental regulations also come in as big obstacles. Farooque et al. (2019) and Tura et al. (2019) stated that it is even possible that some circular solutions will be limited in certain countries, and Finland is one of those countries. There are industries where legislation on circular production is completely absent (Jia et al., 2020).

Internal barrier, as well, is a lack of knowledge and expertise (Mehmood et al., 2021). The complex skills may be necessary when resolving circular solutions. Bhattacharya and Kalakbandi (2018) also brought to light the necessity of a skilled workforce,

especially in jobs that could be regarded as undesirable, especially those in the manufacturing sector. The lack of employees trained in technologies is an obstacle to the realization of circular supply chains because technology is one of the key enablers (Chaouni et al., 2023).

Circular economy rules mainly revolve around waste management, which is not possible due to problems in management policy and waste management, unavailability of sites and plant materials, and the necessary technology. It is particularly problematic in developing states where a lack of effective waste management capacity and favorable legislation prevents any advances in the sphere of a circular economy (Mehmood et al., 2021; Govindan & Hasanagic, 2018).

Lastly, limitations of infrastructure, such as logistics challenges, block the process of adopting Circular supply chains as well (Chaouni et al., 2023). However, although redesigning supply chains is part of a circular practice, it tends to create added logistical and infrastructure issues.

2.4 Circular Supply Chain in Finnish Industries

The economic market of Finland is quite small, and the practice of a circle economy relies strongly on the culture of the country and local law, which differs across regions (Wei, 2015). In this chapter, PESTEL model is employed to provide a brief presentation of the market environment in Finland. PESTEL is an acronym for Political, Economic, Social, Technological, Environmental, and Legal factors, and it assists in providing details on the nature of Finland.

Finland is a parliamentary republic where the country is governed by the prime minister with a 200-member parliament and 12 ministries. Finland has a GDP per capita of 50,871.9$ (24th in the world), which is stable. But in 2024, Finland went into recession with increased unemployment (7.7 percent) and declining inflation (3.0 percent). In the year 2022, the exports and imports of Finland were approximately 90 billion euros (OECD, 2022).

Socially, there are approximately 5.6 million inhabitants of Finland (114th worldwide). The population is likely to decrease as early as 2031, which is likely to add to the demands of skilled immigration (OECD, 2022).

In terms of technology, Finland is well endowed with the tech industry, and brands such as Nokia have helped the country to recover its economy. Finland has the biggest export industry, which is in the technology sector, and digital innovations play a crucial role in the implementation of circular supply chains (Chaouni et al., 2023; Bressanelli et al., 2021; Chen et al., 2022).

The connection between environmental and legal factors is close. Finland leads sustainable development in the whole world (2021) and abides by EU and international environmental regulations. In the 2022 Climate Act, carbon neutrality is tackled by 2035, and emission reduction and climate policy are specified (Ministry of the Environment, 2024). The environmental laws that apply in Finland are really close to the EU directives as well as the UN agreements.

By 2035, Finland plans to go circular with the government incentives and the compliance with the EU legislation (Marjamaa et al., 2021; Finnish Ministry of Environment, 2023). Nonetheless, the attitudes of consumers are ambivalent, and younger cohorts of the Finnish population are both inclined towards sustainable products but experience self-responsibility consumption issues (Mykkänen & Repo, 2021).

One of the challenges in which Finland is specifically lacking is that the size of its market is small, which translates into the unprofitability of investing in circular economy solutions (Tura et al., 2019). Nonetheless, Finland has strong ambitions to achieve leading positions in the global front of the circular economy by 2025 (Sitra, 2016).

While the circular economy originated in academic and industrial debates, its most decisive push now comes from policy frameworks. The EU Circular Economy Action Plan (2020) laid out a strategy for sustainable products, waste reduction, and resource efficiency. Its implementation accelerated with the Ecodesign for Sustainable Products

Regulation (ESPR, 2024), which requires durability, reparability, recyclability, and Digital Product Passports for priority product groups (Van't & Schmidt, 2024). The policies make the circular economy a mandatory item on the agenda, which directly influences supply chain design and data.

As a result, the concept of a circular economy offers strategies on how to address narrowing, slowing, closing, or regenerating resource loops. However, there seems to be a lack of consistency in its definitions. The literature on its social aspects seems less developed. The literature itself proposes the following from the literature review on how gaps can be filled. There seems to be an awareness of its criticisms concerning the concepts of not fully closing loops, efficiency gains that can produce 'rebound effects,' or that 'social justice' can't be assumed.

2.5 Comparative perspectives

Even though Finland has positioned itself among the leaders of the transition into a CE, a comparison of other Nordic countries' or EU member states' approaches can offer insight. Sweden has predominantly used waste-to-energy concepts or modern municipal waste infrastructure, incinerating almost half of its municipal waste (Andersson & Stage, 2018). Norway's circular economy development highly focuses on the use of its renewable energy resources, the fisheries industry, or marine waste recovery. However, the continued reliance on oil resources has created the structural issues (Milios, 2021). Denmark, on the other hand, is famous all over the world for the example of its Eco-Industrial Park of Kalundborg, which practices an 'industrial symbiosis' concept, exchanging materials, energy, or water resources on a closed-loop cycle (Jacobsen, 2006).

At an EU level, there is the Circular Economy Action Plan (2020), which introduces uniform criteria across member countries, including the Eco design for Sustainable Products Regulation (ESPR, 2024), focusing on the design of durable, repairable, and recyclable products (Van't & Schmidt, 2024). However, despite the stimulating role of Finland's policies, its home market remains limited in comparison with other larger member states (Korhonen et al., 2018). The comparison shows that Finland's particular

strengths in the field of CE relate to bioeconomy, textile recycling, municipal waste valorization strategies, Denmark’s experience in industrial symbiosis, Sweden's in municipal waste energy recovery, as well as Norway’s approach in marine resources.

Circular economy is not a local or country-level but is more often placed in the context of global sustainability programs. Circular economy is firmly related to SDG 12 (Responsible Consumption and Production), but also indirectly relates to SDG 7 (Clean Energy), SDG 9 (Industry and Innovation), as well as SDG 13 (Climate Action). In Paris Agreement and EU Climate Goals, it is mentioned that the decreasing dependence on virgin resources and providing low-carbon production must be ensured (Cardoso et al., 2023). The 2035 carbon neutrality objective in Finland is backed by the circular economy (Finnish Ministry of Environment, 2023). Circular economy also echoes border demands to equitable transition (just transitions) which combine environmental change with social justice and skills training (Cardoso et al., 2023). Through instilling the circular economy of global governance structures, the Finnish firms and policy makers can position the circular economy as not only a national policy but also as a contribution to global climate and development policies.

2.6 Synthesis and Research Gaps

Through the literature review it has come out that the circular economy has developed beyond the concept of resource efficiency to a multi-dimensional model that entails the combination of environmental, economic and social objectives. As they look through the available literature, they are skewed in terms of geography. The Nordic setting is not well represented in the empirical research due to the significant number of results on the topic of Western Europe, East Asia, and China (Kirchherr et al., 2017; Geng and Diberstein, 2010). This is especially the case in Finland, where the cultures of corporate sustainability and the policies of the circular economy are at a relatively high level, but there is still the need to conduct further research. Moreover, most circular economy studies either adopt macro-policy or micro-operational views, with fewer exploring the meso-level of firm behavior and inter-organizational collaboration (Cardoso et al., 2023).. This gap restricts understanding of how external institutional frameworks translate into internal business models and circular practices.

3. Research Methodology

3.1. Research Design: Qualitative Approach

This research adopts a qualitative research design approach because it allows exploration of “how” and “why” that helps to explore the implementation of circular economy (CE) practices in Finnish manufacturing and supply chain-oriented companies. An informative approach using theory was used and a conceptual framework was created based on the literature to frame data collection and thematic analysis.

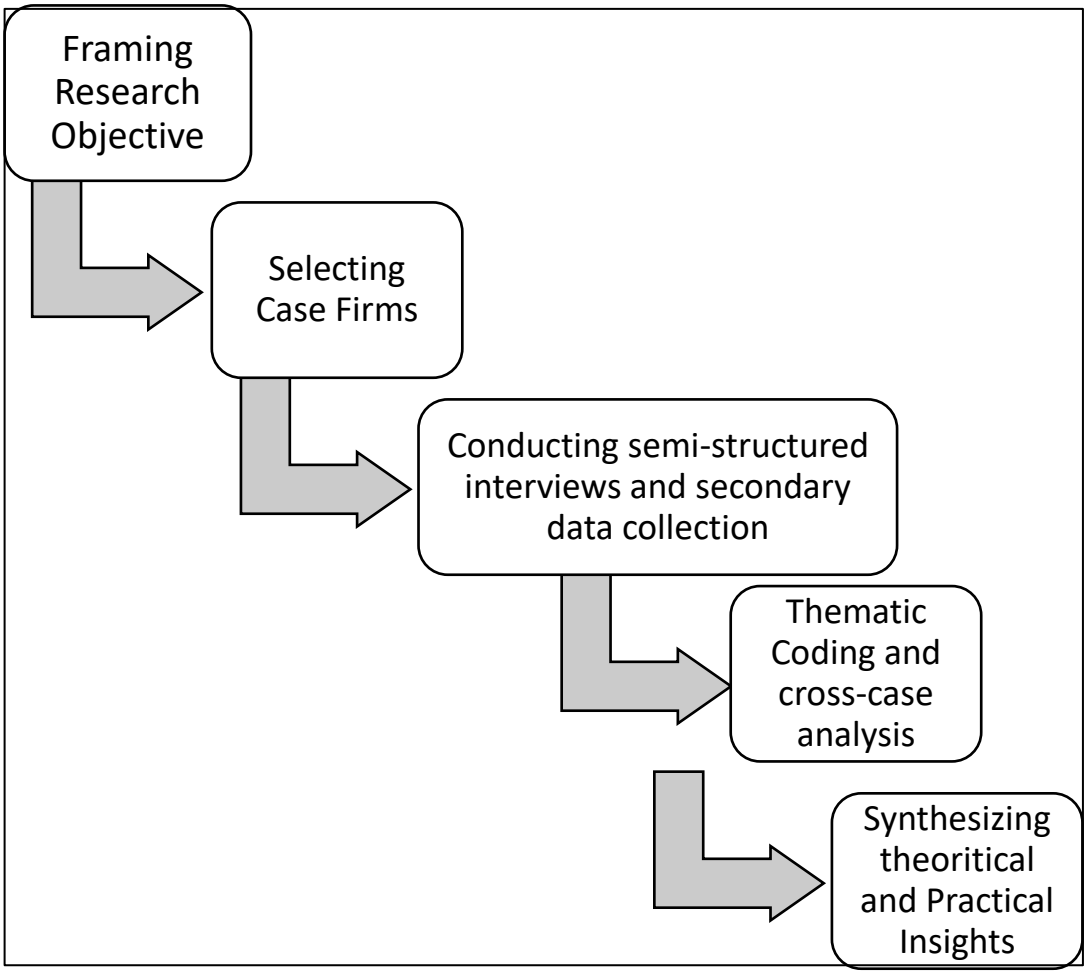

Figure 5. Research Approach Design

The scheme concentrated on three analytical categories, which included drivers, barriers, and enablers of circularity in supply chains. Qualitative methodology was chosen because it would provide a profound picture of organizational processes, strategies, and situational determinants of the adoption of a circular economy. The study used expert interviews to identify a systemic and firm-level dynamics that define

circular economy activities in the case of Finland. The case study design (Yin, 2014) is suitable since the study focuses on the current, actual practice in the complex supply chain settings. Comparative insights across industry sectors are made available by the study by examining more than one case (by energy (Gasum), waste (Stormossen), manufacturing (BEWI), textile innovation (Infinite Fiber), regional growth (VASEK), and textile services (Lindstrom); therefore, allowing the analytical generalization. This renders the findings more solid and confidence-inspiring compared to single-case analysis.

Table 1: Overview of Selected Case Firms

Case Firm	Sector	Ownership	Circular Economy Focus	Data Source
Gasum	Energy	State-owned	Biogas Production	Interview + Reports
Stormossen Oy	Waste Management	Municipal	Waste-to-resource operations	Interviews + Documents
Bewi	Packaging	Private	Recycled materials and design	Interviews
Infinite Fiber Company	Textile Innovation	Private	Textile regeneration technology	Interviews
Lindstrom	Textile Service	Private	Reuse & lifecycle management	Interviews
VASEk	Regional Development	Municipal	Circular economy facilitation & networking	Interview + Secondary Reports (website)

The study is based on the interpretive paradigm that believes organizational reality is constructed socially, meaning it is based on the views of the people most directly involved (Bryman and Bell, 2021, pp. 30-35). This paradigm of research will enable the researcher to derive the meaning and values prescribed by the members of the organization with regard to sustainability decisions (Schwartz-Shea and Yanow, 2012). The research assumes a constructivist position, acknowledging the fact that CE

implementation does not take a one-size-fits-all approach. It is influenced by actors' experiences, choices, and institutional forces. The environment in Finland demands an approach that can capture institutional complexity. The research design is most appropriate in enabling the researcher to understand how individual organizations absorb regulatory patterns, react to EU guidelines, and adapt approaches on a circular pattern. The role of the research, therefore, becomes not testing a hypothesis in a positivist research tradition but testing meaningful interpretations derived from discourse patterns of the industry. Using Yin (2018), the research design becomes a multiple-case design, which facilitates comparison across different research settings. Each firm becomes a distinct "bounded system." However, by themselves, multiple cases help discover patterns of similarities across settings. The research shows more generalized findings that apply across multiple settings than single-case discoveries. The following figure becomes a logical sequence of five stages. Each breaks down into another logical step, ensuring that this research's aims, data quantification endeavors, or attempts on research interpretations stay applied or interconnected. A carefully measured research scheme ensures that its research methodology stays legitimate or useful, bolstered by integrity on the research findings' overall validity or reliability.

3.2. Data Collection Methods

Data was collected from both primary as well as secondary sources. The sources of data include:

(i) Primary Data: Experts' Interviews

(ii) Secondary Data: Reports & Firm's company website

Initially, experts' interviews were performed on the representatives of three Finnish companies that follow the concept of circular economy practices. The six companies that fit this requirement include: Gasum, Stormossen Oy, Bewi, Infinite Fiber, Lindstrom, and VASEK Company. The experts' interviews helped gain information on the best practices of the circular economy. The whole discussion was semi-structured

loosely, where the issues discussed were related to the supply chain practices of the circular economy, policies that influence it, technological factors, and the marketplace role. The same holds true with data gathered in a secondary source.

3.3. Sampling Strategy

Purposive sampling was used to select and identify the interview subjects who had first hand experience and observation of activities within the two tour operations in the manufacturing and supply chain sectors of the Finnish economy that were linked to the circular economy. With the help of purposive sampling, the researcher can select information-rich cases and contextually relevant ones intentionally (Palinkas et al., 2015). This approach was adopted since it offers the flexibility of choice of cases that can best exemplify the phenomenon of interest. It is also unlike random sampling, but it focuses on theoretical relevance, which is in line with qualitative inquiry focused on conceptual comprehension instead of numerical representativeness (Creswell and Poth, 2018). The purpose was to obtain the lessons of companies that already had a relevant experience and could make rich rich descriptions of drivers, enablers and barriers to the adoption of the circular economy. Some criteria were used to select the participants, e.g., participation in recycling, reuse, resource efficiency, or closed-loop systems. In a more precise meaning, there were three principal inclusion criteria which directed selection:

The company should have or should be undertaking circular economy measures. It ought to be a separate sector as a part of the Finland circular economy plan. Availability of sources and the desire to take part in the interview or submit internal reports.

This sampling approach was non-probability and ensured that the data that was to be obtained was meaningful and will give a direct response to the research questions. They were chosen in accordance with their position, including strategic or operational duties in the field of sustainability and circular operations, e.g., Circular Economy Managers or Sustainability Officers. Others worked in companies that were actively

involved in circular operations and experienced enough to uncover internal strategies, collaborative operations, implementation challenges and policy implications.

Using multiple-case technique also strengthened validity of findings due to the cross-case possibility. Trends determined in the various contexts assist in distinguishing between sector-specific practice and institutional influences. This approach to selection is especially consistent with the interpretivist position of the study since it lays emphasis on depth, meaning and variation as opposed to breadth.

3.4 Method

This data were gathered using interviews of the experts and it was subsequently coded using thematic analysis to discover, analyze and understand the pragmatic information in relation to the theoretical information. Interview transcription was the initial step in the process and was accompanied by several readings to ensure that one immersed in the context and got familiar with it. The thematic coding scheme was constructed upon the inductive and deductive methods. Initial codes were created based on the transcripts of the interviews, whereas the general theme categories such as drivers, barriers, and enablers were informed by the conceptual framework on the basis of the literature review. This two-step procedure enabled the correspondence of the theory and the empirical data. Another classification of codes was done into themes which included policy impact, internal motivation, inter-organizational collaboration, infrastructure limitations and technology adoption. Content analysis also helped in facilitating this since it was used to quantify the repeated patterns and perceptions of the various interviewees. This systematic analysis served to identify sectoral conditions as well as transversal concerns in applying the circular economy in the Finnish supply chain and manufacturing industries.

3.5. Overview of Case Companies

These six companies with varying magnitudes of operations were selected in order to develop a multilateral perspective of the circular economy uptake: Gasum, Stormossen Oy, Bewi, Infinite Fiber, Lindstrom, and VASEK Company. The selected companies already are already undertaking circular, although through alternative business models,

supply chain arrangements and regulatory locations. This depth provides reasons to draw parallel with the application, interpretation, and challenge of the principles of the circular economy in different organization contexts.

Table 2 : Case Company Profile

Company Name	Sector	Core CE activities	Turnover	Ownership
Gasum	Energy and Bio economy	Recycling of nutrients, biogas production, circular sourcing	€1,330.8 million (Annual Report 2024)	State-owned + Nordic Partners
Stormossen Oy	Municipal Waste Management	Material recycling, composting, waste valorization	€ 17.2 Million	Municipal Ownership
Bewi	Packaging & Manufacturing	EPS recycling, reuse systems, circular product design	€773.2 Million	Private, Nordic Multinational
Infinite Fiber Company	Textile Innovation	Fiber regeneration from waste textiles, closed-loop supply	Not Public (recent €30 million investment as of 2022)	Startup, Finnish Venture Funded
Lindstrom	Textile Service	Product repair & reuse, shared service model, end-of-life textile repurposing, recycling partnerships	€518.1 Million	Family-Owned Multinational
Vasa Regional Development Company (VASEK)	Non-profit	Promoting sustainability commitments, circular economy	Publicly Funded	Public, Non-profit

		education (Green skills), partnerships with municipalities, businesses, schools		

These companies were chosen using purposive sampling strategy in order to be diverse in terms of size, industry and function within circular systems. Though the individual manifestations of the circular economy are represented by the respective companies, they all have proven their dedication to the environmentally sustainable practices of supply chains, thus making them fitting in case-based studies of how the circle of transformation has been pursued within the Finnish setting. This more detailed analysis of the company has been done in Chapter 4, Section 4.4.

3.6 Validity, Reliability, and Ethical Considerations

During the research process, credibility and ethical grounding of the findings was ensured. Analysis was necessary as the research is based on human perceptions and cherished experience of companies, which are in the circle of the economy. In an effort to improve validity of findings; the insight of interviews was compared to other sources. This was a means of giving more relevance to all the themes and not overly relying on one of the perspectives. The secondary data are triangulated with the presented data. To ensure this conformability, it is made objective through direct quotation and clear coding procedures.

In terms of reliability, the participants had a consistent method of interview. A semi-structured format implied that the most important questions were asked in blocks, but there was also sufficient room where each interviewee could make them theirs and bring their own experience to the table. Identification of themes and response analysis were exhaustive and documented in a comprehensible manner such that they can be repeated in case of necessity. The most important thing during the process was ethical integrity. The reason of the study and the use of their input were well informed to

everyone involved. Participants were interviewed after consent and all participants were informed about the option of anonymity. This report only covers those who agreed to be identified. All the recordings and transcripts were stored in secure places and were only utilized in the context of this study. Most importantly, there was a desire to honor time, knowledge and integrity that all participants shared. The sample size of this research is too small (six companies) and cannot be applied to all industries in Finland. Such reactions can be subject to organizational image as opposed to complete operational reality. Despite this variety, certain industries are omitted in the study, and interviews represent a cross-sectional change and not a longitudinal one. The outline of the research process is provided, and then it will be this process:

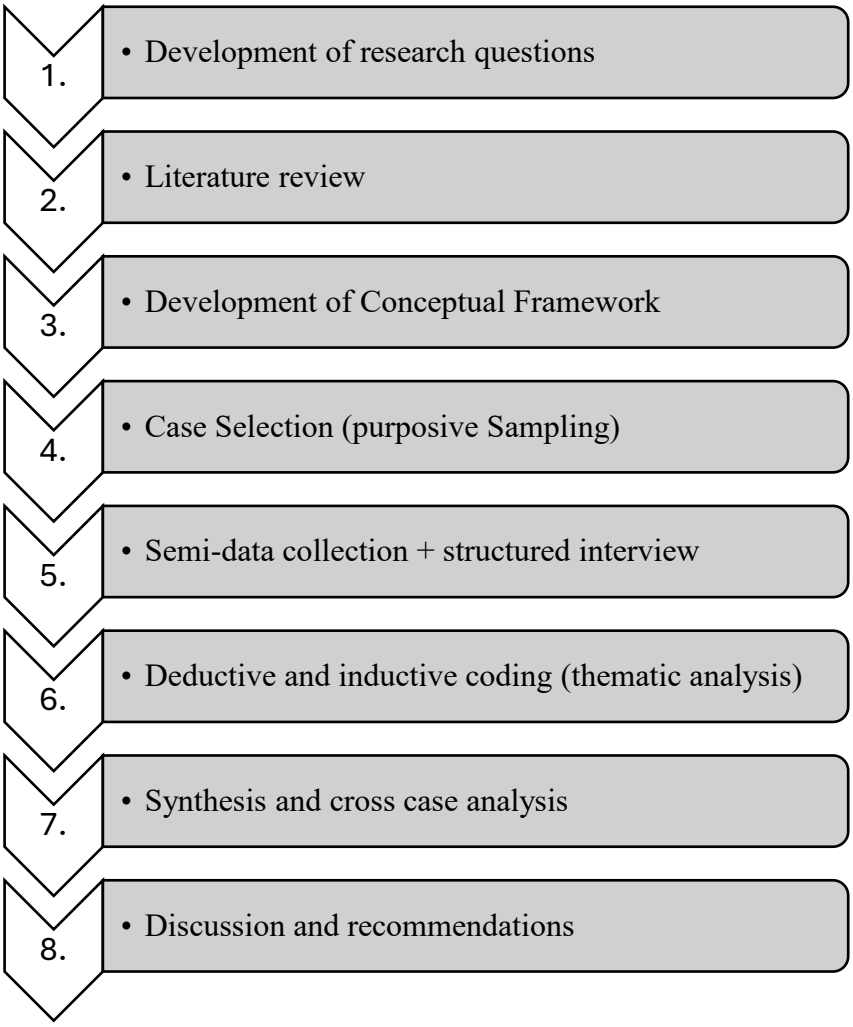

Figure 6. Steps followed throughout the process

3.7. AI Declaration

This thesis has incorporated a few uses of artificial intelligence tools in order to enhance language clarity, quality and proficiency. Specifically, Quillbot paraphrasing tool was used for improving the clarity, grammar, and language flow of the text. The author has done semi-structured interviews with firms, analyzed various literatures, and framed the content ideas. The AI tools were used only for linguistic refinement in fewer lines, however the intellectual effort are of author's. The use of tools were done for linguistic purposes and do not replace the intellectual effort by author. The author assures that all interpretation, arguments, research questions, research outcomes, conclusions and analysis this thesis represents are solely responsibility of author that highlights author's intellectual effort and soundness.

3.8. Limitations of Methodology

Although the research design and methods adopted in this research were well chosen to bring in credibility and depth, some limitations are bound to be indicated. The methodology used in the study was a qualitative multiple-case methodology, which is concerned with in-depth learning rather than coverage. This being the case, though the results are rich in their understanding of the circular economy adoption among Finnish firms, the results should not be used in statistical generalization. Instead, emphasis is made on analytical generalization, where patterns that occur across the case are used to develop theory as opposed to general conclusions (Yin, 2018).

The other limitation was that the study was time-restrained and resource-constrained, which constrained the number of the firms to six. Although this figure is enough to compare the cases across and saturate the themes, a bigger sample would have uncovered some additional sectoral differences. On the same note, only interviews with persons at the managerial level were carried out and this might not capture the views of the operational staff or other stakeholders. Also, there is one more natural limitation, which is related to interpretation by the researcher. Since qualitative inquiry is interpretivist, the analysis of data is bound to be subjective as the researcher tries to identify themes and build the narratives. This was however taken care of by reflexive journaling, peer reviews, and openness in the coding process to preserve the integrity

of the analysis. Likewise the research is contextualized in the institutional and policy landscape of Finland the results of the research may be area-specific.

All of those limitations notwithstanding, the selected structure of the given methodology, nevertheless, suits the research objectives proposed. The qualitative research methodology will guarantee a thorough comprehension of the socio-institutional forces that govern in CE, which may otherwise remain undetected by the research studies that utilize a quantitative research methodology. Thus, it can be safely said that the restrictions mentioned can be viewed not as a limitation, but a boundary.

4. Empirical Findings & Analysis

4.1 Introduction to Empirical Analysis

This chapter gives the empirical results of semi-structured interviews of six Finnish firms that are involved in the initiatives of a circular economy in various industrial spheres. This framework is grounded on the conceptual framework developed in Chapter 2, which includes the key building blocks, including circular principles, the triple bottom line (TBL) aims, strategic drivers, facilitating mechanisms and constraints to the Finnish context. The framework can be applied as an interpretation instrument in the research on the implementation of circular supply chains by companies in the framework of incentives and constraints. The combination of TBL, circular economy and linear economy allows obtaining a comprehensive picture of how the Finnish companies incorporate and realize the principles of the circular economy in the institutional context. The theoretical lenses offer an individual lens each:

It will be discussed thematically, starting with an analysis of the basic mechanisms of the circular economy, and moving to the exploration of transition driving or limiting forces that can be internal or external. Facilitators, barriers and forces of institutional pressures on the behavior of firms will then be discussed. These sections will be based on the findings, which are attained through the interviews and will be assessed within the environment of the previously defined concepts. The conclusion will provide comparative results of the cases.

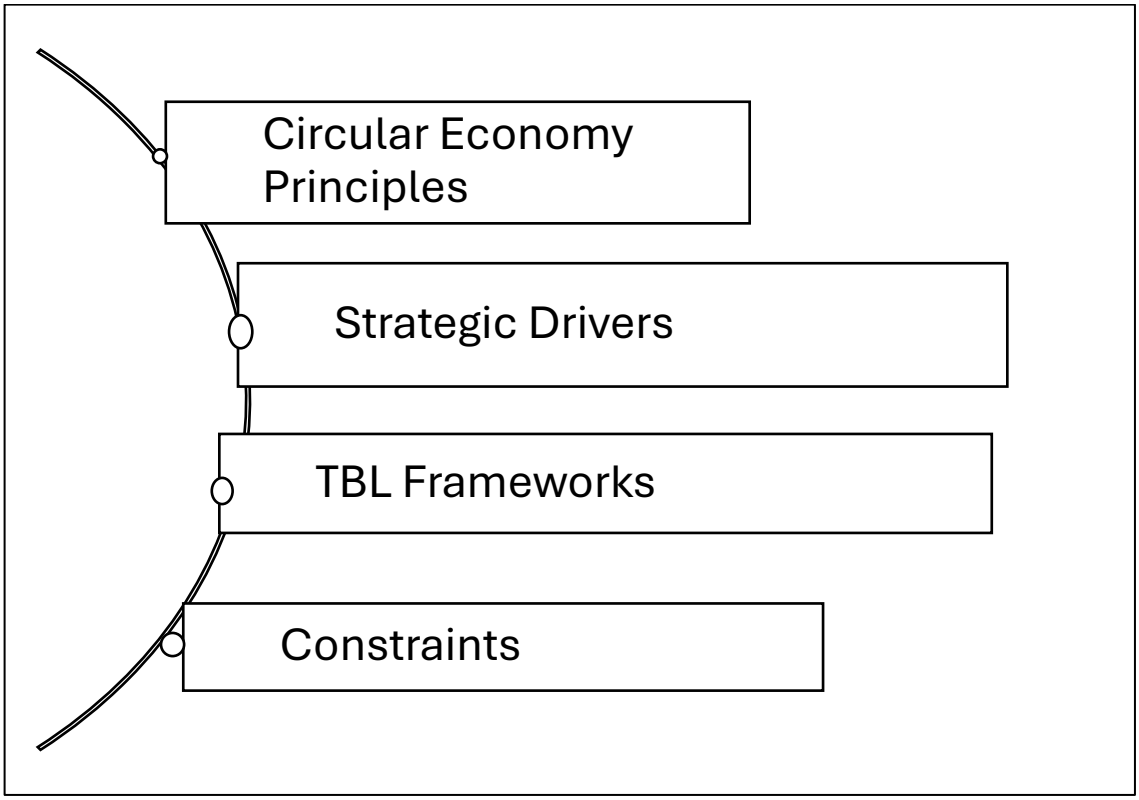

Figure 7. Circular Economy Conceptual Framework Flowchart

4.2 Circular Economy Principles in Practice

Three principles of the circular economy i) design out waste and pollution, ii) keep products and materials in use, and iii) regenerate natural system, are based on the foundation of sustainable value creation in supply chains (Ellen MacArthur Foundation, 2017). Practically, their operationalization is diverse in relation to the sectorial context and value chain complexity, as well as material loops. These principles are mentioned in each of the six case companies in this study, but in correlated manner. This confirms sectorial fluidity of the implementation of the circular economy offered by Geissdoerfer et al. (2017) and increases the practical applicability of the theoretical models.

The operationalization of the circular economy by each of the firms embodies coercive forces of EY and Finnish policies, as well as normative forces of professional and societal expectations of sustainability. This institutionalization of circle economy indicates the fact that companies do not operate on a vacuum, but conform the internal operations to the legitimacy structures in the external environment. Circular

economy is promoted by VASEK as not recycling, but an element of design and methodical cooperation in the form of Green Skills education programs and the Vaasa Climate Commitment platform. Lindstrom, in its turn, is an example of circularity because of its model of textile rental, repair, and reuse as a service which is backed by manufacturing industrial wipers of the used textiles and recycling relationships.

Table 3: Operationalization of Circular Economy Principles Across Finnish Companies

CE Principle	Gasum	Stormossen	BEWI	Infinite Fiber	VASEK	Lindstrom
Design out waste and pollution	Biogas systems converting organic side-streams; nutrient recovery	Early-stage sorting of municipal waste (bio, plastics, compostable)	Eco-designs in EPS packaging; life-cycle thinking	Converts post-consumer textiles into high-quality regenerated fibers	Promotes awareness/ education for waste reduction	Textile repair laundering system reduces new production
Keep products & Materials in Use	Circular energy loops	High recovery rate (>99%) of waste	Collects and recycles EPS into new products	Fiber-to-fiber regeneration; Closed-loop textile	Supports regional circular initiatives, enabling firms	Rental and reuse of textiles; extending product lifecycle
Regenerate	Methane and	Compostable waste	EPS recycling	Recycled fibers	Supports low-	Efficient laundering

Natural Systems	CO2emission reduction via renewable energy	used as fertilizers	reduces virgin material use	reduced dependency on cotton cultivation	carbon logistics and circular clusters	reduces water/energy footprint

In terms of drivers and enablers, while examining all these six companies, there are several shared and sector-specific factors. Gasum VASEK highlights how regulatory sticks interact with reputational and innovative carrots, and observes that the COVID-19 pandemic and the war against Ukraine contributed to the increased speed of efficiency and the adoption of the circular economy. Lindstrom demonstrates that even a circular business model can be self-motivating and the textile rental and reuse systems of the company make it profitable and sustainable.

Additional factors that enhance this model include the renewable electricity grid in Finland, a repair culture that has existed over a long period of time, effective logistics and supplier relationships. This offers structural provisions of scaling circularity. Similarly. Infinite fiber is also dependent on global textile brands that will guarantee demand security of its regenerated fibers. These companies such as Infinite Fiber and VASEK shows that the success of business sustainability through the transition to a circular economy is central to the company, instead of creating value systems between businesses and stakeholders (Murray, Skene, and Haynes, 2017).

The six companies polled reveal how much the companies are committed to eliminating waste by focusing on design-led innovation. BEWI has incorporated eco-design and life-cycle thinking into the design of EPS packaging and insulation solutions through the use of both EU and eco-design guidelines coupled with industry-related sustainability guidelines in products such as food and pharmaceutical. These are the innovation and regulatory alignment, which support design led by circularity with

principles of circular design, technological development and business model such as product-as-a-service (Calzolari et al., 2021). The eco-design and regeneration technologies of BEWI and Infinite Fiber are a good example of strategic circular economy that can improve the resilience and differentiation in the international markets. This supports the idea that circular economy-oriented innovation operates as a strategic resource rather than compliance exercise (de Jesus & Mendonca, 2018).

Similarly, Infinite Fiber Company takes this principle further by converting post-consumer textiles into high-quality regenerated fibers through a proprietary process that eliminates down cycling. This process slows and closes resource loops that enable fiber-to-fiber transformation without quality loss. Moreover, Stromossen Oy is operating in municipal waste, focuses on early-stage value separation such as bio waste, plastics, compostable to reduce contamination and increase recovery efficiency. This emphasizes on system-level waste prevention through infrastructure and sorting innovation (Govindan & Hasanagic, 2018). Furthermore, Gasum designs its biogas systems to optimize nutrient recovery and minimize methane emissions by converting organic side-steams into the renewable energy. The firm embodies vision of waste valorization through energy loops. The operationalization is different across the companies, however, product and material longevity is a shared strategic goal across the companies. As BEWI collects and recycles used EPS through public and industrial systems, and integrates reprocessed materials into new products. This model supports the closed-loop model and material loop closure in Finnish industrial ecosystems (Tura et al., 2019).

Additionally, the Triple Bottom Line (TBL) framework helps to evaluate the outcomes of circular economy initiatives in the six companies through various dimensions (economic, environmental, and social). The TBL framework application facilitates the gap between theory and practicality, which enables the evaluation of the circular economy as a combination of viability, eco-responsibility, and social value (Elkington, 1997, 2018).

Economically, companies like BEWI and Lindstrom are able to lower the cost and gain greater competitiveness through the integration of reused materials and reuse models in their business models. The fiber solution developed by Infinite Fiber improves economic resilience by building brands and accessing funds through EU, which guarantees financial soundness in the growth of its revolutionary fiber solution. The economic value addition by Gasum is through creation of the biogas market and reduction of reliance on foreign fossil fuels. Environmentally, the six companies are all concerned about measurable effects on efficiency in the use of resources and wastage. The Gasum and Stormossen are used to counter climate change not only because they minimize the carbon emission produced by biogas but also because they recycle the nutrients. In the meantime, Infinite Fiber and BEWI reduce the use of landfills and consumption of raw materials. Lindstorm minimizes waste in the textiles by prolonging the product life. Finally, VASEK initiates change on a bigger scale as it aims at education. In relation to society, the effects are job enrichment, job engagement, and growth. Stormossen and VASEK assist in building community in the location through creating awareness on various topics via educational means. Meanwhile, Lindstorm supports proportionality in the employment in textile services.

4.3. Cross-Comparison Analysis

Besides, based on the cross-case comparison, it has been identified that convergence and divergence also exist in the application of the principles of the circular economy by the companies. As an example, there is systemic coordination. Similar to Gasum and Stormossen works between municipalities and energy partners but VASEK between businesses and schools, and Infinite Fiber relies on brand partnerships to grow. The other similar trend is the incorporation of the circular economy in the fundamental business models. The rental and reuse system that the Lindstorm proposes is by definition circular and BEWI embraces recycling into the manufacturing process. In addition, the whole technology of Infinite Fiber is also founded on the regeneration of textile. It is also evident that regulation and policy have a pivotal enabling part throughout the cases with Gasum, BEWI, and VASEK specifically emphasizing the importance of the EU and Finnish frameworks. But the barriers vary capital intensity

and infrastructure gaps can be used to challenge Infinite Fiber and Lindstrom whereas behavioral and communication barriers are more relevant to VASEK and Stormossen Oy.

Infinite Fiber is a niche innovator on the technological frontier whereas Gasum and Lindstrom are regime players the established systems in response to both the market and regulating environments. The facilitative role of VASEK is parallel to the landscape level, which involves systemic coordination and policy incentives influencing the spread of innovation in the sectors. The trends suggest the focus of technological-oriented companies on innovation and scale, and service-oriented players or governmental ones on education, interactivity, and systematic facilitation. This analogy indicates that the circular economy in Finland is progressing in terms of a multi-actor ecosystem, where the firms, municipalities, and development industries complement each other. The innovative ones stretch the limits, and the systemic actors are the ones to guarantee some of the adoption and legitimacy.

4.4. Thematic Findings

Six interviews were analysed thematically, which produced seven central themes. Every theme was coded by repetition of the ideas in companies and refined into sub-themes, and where possible, validated by secondary data.

Table 4: Distribution of Themes Across Case Companies

Theme	Gasum	Stormossen	BEWI	Infinite Fiber	VASEK	Lindstrom
Regulatory Anchors	Y	Y	Y	N	Y	N
Circular Business Models	Y	Y	Y	Y	N	Y
Collaboration and Ecosystems	Y	Y	Y	Y	Y	Y

Communication and Awareness Gaps	N	N	N	N	Y	Y
Infrastructure Constraints	N	Y	Y	Y	N	Y
Crises as Accelerators	N	N	N	N	Y	N
Triple Bottom Line Outcomes	Y	Y	Y	Y	Y	Y

The regulatory decisional aspect of facilitating the circular economy was noted by five interviewees. Gasum emphasized that biogas investments were feasible due to renewable energy objectives in the EU. Gasum, the sustainability manager, notes that without regulation of the same on the EU level, the biogas market would not have grown on this level. Stormossen and BEWI also mentioned recycling requirements and producer responsibility laws. VASEK referred to regulation as a stick that is complementary to innovation and reputation. Interestingly, regulation was not considered central by Infinite Fiber and Lindstrom, and their business models and their customer relationship were the key drivers. In the same manner, four firms, Gasum, Stormossen, Infinite Fiber, and Lindstrom, pointed out that the circular economy is intrinsic in their operations and not an appendage. Lindstrom positioned reuse and repair by arguing that they are economically in line with sustainability and that their entire service model is circular-based and they gain when products are used longer. Infinite Fiber wrote about how Infinna Technology can make new markets by turning textile waste into high quality fibers and Stormossen and Gasum wrote about closed-loop energy systems, where biogas produced by waste become local grids.

Moreover, all the six cases emphasized collaboration and ecosystem building. BEWI highlighted collaborations with local authorities to gather EPS plastics, Infinite Fiber emphasized the importance of global brand commitments in the growth of innovation, and the Climate Agreement platform created by VASEK was mentioned several times as

a place where the systemic cooperation could occur. VASEK said that it is not a single company that could make the transition but it is a system where you require the municipalities, companies and the citizens. VASEK and Lindstrom were the only authors who highlighted the difficulties on how the circular economy is communicated. As VASEK observed, most of the SMEs do not widely share their sustainability efforts, they diminish engagement with the community, and Lindstrom continued, the repair process is not always visible to the customers, and we should make it visible, otherwise it will look like normal business. Further, Stormossen, BEWI, Infinite Fiber and Lindstrom identified Infrastructure constraints. Stormossen made the point about limits in the growth of biogas grids; BEWI mentioned the inadequate EPS recycling system in Europe; Infinite Fiber used the lack of large-scale textile collection; and Lindstrom said there was no universal textile recycling infrastructure. Crises were only mentioned by VASEK as accelerators, and the COVID-19 and the war in Ukraine prompted the necessity to reconsider the resource dependency: now, companies found that they needed to grow smaller and rely on resources more intelligently. Lastly, the six cases related the circular economy to favorable environmental, economic, and social results. Stormossen boasted of its 99% material recovery rate as a flagship, Gasum positioned circular economy as creating jobs and building trust in the region, Infinite Fiber accentuated its competitiveness based on innovations, VASEK attached circular economy to the attraction of talents and local reputation, and Lindstrom highlighted its reduced textile waste and long lifespans of its products.

4.5 Results and Analysis

The analysis combines both the qualitative information and quantitative measures like turnover, employment, production size and recycling effectiveness. The combination of these helps to understand that Finnish firms implement the principles of a circle economy in practice, which impacts them negatively, and which open opportunities they provide.

4.5.1. Infinite Fiber Company

Infinite Fiber Company is a company that involves using technology in the circular textile. Infinna is the main innovation of the company, which converts waste textiles and cellulose-based material in a fibre that has similar visual and functional features to cotton, but is recyclable and can be biodegraded; this technology was invented in 2-16. On the quantitative level, the company is already expanding by building a 30,000 ton/per year capacity plant in Kemi, a significant move towards commercialization of a circular economy innovation. Associations with Zara, H&M, and Tommy Hilfiger are characterized by high market acceptance, especially when they strive to comply with the requirements of the sustainable market defined by the EU. This finding indicates that Infinite Fiber has been able to establish itself as the place between innovation and world market demand. Nevertheless, the obstacles still exist in the shape of capital-heavy investment demands, the reliance on the consistent streams of textile waste, and the consumer attitudes to recycled textile products. It is a pointer of the fact that innovation can trigger the aspect of circular economies in world supply chains**.**

4.5.2. Gasum

Gasum is a concept of the circular economy that is mature and infrastructure-intensive. The company got started in 1994 with its head office being located in Espoo. Gasum operates in Finland, Sweden, Norway and Denmark. The operations of the firm as a part of the process of generating a circular economy include the production of bio gas, natural gas distribution, and LNG/LBG. Gasum has a massive network of biogas plant, which specializes in the treatment of biodegradable waste into energy and fertilizers. Availability of financials are not adequately elaborated, but Gasum was an important player in the energy market in Finland serving the entire countries natural gas transmission network until infrastructure unbundling of the country that happened in 2020. The transmission was separated into the gas grid of Gasum in Finland.

The result shows that the contribution of Gasum in the circular economy is associated with the management of waste processing into generation of energy by renewable means, which has a direct impact of reducing the emission of CO2. However, there are still such obstacles as unstable energy markets, overdependence on regulatory

incentives and infrastructure expansion costs. The EU and national policies as external forces promoting the adoption of the circular economy are crucial, as evidenced in this case. The biogas implementation achieved by Gasum as an adherence to the EU requirements regarding renewable energy sources converts into the strategic circularity. At the same time, its nutrient recovery networks are system-level feedback loops that are congruous (Ranta et al., 2020).

4.5.3. Lindstrom Group

An example of service-oriented circular model is Lindstrom, which relates to textiles. The company has 175 years of experience in the industry and shifted to the circularity by leasing, laundering, repairing and recycling textiles. By 2024 (Sustainability report), Lindstrom had 4,900 employees, had 21.3 million textile products in circulation, and a turnover of over €518.1 million. The fact that it is circular enables a garment to be repaired and used many times, eliminating millions of kilograms of textile waste. Moreover, it has also established a goal of recycling all textile waste by 2025. The findings indicate that the competitive advantage of Lindstrom is its capacity to integrate the concept of the circular economy into its supply chain.

This is possible to facilitate mass reuse, water and energy conservation in the laundry. The participation of customers is hampered by the provision of textile returns in good time, disparities in recycling facilities across the world, and the intricacy of operation in the 24-country activities of its operations.Lindstrom thereby illustrates how scaling circular service models is possible, but depends heavily on customer and infrastructure maturity. Its recycling and repair operations boost TBL results by integrating both economic profitability and environmental effectiveness and just employment policies (Elkington, 1997).

4.5.4. Stormossen

Stromossen presents examples of implementing the concept of a circular economy. The company was founded in 1985 and was owned by a total of six municipalities. The population covered by Stromossen amounts to 108,000. From an operational perspective, Stromossen exceeds the threshold of 99% waste recovery (material +

energy). As of 2024, the company has a total of 50 employees. The company's financial revenue amounts to €17.2 million. From a strategic perspective, the company's focus on a circular economy centers on the production of biogas from organic waste. The biogas serves as a transportation fuel. Stromossen thus directly contributes to a low-carbon transport sector in Finland.

The outcome shows that Stormossen's effectiveness relies on its capacity to ensure public engagement in waste sorting. Moreover, issues of finance can be related to the EU and the municipal subsidy. Through the example of Stromossen, the example of how the municipal level of circularity can be attained is through the association of the practices of citizens and the municipal infrastructure. The Stormossen municipal structure explains the institutions that are adopting the notion of a circular economy.

4.5.5. VASEK

In 2003, VASEK (Vaasa Region Development Company) was established with the main role of enabler of circular ecosystems on a regional scale. It does not manufacture goods or electricity as do the other case companies, but organizes regional growth and sustainability programs. VASEK has a team of 20 professionals, who manage EU-funded projects supporting the adoption of the circular economy, smart mobility and digital transformation. Its flagship program, Energy Vaasa, unites close to 160 companies and research organizations, and creates the biggest Nordic ecosystem in clean energy and sustainable technologies. By means of this cluster, VASEK participates actively in terms of attracting investments, assisting start-ups, and involving low-carbon logistics.

The answer is that VASEK is successful in generating partnership synergies and establishing Vaasa region as a bottomless economy innovation center. Drawbacks however, are its reliance on EU project funding, and its inability to harmonize various stakeholder interests in the long term. This underscores the fact that regional development agencies are agents of change and not agents of implementation of CE practices.

4.5.6. BEWI

BEWI is a giant corporation in the packaging and insulation business, which is one of the industries which have historically been associated with linear production, which is resource-heavy. The company has been eager in integrating the circular economy; this has been achieved by investing in the recycling of the networks that made use of expanded polystyrene (EPS) that is a substance that is infamously difficult to repurpose. BEWI also has come up with closed loop program in some of the selected regions whereby EPS packaging are collected and reused in production. Even though the financials depend on the division, BEWI investments in recycling can be characterized as an expression of strategic interest in not depending on virgin material.

The discovery implies that BEWI takes its circular economy projects in business where recycling is not significant. But logistical costs of collection, less consumer participation in return schemes as well as weak regulation in some markets are some of the barriers. The case demonstrates how the traditional industries are gradually yet significantly turning into circular.

4.6. Cross-Case Comparisons and Emerging Patterns

The six cases exhibit both consistencies in circular economy adoption facilitators and differences by sector, ownership, and size. Cross-comparing interviews, three cross-cutting themes, and two contrasts are discerned.

Regardless of the sectors, all cases emphasized that the circular economy is not something that one actor can undertake alone. Municipal ownership (Stormossen), brand partnerships (Infinite Fiber), industrial alliances (BEWI), and regional platforms (VASEK) are different forms of collaboration. This coming together indicates that the circular economy is systemic and requires a multi-actor ecosystem. For Lindstrom and Infinote Fiber, circularity is embedded in the business model itself, and it is sustainable and profitable. Gasum and Stormossen also consider the circular economy as inherent, though it is shaped by regulatory mechanisms. In contrast, BEWI and VASEK present circularity as a transitional process. BEWI from linear to recycling, and VASEK as enablers for other firms, suggest that they are integrating circulatory into existing

models. State-linked or regulated businesses (Gasum, Stormossen, BEWI) referred to EU and Finnish regulation as decisive enablers, while Lindstrom and Infinite Fiber placed more emphasis on market demand and innovation. This would imply control at its highest level in infrastructure-intensive industries and customer draw and partnership are employed by innovation-driven companies. The communication issues were, however, most manifested in the service-based settings like Lindstrom, VASEK, where sustainability initiatives are not as evident to the customers.

Further industrial companies such as Gasum and Stormossen, whose waste and energy products were more concrete, were less a problem. This is a contrast that is used to point out the necessity of sectoral communication strategies. As Ranta et al. (2018) argue, the circular economy dilemmas appear to be more visible in service companies and not in industrial ones. Crises (COVID-19, war in Ukraine) were also emphasized by VASEK as drivers as a non-profit, which is consistent with its systemic approach to various companies. Crises were not identified by other companies as drivers indicating that support organizations might be more sensitive to increased contextual changes as compared to individual companies. Although the approaches were varied, the circular economy was in the advancement of environmental, economic, and social objectives by all businesses. So these six case firms depict a complicated Finnish circling economy landscape, innovation-initiated startups, established multinational corporations, municipal companies, and regional enablers are all a part of the change.

The objective data on the turnover rates demonstrates its recovery rates which are quantitative, portrays the realization of the progress, and analysis of the difficulties of the scales, costs, and coordination. These observations indicate that the transformation of the circular economy in Finland is both ambitious and complex and needs the constant innovation, which allows regulation, and active coordination. The collective presence of the cross-case patterns underscores the way circular economy is a systemic change and not a company-level endeavor. The mutual relationships between firms, regulators, and local societies reveal that the effective implementation of the circular economy requires responsive feedback strategies, mutual learning, and coordination among the institutions, to avoid the rebound impacts in a linear fashion.

5. Discussion

5.1. Theoretical Implications

The main argument suggested in the literature review is supported, as well as strengthened, by the empirical observation in the six companies. The literature review argues that the shift from a linear to a circular economy requires system change at supply chain levels as opposed to technological innovation. However, they affirm the shifts in business models, networks of collaborations, and policy support. The real-world implementation of the circular economy within supply chains remains piecemeal, most notably in firms' management of flows of resources, measurement, and alignment of incentives. The regulatory function as a spur emerged clearly within the examples of BEWI and Gasum, in keeping with Krichher et al. (2018), who emphasize that legislative "sticks" are amongst the most influential facilitators of circular economy adoption within Europe. However, the companies also illuminate the way regulation is a stabilizing force in terms of diminishing the risk of investment, which is slightly less verified in the literature review so far. The Geissdoerfer et al. (2017) observe that systematic certainty is most crucial for circular economy transitions to gain momentum, which is supported by these facts. Similarly, the business model innovation's role also receives empirical support. Lindstrom's service-based textile system and Infinite Fiber's fiber regeneration project exemplify what Geissdoerfer et al. (2017) describe as strategies to slow and close loops. However, in different instances, it has been argued that firm level innovation cannot be effective without the cooperation of an ecosystem. The industry collaboration of BEWI and the interdependency of Infinite Fiber on brand promises appeal to the networked perspective of the circular economy that the Ellen MacArthur Foundation (2015) has encouraged as based on the value-creation at the collective level.

In addition, the barriers and enabling conditions, which are presented in the case, reflect but continue the literature review. VASEK communication difficulties and reliance of Lindstrom on poorly developed textile infrastructure indicates the capacity and structural limitations that are defined by Ranta et al. (2020) and Korheonen et al.

(2018). Nevertheless, the fact that crises like those posed by COVID-19 and the war in Ukraine motivated adoption gives an additional twist to the available literature, as it can be argued that disruptive shocks, not just gradual changes in policy or market, can trigger circular economy practice. Gasum and BEWI exemplify pressures in coercion in terms of regulatory pressures, whereas Lindstrom and Infinite Fiber show pressures in terms of a mimetic adaptation in the style of imitating successful practices of the circular economy across industries. However, unlike much prior research that treats institutions as static enablers, the Finnish cases demonstrate that institutional frameworks are co-evolutionary, adapting alongside firm innovation and crises.

Additionally, the outcomes of the case analyses also provide some insights into how the theory of the circular economy can be framed in the context of businesses. From the business standpoint, the findings from the research provide more evidence of the importance of business models. According to Geissdoerfer et al. (2020), to attain the long-term results concerning the circular economy, the loops need to be closed, narrowed, or slowed down so that the value proposition could be reframed. This can only be achieved by the examples of Lindstrom and Infinite Fiber.

These findings can be considered an extension of Geissdoerfer et al.'s (2017) framework of circular business models. The findings indicate the result of obtaining an advantage by the notion of circular economies not only requires innovation within an industry's boundaries, as echoed by the Ellen MacArthur Foundation (2019), the systemic approach of looking into issues. The application of the concept of a circular economy can be an effective means of sustainable production. Nonetheless, it demands a change in supply chain practices.

The shift towards a circular economy can be discussed as a socio-technical change, in which niche innovations (e.g. Technology of Infinite Fiber) are exposed to regime incumbents (Gasum, Lindstrom) within landscape-level forces (EU directives and global sustainability standards). This theoretical overview highlights that the achievement of the circular economy requires systemic alignment and not individual innovation. The

theoretical synthesis highlights how success in the circular economy will be based on the systemic coordination and not individual innovation.

5.2. Policy Anchored Circular Ecosystem

To policy makers, the case indicates that institutional scaffolding should not be coercively regulated. As the EU guidelines were the most important catalysts in the case of Gasum and BEWI, the Climate Commitment platform by VASEK and the local governance by Stormossen prove that the notion of legitimacy can also be formed through partnership and local authorities. The different Coercive forces are based on the EU directives like the EU Circular Economy Action Plan (2020) and the Green Deal (2019) which dictate mandatory recycling and the product required life-cycle. The sustainability culture of Finland generates normative pressures that are forced by state policies such as the Strategic Programme of Circular Economy (2023) and the Waste Act (646/2011), which implement EU directives in industries in Finland. sMimetic mechanism where firms emulate perceived leaders can be seen in BEWI's alignment with Nordic recycling norms and Gasum's bioenergy innovation under regulatory certainty (Scott, 2013).

The Ranta et al. (2018), caution that the circular economy must be understood as a socio-institutional transformation rather than purely a technical shift. There is dynamic interaction between the CE governance structures and the micro-level firm innovations in Finland. They include regulatory anchors, ecosystem orchestration, and culture changes. This is to respond to the critiques, such as Korhonen et al. (2021), who warns that the circular economy can be marketed in a limited way to be a win-win solution. Rather, the cases imply that the circular economy is to be tightly aligned with economic, technological and institutional forces so that it could become alive in terms of its transformational potential. The Finnish CE development has this in its respect; the environmental compliance is guaranteed by the legal framework (Environmental Protection Act (527/2014) and Waste Decree (179/2012)) and by the local programs (participatory governance) in which policy and practice intersect (e.g., the Climate Commitment of VASEK). Multi-level policy mix promotes the adaptive stability, the

balance between innovative flexibility and institutional cohesion (Linder and Williander, 2015; Ranta et al., 2018).

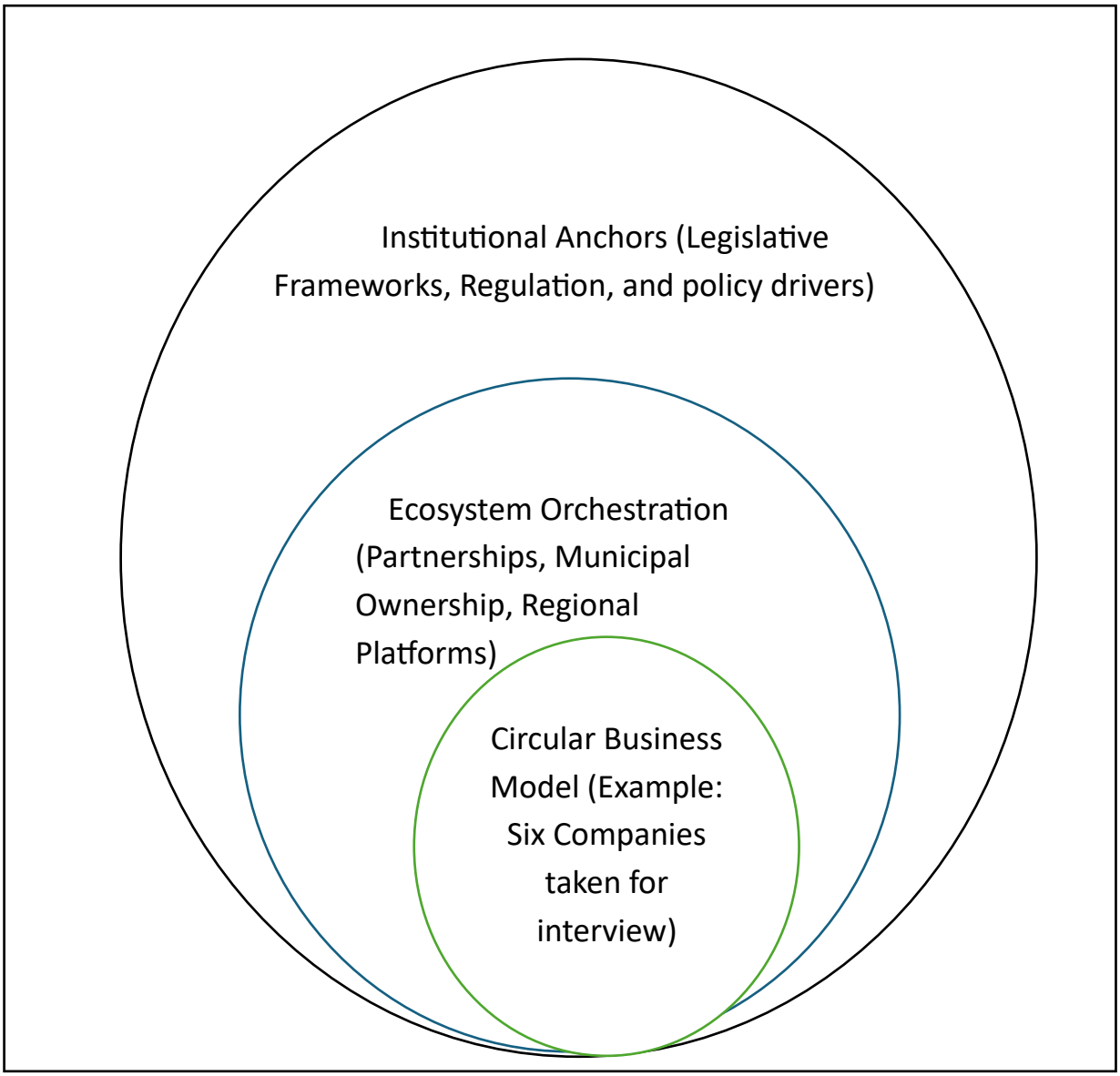

Figure 8: Policy-Anchored Circular Ecosystem

This model agrees with the socio-technical transition theory. It emphasizes the fact that transformative sustainability requires institutional alignment, cross sector co-operation and cultural change as well as not merely the technical interventions.

5.3. Practical Implications and Critical reflections

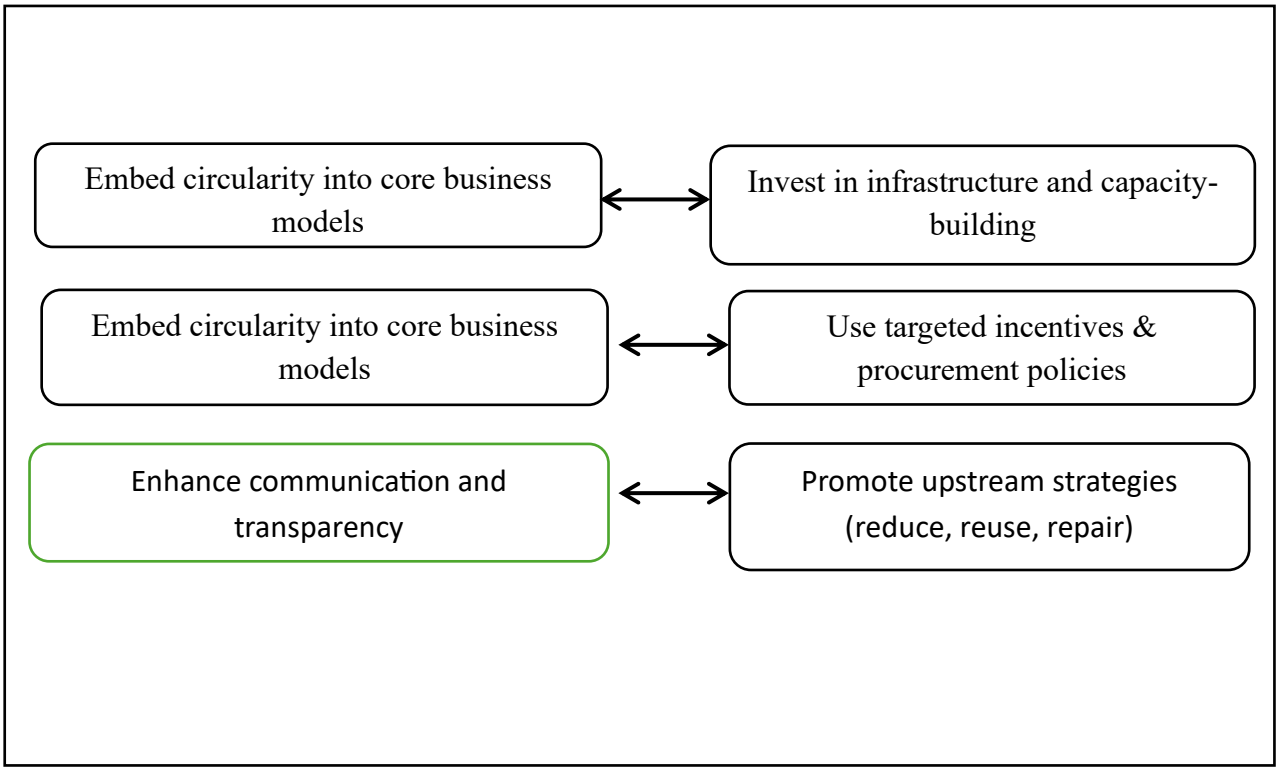

Figure 9: Connection between the Practical Implications for Firms and policy makers

It shows that business model circularity as such is more sustainable than erudition sort of initiatives. The results of this paper have significant consequences on managerial practice and policy within the context of the use of circular economy by Finnish supplies chains. The practice observed reveals that these types of capabilities as reserve logistics, material innovation and digital traceability are circular capabilities that are strategic assets that trigger long-term competitiveness (Hart and Dowell, 2011; Chen 2021). Companies like Infinite Fiber in Finland demonstrate how CE-based innovation can serve as a significant source of differentiation in the context of partnering with enabling institutional structures and sustainability guidelines.

These results have different managerial implications on the firms. Based on the previous research, supply chain collaboration and new business models are essential to successful implementation of a circular economy (De Angelis et. al, 2017;

Geissodoerfer et al., 2020). The information confirms the conclusion that Finnish companies may use digital technologies, including traceability systems and data platforms, to gain more efficient closed-loop systems (Bressanelli et al., 2021). On the same note, incorporation of circular economy activities assists the enterprises to minimize wastage, to be more efficient, and to foster sustainability. This approach is reflection of the Triple Bottom Line (TBL) model, with enterprises achieving environmental stewardship, social value, and economic sustainability simultaneously. Lindstrom's clothing circular model has environmental advantages with recycling and social advantages with green jobs which demonstrates Finland's Sustainable Growth Programme (2021) and the EU Green Deal's social equity goals (Hahn et al., 2025; Morioka & Carvalho, 2016).

Furthermore, the results concur with the argument of Korhonen et al. (2018), who note the difference between circular economy policy ambitions and other operating practices among EU member states. This shows that even if there is partnership and openness, institutional barriers such as irregular laws and missing incentives continue to be an obstacle in totally transition towards circularity. Apart from this, as per recent studies, stakeholders' engagement across the supply chain involves SMEs, customers, and regulators. These constitute one of the primary issues of overcoming root causes of high costs, poor infrastructure, and culture aversion (Govindan and Hasanagic, 2018;) Mehmood et al., 2021). Such interactions confirm that CE success relies on coordinating various interests such as suppliers, regulators, and customers (Schaltegger et al., 2019). For the Finnish case, institutional legitimacy is facilitated through inter-municipal cooperation among municipalities, industry associations, and research organizations while shaping innovation ecosystems.

Cross-sectional collaborative economy plays the major role in circular economy. The case of BEWI that collaborates with municipalities, Infinite Fiber that forms global partnerships, and VASEK that creates the Climate Agreement platform affirm that scale necessitates multi-actor cooperation of circularity (Tura et al., 2019). It means that managers should take the ecosystem view that encourages teamwork, exchange of knowledge, and innovation as a way of meeting the aims of the circular economy. The

critical contributions of policymakers shall be made to facilitate systemic change towards a circular economy. The strategic programme on a circular economy in Finland (Finnish Ministry of the Environment, 2023) and the EU-level systems (European Union, 2023) are both key agents of institutional change. The reliance on the energy subsidies by Gasum and the authorities' reliance on the municipal and EU support by Stormossen indicate how regulatory frameworks allow large-scale circular economy activities but also introduce weaknesses when the financial assistance cannot be guaranteed. According to various researches, the policy needs to be aimed at balancing economic interests with the targets of sustainability (Ghisellini et al., 2016; Hobson and Lynch, 2016). Infinite Fiber and Lindstrom demonstrate that market-oriented models can flourish even in the absence of direct regulatory pressure, but nevertheless are vulnerable to the limitations associated with infrastructure and scale in places in which state backing may act as a facilitating factor. The regional initiatives by VASEK also support the significance of policy to establish collaboration platforms and ecosystem-building (Finnish Ministry of Environment, 2023; Sitra, 2016). Considering this, the Finnish require greater economic stimulus like subsidies, green taxation plans and financing of innovation within the country, so as to lower barriers of entry and promote long term adoption. Moreover, with the help of numerous Circular Economy Strategic Programme (2023), Green Taxation Reform (2022), and EcoDesign Directive (2009/125/EC), policy formulators can make the incentives of industrial actors sustainable. Combined, they form a consistent incentive framework that both encourages innovation and adherence and has the potential to scale CE to the long term (European Commission, 2023; Finnish Ministry of Environment, 2023).

Overall, the six cases demonstrate that the shift of a circular economy in Finland is conditioned by both the institutional pressure and the business models on the basis of innovations and collaborative ecosystem. The empirical implication is that managers need to incorporate the circular economy into their main strategies and not peripheral and policymakers should incentivize them to offer differentiated support mechanisms to consider the sectoral and organizational diversities.

The overall discussion of the policy and practical implications indicates the way that the results all contribute as a proof and expand the existing institutional change theory, resource-based advantage theory, and systemic transition theory. Instead of passive conformity, firms like BEWI and Gasum used regulation as strategic leverage. Similarly, the findings reveal that collective capabilities such as shared infrastructure, brand partnerships, and policy-driven ecosystems. This collective capability now shows competitiveness.

The Finnish case provides evidence of a meso-level orchestration, where intermediary actors intermediate between policy landscapes and firm niches (Cardoso & Ulvenblad, 2023). Lastly, policy and theory meet at the point where it is proven that transitions into the circular economy are not linear and universal. They develop in the cultural, institutional, and geographic settings. The model of Finland is an example of contextual circularity i.e., an adaptive system based on coherent governance, firm innovation, and trust by society. Future studies ought to adopt this framework in developing or transitional economies to determine whether it is transferable out of a high-institutional trust context.

6. Conclusion and Recommendations

6.1. Overview

The general purpose of this thesis was to examine how the principles of the circular economy could be successfully applied to the Finnish supply chains to make them more sustainable and efficient. To this end the research had aimed to analyze the institutional, organizational and technological aspects that affect the adoption of CE as well as to determine the policy and managerial implications required in promoting systemic change.

The four objectives were interrelated and had a crucial role in the process of analysis. The first two goals were to bring empirical reality to the field: the determination of the underlying drivers and barriers in action, and then the analysis of the operationalization of the principles of CE with respect to various case firms. This defined what and how of the present practices of CE. The latter two goals then revolved around facilitating the transition: assessing systemic functions of the regulation, collaboration, and innovation, and finally formulating working policy and managerial suggestions. It required such chronological order in the following sense that the analysis followed the logical direction of arriving at a descriptive insight by prescribing a strategy.

This systematic investigation was directed by two guiding research questions which determined the narrow scope of empirical research. To begin with, it spurred detailed, micro-level investigation, attempting to find out the particular mechanics of CE integration into supply chains of firms and the immediate conditions, either internal or external, that facilitate or limit success. The second question gave the macro-level view, as it was interested in the decisive role of the institutional policy frameworks in the launching and scaling up of circular business models. The thesis addressed the operational challenges as well as the governance solution by applying the case companies allowing it to make sure that its findings were based on the empirical reality and provided system-level implications.

6.2. Key Outcomes and Findings

The empirical study of the six case companies provided four interrelated major findings which in turn answer the major research questions. The initial two outcomes are on strategic and institutional motivation of transition. It is based on its institutional coherence as clear and uniform policy structures are critical to CE investment and credibility. Moreover, strategic value-creating power is innovation; businesses like Infinite Fiber and Lindstrom consider circularity in their business model.

The latter two outcomes prefer the systemic and multi-dimensional outcomes of CE implementation. The findings reveal that coordination and collaboration is not an extraneous value but one that must be in place in a given ecosystem. The local initiatives such as the platform provided by the VASEK support the reality of CE as interdependent evolution of an ecosystem. Finally, the research confirms the multidimensional sustainability results, which restores the triple bottom line by introducing environmental efficiency gains and economic resilience gains. Nevertheless, a critical gap found in the study is also that the social pillar, encompassing community well-being and equity, is not quite advanced. Together, these four results show that there is a great fit between the research questions, theoretical frameworks and the empirical data in confirming the fact that the CE transition in Finland is essentially a socio-institutional evolution based on innovation, collaboration and shared governance.

After re-examining the research objectives, questions, and significant findings, the sections of the questionnaire that follow present a synthesis of the theoretical, empirical and practical contributions of the study. This thesis proposed to research the question of how the principles of the circular economy can be successfully applied to Finnish supply chains to increase their sustainability and efficiency. The research synthesized the experiences of six different case firms by relying on the concept of the circular economy and Triple Bottom Line (TBL) paradigm to identify the drivers, obstacles and the facilitators of the journey towards circularity in Finland. The results solidly support the existing literature (Kirchherr and Piscicelli, 2019; Korhonen et al., 2018) according to which regulation is one of the most decisive factors influencing the

adoption of the circular economy, especially in the infrastructure-intensive industries of energy and waste management. The growth of biogas by Gasum and the valorization of municipal waste by Stromossen rely on both the EU directives and the Finnish climate legislation. On the same note, producer responsibility regulations and eco-design guidelines have significant effects on the EPS recycling efforts done by BEWI. Such examples highlight the fact that the absence of clear and consistent policy frameworks may very well mean that there will be no large-scale circular economy investments.

The study also notes that the circular economy can be propelled by innovation at the firm level and business model design despite no regulatory pressure. The example of Lindstrom textile rental and reuse service shows how profitability and sustainability can be reconciled by introducing the principles of circularity into the business model. This allows the literature-based theoretical hypothesis to be correct that CE transitions must entail top-down (institutional) and bottom-up (innovative) integration. Infinite Fiber and its approach of textile regeneration technology supported by brand partnerships can further exemplify that innovation supported by the market is able to reinvent global value chain. The results are a continuation of Geissdoerfer et al. (2020) and demonstrate that the strategy of slowing, narrowing, and closing loops can be a commercially viable solution in combination with market acceptance. Likewise, a cross-case analysis shows that collaboration is not only positive but also the key to adopting a circular economy. The regional platform of VASEK, the municipal cooperation of BEWI with the collection of EPS, and alliances of Infinite Fiber with the brands of the international system all support the systemic nature of the transitions to the circular economy (De Angelis et al., 2017). Risk-sharing, knowledge transfer and scaling, which cannot be achieved by a single firm, can be facilitated by ecosystem orchestration, whether by municipalities, clusters or industry alliances. This finding is congruent with 1st and 2nd research objective that depicts the way in which firm-level innovation and inter-organizational collaboration together input to how the principles of CE become embedded in practice.

Despite these drivers and enablers, barriers remain significant and consistent with prior literature (Govindan & Hasanagic, 2018; Mehmood et al., 2021). Firms repeatedly

pointed to high implementation costs, capital intensity, and infrastructure gaps as critical constraints. Knowledge shortages and a lack of skilled workforce further inhibit adoption, particularly in technology-intensive sectors (Chaouni et al., 2023). Communication issues were also noted in service-oriented organizations like Lindstrom and VASEK, in realizing circular economy practices visible to customers and stakeholders (Ranta et al., 2018). The paper has shown that the introduction of a circular economy in Finland has a positive impact on the three pillars of the Triple Bottom Line (Elkington, 2018). On the environmental front, the firms minimize carbon emissions, reliance on landfills, and the use of virgin material. Circular economies exemplified by Lindstrom and BEWI models bring new sources of revenue and reduce expenses. On a social level, the organizations such as VASEK and Stormossen offer community benefits in the form of education, local jobs, and development of skills. However, the results align with critiques Murray et al., 2017; Neves and Marques, 2022) of environmental and economic considerations taking the lead over the social aspect, indicating that more intentional incorporation of equity and labor factors into a circular economy shift is necessary.

Lastly, as much as sector specific variations are seen to be there with regulatory anchors with energy, innovation with textiles, ecosystem facilitation in regional development, the case come to a point of critical insight. Circular economy in Finland cannot be adopted by individual players but systemic multi-actor cooperation is necessary. This is coherent with the concepts of the systemic approach by the Ellen MacArthur Foundation (2017) and indicates that the shift to the circular economy in Finland should be perceived as a socio-technical, but not a strictly technical or market-based move. The systemic approach of the Ellen MacArthur is a whole system approach that reinvents production and consumption systems by observing the interrelationships between industries, value chains, and policy systems.

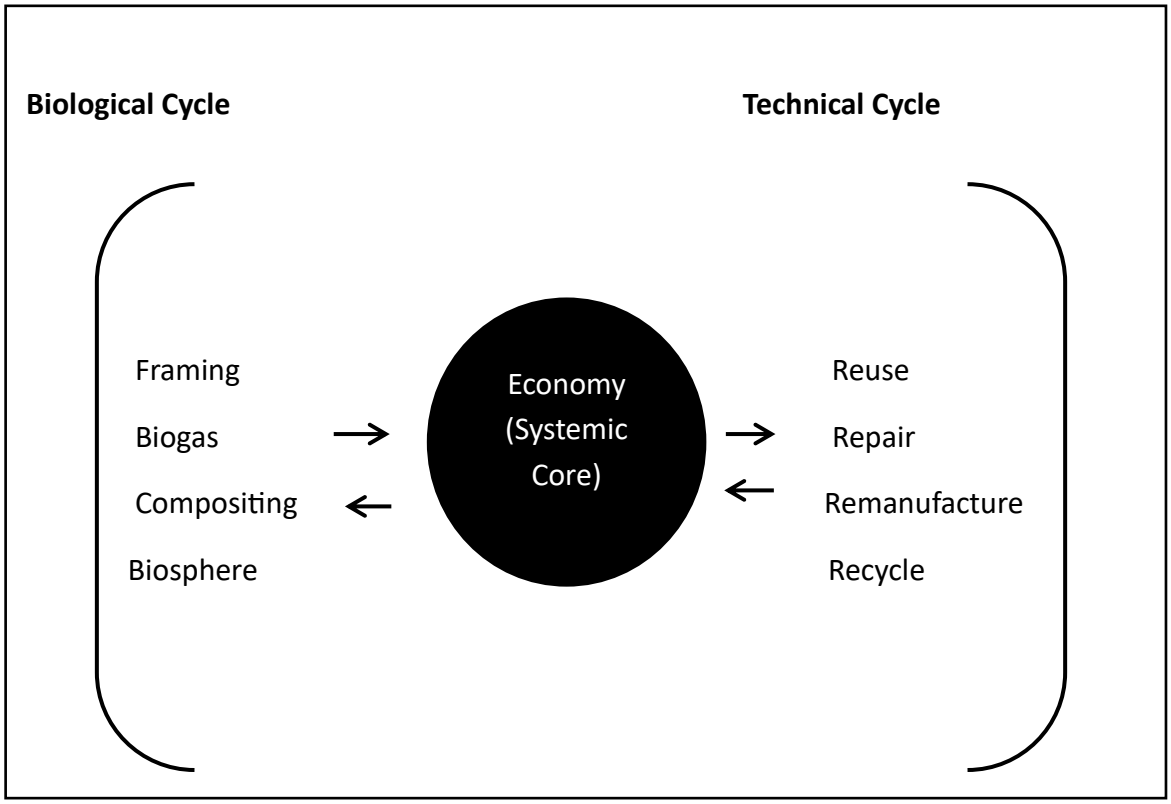

Figure 10. Systemic Method in Circular Economy Butterfly Diagram

6.3. Contributions of the Study

This study adds value to the literature and practice of circular economy and supply chain management in a number of important aspects.

Theoretically, the research makes a contribution to the discipline in three aspects. The first aspects it covers by incorporating organizational prism and shows how regulatory push and firm-level innovation interact to form adoption of circular economies. Most of the literature are highly focused on either strategies of firm (Geissdoerfer et al., 2017) or macro-level policy settings (European Union, 2023; Sitra, 2016) but this thesis reflects that both forces are independent. Gasum and BEWI demonstrate Scaffolding is a regulatory system that facilitates circular practices, and Infinite Fiber and Lindstrom demonstrate how companies can be innovative within and outside of said institutional frameworks. Secondly, the research confirms the role of circular economy in

environmental and economic sustainability and represents the comparative weak point of the social aspect that further expands the Triple Bottom Line approach (Murray et al., 2017; Neves and Marques, 2022). The thesis reveals the ways of better integrating equity into the circular economy by demonstrating how organizations like VASEK and Stormossen can train the local community on experiences in education, skills building, and employment. Due to this, contribution to a more balanced Triple Bottom Line application practice is possible. Third, the research frames the circular economy as a socio-technical transformation rather than a purely technical fix. By emphasizing collaboration, regional clustering, and ecosystem orchestration, it strengthens arguments by Ranta et al., and Korhonen et al., (2021) that successful transition requires regulatory anchors, cultural change, and cross-sectoral alliances.

Empirically, the thesis contributes by providing one of the few cross-sectoral comparisons of circular economy adoption in Finland. Most studies remain confined to single industries such as textiles, packaging, or energy, this research spans sectors such as energy, waste management, textiles, packaging, municipal services, and regional development, which offers a panoramic view of Finland’s Landscape. In contrast to most studies that are confined to a specific industry, such as textiles, packaging, or energy, this study crosses sectors such as energy, waste management, textiles, packaging, municipal services, and regional development that offering an overview of Finland's Landscape. Furthermore, the study offers rich case-based proof of ecosystem strategies, the regional orchestrating role of VASEK, Infinite Fiber's international brand alliances, and the municipal recycling partnerships of BEWI. These results identifies that systemic cooperation is a major action taken for circular economy transformations. The second empirical input is that crises such as the COVID-19 pandemic, the conflict in Ukraine were the catalyzing factors in the adoption of circular economies. This view is opposed to the current literature, which overall describes the process of transition to the circular economy as a phenomenon, which occurs due to the policy or a market shift (Geissdoerfer et al., 2017).

Lastly, there are practical implications of the research. To firms, it proves that integrating circularity into the business model nucleus, as opposed to being attached to

it, increases profitability and resilience. It defines the policy makers that balance of the regulatory sticks with collaborative carrots, and prioritize policies that involve tradeoffs between institutional organization and innovation and cooperation is a necessity. It provides an empirically verified conceptual model that integrates drivers, inhibitors, and facilitators of the circular economy in supply chains. It provides a model applicable and even adaptable to other industrial and national settings.

6.4. Policy recommendations and Managerial recommendations for Firms

The results of this study highlight the need to make public policy and management strategies at the firm level converge to promote the circular economy uptake. Policy-wise, regulation is a key determiner. The EU and Finnish policymakers are urged to enhance and harmonize the regulation to make it more effective in its determination. Extending eco-design and producer responsibility legislation to additional sectors, including textiles and packaging, will reduce fragmentation and provide certainty for firms that make investments in circular infrastructure. Financial incentives also play a critical role in reducing barriers such as high capital intensity. The subsidies, tax credits, and subsidies for innovation need to be raised for small and medium enterprises, and green financial models and public-private partnerships promoted to allow for risk-sharing on large-scale circular schemes. Investment in national infrastructure, such as integrated collection systems for textiles, plastics, and biowaste, and digital tools like product passports and traceability platforms, must be made in order to allow for the free flow of materials and for transparency of operation. In addition to this, policies must incorporate social equity, which underlies skill development initiatives, defending labor rights, and ensuring that equitable employment practices are used to drive fair transitions. Regional ecosystem building should be prioritized by ongoing appropriations of local development agencies and incentivizing cross-sector partnerships to make Finnish regions hubs of circular economy innovation. At the managerial level, businesses must make circularity part of their business models and convert reuse, repair, and regeneration into value-driving strategies.

An example of Lindstrom and Infinite Fiber serves to show that not only environmental performance is maximized by integrating circular thinking but it also guarantees competitive advantage, and attracts green-sensitive customers. Digital technologies such as blockchain, Internet of Things (IoT), and product passports can additionally aid traceability, cut down the cost of transaction and meet the regulatory frameworks and customer trust is also enhanced. Cooperation with local governments, colleagues in the industry, and research organizations can help in the quicker adoption of the circular economy by sharing costs and risks, which were proven by BEWI and its municipal partnerships and VASEK and its regional clusters. Managers also have to place consumer engagement and communication at the top of their agendas to overcome low awareness and perceived value for circular products by applying eco-labeling, awareness campaigns, and transparency reports. Organizational capacity building through continuous education and partnership with schools ensures that the workforce has the technical competency necessary to implement and develop circular economy innovations. Finally, firms should recognize that circular strategies both drive sustainability and resilience. It enables businesses to ride out crises such as pandemics or geopolitical shocks that affect resource availability more effectively. While these recommendations offer explicit guidance, one should read them in context. The findings from the study draw conclusions from a narrow sample of six Finnish organizations. It cannot be universally generalized to other industries or countries with different regulatory, culture, or infrastructure.

Secondly, self-reported data identification might capture idealized organizational narratives instead of real working conditions. A Cross-sectional design cannot provide in-depth insight into long-term transition. Nevertheless, the integrated policy and managerial advice provides a topical approach to the further development of the circular economy implementation in Finland and other such settings. It intensifies synergy in encouraging policy regimes and innovative organizational functions. This thesis is also congruent in its purpose, theories, and empirical data. There was an opportunity to apply the various theories to come up with a comprehensive picture of the situation with a circular economy in Finland. The qualitative multiple-case analysis

approach proved to be successful in laying bare the multi-level interconnections between policy, firms, and regional contexts. By bridging regulatory contexts to firm-level strategy and stakeholder relations, the study expands circular economy discourse from technological innovation to systemic socio-institutional transformation. The results not only fulfill the research purposes but also provide new theoretical and practical implications useful for policymakers, managers, and scholars interested in understanding and advancing circular transitions globally.

6.5 Limitations of the Study

The thesis also has several restrictions, which should be kept in mind when the results are interpreted. The research was limited to six case companies. Since the selection sought diversity in size, ownership, and industry, it does not represent all industries in Finland, nor is it possible to represent the entire range of circular economy measures. Very material-intensive industries such as construction, food processing, and healthcare have not been addressed. Similarly, the research relied extensively on company representative interviews. Although these interviews yielded rich insider views, they also potentially are compromised by organizational agendas or reputation management considerations. Firms will, of course, tend to promote successful projects and downplay internal difficulties or unsuccessful projects. Secondary data (annual reports, sustainability reports) have been used to triangulate the results, but there is the risk of response bias.

Moreover, the qualitative cross-sectional design provides a snapshot of practices at the particular moment. Circular economy transitions, however, are long-term processes that evolve with changes in technology, regulation, and consumer behavior. As a result, this study cannot capture how company strategies may shift over time or in response to external shocks such as economic downturns, policy changes, or global crises. Although theoretical frameworks such as the Triple Bottom Line and circular economy provided useful lenses, they also constrained the analysis. As an illustration, consumer-psychology questions, innovation ecosystem/behavioral economics were outside the range of this study. Further studies based on other frameworks could uncover new

findings in the area of cultural acceptance, consumer readiness to pay or the extent to which entrepreneurship can usher in change in a circle.

In this way, the research was limited geographically to Finland. The regulatory climate in Finland is high, which might be an advantage in the implementation of the circular economy since the market size and culture of sustainability in Finland are low. Research results, hence, cannot be immediately applied to the low institutional support or consumer culture economies.

6.6. Suggestions for Future Research

Although this research contributes to the current knowledge about the adoption of the circular economy in Finnish supply chains, it also reveals new gaps in the knowledge that can be answered in the subsequent studies. One of the potential directions is the longitudinal analysis as this thesis mimicked one moment in time; it is unable to determine how the strategy of firms is tailored to the changing regulations, markets, and crises. Researchers like Ghisellini et al. (2016) and Korhonen et al. (2021) propose circular economy transitions as iterative processes; therefore, it may be possible to follow the development of such a firm as Infinite Fiber or BEWI over several years and trace the maturation, scaling, or even stalling of the circular projects.

Besides, cross-country and comparative studies are also important. This country is a promising site of the circular economy due to the presence of high institutional structures and cultural alignment of Finland with the concept of sustainability (Sitra, 2016; European Commission, 2020). But, comparing these results with situations with a weaker regulatory enforcement or lower knowledge of consumers would help to understand which drivers are universal and which are context-specific. This form of comparative analysis can also facilitate the transferability of policies outside the developed economies. In the same way, social aspect of the circular economy has to be better researched. Current scholars are focused solely on environmental efficiency and economic viability, whereas equity, inclusivity, and labor transformation are not adequately investigated (Hobson and Lynch, 2016; Murray et al., 2017).

Among the future research areas is the emerging technologies and systemic risks. Several tools, including blockchain, IoT, and digital product passports, are actively advocated as enablers (Bressanelli et al., 2021), yet their scalability, in particular to SMEs, is doubtful. Similarly, because the circular economy would create rebound effects and efficiency gains, the consumption of fuels by default would also be created, as Korhonen et al. (2018) warn. These systemic and technological tensions can be investigated to create the sustainable nature of the circular economy schemes. Concisely, the future of circular economy scholarship should be to abandon nation-specific, nation-specific analysis in favor of more dynamic, comparative, and socially sensitive analysis. By extending a systemic perspective as an argument promoted by the Ellen MacArthur Foundation (2017), scholars can make sure that the circular economy does not only provide environmental and economic benefits but also enduring social values.

Appendix

Interview question

Background

1. What is your role in the company? (title)

2. What is the field of your company?

3. Does your company consider circularity in the supply chain? If yes, how?

For Assessing Current Implementation of Circular Practices

1. What circular practices like recycling or reuse does your company use?
2. Do you work with other companies or groups on circular economy projects?

For Identifying Key Challenges and Barriers

1. What are the main challenges or barriers your organization has faced in adopting circular economy practices within the supply chain?
2. Do you think there are specific barriers unique to the Finnish market or your industry? If so, what are they?
3. What is the impact of policy, infrastructure, costs, or knowledge deficiency on circular economy practice implementation?
4. Does it have any regulatory or policy loopholes that reduce the adoption of the circular economy?

For Identifying Enablers and Additional Practices

1. What has enabled your company to embrace the idea of circular economy?
2. Which tools and technology or collaborations were beneficial to your company?
3. And what more do companies require in order to ensure that the circular economy is more approachable in Finland?

Outlook and Recommendations

1. What do you consider to happen to circular economy in the future in Finland?
2. What do you believe a company ought to do when it is executing the concept of the circular economy?
3. So, what seemingly can be done to increase the sustainability and effectiveness of supply chains?

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