UNIVERSITY OF TURKU
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Business Alignment with Circular City Initiatives

A cross-case analysis of business in the city of Turku

International Business

Master's thesis

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Global consumption of materials has increased at a significant rate over the recent years and the high level of material usage and consumption pose a significant threat to the social, environmental and economic stability of the world. Linear model of consumption, which is taking, making and disposing, has been the most prominent pattern of consumption for many economies over the years. With the rising need of material needs, the linear model of consumption adds an unsustainable pressure on biodiversity, climate and the entire ecosystem. As a solution to address this pressing concern, the concept of circular economy has been emerged and becoming increasingly popular as a sustainable model of consumption to replace the linear consumption of materials. The transition from linear economies to circular is recognized as a challenge for businesses and governments, largely due to the deeply rooted and well-established linear business models. The transition towards the circular model requires strategical and behavioural changes from many actors in both the organizational and personal levels. Aggressive changes to existing policies are required to speed up the transition and it has been a major topic of discussion in the European politics. Cities have been identified as the key driver of the circular transition as they are the main contributor to high levels of material consumption. The circularity initiatives adopt by cities can have a strong impact on business due to the deep-rooted factors of linear business models. The thesis investigates the circularity initiatives that have been adopted by the city of Turku, a city in southwest Finland, that is home to a diverse business eco-system. The author examines the key circularity initiative adopted by the city: the circular city roadmap, a policy document driven by the 5R framework, which is a set of principles that promotes sustainable practices within the circular economy. The businesses in the city need to support these new policies to become a resource-wise city the city of Turku expect to be by 2040. The author investigates three businesses representing multiple sectors in the city's business eco-system and uses cross-case analysis to draw similarities and identify patterns to discuss the alignment of the businesses to circular city roadmap of the city of Turku. The thesis findings suggest the companies welcome the transition from linear business practices to circularity in businesses and support the city's circular economy initiatives.

Key words: circular economy, circular city initiatives, city of Turku

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1 Introduction

1.1 Background

The current trends in global consumption patterns pose a significant threat to the social, environmental and economic stability of the world. Resource depletion, environmental degradation and climate change are a few unprecedented challenges the world is currently facing. Climate change has continuously been the most recognized sustainability issue throughout time. Frequent temperature changes, melting glaciers and rising sea-levels are a few reasons that cause climate change (IPCC 2023, 4-6). The high level of material usage and consumption adds an unsustainable pressure on biodiversity, climate and the entire ecosystem. Between the years of 2016 to 2021, 582 billion tonnes of materials were consumed by the global economy (Circularity Gap Report 2024, 19). This possesses a threat to the environment as the waste created by the rising populations and increasing economic activity led to the "triple planetary crisis". Further, refers to the interrelated problems of climate change, biodiversity loss and pollution. These 3 factors has its own causes and effects but are interconnected and must be addressed together to develop systematic solutions to ensure a sustainable future. (What is the Triple Planetary Crisis 2022) Each year, over a 2 billion tonnes of municipal solid waste is generated globally. This is predicted to grow to 3.8 billion tonnes by the year 2050. (Masterson, 2024)

Majority of the economies in the world are based on linear model of consumption, which is taking, making and wasting. This concept has caused an excessive use of natural resources in the world. The current linear economic model has proven to be unsustainable and is ill-equipped to meet the demands of a growing population with increasing consumption patterns (Usvasalo et al. 2023, 94). The concept of circular economy is to create a framework that focuses on sharing, reusing, and recycling materials and products in order to extend the product life (European Parliament 2023). The concept of circular economy contrasts with the traditional linear economy of taking, making, consuming and wasting (European Parliament 2023). Circular economy follows an alternative economic model which is based on a cyclical flow of materials in the economic system. Therefore, this concept focuses on product and material reuse, remanufacture, repair, refurbishment and many forms of sustainable methodologies throughout the lifecycle of the product (Korhonen et al. 2018, 37).

The transition from a linear economy to a circular economy is highly visible in today's business environment. A higher percentage of the global economy is derived from the linear use of natural

resources from raw materials to product disposal (Usvasalo et al. 2023, 94). Overpopulation, commercialization and the linear economy are the main factors leading to the overconsumption of planet's resources (Usvasalo et al. 2023, 95). The circular economy is an economic strategy that suggests innovative ways to transform the current linear system of consumption into a circular one while achieving economic sustainability with much-needed material savings (Singh & Ordoñez 2016, 660). It depicts that reducing both input materials and output of wastes by closing loops in the flow leads to sustainable business practices (Haas et al, 2025, 766). Circular business models can also be interpreted as a model of economic development that aims to prevent pollution and protect the environment (Ma et al. 2014). To add on, Ellen MacArthur Foundation (2015a) claims that circular economy could provide opportunities for an economic renewal. For a transition towards a more sustainable future, a paradigm shift towards a circular economy is essential (Usvasalo et al. 2023, 95).

Businesses find it difficult to move toward the circular economy concept because of their established business models (Krmela et al. 2022, 2). Tackling new challenges and adapting their products and services towards a circularity model is complex but helps the company to follow the triple bottom line, making the business become socially responsible (Krmela et al. 2022, 2). The transition towards the circular model requires behavioural changes from many actors in both the personal and organizational levels (Krmela et al. 2022, 4). These changes may involve in enhancing knowledge of the circular economy, providing coaching and improving both external and internal communication. In a recent article on circular economy barriers within the European Union by Kirchherr et al (2018), the authors argue that the social/cultural dimension of businesses is the paramount barrier to adjust. Lack of stakeholder awareness, interest and demand, company culture and the reluctance in engagement for collaboration with lack of knowledge in the circular economy and its principles are the 4 main barriers highlighted in the study Kirchherr et al (2018, 270-271).

The circular economy has become a prominent topic on political agendas, particularly within the European context. And it is expected to promote economic growth, create job opportunities, establish new businesses, save material costs and reduce environmental impacts of economic actions. (Kalmykova et al. 2018, 190) Further, the concept of the circular economy is an important topic of discussion at the European Union as well as in many governments across the world. The European union together with its member countries have established "SMART" goals to achieve circularity at various levels. These policies include developing sustainable products, taking legislative actions to manage plastic production and pollution, waste management, green claims, increase consumers rights to repair goods, addressing issues of textile manufacturing, use of critical

raw materials, reducing industrial emissions and leading the way to a global circular economy (European commission 2020).

1.2 Circularity in Finland and the city of Turku

Particularly in Finland, the concept of circular economy has increased over the last few years. The government of Finland has taken significant strategic decisions to establish the concept. Finland was the world's first country to ever develop a roadmap towards circular economy in 2016 (Sitra 2016). This program implies to strengthen Finland's role as a leader in the circular economy by aiming to achieve carbon neutrality by 2035.

Cities are the drivers of circular transition (OECD 2020). The material consumption of cities is expected to grow from 40 billion tonnes in 2010 to 90 billion tonnes by 2050 (IRP 2018, 68). Cities need new and improved ways to minimize waste and find solutions to the degradation of the eco-systems. More than 80% of the global GDP is generated by cities, making cities the highest contributor to global waste (World Economic Forum 2018, 9).

Located in the southwest Finland, Turku is Finland's oldest city. Turku has more than 700 years of history along its way and the city is now home to more than 195,000 residents. Along its way, the city has stepped into many milestones that has made its way in becoming a developed city. In the city of Turku's mission to become a circular city, joining ICLEL's (International Council for Local Environmental Initiatives) Green Circular Cities Coalition in 2018 was a turning point. This alliance created a clear roadmap for the circularity ambitions of the city of Turku. It helped the city to draw a stakeholder mapping to identify its actors and how their involvement affects the circularity targets (The city of Turku & ICLEI 2020).

The city of Turku anchors an ecosystem of many actors and initiatives driving towards a circular city. With direct collaboration with regional, national and international stakeholders, the city of Turku has defined its circular economy roadmap through principles of "resource wisdom" where it tries to achieve effective energy systems, efficient water management systems, an effective food chain, a sustainable construction sector and transparent logistics schemes (The city of Turku & ICLEI 2020). The goal of the city of Turku is to mobilize a collaborative action plan for incorporating principles of circular economy from top to bottom. As a key start for this, the city of Turku believes that ensuring need-based policymaking and clarity of 'who is active' and 'who is in control' of each topic along with its opportunities and challenges are essential (The city of Turku & ICLEI 2020).

1.3 Research Gap and Questions

Circular economy is now a globally developing strategy that has an enormous potential for growth. There has been a significant development on this subject around the world in the recent years with many countries developing solutions for growth driven by circularity. Despite the increasing knowledge in the topic of circular economy and the scarcity of resources, both public and private companies have not yet maximized the full potential of the circular business (Ahmad et al. 2023).

Research on city circularity seems to be scares and there is a lack of conceptual clarity on the topic of circular cities in general (Bortolotti et al. 2023; Friant et al. 2023). The circularity initiatives adopt by cities could have a strong impact to the businesses operating in those business environments. The author was particularly interested in referring academic research conducted to analyse the compliance by business eco-systems to circular economy initiatives of cities, but it was evident such work is limited. In particular, the academic investigations on circular economy initiatives of cities in Finland are very limited and the resources are extremely scares for the work done on the circular initiatives of the city of Turku (Silvonen & Kaskinen 2019 ; Silvonen 2019). This hinders the ability of the academics to understand how the city circular economy initiatives shape the behaviour of businesses, especially in Finland. This research is motivated by the aim to address this gap by examining how circular economy initiatives adopted by cities impact businesses. The author chose to conduct this investigation in the city of Turku and business surrounding the city as the author lives in the city.

This points out to the main research question is of the thesis: **How do businesses in Turku align their practices with and contribute to the city's circular economy initiatives aimed at supporting the circular transition?**

To answer the main research question, below two sub-questions will be answered.

1. What circular economy initiatives have been introduced by the city of Turku?
2. How do these initiatives shape business practices toward circularity in Turku?

The first sub-question will carry out a detailed analysis of the initiatives taken by the city of Turku to become a circular city. The first sub-question will be answered using the secondary data resources; hence the author will use the literature review to answer the question as it gives more clarity to the flow of the research. The second sub-question will investigate on how these initiatives have shaped the way of doing businesses in the city. By answering these two sub-questions, the author expects to answer the main research question.

2 Circular economy and city actions

2.1 Introduction to the Circular Economy

There is a rising need for an alternative approach to today's take-make-dispose model. This discussion in demand has led to the concept of the circular economy. According to the Ellen MacArthur Foundation (2015), the circular economy has goals to design away waste by remanufacturing, reusing and recycling goods. Instead of discharging value by excluding products and materials after use, this concept of circular economy remodels the processes, products, business models and supply chains to create, conserve and circulate value (Weetman 2021, 14). Further, the circular economy prioritizes the continuous circulation of resources, without aggressive consumption and the elimination of waste from the system. The focus of this concept is to get more from less and get more "use" and value from every material, component, product and ensure that all "waste" becomes an input to another industrial process or to the nature. (Weetman 2021, 4). Simply, the concept of circular economy can be explained using a simple example that can be taken by making an orange juice. The peels, pulps and zest left out while making the juice is used by sectors like the cosmetic industry and pharmaceutical industry to produce essential oils (Weetman 2021, 14). The circular economy is far more innovative than recycling. This concept extends the value chain, redesigns the products by using different raw materials, creating new by-products and recovering value from waste generated from previous sections of the life cycle. (Weetman 2021, 5)

The topic of circular economy was increasingly popular from the late 1990s, as the concept was first introduced by Pearce and Turner (1990) in the book titled "Economies of Natural Resources and the Environment", even though this concept has deep roots since the 1960s. The main idea of the book was to conceptualize environmental issues in the economics textbooks and highlight the importance of sustainability in Economics. Ever since, there have been number of researchers, scholars and practitioners who have been studying the concept of circular economy (Klewitz & Hansen 2014; Konietzko 2020; Saidani 2019; Webster 2015).

Studies on circular economy was not only limited within researchers and scholars. This topic is a well-discussed topic at an international level. Many countries, unions have identified the need for the movement from a linear to a circular economic model.

2.2 Definitions of Circular Economy

The concept of circular economy is restorative or regenerative by purpose and its design. The “end-of-life" concept is replaced with the approach of restoration and shift towards the use of renewable energy, eliminating toxic inputs and eliminates waste through sustainable business models. (Ellen MacArthur Foundation 2013, 7). This economy brings the topics of technical and biological cycles into the discussion (Ellen MacArthur Foundation 2013, 27). Technical cycles is the process of using finite resources like minerals, fossil fuels and metals, which can be cycled infinitely. The product design here could support effective separation at the end-of-use for efficient recycling. Biological cycles is utilizing renewable nutrients like timber, food and fibres, which should be utilized sustainably. This means that these resources should not be extracted faster than nature can replace them. (Weetman 2021, 14-15) Further, Weetman (2021, 14), claims that these resources should be renewed or must exceed the rate of extraction. This statement also supports that these renewable resources should be renewed at the same or faster rate than it is been extracted. (Weetman 2021, 14-15) Further, circular economy focuses on the concept of restoration and roundness to replace the traditional system of end-of-life and shift towards the use of renewable energy whilst eliminating waste through a structured design (Michelini at al 2017).

The circular economy is said to be a great tool for achieving sustainability, not only within the subject of environmental aspect but also in economic and social dynamics (Krmela et al. 2022 3). Further to mention, the European Parliament (2023) defines a circular economy as a “model of production and consumption that involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended”.

The concept of circular economy has been defined by many scholars and authors over the years using various terminologies. Table 1 represents a summary of definitions of some previous research conducted on the topic of circular economy.

Table 1: List of definitions of circular economy

Source	Definition
European Commission (2015, 1)	“In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimized, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value”
Ellen MacArthur Foundation (2015a, 12)	“A circular economy is one that is restorative and regenerative by design and aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles”.

Gutberlet et al. 2023	"The circular economy is a multi-level resource use system that stipulates the complete closure of all resource loops. Recycling and other means that optimise the scale and direction of resource flows, contribute to the circular economy as supporting practices and activities. In its conceptual perfect form, all resource loops will be fully closed. In its realistic imperfect form, some use of virgin resources is inevitable."
Akanbi et al. 2018	CE is a sustainable development strategy that aims at improving the efficiency of materials and energy usage. This is a paradigm shift from the existing linear economy model of "take-make-consume and dispose" to a more sustainable model of "take-make-consume-reuse and recycle"
Geissdoerfer (2017, 766)	"Circular Economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling."

Many authors have the same interpretation to the subject of "circular economy" but some scholars provides more critical and detailed interpretations. Over the years, the concept has improved significantly. As mentioned in table 1, the definition of the circular economy provided by the European Commission offers a simple, meaningful and practical explanation, making it well-suited for the context of the study.

The first section of this definition mentions "*the value of products and materials is maintained for as long as possible*", this means that products are designed with the intention of product longevity to last long with a modular design. Further concepts like reuse, refurbishment and remanufacturing is put into play to ensure that product as a long-life cycle. The second section of the definition claims that "*waste and resource use are minimized*". This reveals that efficient production methods are used with fewer raw materials, waste prevention strategies are implemented in the process and improved methodologies are utilized to reduce energy and resource use. The section of the definition "*resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value*" refers to the circular flow of materials within the systems. It reveals that once the product reaches its final stage, the product is recycled and repurposed at all possible ways.

2.3 Evolution of the circular economy

The topic of circular economy is one of the most discussed topics in recent years. Many scholars, researchers and businesses have discussed its importance in the current business world. The origin

of this concept dates back to decades connected with the industrial revolution and environmental pollution has come with it (Rada 2023; Arruda 2021)

The concept of circular economy can be traced back to the early discussions on industrial symbiosis and resource limitations. Renner (1947), emphasized the value of industrial symbiosis, where the waste from one industry becomes an input to another industry. This concept laid the groundwork for resource-efficient systems. This idea was reflected with Boulding's (1966), metaphor of " Earth is a closed sphere, like a spaceship" in the article of "The Economics of the Coming Spaceship Earth." This statement signals the need to align economic activities with ecological limits and recycle resources within the boundary of a finite system. With time, the concept of circular economy evolved and many new aspects were added to the concept. The introduction to the performance economy, later which became known as the cradle-to-cradle framework was introduced.This framework distinguished that the materials used in an economy can be classified as "Technical" or "Biological" nutrients.

From the 1990's, the emergence of the circular economy was taking a more structured approach. The concept of the Blue economy was introduced by Gunter Pauli in 1994 (Pauli 2010). This study contrasted the Red economy, which focused on a single profit-driven model and the Green economy which incorporates environmental concerns. This study highlights the restoration of ecosystems while creating jobs through innovative models. As the use of technology increased, Benyus (2002), identified the need for a connection between technological innovation and ecological integrity. Further, this study resulted by highlighting the emphasis on how nature-inspired designs could lead to sustainable innovations. A large academic and practical contribution to the concept of circular economy was given by the Ellen MacArthur Foundation. A global framework on how to shift away from a linear production model to a circular model was described by Ellen MacArthur Foundation (2013).

The concept of the circular economy gained a large level of attention with the EU-circular economy action plan that was developed in 2015 (European Commission 2015). This was a milestone for the concept of the circular economy and this presented a clear roadmap of policy measures and legislation on Europe's shift towards circularity. Ghisellini et al. (2016), conducted a comprehensive study highlighting that the adaption of circular economy can lead to more innovation capacity, reduced resource dependency and more economic opportunities. However, this study also reveals that there are critical barriers like financial constraints, regulatory misalignments and behavioural restraints can reduce the pace of the transition from linear to the circular economy.

Kirchherr et al. (2017) and Sandoval et al. (2018), analysed definitions and research trends within the concept of circular economy. These studies emphasized on concepts of reduce, reuse and recycle models. With time, scholars and researchers developed interests in studying about various business models within the concept of circular economy . These studies resulted in emergence of many models and how the integration of these models should be incorporated with business strategies (Geissdoerfer et al. 2020).

It is clear that the subject of circular economy has a vital role in leading the world into sustainability. With the limited resources we have in this world, it is the responsibility of the general public, businesses and governments to pay utmost importance to this topic and encourage and build awareness on this.

2.4 Transition from Linear to Circular Economy

In recent years, the growth of environmental challenges and resource scarcity has developed the need for sustainable economic practices. Sustainability has emerged as a central focus for businesses and policymakers to minimize environmental harm (Euromonitor International 2024). Societies, governments and industries are eagerly seeking opportunities to seek sustainability, stop resource use and minimize pollution (Dabija and Nastase 2024). While starting to analyze the circular economy, a clear understanding of the linear economy must be grasped.

"*Linear economic model is a system in which people buy a product, use it and throw it away*" (European Investment Bank 2023). Also, the economic model of take-make-dispose model used high volumes of easily accessible energy and resources (Ellen MacArthur Foundation 2013a, 26). This type of economy consumes a high volume of new materials because there is no recycling along the line of production. Figure 01, gives an understanding in the traditional system (Ellen Mc, European Investment Bank).

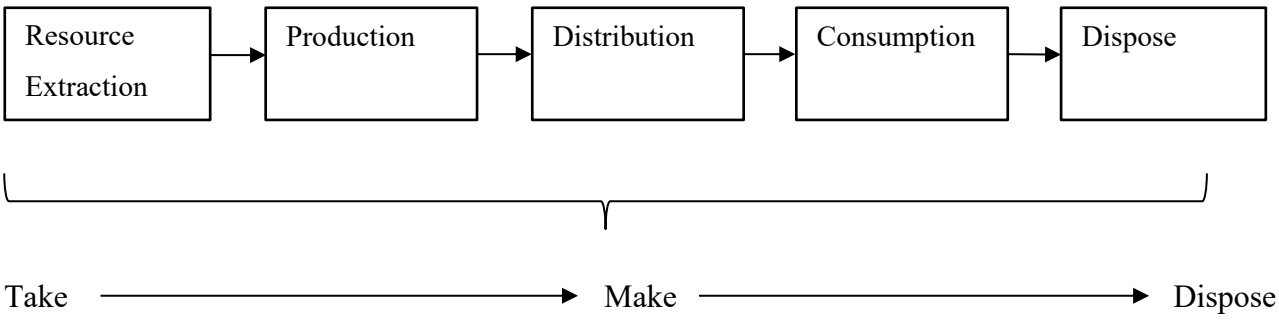

Figure 1: Linear Economic model (Weetman 2021; Ellen MacArthur Foundation 2013)

In this model, raw materials are often extracted at the expense of the eco-system and these materials are transferred into manufacturing or assemble lines to create an end product. As drawn in figure 1, consumption refers to the purchase and use of the end product that has been manufactured. In the linear model, this step is followed by the process of disposal, once the product reaches its end-stage. (Weetman 2021; Ellen MacArthur Foundation 2013) Referred to figure 01, firms make products, consumers use and dispose them. According to Pearce and Turner (1990), the linear model ignores the by-products made during each step of the economic system. The linear model incurs a large number of resource losses and resource depletion along its way. Waste during the production chain, end-of-life waste, erosion of eco-systems and energy wastage are a few leaks of resources in this system. The linear model, in simple terms, is summarized as take-make-dispose theory. (Bocken & Bakker 2016) Here, the resources are taken, the goods are made, sold by making a profit and then finally disposed of after use (Sariatli 2017). According to the Ellen MacArthur Foundation (2013), states that 21 billion tons of materials used in production are not being utilized in the final product.

Resource depletion and disposal have created an urging call for a system change. The concept introduced by Boulding (1996) was less structured. However, a more detailed approach was developed known as the Closed Loop economy (Stahel 2010). In 2010, Stahel improved the concept of the closed-loop economy to the idea of "Performance economy". The core idea of the performance economy also known as the Functional Service economy. This type of economy optimises the use of raw materials and components in its system. Its economic objective is to create the highest possible value for the longest possible time while consuming few inputs (Stahel 2010). The performance economy will focus on regional economies, developing business models and extending the life cycle of components and goods through upgrading and remanufacturing. Thus, this will create more local jobs and prevent waste and resource husbandry. Nature conservation, limiting toxicity, resource productivity, social ecology and cultural ecology are the five main pillars that support the vision of the performance economy (Weetman 2021, 20).

Natural capitalism is another main influence that led to the creation of the concept of circular economy. Hawken at al. (1999), focus on both natural resources and ecological systems providing vital support to all living things. Increasing the productivity of natural resources, using biologically inspired production models and materials, incorporating 'service-and-flow' business models, and reinvesting in natural capital to ensure prosperity are the four principles of Natural Capitalism (Weetman 2021).

Preserving materials and energy embedded in a product with its process aids is the basic concept of Industrial ecology. This concept has helped businesses identify how they use their key resources, track materials and energy and simply account for a product through its life cycle. Here the use of resources is being changed from implicit to explicit from the initial stage to the end of the use of the product.

The Cradle-to-Cradle initiative of Braungart and McDonough (2008) was incorporated to the concept of circular economy. And two new branches were identified as technical and biological and thereby extending the 'use period' for all these nutrients. The Cradle-to-Cradle concept measures the environmental aspects as well as the social impacts in relation to the circular economy. Further, this initiative suggested that all materials entangled along the industrial and commercial life cycle are nutrients. This framework promotes effective design of products with a positive impact while reducing products with negative impacts. To add on, this concept aims for 'eco-effectiveness' rather than 'eco-efficiency' driving leadership and innovation towards positive goals. Valuing materials as nutrients that are safe and enables continuous cycling, maintaining continuous flow of technical and biological nutrients, powering all operations with 100 percent renewable energy, respecting water as a precious resource and celebrating equality, social fairness to all people and natural systems are key principles of Cradle-to-Cradle concept. (Weetman 2021).

Figure 2 depicts the differences between a Linear model and circular model. Here, it's visible that the linear economic model has a one-way flow whilst the circular economic model has a closed loop system.

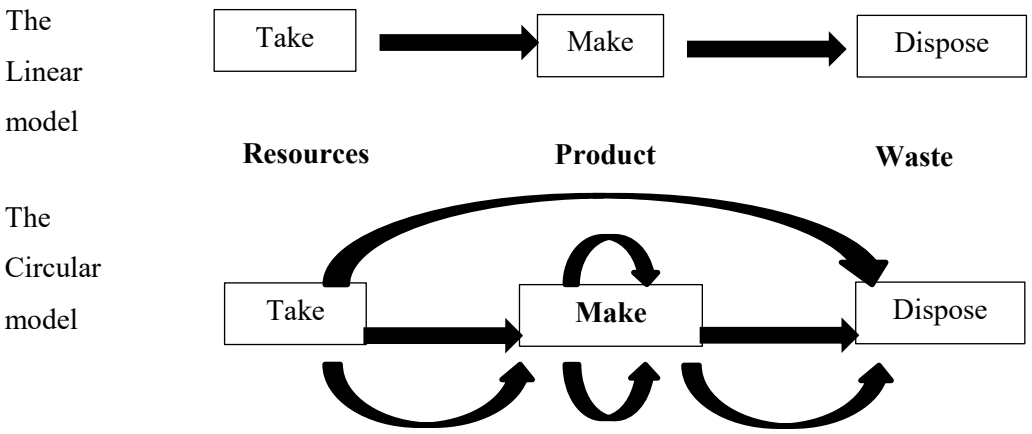

Figure 2: Differentiating the linear and circular economic model (Based on Pearce and Turner 1990)

Figure 2 outlines the differences between linear and circular economy and how resources are flowed. It is natural to create waste during any process. However, what must be considered here is that how can the waste that we make, can be utilized for an advantage and would not be wasted. In a circular economy, the waste that in created is turned around into nutrients, materials or even sources of energy for another production process.

2.5 Business models in the circular economy

2.5.1 The concept of circular business models

Extensive knowledge is needed to successfully stimulate and aid the implementation of circular economic models into businesses (Lewandowski 2016). A business model resembles how an organisation creates, delivers and sustains value. This is a tool used by a firm to understand on how to do business, which simply portrays reality. (Renswoude 2015, 2) There is an extensive count of literature that can be used to study various business models that can be implied to achieve circularity (Dzhengiz et al. 2023; Geissdoerfer 2016a; Geissdoerfer 2016b; Islam 2024; Krmela 2022; Lüdeke et al. 2018; Osterwalder 2010). The main aim of circular economy business models is to help businesses create value by using resources in various cycles, while reducing waste and consumption (Lüdeke et al. 2018).

“Value proposition, value delivery, value creation and value capture” are majour dimensions considered during the development of circular business strategies (Lewandowski 2016). Value proposition is linked with the product or service that the business offers. For products, these can be developing long-lasting products, repairing and developing products from recycled products, whilst for services this could be facilitating collaborations, upgrading and auxiliary services. Collaborations is an important aspect when it comes to achieving circular economy (Gulati et al. 2012 ; Thomson et al. 2009 ; Thomson et al. 2006 ; Krmela et al. 2022). Value delivery is related to target customers and value delivery processes. Selecting quality-conscious customers, costs-conscious customers, waste management and proving access to the products functionability increases the circular value delivery of the business (Lewandowski 2016).

The concept of value creation is how value can be generated in the product or service with the aid of value creation processes along with its partners and stakeholders. Suppliers, manufacturers retailers, service providers, public institutions together with value creation processes like repairing product components, upgrading and upcycling products and designing products with less inputs lead to Value creation. Value capture is associated with revenue and costs. Additional product

revenues, payments for functions, price premiums help create revenue in circular business while labour, waste handling charges, resource inputs and supply risks create costs in a circular business model. (Lewandowski 2016)

2.5.2 Developing a circular business

The business model canvas elaborated in table 2 is one strategic management tool that is used by businesses to structure their operations. Lewandowski (2016, 20) added two more concepts to the existing business model, which can be used by businesses incorporating circular economy in their principles.

Table 2: The circular business model canvas

<table>
<tr><td rowspan="3">Partners
Cooperate Networks
Collaborations</td><td rowspan="3">Activities
Enhancing product efficiency
Developing eco-friendly products
Sharing technologies</td><td rowspan="3">Value Propositions
Virtual offerings
Products leading to sustainability
Rewards for customers using Take-Back systems</td><td>Customer Relationships
Co-creating value through engagement
Establishing partnerships</td><td rowspan="3">Customer Segments
Customer types</td></tr>
<tr><td>Channels
Virtualization</td></tr>
<tr><td>Take-Back Systems
Take-back management
Customer relation</td></tr>
<tr><td colspan="2">Cost Structure
Recycling expenses
Material flow management expenses</td><td colspan="3">Revenue Structure
Efficient resource use
Availability based
Performance based</td></tr>
<tr><td colspan="5">Adoption Factors
External economic environment
Organisational Strengths, Opportunities and weaknesses</td></tr>
</table>

The *value proposition* of a company is a core element to any successful business in the economy. Table 3 depicts the products and services of the company, how its processes are been handled, how they deal with stakeholders along with revenue and cost structures (Lewandowski 2016, 17). *Key partners* are the stakeholders of the company, these could be actors who work outside of the company but still is linked with the operations of the business (Scott 2018, 58). *Key activities* of the business are the roles that they offer to customers alongside offering its value proposition. *Customer relationships* mean the tactics that the business utilizes in creating stronger and loyal customer relationships. The different target groups that the business aims in selling their products in known as *customer segments*. *Channels* are the ways used to offer and deliver the intended value proposition to the selected customer segment. *Revenue streams* represent all the revenues the company will gain while the *cost structures* mean the expenses that are incurred in the business from its material sourcing to delivering the product or service (Lewandowski 2016.)

To the existing business model take-back systems and adoption factors were included to bring in light of the theme of circularity. *Take-back systems* refer to the logistical mechanisms involved in the company which facilities material recirculation and supports effective management of reverse flows. Once circular economy initiatives ae embedded to the systems of the company, there are many factors that the company must anticipate to address. These factors are known as *adoption factors*. External adoption factors are factors that the company had no control over, these could be consumer behaviours, government policies and even accessibility of materials. While internal factors mean, factors like organisational culture, knowledge about circular economy within company and employees and transition procedures from linear to circular economy (Lewandowski 2016.)

The Product-as-a-service model is another way that a business can deliver circular principles. Circular inputs, sharing platforms, product life extension and resource recovery are features of this model. Closer customer relationships are developed throughout the life cycle of the product, after markets for products are developed and specially, customers are given the ability to use the product while the ownership of the product remains with the customer in the facet of “product as a service”. Sharing platforms are working as digital platforms, focus on sustainability with peer-to-peer sharing, enabling maximization of asset and resource utilization and creating social sustainability by allowing assets accessible to public. Product life cycle extension is using take-back systems, reselling, rebranding and providing maintenance services to ensure that the product stays in the cycle as far as possible. Renewability is when companies promote the use of renewable and

recyclable resources and inputs for the production process. Finally, resource recovery is generating value by utilizing waste and enabling closed loops in the system (Chabowski et al., 2023.)

The ReSOLVE framework is another concept that provides a detailed analysis on how businesses can implement circular economy into their business. (Chabowski et al., 2023). Also, this model acts as a key factor that enables the development of new business models oriented with the concept of circular economy (Costa et al. 2023). The framework demonstrates how businesses can create value by regenerating, sharing, optimizing, looping, virtualizing and exchanging. These principles can be integrated to various circular model for businesses to achieve trends of circular economy (Chabowski et al., 2023; Ellen MacArthur Foundation 2015b).

Table 3: ReSOLVE framework (Based on McKinsey Center for Business and Environment 2016)

Principle	Models	Description
Regenerate	Energy recovery	Transforming non-recyclable waste into energy
	Circular supplies	Using renewable energy
	Efficient building	Establishing business activities in efficient buildings
	Sustainable product location	Establishing business in industrial locations
	Chemical leasing	Producers offer the functions of the chemicals, to reduce environmental impact
Share	Maintenance and repair	Extend product life cycle of product by providing repair and maintenance
	Collaborative consumption	Promoting sharing use, access and ownership
	PPS: Product lease	Providing facilities to use the product without being the owner
	PPS: Availability based	Product is available for use for a specific period of time
	PSS: Performance based	Revenue is created according to the value created
	Next life sales	Customers return old products to an agreed value and then sold or refurbished.
	Upgrading	Replacing components with quality ones
	Attachment and trust	Developing products that customers like and be loyal
	Bring your own device	Users bring their own products and devices to get the services rendered
	Hybrid model	A durable product contains short-lived consumables
	Gap exploiter model	Exploiting lifetime gaps in the product
Optimise	Asset management	Resing, refurbishing and resales of used products
	Produce on demand	Manufacturing products based on demand
	Waste reduction	Reducing waste creation along the process

	PSS: Activity management and outsourcing	Efficient use of human resources, materials and capital goods through outsourcing.
Loop	Remanufacture	“Restoring a product or its components to as new quality”
	Recycling	Recovering resources out of used products or by-products
	Upcycling	Materials are utilized and their value is upgraded
	Circular supplies	Using supplies and inputs from bio-based, recyclable from material loops
Virtualize	Dematerialized services	Shifting products, services and processes to more virtual
Exchange	New technology	Using new technologies for manufacturing

This model provides practical strategies that businesses could implement depending on their sector, size and sustainability goals (Ellen MacArthur Foundation 2015). *Regeneration* emphasizes on restoring and enhancing natural systems (Geissdoerfer et al. 2017). Further, this aspect focuses on actions that enhance the world’s biocapacity by protecting energy, reclaiming land and protecting ecosystems (Williams, 2016 : Chabowski et al., 2023). The aspect of regeneration acts as a foundation for value proposition for businesses that are heavily dependent on natural resources (Geissdoerfer et al. 2017). *Share* highlights the need for maximising material utilization and eliminating waste . Implementing this concept allows businsses to shift their business models to concepts like the product-as-a-service model and sharing platforms. (Bocken et al. 2016). This allows businesses to extend their lifecycles, reduce use of new resources and create additional streams of revenue (Collaborative consumption ... 2025). *Optimize* focus on improving the performance of the product and efficiency throughout the value chain. Eliminating waste, reducing energy consumption and using smart technologies are ways that businesses could use to optimise the product performance. (Lewandowski 2016). Further, businesses that integrate such technologies could result in high output value (Williams, 2016 : Chabowski et al., 2023). *Looping* involves when material loops are closed using concepts like remanufacturing, recycling and refurbishing. Integrating these concepts to the value chain of the business closes all possibilities of waste generation and excessive energy consumption. (Korhonen et al. 2018) In today’s world, the concept of *virtualization* is highly incorporated in business models. This involves replacing physical materials with digital services. (Williams, 2016 : Chabowski et al., 2023). Further, Ellen MacArthur Foundation (2015) claims that reducing reliance on physical components and moving towards virtualization contributes to material efficiency, energy conservation and reduced waste generation. Finally, Exchange allows businesses to incorporate innovative technologies, and rethink on their business models to develop possible options for circularity (Geissdoerfer et al. 2017). Further, this

means shifting towards new technologies, advanced machineries and automation to the production line. (Williams, 2016 : Chabowski et al., 2023). This shift demands a substantial investment, but once implemented the environmental benefits will be at large scale (Geissdoerfer et al. 2017).

2.6 The role of cities in circular transition

Regions and cities play an important role in the circular transition of a country. According to OECD (2020), cities are to host two thirds of the world's population by 2025. This means that the density of businesses and consumers using resources will be increased at a large scale. Cities are leveled up as the centre of key decisions which determines its economic growth, environmental benefits and social well-being. Further, cities have a direct impact on the direct competencies of Circular management in terms of mobility, waste management and buildings (European Commission 2020).

"A circular city is one that promotes a just transition from a linear to a circular economy across the urban space, through multiple city functions and departments and in collaboration with residents, businesses and the research community". (Circular City Actions Framework 2021, 3). A circular city has the goal of generating growth and economic resilience for its residents and itself. This is achieved through taking steps parallelly with utilizing finite resources and creating value (World Economic Forum 2018). The concept of circular economy was introduced into urban development when the concept of smart cities was gaining popularity as a result of technological advancements (Anttiroiko 2023). A smart city is a multi-dimensional model, where artificial intelligence and technological advancements are utilized in order to create collective intelligence and systematic capabilities io improve effectiveness, quality of life and sustainability of the city (Anttiroiko & Komninos 2019) Further by implementing localised targeted initiatives, cities can evolve into sustainable systems that integrate circular economy principles and smart technologies. (Formisano et al. 2022 148; Saidani et al 2019; Vanhuyse et al. 2021)

Many countries around Europe have started implementing the concept of circular economy. Urbanization, supply and price risks, ecosystem degradation, environmental accountability, consumer behaviour and advances in technology are the drivers for cities' interests in circular solutions as claimed by the World Economic Forum (2018, 11). It is clearly visible that cities have now realized the need for adopting circular economy initiatives into their policies. With advancements in technology, consumers being more eco-friendly and with the open communication and free flow of information about the concept of circular economy, there are many aspects that the

city can explore in terms of achieving circularity. Cities can implement circular economy to many industries such as health care, construction, energy systems, waste management systems, pharmaceutical industry and many more. There are many cities in Europe that have implemented these initiatives into their policies.

Many cities in Denmark are forerunners in adopting circular economy initiatives. The Resource Rows in Copenhagen will be the first residential housing scheme that has been build up by upcycled bricks from abandoned buildings across Denmark. By using recycled materials, cities can reduce 70% of Co2 emissions than traditional building methods (World Economic Forum 2018, 13). Further to support the increase in cities adopting circularity, cities like Munich, Barcelona and Frankfurt is aiming to use renewable sources of energy. Munich aim to use 100% renewable energy by 2025 whilst Barcelona targets to become energy efficient 2050 (World Economic Forum 2018, 14). Cities use advanced methods and technologies to aid them in reaching these goals. In the municipality of Eskilstuna Sweden, a shopping mall named ReTuna was built which specialised for resale of second hand and repaired products. This shopping center has individual entrepreneurs selling all kinds of products from household items to toys and clothes. (Retuna NA)

2.7 The circular city actions framework and the city of Turku

2.7.1 The city of Turku

The city of Turku, that has a history beyond the 13th century, is Finland's oldest city. Turku has more than 700 years of history and is now home to over 195,000 residents. The Turku business region is a world-renowned innovation hub which consists of over 22,000 businesses and has 06 universities.(The city of Turku & ICLEI 2020) *"One in every four residents of Turku is a student, and thousands of new professionals graduate from the area's many universities and educational institutions each year" (The city of Turku & ICLEI 2020).* This statement claims that Turku is home to a large and diverse talent pool and this population could have a large impact on the economic environment.

The city and its residents are awaiting to celebrate its 800th anniversary in 2029. With the anniversary in mind, the city of Turku has developed a roadmap to achieve circularity through a set of key activities. The goal of the roadmap is to use natural resources sustainably while minimizing waste and emissions. Further, the city believes that this is the only way, that a sustainable foundation can be implemented with the thought of improving residents' well-being (The city of Turku & ICLEI 2020). Turku aims to use the concept of the circular economy to develop into a

resource-wise city by 2040. According to Characteristics of a resource-wise city (2014), a resource-wise city is when the city has the ability to reduce emissions along with the use of natural resources, with the aim of improving the living standards of residents. Carbon-free, Zero-waste and one-planet living are the three components of a resource-wise city (Characteristics of a resource-wise city 2014).

Achieving Carbon neutrality by 2029 is one breakthrough in achieving the target of becoming a resource-wise city by 2040. To achieve this goal, the city of Turku, together with many stakeholders, has developed a roadmap named the "Circular Turku Roadmap". This roadmap aids the city in taking measures to use natural resources effectively and reduce waste through all actions (The city of Turku 2021). Further, it seems this roadmap positively correlates with the climate actions and biodiversity projects of the municipality.

*"*Global carbon neutrality goals will be difficult to achieve if cities do not target indirect emissions" (The city of Turku 2021). This statement highlights that cities must target reducing their emissions collectively. Further, a study by Sun et al. (2022), revels that urban planning is key for cities to reduce its emissions. This means that achieving circularity must be a collaborative goal of all cities, if it needs to be achieved properly. The city of Turku was one of the first cities to link circularity and climate change to find solutions to greenhouse gas emissions.

The topic of circular economy is not a new topic for the municipality, businesses and residents of the city. Turku is said to be the oldest city in Finland and is now home for many researchers and businesses both in private and public sectors that focus on a sustainable and resource-wise city. The circular economy roadmap of Turku and its initiatives are to help its stakeholders in creating the correct methodologies for this transition. The city of Turku is ready to facilitate businesses and residents to have a smooth and fair transition in the circular transformation (The city of Turku 2021).*"We believe that this transformation will be achieved together, through active collaboration among different sectors and actors and through international cooperation with local governments around the world" (The city of Turku 2021).*This claims that the city of Turku believes that active collaboration and open communication aids to foster the goal of becoming a circular city. The need for collaboration is also highlighted as a factor to be highly considered (Danvers et al. 2023; Mariani et al. 2022). Cities play an immense role in creating a sustainable environment and thus cross-sectional synergies and collaborations are needed to achieve these goals that are otherwise would be impossible to achieve (Gómez et al. 2024; Mariani et al. 2022; Haines & Dora 2021).

Multi-stakeholder collaboration has been one of the key benefits for the city of Turku. Turku is home to a diverse eco-system of circular economy actors that help the municipality reach its targets. Since 2015, the municipality has made efforts to build connections to develop and strengthen collaborations with various stakeholders. The municipality aims to develop a collaborative action plan to optimize the circular economy from bottom to top. A comprehensive stakeholder mapping has allowed the city to boost these initiatives. During the development stage of the roadmap, over 700 actors were counted and about 270 businesses implementing circular economy initiatives were identified. (The city of Turku & ICLEI 2020, 30-33).

2.7.2 Circular City Actions Framework

The main framework behind the development of the city of Turku's circular roadmap is the "Circular city actions framework". The city actions framework was developed by the collaboration of authors and contributors from ICLEI - Local Governments for Sustainability, Ellen MacArthur Foundation, Circle Economy and Metabolic (Circular City Actions Framework 2021). This framework aids governments and cities to have a smooth transition from the linear model to a more circular and sustainable model. The framework, shown in figure 3 is segmented into 5 strategies and also is linked with 15 actions that they can use along the transition. These actions will help cities identify their existing circular practices, help in stakeholder engagement, explore best practices with the peers and also foster in expanding city's local boundaries on circular economy implementation beyond solutions of recycling. (Circular City Actions Framework 2021)

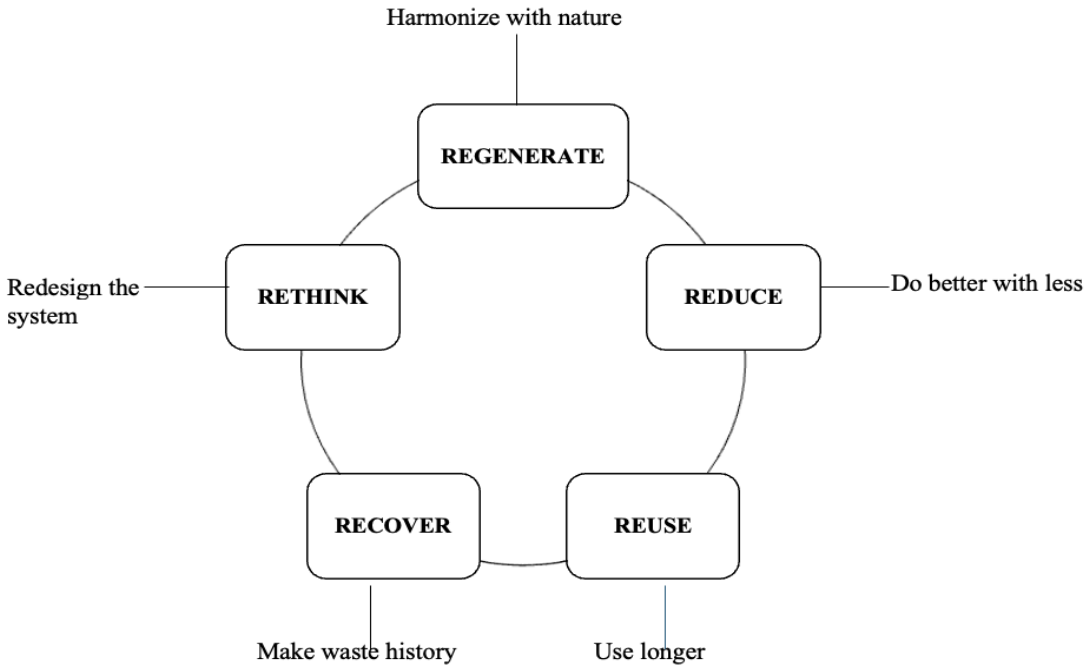

Figure 3: The Circular City Framework (Sourced from the city of Turku & ICLEI 2020)

As illustrated in figure 3, the circular city framework was developed to bring the connections of rethink, regenerate, reduce, reuse and recover. “Rethink helps cities and regions to redesign and lay the foundation for circular activities and aid in a smooth transition. The term *rethink* plays a major role in today’s circular city transformations because the current economic and legislative structures are built based on traditional systems and assuming that resources are finite. Creating systems that “close the loop” are the main aims of the strategy of *rethink*. Eliminating linear incentives and providing incentives for circularity promotes businesses to rethink on their business strategies. Facilitating collaborations to support closed loop systems along with cross sectoral synergies thrive the concept of *rethinking*. Further, improving awareness, information sharing and initiating public events enable sustainable lifestyles make room for people to *rethink* on how they can live sustainably (Circular City Actions Framework 2021; Catalogue of Circular City Actions 2022; The city of Turku & ICLEI 2020.)

“Embracing the infrastructure, production systems and sourcing that allow natural eco-systems to thrive” is the objective of the second pillar of this framework. *Regenerate* stresses to say that no city’s circular transition would be successful without committing to biodiversity and to a healthy eco-system. Taking actions to restore degraded ecosystems and developing measures to protect ecosystems within and outside city boundaries help cities regenerate and “Harmonize with nature”. Prioritizing the use of the power of existing and functioning ecosystems to provide services to the society help thrive natural systems. Further, prioritizing the use of low impact and diverse resources into the business model helps cities reach circularity (Circular City Actions Framework 2021; Catalogue of Circular City Actions 2022; The city of Turku & ICLEI 2020.)

“*Reduce: Do better with less*”, aims to design infrastructure, processes and products to reduce waste generation, water consumption along with material and energy consumption from manufacturing to end use. Resource efficiency is a key aspect that plays a pivotal role in the concept of *reduce*. Ensuring that the buildings and infrastructure in the city is designed to be as resource efficient as possible helps cities reduce their energy wastage. Enabling circular businesses to grow, innovate and thrive and supporting these local businesses to be energy efficient curates a positive impact to the sustainable development of the city. Another way to reduce resource wastage is by increasing efficiency and promoting local economic growth by reducing the gap in the value chain by the local producers and consumers (Circular City Actions Framework 2021; Catalogue of Circular City Actions 2022; The city of Turku & ICLEI 2020.)

“Use longer and more often – *Reuse*" is the next pillar of this framework as shown in figure 03. Extending and enhancing the use of existing resources, products and infrastructure is the objective of this pillar. Developing city policies to allow extended use of products help reuse assets. Also, incorporating this concept in the planning phase, adds great circular value to the production process. Establishing space for second hand markets, sharing and exchange platforms create ways for materials, resources and products to be reused. Providing facilities for maintenance, repairing and remanufacturing within the city helps companies and also residents to take part in the process of reusing their belongings (Circular City Actions Framework 2021; Catalogue of Circular City Actions 2022; The city of Turku & ICLEI 2020.)

“*Recover*” has the objective to maximize resource recovery at the end of the use phase and reintroduce them into the manufacturing process. A key aim of circular economy is to eliminate pollution and waste and therefore, the concept of recover helps cities and companies achieve this if the other four R’s have been placed firmly. Regulations are to be set to coordinate waste separation in order to maximise the value of recovery. Recovering resources from the residual streams must be planned in the design and planning stage of each process in order to benefit at a large scale. Further, processed waste must re-enter to the system to its users at its highest value (Circular City Actions Framework 2021; Catalogue of Circular City Actions 2022; The city of Turku & ICLEI 2020.)

2.7.3 The circular economy roadmap of the city of Turku

With the aid of the circular city framework and policy documents like: Turku’s City strategy, the Turku Climate Plan 2029, The Action Program for Biodiversity Protection of the city of Turku and The Environmental Program 2030 for Southwest Finland, the city of Turku has developed a roadmap to achieve a resource-wise circular city by 2024. (The city of Turku 2021) The city highlighted 05 main sectors to initiate the concepts of circular economy.

2.7.3.1 Energy systems

“*Turku’s energy system is the city’s largest single source of emissions*” (The city of Turku 2021). Therefore, this plays a pivotal role in the activities of the city. The aim of becoming carbon neutral by the year 2029 requires the city to r*ethink* on how these energy systems can minimize the emissions. The concept of “Closing the loop” mentioned by the city of Turku & ICLEI (2020), supports this statement as “r*ethinking*” means figuring out ways to reduce and limit the emissions and waste developed in the system. Developing a resource-wise, cost-effective, smart, flexible and

multi-directional circular energy system is one facet of the city of Turku's roadmap towards circularity (The city of Turku 2021).

Further, being flexible and multi-directional allows the city to develop ways to r*euse* and r*egenerate* possible energy sources. The need for additional thermal energy production to be reduced is another goal of the city of Turku. To overcome this, the city of Turku has partnered many regional and national level actors to r*ecover* and r*euse* the efficiency of energy systems in the city of Turku. (The city of Turku & ICLEI 2020) Development through collaborations has been made to store thermal energy locally and to automate it to support the use of heat "*as quickly as possible to the source*". At the same time, it's important that the residents of the city have a sound knowledge and awareness on how their use of energy affects the energy consumption of the city. "*Communities play an active role in saving energy and investing in renewable energy solutions*". To comply with this statement, the city of Turku offers comprehensive assistance and advice on maintenance, efficient use of energy and even financing (The city of Turku 2021)

2.7.3.2 Food value chains

"Southwest Finland is often called "Finland's food basket" as it holds a central position in Finnish food production, from agriculture to the food processing industry" (The city of Turku 2021).This statement is supported by the geographical positioning of the city. The city of Turku plays a key role in supporting the circular food systems of Finland. "Agriculture is responsible for 10 percent of Finland's greenhouse gas emissions" (The city of Turku 2021). It is evident that food systems of Turku are contributing largely to the emissions. Promoting resource-wise food across the city of Turku is one aim of achieving circularity. This allows residents and restaurants to rethink and regenerate possible ways to consume organic and resource-wise food.

Turku is popular and is known as "a centre of food innovation research" (The city of Turku 2021). With the rising research and ability to access these findings gives the ability for residents to get an idea from where they see in the shelves comes from and a chance to rethink on their food consumption decisions. Further, strengthening local farms allows the city to reach circularity because it opens doors to rethink and improve ways to reduce the use of different inputs in their food production. In addition, it allows them to create jobs and improve the living standards of the community (The city of Turku 2021)

"The carbon and resource footprint of menus in canteens and schools in the Turku region is closely monitored and efforts are made to reduce carbon and resource impacts" (The city of Turku 2021,

30) Canteens function as resource centres to identify methods to Reduce cardon and resource impacts of the city's food systems. Reducing and reusing packaging materials and certain inputs by diversifying the food value of the city of Turku is another facet. Achieving circularity through public procurement by supporting circular food systems is another main factor in discussion. "Turku nearly has over 140 types of kitchen facilities that cater to a multitude of people daily". In 2020, Turku had 420 million worth of public tenders related to food, further justifying that the food systems in Turku can contribute largely to the circularity in the region (The city of Turku & ICLEI 2020, 46).

2.7.3.3 Water Cycles

Water is a basic need for all living things, it plays a pivotal role in nature and its lifecycle. Developing a systematic solution for water management has been a topic over discussion for many years by the city of Turku. Municipalities in Turku have collaborated to establish joint circular solutions from water extraction to resource recovery. These regional and cross-sectoral collaborations allow the city to r*ethink* how synergies can be developed to *reuse* all wastewater and *reduce* water wastage. Designing regenerative solutions for runoff water management is another key aim of the city of Turku's Circular roadmap. The drainage systems of Turku and landscapes are utilized for stormwater management and agricultural water management. (The city of Turku 2021, 34-33) Incorporating the concept of r*euse* in city policies helps extend the lifecycle of the product (ICLEC). The circular roadmap of Turku, had developed claims to incorporate this statement and develop opportunities for residents to r*euse* grey and runoff water, thus leading to a reduction in the need for clean water. In addition, the city of Turku aims to *reduce* water pollution by increasing the efficiency of proper data management and monitoring. Establishing a comprehensive data management system will allows the city to analyse trends of residents and businesses to find ways to r*educe* water pollution. (The city of Turku 2021, 34-33)

2.7.3.4 Building and construction

Over the years, construction activities have generated large amounts of waste across the world. The waste generated is due to the continuous constructions, demolitions and renovation activities that develop villages into towns, towns into cities and cities into mega cities (Jaillon & Poon 2014). Laying the foundations of circularity in the construction industry is another goal of Turku. This part of the plan aims to address the needs of the rising population of Turku and its requirements for more housing, schools, care homes and kindergartens. *Rethinking* and *reusing* the occupancy of existing buildings in the city of Turku is a form of achieving circularity. Raising awareness of such unused

spaces and facilitating the option of renting them out allows the city to achieve this goal. Nature-based solutions, energy conservation and water usage incorporated will aid in r*educing* excessive inputs in future building and construction prospects. Additionally, *recovering* demolished materials and increasing the use of material recovery is also an aim of the city of Turku to achieve circularity. (The city of Turku 2021, 44-53)

2.7.3.5 Transport and logistics

Another important area of focus of the city of Turku is transport and logistics. Circular city transport and logistics are fuelled by nurturing sources and minimizing pollution. The city of Turku aims to have more accessible walking paths and cycling networks to improve the mobility of residents. This aim has made the city of Turku to r*ethink* and develop strategies to make residents move. *Reusing* and sharing vehicles is another aim of the city of Turku. This model will allow Turku to reduce emissions and witness the advantages of a shared economy. Eventually, the city aims to have transport and logistics free of emission and noise-free by 2029. This allows the city to achieve goals of becoming a resource-wise logistics and a circular city (The city of Turku & ICLEI 2020, 54-63)

3 Methodology

This chapter dives deeply into how the study is conducted. Initially an emphasis will be given to the research approach for the study. This study employs a qualitative research method. Starting with the research approach, a detailed description on research design and data analysis will be discussed in this section of the study.

3.1 Research Approach and Research Design

A qualitative research approach was selected to conduct this study. Qualitative research is defined as "a method for exploring and understanding the meaning that individuals or groups attach to a social or human issue" (Creswell 2018, 50). This type of research typically involves developing questions and procedures as the study progresses, collecting data directly within the participants' environment and analysing the data inductively, moving from specific details to broader insights. The researcher also interprets the meaning of the material gathered (Creswell 2018, 50). Qualitative research focuses on text rather than numbers. According to Myers (2013, 8) this approach was introduced to study social and cultural phenomena in social sciences. Using a qualitative approach is appropriate when aiming to study a particular subject in depth and also when there is very limited research published on this topic (Myers 2013, 9). This research focused on understanding how the circular economy initiatives shape businesses in city of Tuku, which makes a qualitative approach more logical for this research. To add, this approach best suits when the purpose of the research is to understand texts of existing documents like publications from of the city of Turku, and to identify the influence that those initiatives have on businesses in Turku. This approach allowed to carry out a detailed and comprehensive analysis on a few businesses currently operating in Turku who are affected by circular economy roadmap.

When it comes to research design, there are four primary types: exploratory, descriptive, explanatory, and predictive (Collis and Hussey 2021). An exploratory research design was chosen for this study, considering the nature of the study and its research questions. Exploratory research is a valuable tool for gaining insights and understanding a problem or topic of interest. It involves asking open-ended questions to discover what is happening and clarify the nature of the issue at hand. This type of research is particularly useful when nature of the problem is not precise or if the a new area of study is to be explored. The flexibility and adaptability of exploratory research allow researchers to change direction based on new data and insights that emerge during the study. The purpose of descriptive research is to obtain a precise and detailed account of occurrences,

individuals, or circumstances. This type of research can either follow or precede with exploratory research or more common in explanatory research. Establishing a clear understanding of the phenomenon under investigation is crucial before proceeding with data collection. Since the circular economy initiatives adopted by the city of Turku are discusses in chapter 2, they served as a clear guideline for the author. Further, by using open-ended questions, the author was able to capture a detailed analysis of the selected company and its actions to circularity.

3.2 Case company selection

The author selected three different businesses representing multiple sectors in the business ecosystem of Turku to get a diverse view on the alignment of the circular economy roadmap of the city of Turku in businesses operating in the city. Eisenhardt & Graebner (2007, 27) claim that "theory building from multiple cases typically yields more robust, generalizable and testable theory than single-case research". Additionally, it states that if the purpose of the study is to broaden the knowledge on a specific phenomenon the case companies selected must serve the purpose of the study. Therefore, in this research, the author has used a qualitative exploratory multiple case study method to conduct the study.

The research focused on 3 case companies aligned with the central theme of the study. The selected companies operate within the region of Turku and was recognized for their commitment towards sustainability, particularly through practices with the principles of the circular economy. The case company selection criteria aimed to ensure diversity in terms of size, industry background, scope and ownership. This allowed for a more comprehensive analysis of circular economy implementation across different organizational contexts.

Eriksson & Kovalainen (2015) claims that case study selection criteria can also be based on practical reasons like access to information and feasibility. To execute the purpose of the study, extensive use of publicly available information on companies was required and with this, the author selected 3 case companies that have public reports about the business and sustainable actions. Further, the author was also able to collect primary information from these 03 companies.

The company A, is a leading European juice manufacturer, having one of its factories in South-West Finland, operating since 1857. The interviewees from the company had strong experience in the subject circular economy and sustainability. Company B is a renowned company in Turku that manufactures and installs outdoor children's play equipment, environmental furniture and outdoor exercise and fitness furniture. The interviewees from the company included the CEO, the industrial

manager and the product manager, both of whom possessed in-depth knowledge of sustainability. Additionally, both of them had direct experience collaborating with the city of Turku on circular economy projects. Company C is a leading second-hand clothing store based in Finland, with some of its outlets in Turku. The main reason to select this company was the fact that the company's core business itself embodies circularity and the impact that it has on communities to promote circularity.

3.3 Data Collection

Data collected for research can be mainly divided into primary and secondary data. First-hand data gathered by the researcher is known as primary data. Secondary data used in research means the use of existing data and facts that have been sourced earlier. The type of data to be collected on the research depends largely on the nature of the study, its objectives, and its research questions. (Collis & Hussey 2022, 21) Both primary and secondary data was used in this study to analyse how the current circular economy initiatives of the city of Turku has made changes in businesses in the city.

A mix of both primary and secondary data was used to investigate the research sub-question two. Eriksson & Kovalainen (2015), argue that it is important to consider the original purpose of the existing data as it significantly effects the validity of the research. The author has used secondary data to develop a perception to the theoretical background of the research and to identify relative case companies to gather data. Table 4 provides the list of secondary data that was used in the study.

Table 4: Sources of Secondary data

Source of Data	Description	Objective
Websites of selected case companies	Shows business strategies and sustainability initiatives	Assess how the company aligns with circular economy through public communication
Annual reports of selected case companies	Contains financial data and evaluations of economic instruments	Helps determine the impact of these initiatives in terms of financial and economic performance
Sustainability reports of case companies	Offers detailed analysis on environmental and sustainable initiatives	Aids in assessing level of commitment towards these initiatives

The data collection from the secondary data sources mentioned in table 4 assisted the author to validate the data collected from the primary data sources such as interviews.

Primary data provides the opportunities to the researcher to understand the phenomena of the research questions whilst observing the respondents in their natural environment (Malhotra & Birkis 2006 84). Using qualitative methods like interviews for data collection is a popular form of data collection methods in Finland (Eskola & Suoranta 1998). Interviews were the main form of primary data collection method that is used in this study. Qualitative interviews can be divided into three main sub-sections: structured interviews, unstructured interviews, and semi-structured interviews. (Collis & Hussey 2022 120 - 122) The study primarily used a semi-structured interview style and the main reason for this was to gain as much information as possible. Semi-structured interviews are a combination of both structured and unstructured interviews. Here the researcher will have a general plan on what the questions will be but does not follow a pre-set order. This type of interviews is usually open-ended and follows a thematic approach.

The objective of the author was to have primary data sources from a range of industries to analyse different sectors that comply with the regional circular economy initiatives developed by the city of Turku. The author was able to investigate three companies, listed in table 5 which operates within the region of Turku. These companies were given the possibility of staying anonymous with the intention of getting the most accurate data. And all 3 companies expressed their intention to stay anonymous.

Table 5: Sources of primary data

Company	Method of interview	Title of interviewee	Company Description	Interview Date	Duration
Company A	Semi-structured online interview	Interviewee 1 - Environmental engineer Interviewee 2 - Production engineer	Juice manufacturer	28th January 2025	30 minutes
Company B	Semi-structured online interview	Interviewee 1 - CEO Interviewee 2 - Product manager	Playground equipment and outdoor furniture	07th February 2025	30 minutes
	Semi-structured personal interview	Interviewee 3 - Industrial manager Interviewee 2 - Product manager	Playground equipment and outdoor furniture	27th February 2025	45 minutes
Company C	Structured email interview	Interviewee 1 - Communications specialist	Second-hand retail shop	31st of January 2025	N/A

Company A and Company B were interviewed via online platforms as listed in table 5. Both companies had two interviewees each. However, after the first interview with the Company B, the company invited the interviewer for a factory visit, which allowed the researcher to have a hands-on experience of the things that were discussed in the interview. With the time limitations, Company C agreed to answer the questions via email, hence the interview conducted can be identified as structured interview. All the interviews were conducted during the time between week 3 - 6 in 2025. All six interviewees were asked with a similar interview guide although slight changes were made based on the industry they operate in. In the interviews with Company A and Company B, some questions were changed, and additional questions were asked based on the responses of the interviewees, which is the nature of semi-structured interviews. All the interviews were recorded with the permission of the interviewees and then carefully transcribed in order to avoid any misunderstanding and misinformation. The interviews were conducted in English as both the researcher and interviewees spoke fluent English.

In the interviews conducted, the interviewer managed to ask exploratory questions with the intention to dive deep into the topic of discussion. The researcher consults existing theories that can be applied to the observed events or develops new ones. Exploratory research questions in appendix 01 emphasize the exploratory element of the research by asking 'how', 'what', and 'where' inquiries (Collis and Hussey 2021, 5). Because the thesis used the semi-structured interview style, the research strategy is exploratory. The research questions beginning with 'how' highlight the exploratory aspect of this thesis. The interview questions of this research were developed based on the principals of the regional circular economy road map and using a synthesis framework that was broken down into different themes. As the interviews were semi-structured interviews, the researcher had the ability to deviate and ask questions outside of the list but within the themes and content that was initially decided.

The concept of the circular city framework and circular economy roadmap of the city of Turku were the main topics of discussion during the interviews. These topics were discussed in-depth to investigate how these themes comply with their business operations. Another important aspect of the interviews was that the interviewees were given the opportunity to clarify the interview questions to make sure that the accurate data were collected. Table 6 illustrates how the themes identified in the literature review was synthesised to the interview question guide. The interview guide can be found in Appendix 1.

Table 6: Operationalization table with code frame

Main Research Problem	Sub Research question	Description
How do businesses in Turku align their practices with and contribute to the city's circular economy initiatives aimed at supporting the circular transition?	What circular economy initiatives have been introduced by the city of Turku?	05 themes of the roadmap were discussed in sub-section 2.7 Energy systems Food and value chains Water cycles Building and construction Transport and logistics
	How do these initiatives shape business practices toward circularity in Turku?	Based on the 05 themes above, each case company was analysed.

The operationalization table in table 6 shows how the main research question and the sub-questions lead to different themes identified in the literature review. The operationalization framework allows the researcher to build the interview guide, which acts as a framework for structuring the interviews (Kaliio et al. 2026).

3.4 Data Analysis

Data analysis is one of the most crucial steps in a research. By analysing the data collected, the researcher can interpret, structure and formulate the findings to match the research questions. Data analysis involves examining, categorizing, and tabulating empirical data (Yin 1989, 105). Further, it can be said as "it is a process of resolving data into its constituent components, to reveal its characteristic elements and structure" (Dey 1993, 31).

Data in qualitative research is non-numeric and not quantified, therefore in order to make these data useful, a detailed data analysis must be conducted (Saunders et al., 2009 480-481). The main aim of analysing data in qualitative research is to bring clarity to the gathered data and by doing this to bring useful information to the content of the study. Data analysis is the most challenging phase of the research, however, this is the phase that creates the possibility to find new information and bring additional value to the subject of study. The process of data analysis expects that the researcher possesses complete interview transcripts. However, transcribing the interviews can be challenging and time-consuming, which must be considered during the data analysis phase (Saunders et al. 2019, 481).

The researcher used thematic analysis to analyse data in this research. Thematic data analysis is a widely used methodology in qualitative research. It helps to provide rich and comprehensive analysis of qualitative data. Braun & Clarke (2006), claim that this method works well to reflect reality and to unravel the surface of reality. An important part of thematic data analysis method is selecting themes. Themes captured in relation to the research questions provides a pattern and meaning to the data set (Braun & Clarke 2006). Two pre-existing frameworks were used in this study to analyse the two sub-research questions which ultimately answer the main research question. Having pre-existing themes derived from these models help the author to organize and analyse the data systematically (Braun & Clarke 2006).

The circular city roadmap developed by the city of Turku (based on the circular city framework) and the circular business model canvas by Lewandowski (2015) were the two main frameworks used to analyse the findings. The author used theoretical analysis to find answers to the research sub-question one, analysing the secondary data (city published policy documents) gathered from different sources. This was done in the literature review chapter itself, as it is was more suitable to investigate the pre-existing themes and establish a theoretical framework in the literature review chapter. Sub section 2.7 discusses these findings. These findings serve as a base to answer the second sub-question using the emphatical data collected in the data collecting phrase.

In the data analysis chapter, the empirical data collected from primary sources (interviews) and company publications were analysed. The collected data were critically analysed with the help of themes discussed in the sub section 2.7. Cross-case analysis was used to perform this analysis. Cross-case analysis is used when the author draws out similarities and differences to identify patterns in the study (Collis and Hussey 2021, 61). By doing so, the author analyses the actions of the three companies studied in this thesis to draw similarities and identify patterns to investigate how the businesses align with and support the circular city roadmap of the city of Turku and the overall circularity of the business models.

The author used the qualitative data analysis application “N-vivo” to aid the analysis process. This software helps to code the collected data based on the themes identified. With the use of the developed themes (Figure 4) , the author can interpret data to identify patterns, relationships and key areas that is discussed in the data analysis chapter.

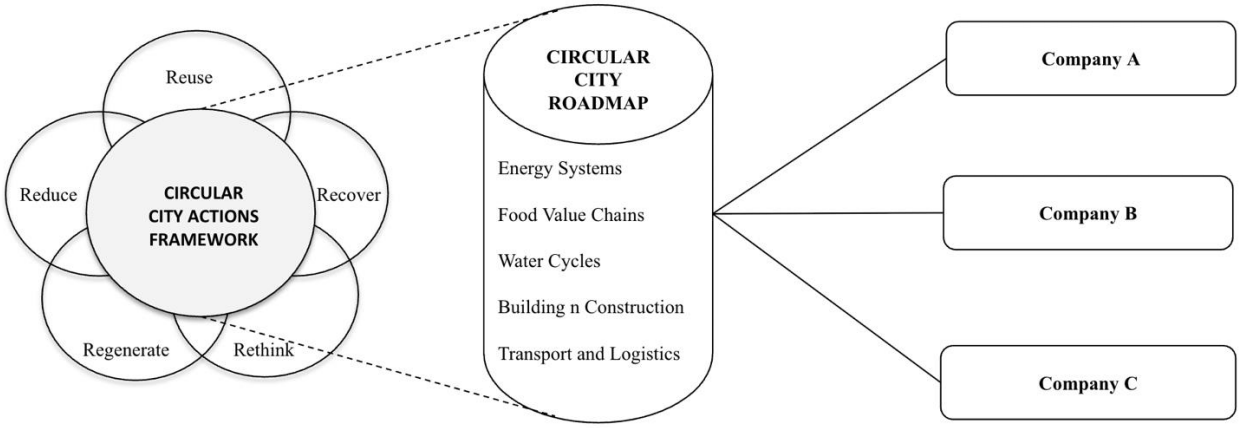

Figure 4: Data analysis structure

3.5 Evaluation of the study

The evaluation of the trustworthiness of this research follows the guidelines mentioned by Lincoln and Guba (1985). Credibility, dependability, transferability and confirmability are the four factors that determine the trustworthiness of a study (Lincoln and Guba 1985 300).

Generating research findings that represent real-world phenomena is known as credibility. Being credible, requires the author to remain precise in while writing and interpreting the collected data. This simply means that the answers to the research questions are in line with reality. This study ensures its credibility due to many factors. The study brings out recommendations of experts in the subject of circular economy. Further, the selected interviewees had a clear understanding on the subject matter and they ensured that they provided insightful information and responses. Also, since the interviews were carried out in a semi-structured interview style, the interviewee also had the ability to rectify any doubts they had and be truthful to their responses. With permission, the response of the interviewees was recorded to ensure that, the data stays accurate while coding them. However, recording the interview might reduce a certain level of openness while responding. The researcher felt that they spoke truthfully because they were open to answer any questions, and they were even ready to reply back if the researcher had any further clarification post interview. Also, the researcher was able to visit case Company B and observe many of the things that was discussed during the interview. One another factor, to enhance the credibility of the research was the presence of a clear interview guide. With this, the researcher ensured that no questions were deviated from the subject of discussion. However, one general weakness of a qualitative interview is that, data should be gathered quickly because of the limitation of time. Each interview conducted was within a time frame of 30 minutes, so it was difficult to cover such a vast topic during a time spam of 30 minutes.

Transferability of a study means the possibility of generalization of the research results to similar settings. This is crucial for assessing the applicability and relevance of the research. (Lincoln and Guba 1985, 296) This aspect determines how well the findings of the research can be transferred to a broader context. For research to have a high level of transferability, the subject of the research must be selected based on specific criteria while ensuring that it aligns with the objective of the study. (Lincoln and Guba 1985, 297) Circular economy is a rapidly growing topic which discussed through all levels of the economy. The relevance of this topic is at a high scale to the selected context. The European union has incorporated circular economy to its propaganda at a large scale. And with this Finland has understood the benefits that this economy brings to the country and its environment when the traditional linear economy is put aside. The city of Turku being, the oldest city of Finland, has incorporated the concept of circular economy into its local initiatives by all possible means. Further, countless previous research findings can be gathered and this makes the topic more relevant due to its extensive existing literature.

Dependability of the study ensures that gathered data is truthful and has a reliable presentation of the phenomenon of the study. Also, this refers to the importance of research situation, scenario and the objective of the study. (Lincoln and Guba 1985, 299) This study followed a well-developed process from the development of research questions, construction of the operationalization table, data collection, transcribing the interviews to data analysis. The themes selected in the interviews were themes that was already established by the city of Turku, in the form of its roadmap. Therefore, the themes selected for the study was dependable and this was increased because the selected interviewees for the interviews were respondents who had a very good knowledge about the subject of circular economy.

Confirmability of the study resembles the importance of the objectivity of the data analysis. Further, it means that the study provides evidence that the research findings are developed based on the responses received from the interviewees and not from the subjective point of view of the researcher. (Lincoln and Guba 1985, 300) Here, this requires the researcher to describe all the steps that was taken when conducting this research. The data collection method of this research is reported, the research questions is reported, and how the research findings were developed is mentioned in this study. The themes discussed is also mentioned in this research. Further, the interview guide that was used during the interviews is attached in appendix 1. Mentioning all the information required increases the transparency of the research process.

3.6 Research Ethics

Research ethics is concerned with how the author conducts the study and reports the findings. In accordance with the guidelines on a good scientific practice issued by the Finnish National Board on Research Integrity (TENK 2023), the core principles of ethical research include trustworthiness, reliability, ethical integrity and responsibility. During the entire research these factors were considered.

Voluntary participation, anonymity and confidentiality are vital factors to be considered when conducting research (Collis and Hussey 2021, 29). The participants of the research were approached by an email with the details of the research. All participants were involved in a voluntary basis and provided informed consent via email before taking part. The interviewees were fully informed about the purpose of the study, how their inputs would be used and they had the right to withdraw at any point without any consequences. Further, the author has taken careful consideration to protect the privacy of the participants. Their names have not been mentioned in the study and the names of the companies they represent are not mentioned to ensure confidentiality. These steps were taken by the author to create a safe and respectful environment for the participants. More information on data management is attached in appendix 2.

Artificial intelligence (AI) was used in this research by the author to get assistance on few occasions. It supported the author in brainstorming ideas and refining research questions. AI assisted tools were also used to help the author with grammar and improve the clarity and conciseness of sentences. Further, some tools were used for the purpose of translation form Finnish to English. These tools were used responsibly and the author. The tools used by the author and example prompts given to these tools are listed in appendix 4.

4 Findings

The main purpose of this chapter is to present the findings, and then analyse them based on the theoretical themes discussed in the literature review. The chapter consists of four sub-sections discussing each case company and its cross-company analysis. Each case company is analysed to see how their business operations support the circular city roadmap of the city of Turku. The chapter ends with a critical cross- company analysis of the findings.

The first sub-question is answered in the literature review under section 2.7, primarily using secondary data collected. As described in the methodology chapter, the second sub-question will be answered using primary data collected and other secondary data available online of the case companies. The focus of this section is to draw connections to see how the selected case companies get on board the city of Turku's circular economy roadmap that was discussed in the literature review. To closely investigate the alignment of the companies, the author has categorised the findings of each case company into the five different attributes of the circular city roadmap of city of Turku. Once the findings are presented, the sub-section 4.4 will provide a critical discussion of the findings in relation to the theoretical themes discussed in the research.

4.1 Case Company A

Case Company A is a multinational company with its headquarters in Germany and has production setups in many countries, including in the city of Turku, Finland. This company is a Finnish-based beverage company that produces and distributes fruit juice and other non-alcoholic beverages. As a key player in the industry, the company has integrated sustainability practices from optimizing raw material sourcing, reducing waste in production and environmentally friendly packaging.

4.1.1 Energy Systems

Aligned with the city of Turku's circular economy initiatives, the company has taken steps to minimize its adverse environmental effects through efficient energy systems in the factory whilst ensuring smooth operations. The company is involved in the energy efficiency agreement system coordinated by the Ministry of Employment and the Economy of Finland. As a part of this agreement, the company is committed to continuous improvement through audits and regular reporting and monitoring, which ultimately provides a structure and ambition to comply to the regulations imposed. Below statement by interviewee 1 emphasis the idea.

"*Quarterly meetings are conducted to ensure continuous improvement is happening and during these meetings we can discuss more ways to become sustainable...*" (Company A, Interviewee 1)

Technological innovations play a key role in achieving energy efficiencies (Wang et al. 2020). Company A has installed "frequency convertors" and has secured infrastructure to "optimize product packaging temperatures" in energy systems in the factory, which has contributed to a considerable energy-saving. These decisions contribute largely to the reduction of energy consumption and complies positively with the energy saving initiatives of the city of Turku. The interviewee 1 further stated that this initiative aims to reflect as a goal to close energy loops and share surplus energy where it can be better used. This strategy links to a positive link to the energy-saving initiatives by the city of Turku.

> "In our factory, we have initiated technological innovations that help improve energy efficiency. Improving ventilation units and replace lights with energy-efficient lights have helped the company save more energy. And also, whenever we get new equipment, it should at least be an upgrade in terms of energy efficiency or environmental performance." (Company A, Interviewee 2)

This reflects that the company is taking initiatives by thinking long-term. Replacing fixtures and fittings is a cost for the company, but the company has believed on the benefits that is in the future. Additionally, thinking ahead of machinery depreciation and possibilities to improve its life-cycle prior to purchasing adds value to the circular economy concepts that the company is aiming to achieve. The Company A has also initiated concepts and methodologies to continuously monitor its waste generation. *"We actively monitor how much waste is generated, how much waste can be recycled and what kinds of different waste streams have been generated" (Company A, interviewee 2).* The implication of this statement positively correlates with the aims of the city of Turku to recycle and recover energy through waste management.

4.1.2 Water Cycles

A factory with a large industrial process has factors like water treatment, pumping, heating and wastewater processing that link to water systems. The company facilitates the concept of closed-loop system, hence representing a strong commitment for circular economy. "*The majority of our water circulates in an internal, closed loop within the factory" (Company A, Interviewee 1)*. This statement is consistent with the aims of the city of Turku's water management initiatives on circular economy. The city of Turku pursues the goal to increase the reuse of wastewater thus reducing the need for clean water. The city aims to promote this principle to all the businesses and residents

living in the city of Turku. This strategy not only supports water conservation but also contributes to energy efficiency.

However, the following statement seems to contradict the above strategy. "*still all the process and sanitary wastewater just goes straight into the city of Turku's wastewater system" (Company A, Interviewee 2).* Discharging sanitary wastewater to the city's municipal systems follows the standard industry practice and promotes a linear model as the wastewater of the site is left out without recovery or reuse. The city of Turku's strategy to increase the reuse of wastewater works in-line with the aim to strengthen corporation among regional actors and municipalities to develop synergies and support partnerships. Yet, this statement does not comply with the strategy the city of Turku pursues.

Further, the company intends to reduce the amount of chemicals used in process washing "We have identified that we need to *optimize process washing to reduce the amount of washing chemicals and also the generation of wastewater" (Company A, Interviewee 2).* When chemical input is reduced, the environmental harm to water is also minimised. This also reflect in the energy efficiency as the limited requirement to treat water for purification translates to less energy consumption. The policy direction of the 'water cycles' guides the company to avoid emphasizing the value of water and make sure that the pollutants do not enter the water systems.

4.1.3 Transport and logistics

The company seems to have align its logistics setup with the vision of the city of Turku to reduce emissions in logistics to become carbon neutral by 2029.

*"Recently, we have converted our vehicle fleet to electric vehicles and we offer charging options for all our employees with electric cars.... for internal transport inside the factory, we use electric forklifts" (Company A, Interviewee 1).*In an attempt to reduce emissions, the company also has taken steps to incorporate shared mobility solutions at all possible occasions within the company. *"We manage the concept of vehicle sharing and logistics by optimizing logistics" (Company A, Interviewee 1).* The initiative also contributes to fulfilling the city of Turku's circular economic aim in reusing vehicles, with the intension of "making shared mobility the new normal" by developing strategies to have multi-model transportation and sharing vehicles. Further, using electric forklifts and switching to electric machinery within the factory supports the aim of reducing carbon emissions inside the factory.

> Our company doesn't have its own fleet of transport. We use outsourced companies for transport. When we decide on transport companies, we always analyse to see if they are sustainable companies. Also, when it comes to logistics, we try to achieve optimal load planning and full loads (Company A, Interviewee 1).

Outsourcing logistics supports resource efficiency, and it serves as a core principle of circular economy. The city of Turku encourages collaboration and partnerships with shared logistics platforms. This intends to reduce emissions of transportation and increase the efficiency of use of vehicles. Selecting environmentally friendly transportation partners leads to the concept of sustainable procurement, which is emphasised in the city of Turku's roadmap.

*"In logistics, the aim is to achieve optimal load planning and full loads" (Company A, Interviewee 1).*The company also seems to strive for maximum efficiency in transportation. Aiming for optimal load planning reduces fuel emissions and fuel consumptions utilized through logistics. This reinforces the city of Turku's commitment to reduce emissions in logistics. Further, transport efficiency also translates to reduction of transport infrastructure usage and energy

4.2 Case Company B

Case Company B is a company based in Turku, Finland. The company specializes in designing and manufacturing outdoor gym equipment and children's play areas. The company is passionate about promoting diverse physical activities and has the intention of getting people of all ages to move. The core business of this company is not related to a high consumption sector but focuses on material efficiency, sustainable energy use and modular design. Modular design refers to the practice of designing products that can be assembles, disassembled, repaired and replaced. Further, the concept of modularity enhances repairability, maintainability, sharing, recyclability, durability and upgradability. (Olsen 2023)

4.2.1 Energy Systems

Quality of the product can have an impact on saving energy as long product life cycles support the concept of circular economy because a long-lasting product offer a better chance of reuse (Lewondowski 2015)

The modular design of the products of the Company B promotes the concept of a long-life cycle. Interviewee 1 claims that they specialize in designing outdoor play and gym equipment what is functional, easy to maintain and long lasting. The company has acknowledged the importance of the efficient use of energy in the production process. It seems to believe that the product design plays a

key role in its vison of producing long-lasting products. These two aspects are given an equal importance to produce a quality product under an energy-efficient production process. Looking at the bigger picture, a long-lasting product helps to reduce energy consumption at all stages of its life cycle. This supports the city of Turku's aims of reducing its carbon footprint and energy usage.

4.2.2 Building and Construction

Reusing demolished materials is one objective of the circular economy roadmap of the city of Turku. Recovering materials whenever possible when demolishing buildings, contribute to the concept of circular economy.

> "The initiation came from the city of Turku, to see if the lumber can be recovered and reused in our manufacturing process. An old industrial building close to our factory was demolished in a way that the materials like lumber, tiles and even the metal staircase can be reused. We partnered up with the city of Turku and we were able to make outdoor benches, still being in the testing phase but could be used at Kuppitta..". (Company B, Interviewee 1)

The careful deconstruction allows materials to be recovered and reintegrated to the manufacturing process and thereby reduces the need for new materials to be purchased (Bertino 2021). This complements with the circular roadmap of the city of Turku. The city of Turku emphasises the partnership and collaboration among businesses and authorities to achieve circularity (The city of Turku 2021). The CEO of the Company B highlighted the importance of the private-public relationship and collaboration that this project between Company B and the city of Turku had created. The partnership not only developed a collaborative model but also presented a market opportunity to resell demolished materials. Interviewee 2 further highlighted that the partnership with the city of Turku opened a new business scope to their operations.

"Even though we are still in the testing phase of this project, what really happens here is that we are turning waste into public amenities" (Company B, Interviewee 1).

The author was invited to investigate the production facility in Turku, Finland and was able to see the benches that are manufactured at the factory.

4.2.3 Logistics and Transport

Transport costs are a main cost driver of the company. The company also acknowledges the impact of transport emissions and how the long-distance transportation could adversely impact the emission levels. Hence, the company is making a conscious effort to have a local supply chain setup

to minimise the need of transportation. Most of the materials and component suppliers as well as other partners that the company operates with are Finnish companies resulting in reduction of transport needs. The company believes in that way the company can save money on logistics costs as well as reduce environmental load.

The local supply chain setup the Company B work with goes in line with the city of Turku's circular roadmap in achieving circularity through logistics and transportation by reducing emissions in logistics. By sourcing raw materials mainly from Finnish suppliers, this company reduces transportation distances, thus leading to reductions in fuel consumption and emissions. This corresponds with the city of Turku's environmental targets.

4.3 Case Company C

Second-hand retail acts as a key player in the topic of circular economy, offering an alternative option to traditional consumption patterns of textiles by extending their lifecycles (Persson & Hinton 2023) This case company is a non-profit second-hand clothing retailer operating in Finland. The company is established as a major actor of reusing and redistribution of textiles with a well-organized collection system and a large network of outlets. The foundation's aim is to meet the circular economy targets at all stages of the value chain from the collection of used clothes to reselling them. The city of Turku is home to two outlets of this organization.

4.3.1 Energy Systems

With the belief that energy systems contribute largely to the degradation of the environment through business practices; the company aims to use renewable energy sources. The use of renewable sources of energy reduces both direct and indirect emissions in the business operations across many functions within the organization. According to Company C (Interviewee 1), the foundation was able to use 100% renewable energy sources for its operations in sorting and packaging centres. Shifting from non-renewable energy sources to renewable sources goes in line with the objective of the circular economy roadmap of the city of Turku. Using 100% renewable energy eliminates the use of fossil fuels, decarbonizes and reduces the impact for climate change.

The initiative of using renewable energy resembles the company's aim of improving lifecycle of textiles. Using renewable energy sources adds up to creating synergies between circular energy systems and circular material flows. These synergies build up the foundation for well-functioning circular economy. These interrelated functions are reflected in the city of Turku's circular economy

vision of being systematically resilient. Not utilizing any non-renewable energy sources means that the foundation is less vulnerable to fluctuations in energy markets and contributes to the localization of energy production.

While using renewable sources of energy at sorting and packing centres, the foundation also aims to source all its energy needs for the offices and shops from renewable energy sources. The foundation is making plans to soon improve its energy efficiency by increasing the use of renewable energy sources in their shops. This illustrates the desire to be involved and committed to protect the environment and establish circular economy initiatives at all stages of the lifecycle of the business. This goal strongly complies with the circular economy roadmap of the city of Turku. The vison of achieving a resource-wise energy system can be met when companies move from the traditional way of doing business to a circular economy business model (Characteristics of a resource-wise city 2014). Shops and offices consume a large amount of energy for its lighting, heating, ventilation, electronic display and many more. Moving into renewable energy sources not only bring circular economic advantages but also help in reducing operational costs in the long run. This alignment helps the city of Turku to localise their circular economy objectives. (The city of Turku 2021)

4.3.2 Transport and Logistics

The logistics and transportation model of the company C seems to follow the city of Turku's circular economy roadmap. Reducing emissions in logistics is one key aspect of becoming a resource-wise city for the city of Turku (The city of Turku 2021). The organization has focused on having an efficient logistics setup by developing a centralized logistics system for collecting, transporting, sorting and redistribution of clothes. By having a centralized sorting facility, the company aims to achieve high resource utilization and optimised transport routes.

Reverse logistics is a key driver of circular economy (Govindan 2015). Due to the nature of the business, reverse logistics is an integral part of business operations. The company has a network of collection points established across the country to support the reverse logistics of cloths. These collection points are called "collection bins" and the cloths collected to these bins are transported to the centralised sorting facilities before going on sale in the shops.

4.4 Cross-case Analysis

This section will analyse the findings across three companies presented in the preceding sub-chapters. Cross-case analysis is when the author draws out similarities and differences to identify

patterns in the study (Collis and Hussey, 2021 61). The author will analyse the findings across three companies to draw links to the circular city roadmap presented in the literature review of this thesis. The focus of the cross-case analysis is divided to two streams. First, the analysis will be conducted to identify how the case companies react to the circular road map of the city of Turku. The sub section 4.4.1 discusses the behaviour of the companies with regards to the different attributes of the circular city roadmap of city of Turku. It will be followed by cross-case analysis of the case companies to investigating the circularity of the businesses. The idea of this cross-case analysis is to identify circularity of the case companies after observing how the companies adopt the circular city initiatives of the city of Turku. To investigate the circularity of the businesses, the author will use the circular business model canvas by Lewandowski (2015) that is discussed in the literature review of this thesis.

4.4.1 Businesses' reaction to the Circular City Road Map of the city of Turku

Turku City inherits a diverse business ecosystem. The connection the city of Turku has in this business eco-system seems quite substantial and healthy. All three companies that are investigated in this thesis have developed a healthy relationship with the city of Turku and seem to continue a close dialog on sustainability and circularity. A common theme among the companies was the recognition and encouragement to enhance circularity practices in their businesses and contribute to the overall sustainability of the city.

Case Company A strongly believes that energy systems are the main and the largest system that leads to environmental degradation. It seems to be a valid claim as the International Energy Agency (2016) claims that the energy system is the largest source for environmental pollution. The interviewee 2 from the company mentioned that the company takes serious actions to reduce energy wastage and ensure a closed-loop energy system in the entire value chain of the company. To achieve a circular energy system, the city plans to implement an extensive energy distribution system, enhance thermal energy storage and increase resident awareness of consuming energy efficiently. Improved and reliable energy distribution system will help reduce expenses of businesses. (Circular city actions framework 2021).

The ReSOLVE framework also highlights the importance of shifting to renewable energy and materials (Williams 2016). Case Company A has exploited significant strategies to keep the energy systems on a close loop. Using 100% renewable energy in the sorting and packaging centres of the case Company C shows its support to the city of Turku's circular economy roadmap. Utilizing less materials in the production process makes company B comply with circular economy initiatives

because it reduces resource extraction, minimizes waste and improves material efficiency (Geissdoerfer, M 2017). In addition, it was observed that the Company A and B promote positive work culture, which is related to circular economy and sustainability, by openly discussing the areas of improvement in general as well as the ways to save energy and enhance sustainability. This shows that the feedback given is considered and promotes to a fair transition of the circular economy roadmap of the city of Turku.

The findings reveal that the selected companies support the energy saving initiatives derived in the circular roadmap of the city of Turku and the relationship the companies have with the city of Turku looks promising for further collaboration in the future. The author also believe that the selected companies are in fact benefit from the circular energy practices that they must comply with because those systems ultimately improve the efficiency in energy consumption and storage. Having such regulations makes the businesses align operations with the vison of the city, thereby improving the value proposition of the business.

Managing wastewater in the region of Turku is a key aspect of the city of Turku's circular economy roadmap. Reusing wastewater and having access to improved wastewater treatment plants provide opportunities for businesses to reduce their operational costs whilst improving the circularity of the business. The city of Turku's aim of improving circularity through water systems brings in new opportunities for businesses, especially businesses in the water systems sector to improve and be innovative to recover the wastewater for reuse. The concept of a closed-loop system was again highlighted by interviewee 1 of case Company A. The company has developed an internal system for water to be treated and reused. Strengthening the regulations related to this sector has also allowed businesses to meet new standards and comply with new environmental standards and certifications.

However, it is worth mentioning that these regulations require additional investments from the firms, which could not be openly welcome by businesses. It could also result in increase of operational and administrative costs for the business. However, none of the companies investigated had took these regulations negatively. In fact, all three companies seem to be highly corporative and committed to comply with the vison of the city of Turku to improve the circularity of the city. The city of Turku also highlights the importance of active collaboration while achieving circularity. The interviewee 1 of case Company A mentioned the active collaboration and engagement that they have with the city municipality to ensure that city standards are met. During the factory visit paid by the author to the case Company B, it was evident that the company's commitment to contribute to

enhance the circularity by improving the wastewater management. Establishing of these initiatives strengthen the public-private relationships of the city, thus companies have an active participation role and involvement in improving the circularity of within the Turku city.

All the 3 case companies have incorporated circular economic strategies into their buildings and constructions. Increasing the occupancy rate of existing buildings is one initiative of this sector and this develop opportunities for current businesses to rethink and reuse spare spaces left out. The city of Turku plans to develop partnerships and come up with regulations to increase the lifecycle of buildings during the planning stage itself, by pushing for increased quality of design and materials of the buildings and constructions. Recovering and reusing materials from demolished sites in another initiative of taken by the city of Turku. The concept of reusing materials from demolished buildings was mentioned by interviewee 1 of case Company B and was further observed by the author during the factory visit. This initiative aids the city of Turku to achieve its circular economy goals whilst the business gets to make a value from the recovered materials. These initiatives benefit the businesses as they promote a sustainable and circular business framework.

Circular transport and logistics is also considered as an important sector in the circular city roadmap of the city of Turku. Improving methodologies for sharing vehicles, using sustainable transportation methods, high resource utilization and local supply chains can be identified as main drivers to promote circular economy by the businesses investigated. These drivers seem to go in line with the city of Turku's vison of promoting a shared economy with reduced emissions. It is visible that these businesses have given a conscious emphasis to vehicle sharing as much as possible. The vison of the city of Turku is to shift towards a shared economy by improving the quality and affordability of transportation by improving efficiency of transportation means using strong collaboration among different stakeholders.

4.4.2 Circularity of Businesses

The city of Turku circular city roadmap guides the business to adapt and promote circular economy principles to become a resource-wise logistics and a circular city. The preceding cross-case analysis investigated how the businesses have aligned the circular city initiatives published by the city of Turku. The author is convinced that all the three companies investigated closely follow the city of Turku's circular city roadmap to promote circular economy within the business eco-system of the city. Even though the companies support city of Turku's circular city initiatives, the author needs further evidence to suggest this support is reflected in circularity of the businesses. Here, the behaviours of the companies are investigated under the key elements highlighted in the circular

business model canvas developed by Lewandowski (2015) to analyse the circularity of the businesses.

4.4.2.1 Key Partners

Sustainability and collaboration are two terms that go close together. Among business value chains, collaboration has become an important element to achieve sustainability targets within different business models (Chen et al. 2017). Therefore, developing business partnerships helps companies to access key resources and perform key activities (Lewandowski 2015). The concept was present in the three companies that were investigated in this thesis.

The company A is conscious of the complexities of its business model and the different challenges in the supply chains when it comes to circularity. The firm works closely with many partners in its complex supply chain, including different suppliers, logistics companies, customers as well and retailers. Company A interviewee 2 believes it is important that these partners share a common set of values when it comes to circularity and work towards a common goal. The firm also seems to highlight the importance of the "ecological responsibility" its partners have in their own business. Different forms of contractual bindings, audits and training have been used to ensure that such "ecological responsibility" by its business partners is respected.

Company B has a different approach when entering partnerships compared to Company A. Company B believes an important step to circular economy is having a less sophisticated supply chain (Interviewee 02). The idea is supported by the emphasis to have suppliers and sub-contractors closer to the markets as much as possible. A significant portion of the suppliers and sub-contractors of the firm are local partners, helping to make the business circular.

A common theme that was seen in all the companies is their partnership with the municipality of Turku. Company A is in a close partnership with the city of Turku as the waste management mechanism in the city is closely integrated with the municipality and the companies that are responsible for waste management. All companies, including Company B and Company C, work with the city of Turku to have direction and regulatory guidance when it comes to promoting the circular economy in the city of Turku.

4.4.2.2 Key Activities

Firms are engaging in key activities that directly or indirectly help to promote the circular economy (Lewondowski 2015). These activities could ultimately lead to increasing the quality of the product,

resulting in a longer product life cycle and thus contributing to circularity. These key activities include product design, better housekeeping (to reduce waste/inefficiencies), process control as well as technology improvements (Lewondowski 2015).

Company A believes environmental protection and sustainability should be emphasised in every stage and hierarchy of the business and believes this approach helps the company to reach collaborative growth in sustainability. Driven by this approach, the company encourages its employees *"to internalize environment protection as part of their own activities"* (Company A, Interviewee 2). According to (Lewondowski 2015), employee participation in the development of environmental issues is a key activity of the company. Having such awareness among employees helps the company to have "good housekeeping" in its production process, eliminating "unnecessary losses" and inefficiencies, leading to improved process controls and higher efficiencies (Lewondowski 2015). The firm also conducts a set of activities that promotes sustainable initiatives and raises the environmental awareness among communities. These activities vary from raising awareness through online platforms, charity programs, using packaging material of its products and providing scholarships for families and children to in relation to sport activities. All of these activities contribute to the push that is necessary for promoting circular economy (Lewondowski 2015). Company B also seems to promote sustainable product design to promote circularity of the business. They have adopted advanced digitalised systems in its product design to come up with environmentally friendly and long-lasting products (Company B, Interviewee 2).

The company C does not produce anything to have a production cycle. However, the author believes the key activities it carries out to collect used clothes, sort them effectively and price them according to the wear and tear of the products and launch different campaigns to sell these products are key activities that promote the appeal of the circular economy.

4.4.2.3 Value Proposition and Customer Segments

According to Lewondowski (2015), the most important attribute of a circular business model is the value proposition. Firms need to offer their consumers a product that has a long-life cycle with enhanced reusing and recycling qualities while serving the original purpose of the product. The product should also have an optimal product design that promotes sustainability (Lewondowski 2015).

Company B have identified the importance of using wood while respecting the sustainability and circularity principles. Using wood by principle is going against the value of environmental

protection, but the company seems to have taken actions to address such environmental concerns and support sustainability. According to Company B Interviewee 2, it only uses the type of wood called PRF-quality wood, which is a demanding type of wood that is high in durability, resilient to external elements, water, heat and chemical resistant (Difference between PRF ... (2024). The company believes the use of PRF-quality wood helps the company to produce a durable product that can be later recycled and reused. The company's value proposition also seems to highlight the after-sale service it provides for its goods, which have a direct impact on the life cycle of the product, thus helping the circularity.

Company A also seems to follow this trend by having sustainability focused initiatives integrated in its product design. 75% of the products offered by company are packaged with recyclable liquid cardboard packaging. In addition, the company was the first juice manufacturing company in Finland to introduce FSC label on its packaging. FSC is a label given by the Forest Stewardship Council for products that are made of recyclable and sustainable materials (FSC, 2025). The company is also on its way to converting its vehicle fleet to fully electric vehicles and has offered charging positions for its employees' electric vehicles, further strengthening its commitment to sustainability. Company C operating as a non-profit, this company inhibits its value proposition as a 24/7 clothing collection service provider that operates by the aim of extending life cycle of clothes. Also. Global development funding is the ultimate objective of company C. The proceeds collected from the resale of used clothes is used for funding education, water and sanitary systems of underprivileged countries.

Customer segments are closely linked to the value proposition of the company. The firms need to know to which customer segments their value propositions can be sold (Lewondowski 2015). All three companies investigated seem to have a sound idea about the customer segments they need to capture. A common theme visible among the three companies is targeting the eco-conscious consumers. Both Company A and Company B highlight their commitment to using sustainable materials in product design. Company B also seems to target the consumer segment that values quality and long-lasting products that have longer product life cycles by strengthening their after-sale service. The core-business of company C is strongly connected to circular economy as both the suppliers and the customers of the company are sustainability-conscious people who appreciate the values of circularity.

4.4.2.4 Channels and Customer Relationships and Takeback Systems

The different channels from which the companies sell their value proposition to the consumers also an important attribute to circularity. This could range from selling locally, online or omnichannel strategies to reduce transportation to use virtual marketing platforms (Lewondowski (2015). Company A is a large-scale business, and the company revolves around many channels of distribution but mainly focuses on sales through supermarkets and hypermarkets. Bulk purchasing happens in this form of distribution in which it reduces emissions, optimizes full-load deliveries and reduces idle time. Company B mainly offers door-to-door deliveries because of the nature of their product. The company is responsible for the fixing and assembling of the product at the desired location. “We always try to complete the assembly of the product soon and ensure that all necessary equipment and required staff is taken to the location” (Company B, Interviewee 2). Company C has a strong presence online. In 2023, 80% of their sales was made through online wholesaling.

All the three companies examined in this thesis seem to share the idea that customer relations are important for the circularity of the business. Company A uses web forms, social media platforms and other surveys to interact with consumers to ensure an open communication with customers. The company also build relationships through different crowd-engaging activities. Company B also listen closely to its consumers using different platforms and values the relationship with consumers that is based on “trust and openness”. According to Lewondowski (2015), these close relations with consumers help the businesses to identify the consumer preferences, ultimately paving the way to eliminate waste. Having a close and open discussion with consumers allows the companies to understand which products they like the most, the features they like, as well as things they would like to change. Having this feedback is vital for the companies to align their product designs accordingly and come up with products that are closer to the consumer preference (Lewondowski 2015).

The main difference between a linear economy and a circular economy is the loop of material flow that promotes “reuse” and “recycling” (Dabija &Năstase 2024). Takeback systems is a key component in a circular business model. Therefore, it's important that the companies have sufficient reverse logistics setups to support takeback systems that enables them to collect products from the consumers which can be refurbished, remanufactured or recycled to be reused (Lewondowski, 2015). All three companies have dedicated takeback systems to drive circularity of the businesses. Company C, as stated several times before, has circularity as its core business, thereby significantly depends on the success of the takeback systems to collect cloths to sell.

Company A's major takeback system is Deposit Return Scheme (DRS) of Finland. The company is a member of the return system managed by Suomen Palautuspakkaus Oy, which allows beverage manufactures and importers in Finland to pay a membership fee that make them exempted from a beverage packing tax (Tugran 2023). The system indirectly helps the Company A and the other beverage manufacturing companies and importers to avoid negative environmental impacts and facilitates the "takeback" of the packing material they use. The Company B also has partnered up with different organizations to takeback used materials such as wood to be recycled and reuse. It seems to have a close relationship with the Turku city municipality, through which it gets the information about available materials, such as those from demolition sites and other sources.

4.4.2.5 Cost Structure and Revenue Streams

Cost structures help companies to identify gains of promoting circularity and perhaps to find drivers to push circularity-related initiatives. These gains could be cost savings from reusing or refurbishing products, using recycled materials, efficiencies achieved or enhancing reputation. (Lewondowski 2015). Often, sustainability comes with a cost for companies, but sustainability driven actions like reducing waste and maximising efficiencies could also reduce costs (The financial benefits of... 2024). In its goal to reduce inefficiencies and decrease CO2 emissions, Company B is strict on planning transportation with full loads. By doing so, the company also saves money on transportation costs, one of the most significant expenses in logistics (Lewondowski 2015). The company's policy to source locally is also helping it to save money on transportation. This also helps the company to avoid costs related to unexpected delays which are often frequent in modern supply chains.

On the other hand, the company also have cost drivers connected to circular business initiatives. The two most significant costs identified are additional costs of sustainable raw materials and quality checks. For instance, the type of wood it uses (PRF-quality wood) for production is environment friendly, but costs more than normal wood. The company also highly focused on maintaining the quality standards it requires obtaining and renewing different certifications, further contributing to higher costs. Same cost drivers can be seen in the Company A as well. The company pays relatively higher prices to its suppliers to ensure the suppliers and sub-contractors have sustainable sources. The company also spend a considerable portion of its annual expending on the different food quality certificates. The core business of Company C is circular economy, thus its cost structures as well as revenue streams are highly interconnected to circularity. The main costs of the company include operating clothing collection services, sorting and packaging. The non-profit

organization also conducts projects overseas (for instance in Africa and India) to help climate initiatives and uses these projects to raise public awareness about circularity, thereby increasing its sales.

Revenue streams vary according to the value proposition and is simply the ways in which a company makes money (Lewondowski 2015). Circular economy opens the chances for companies to increase new profit possibilities, build resilience and increase the competitive advantages (Lewondowski 2015, 15). Company A generates most of their revenue from sale of packaged drinks. This type of revenue model correlates to the input-based product-service system (Lewondowski 2015, 17). The company stands strong as a sustainable company and has invested on recyclable packaging materials, an investment that has potential for long-term profitability. The company's commitment to sustainability could be well received by communities that are increasingly aware of environmental concerns, thereby potentially leading to higher revenues in future. The main revenue streams for Company B are the sale of products related to outdoor gyms, play areas and sports equipment. Additionally, customised designs and installation services generate a premium revenue to the company, whilst the company ensures that the product has an extended life cycle and low maintenance costs for the customer. The repairing and refurbishment services the company offers generates recurring income. The main source of revenue for the company C is sales of used clothes. The company also exports collected garments to other countries to extend the lifecycle of them, plus to make a sale and raise money for their foundation. The clothing sales makeup 99% of the company's annual sales.

5 Conclusions

5.1 Theoretical Contributions

This thesis contributes to the overall academic literature on circular economy and how the business eco-systems react to the circular economy initiatives adopt by cities. The transition from linear consumption model to circular model is challenging for both businesses and governments and the cities have a key role to play in the process. The thesis findings could contribute to the existing, but very limited literature, on the performance of businesses against the circular economy initiatives adopt by cities. The fact that all three companies investigated highly compliant with the city of Turku's circular city roadmap suggests the businesses are open to welcome circularity and sustainability if there is clear communication between the city administration and the businesses.

The thesis in general helps the academics to understand the behaviour of businesses to the circular economy initiatives of cities as well as the city of Turku in particular, as the academic investigations conducted on the alignment of the businesses to the circular city roadmap of the city is extremely scares. The author believes the findings of this thesis has a starting point to fill the knowledge gap on the effectiveness of the circular city initiatives and how businesses react to such changes.

5.2 Managerial implications

The findings of this study provide important managerial implications for city administrators. It provides them with evidence that the businesses are open to embrace the circularity initiatives if the city administrators can come up with a clear plan and the communication can be carried out effectively. The city of Turku is the main stakeholder that acts as the main enabler for the local circular economy transition in the city of Turku. Therefore, the city of Turku is the primary beneficial stakeholder of the findings of this study. The conclusions of the study will help them evaluate how well the circular economy roadmap complies with the businesses operating in the city. Further, the study informs stakeholders such as municipalities, policymakers, urban development planners and sustainability coordinators of the city about the level of alignment of the circular economy roadmap by the businesses operating within the city of Turku.

The study also provides useful insights to managers, entrepreneurs and businesses in Turku. The study enables them to analyse how the other businesses adopt circular economy principles and what benefits they get and gives back to the environment. Further, the study highlights

the importance of aligning business strategies with public sector goals, which opens opportunities for collaboration and long-term resilience. Furthermore, the study provides managerial implications for the local community and the public. The study shows how businesses are contributing to the city's circular economy goals. Also, the author has tried to promote transparency within these goals and actions of the businesses. This could inspire the public to support businesses that promote circularity and localise sustainability.

Overall, the research supports a more integrated and collaborative approach to circular economy development with the city of Turku. The study encourages public-private partnerships, continuous learning and feedback. Further, the study positions the city of Turku not as a policy maker but as a facilitator for the transition from linear economy to circular economy.

5.3 Limitations and suggestions for future study

Despite the theoretical contributions and managerial implications, it is essential to address the limitations of a study. Firstly, the geographical scope is confined to a single city which restricts the transferability, dependability and confirmability of the findings. While the case study approach allows for a deep exploration, the specific nature of the study does not reflect the diversity of circular economy practices in other regions. Additionally, the circular economy is a broad concept which is developed by many frameworks, theories and models. Due to the restrictions of time, author was only able to bring light to a few theories in this study. However, even though the subject of circular economy has many existing literatures, the author found it difficult to find literature that was conducted for cities, especially for cities in Finland and the city of Turku.

The qualitative nature of the research also brings forward few limitations. The author had only conducted interviews with three case companies. This narrowed the ability to collect data that could affect the quality of the analysis. The main concept that was discussed in this study is about the circular economy roadmap of the city of Turku and how it complies with businesses in the region of Turku. The roadmap has been created with the input of hundreds of stakeholders and many theories to support the decisions. However, it only focuses on 5 main sectors in the city's vision to achieve circularity. The author identified few other avenues that the case companies discussed in terms of committing for sustainable practises to achieve circularity in the business. These factors were not presented and analysed as they did not fall under the framework the study was carried out.

6 Summary

With the rising environmental challenges, resource scarcity and climate changes, the concept of circular economy has emerged as a critical model for sustainable development. In contrast to the linear economic model of take-make-dispose, the circular economy focuses on concepts of rethink-regenerate-reduce-reuse-recover. Countries, governments and cities around the world are adopting circular economy frameworks to reduce environmental impacts within them. As urban areas play a significant role in waste generation and resource consumption, cities are compelled to incorporate circular economy frameworks for urban planning.

The city of Turku, Finland has positioned itself as a forerunner of urban sustainable development, aiming to localise the concept of circularity by the year 2040. The first step of achieving this, is targeted to be completed by 2029, when the city plans to become carbon-neutral.

This thesis investigated how businesses in Turku comply with the circular economy roadmap of the city of Turku and how these initiatives comply with the business models of businesses operating within the city of Turku.

To overcome the research gap and investigate the research questions, the author used extensive literature review and primary data to answer the main research question: "*How do businesses in Turku align their practices with and contribute to the city's circular economy initiatives aimed at supporting the circular transition?*" To analyse this question logically, the study uses two sub-questions. They are SQ1: *What are the circular economy initiatives taken by the city of Turku*? and SQ2: *How these initiatives shape business practices toward circularity in Turku?*

The data related to the first sub-question as to *What are the circular economy initiatives taken by the city of Turku*? was gathered by the existing public sources of information by the city of Turku. This reveals a critical understanding on what are the current initiatives the city has placed, what their roadmap is and how they have generated the circular economy roadmap of the city of Turku. This section of the study was conducted in sub-section 2.7. this provided clarity and structure for the reader.

The study was conducted with qualitative approach focusing on 3 case companies. These case companies represented 3 different industries operating with different business operations, scopes and ownership models. Data was gathered using a semi-structured interview approach. The data gathered during the interviews were used to answer the SQ 2. The interviews provided indepth insights into how each company engages circular economy practices within their business

operations. The responses were then used to analyse common patterns, similarities and differences along with publicly available information about the case companies with the city of Turku's circular economy roadmap.

In the findings, it was evident that the connection the city of Turku has in this business eco-system seems quite substantial and healthy. Collaboration is a key indicator that was found, which brings light to the concept of circular economy. The selected case companies showed interest to partner up with the city of Turku in order to localise these initiatives. They believed in the importance of public-private collaboration when trying to initiate a very and fast-growing trend. Further, a common theme among the companies also were the recognition and encouragement to enhance circularity practises in their businesses and contribute to the overall sustainability of the city.

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Appendix 1 : Interview Guide

Interview Guide

Background Information

1. About your business? (e.g., type, size, industry, years in Turku)
2. How does your business currently address sustainability or environmental issues?

Circular Economy

3. Are you familiar with the city of Turku's circular economy goals
4. Have you heard of any specific circular economy initiatives in Turku? (Especially the roadmap).

Participation in Circular Economy Initiatives

7. Has your business been involved in any city-led programs or partnerships related to circular economy practices?
8. Have you made any

Impact on Your Business

Energy systems

9. What types of renewable sources is used at the moment?
10. How is energy efficiency monitored?
11. What are the initiatives used of energy recovery?

Food value chains

12. Do you ensure food waste reduction?
13. Are regional food suppliers prioritized?
14. What packaging innovations are used to reduce environmental impact?

Water cycles

15. Whats measures are used to minimize water reduction?
16. How is wastewater treated?
17. Is rainwater or greywater reused?

Building and Construction

18. How is reused or recycled materials used in your building?
19. What energy efficiency methods are used in the construction of the office/ factory?
20. What energy efficiency standards does the building meet?

Transport and logistics

21. What steps are being taken to reduce emissions on logistics?
22. Have you'll signed up with partners to optimize transport routes?
23. How is sustainability performance monitored in terms of logistics?

Support and Collaboration

15. Have you received any support from the city of Turku, such as funding, training, or information?

16. Do you collaborate with other businesses, the local government, or organizations on circular economy projects?

Future Perspectives

17. Do you think circular economy practices will be more important for your business in the future? Why or why not?

18. What additional support or changes would help your business adopt circular economy practices more effectively?

Appendix 2: Data management plan

Research data

Research data type	Contains personal details/information*	I will gather/produce the data myself	Someone else has gathered/produced the data	Other notes
Data type 1: Interviews	x	x		
Data type 2: Transcripts	x	x		
Data type 3: Notes	x	x		
Data type 4: Published reports of case companies			x	
Data type 5: Websites of case companies			x	

* Personal details/information are all information based on which a person can be identified directly or indirectly, for example by connecting a specific piece of data to another, which makes identification possible. For more information about what data is considered personal go to the Office of the Finnish Data Protection Ombudsman's website

Processing personal data in research

I will prepare an email and give it to the research participants before collecting data [X]

The controller** for the personal details is the student themself [X] the university ☐

My data does not contain any personal data ☐

** More information at the university's intranet page, Data Protection Guideline for Thesis Research

Permissions and rights related to the use of data

Data type 1: Interviews

- The collected data will be used for research purposes only and this will be recorded on my personal computer

Data type 2: Transcripts

- The collected data will be used for research purposes only and the recorded interviews will be used to get the transcripts

Data type 3: Notes

- The collected data will be used for research purposes only and the recorded interviews will be used to get the notes

Data type 4: Published reports of case companies

- The collected data will be used for research purposes only and published reports will be used for the data analysis

Data type 5: Websites of case companies

- The collected data will be used for research purposes only and website details will be used for the data analysis

Storing the data during the research process

In the university's network drive ☐
In the university-provided Seafile Cloud Service ☐
Other location: please specify [X]
Researcher's personal computer

Documenting the data and metadata

To document the data, I will use:

A field/research journal ☐
A separate document where I will record the main points of the data, such as changes made, phases of analysis, and significance of variables [X]
A readme file linked to the data that describes the main points of the data ☐
Other, please specify: ☐

Data arrangement and integrity

I will keep the original data files separate from the data I am using in the research process, so that I can always revert back to the original, if need be. [X]

Version control: I will plan before starting the research how I will name the different data versions and I will adhere to the plan consistently. ☐

I recognise the life span of the data from the beginning of the research and am already prepared for situations, where the data can alter unnoticed, for example while recording, transcribing, downloading, or in data conversions from one file format to another, etc. ☐

Metadata

Metadata is a description of you research data. Based on metadata someone unfamiliar with your data will understand what it consists of. Metadata should include, among others, the file name, location, file size, and information about the producer of the data. Will you require metadata?

I will save my data into an archive or a repository that will take care of the metadata for me. ☐

I will have to create the metadata myself, because the archive/repository where I am uploading the data requires it. ☐

I will not store my data into a public archive/repository, and therefore I will not need to create any metadata. [X]

Data after completing the research

The researcher will store the data till the research is completed, approved and assessed. Data will be stored on the researcher's computer until destroyed.

Appendix 3: Consent form

Informed Consent form for participation in scientific research

Research project title: Business alignment with circular city initiatives: A cross-case analysis of businesses in the city of Turku

Place of research: Turku, Finland
The person responsible for the research: Ranaweera Arachchige Sheraya Melki Perera

I have been invited to participate in the above-mentioned research. I have read and understood the information given and I agree to participate in the project. I understand that participating in the research is voluntary and that I can at any point withdraw from participating in the research without giving any reason or cancel my consent without any negative consequences. I have received sufficient information about the research and how my personal data is processed. I have had the opportunity to ask questions from the researchers. With my signature, I give consent for participating in the research.
Yes ☐ No ☐

I consent that my interview can be audio-recorded

Yes ☐ No ☐

I consent that my interview can be video-recorded

Yes ☐ No ☐

I agree to be identified in the following way in the research outputs
[Pseudonym; alternative name/code chosen for the participant by the researcher]
Yes ☐ No ☐

Impersonal attribution
[e.g. by profession: company official, firm official]
Yes ☐ No ☐

Contact information

_____	_____	_____
Name of participant	Date	Signature

Ranaweera Arachchige
Sheraya Melki Perera

_____	_____	_____
Name of the interviewer	Date	Signature

Appendix 4: Use of AI

AI Tool	Purpose	Prompt	Output
Grammarly (Application)	Checking Grammer	N/A	Grammer suggestions throughout the document
ChatGPT (Generative AI)	Brainstorming ideas	What is the difference between compliance and alignment?	Compliance is following mandatory rules or regulations, while alignment is voluntarily coordinating actions or strategies with shared goals or values.
Quill BOT (Tool)	Translations	N/A	Environmental reports translated to English

Appendix 5: Privacy Notice

Name of the register	Business alignment with circular city initiatives: A cross-case analysis of businesses in the city of Turku
Data controller	Ranaweera Arachchige Sheraya Melki Perera +358417232376 sheraya.r.perera@utu.fi Turku School of Economics, University of Turku, Rehtorinpellonkatu 3, 20500 Turku
Contact information of the responsible person	Ranaweera Arachchige Sheraya Melki Perera +358417232376 sheraya.r.perera@utu.fi
Purpose and legal basis for the processing of personal data	The research collects data from selected company representations to understand the alignments of business practices towards circular economy initiatives. The legal basis for processing personal data in Article 6 of the EU General Data Protection Regulation is: ☒ Processing is necessary for scientific research (public interest, Point 1a of Article 6) Data subject has given their consent to process personal data (consent, Point 1e of Article 6) Other, what____
Processes personal data	The following information of the data subjects is stored in the register: Name, contact number, position, experiences, and views on the research topic.
Recipients and recipient groups of personal data	The data will not be transferred or disclosed to parties outside the researcher or his supervisors.
Information on transferring data to third countries	Personal data will not be disclosed to parties outside the EU or the European Economic Area.
Retention period of personal data or criteria for its determination	The recorded interviews will be transcribed into text files and the recordings will be automatically removed from the University MS Teams account after three months. Simultaneously, the research data will be anonymized by using some pseudonyms. The text files of the interviews will be kept stored till the research process ends.
Rights of the data subject	The data subject has the right to access their personal data retained by the Data Controller, the right to rectify or erasure data, and the right to restrict or object to the processing of data. The right to erasure is not applied for scientific or historical research purposes in so far as the right to erasure is likely to render impossible or seriously impair the achievement of the objectives of that processing. The realization of the right to erasure is assessed on a case-by-case basis. The data subject has the right to complain with supervisory authority.
Information on the source of personal data	In order to send the invitations to interviewees, email addresses were used. It will only be done after a primary contact and consent to participate have been given by the subject. The other data is collected directly from those who participate in the interviews for the study.
Information on the existence of automatic decision-making, including profiling	The data will not be used for automatic decision-making or profiling.