TALLINN UNIVERSITY OF TECHNOLOGY
SCHOOL OF ENGINEERING
Department of Civil Engineering and Architecture

# ENHANCING CIRCULAR ECONOMY IN LOCAL MUNICIPALITIES OF ESTONIA - THEIR ROLE, MAIN BARRIERS AND BEST PRACTISES

## RINGMAJANDUSE EDENDAMINE EESTIS KOHALIKU OMAVALITSUSE TASANDIL - OMAVALITSUSTE ROLL, PEAMISED TAKISTUSED JA PARIMAD PRAKTIKAD

MASTER THESIS

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Tallinn 2023

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**Department of Civil Engineering and Architecture**

# THESIS TASK

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**Thesis topic**:

(in English) ENHANCING CIRCULAR ECONOMY IN LOCAL MUNICIPALITIES OF ESTONIA – THEIR ROLE, MAIN BARRIERS AND BEST PRACTICES

(in Estonian) RINGMAJANDUSE EDENDAMINE EESTIS KOHALIKU OMAVALITSUSE TASANDIL – OMAVALITSUSTE ROLL, PEAMISED TAKISTUSED JA PARIMAD PRAKTIKAD

**Thesis main objectives**:

1. Summarise existing situation and practices
2. Find inputs from front-runners in Europe
3. Provide recommendations for future activities in Estonia

**Thesis tasks and time schedule:**

| No | Task description | Deadline |
|---|---|---|
| 1. | Preparation of questions for the expert interviews | 05.04.2023 |
| 2. | Conducting interviews with circular economy experts | 20.04.2023 |
| 3. | Literature overview | 01.05.2023 |
| 4. | Finalising the thesis | 22.05.2023 |

**Language:** English **Deadline for submission of thesis:** "29" May 2023a

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## CONTENTS

# PREFACE

The author of the thesis “Enhancing circular economy in local municipalities of Estonia - their role, main barriers and best practices” has previously worked in the Ministry of Environment of Estonia in the field of resource efficiency and circular economy.
The author was project lead for developing the national circular economy webpage and for the first national circular economy conference in Estonia as well. Hence the subject of enhancing the circular economy in Estonia is of main interest of the author. The author is also contributing to Tallinn Technical University's project of creating circular economy roadmaps to all 79 local municipalities of Estonia. While getting acquainted with the mentioned project, the idea for the topic of the current thesis arose. The author would like to thank the supervisor Kristjan Piirimäe for the suggestions for developing the topic of the thesis and for the consultations on how to conduct it.

The thesis is focused on the role and activities of local municipalities in facilitating circular economy, main barriers for the transition and learnings from the best practices from the front-runner countries of Europe.

Keywords: circular economy, local municipalities, best practises, master thesis

# 1. INTRODUCTION

It is a fact that the natural materials on Earth are limited and there is a real threat of depletion of resources due to the constantly increasing number of people and demands. It is estimated that by the year 2050 the number of people will reach 9.8 billion (United Nations, 2017).

Earth Overshoot Day marks the date when humanity has used all the biological resources that Earth regenerates during the entire year. In 2022 that date was July 28 which means humanity is using resources almost twice as much as the capacity to renew them (Lin et al., 2022). Production and use of commodities is responsible for nearly half of the emissions that cause climate change. When emissions from freight transport and energy use in non-residential buildings are added the number rises to 70% of global emissions. As the population and consumerism increases, so does the demand for materials (van Veldhoven & Schmidt, 2021).

By 2050 it is estimated that resources including materials such as biomass, fossil fuels, metals and minerals will be used in the quantity of three planets (European Commission, 2020; United Nations, 2022).

To control this severe situation global organisations have agreed on different sustainability goals and made policy agreements accordingly. In 2015, in the United Nations 193 countries agreed upon The Sustainable Development Goals to end extreme poverty, reduce inequality, and protect the planet by 2030. Ensuring sustainable production and consumption as well as climate actions are one of the 17 goals (United Nations Foundation, n.d.).

Circular Economy and the Green Deal are one of focus points in the European Union as well as the ambitious goals of achieving climate neutrality and circular economy by 2050 (Bäckstrand, 2022).

The transition to circularity is a much needed process, but a process that is difficult to accelerate in Estonia as well. There are a number of ongoing supporting activities and facilitators in the field, but many obstacles to overcome.

The aim of the current thesis is to analyse the obstacles and facilitators for circular transition and to bring out the best practices and solutions for Estonia. Solutions for overcoming the barriers are based on analysing the facilitators and best practises.

Cities consume about 60% of global energy, produce up to 80% of greenhouse gas emissions and 50% of global waste and therefore play a key role in promoting, facilitating and enabling the circular economy (OECD, 2020). In this thesis the biggest cities of Estonia, Tallinn and Tartu, have been chosen as the focus points to analyse.

The study is based on analysis of documents, including articles, European and national strategies and professional literature. In addition in-depth interviews were carried out with circular economy experts from Europe and Estonia whose field of profession is to facilitate circular economy.

The theoretical part of the thesis explains the importance and role of circular economy in the face of solving the problem of resource scarcity and environmental depletion, gives an overview of the European Union goals and framework for circular economy which also affect Estonia's development direction and explains how the transition is lead and in addition highlights the importance and role of the cities and local governments in enhancing circular economy. Theoretical part also contains an overview of the current situation of the circular economy in Estonia and in the selected front-runner European countries with best practices to learn from.

In the methodology part of the thesis in-depth interviews are described by presenting and explaining the questions asked and the experts interviewed. The questions and names of experts can be found in the appendices.

The results of the interviews are interpreted in a manner of presenting a holistic view of how the experts from Europe and local municipalities of Estonia apprehend the main barriers, how to overcome them and implement the change to circularity most effectively.

In the conclusion all gathered information is taken under evaluation to highlight the importance and role of local municipalities, the main barriers to circular transition and offering solutions to overcome them.

# 2. THE IMPORTANCE OF CIRCULAR ECONOMY

There is only one planet Earth with a limited number of resources and with constantly rising pressure on clean air, water and soil. By 2050 there will be 9.8 billion people on Earth making use of resources in the amount of three planets. Use of resources has tripled since 1970 and could double again by 2050. In a world of growing numbers of people with increasing higher life expectancy and demands for better life quality, it is inevitable that the way Earth is currently exploited needs to stop (United Nations, 2017; McGinty, 2021).

Currently, mainly the traditional linear economic model is in practice, where the resources are taken from the Earth, products are made and used and when broken or no longer necessary, products become waste (Figure 1). The linear 'take, make, dispose' economic model does not consider the life-cycle of a product, its environmental footprint, consequences nor opportunities it could have. As only focused on economic growth, the linear model contributes to the growth of consumption of products and puts high pressure on more use of resources (Ellen MacArthur Foundation, 2013).

It was said already in 1987 that even though Earth resources are running out, there are still possibilities to stop the exhaustion. For that development of energetics, modernization of industrial technologies and keeping control on urbanisation are needed. In addition, global economics, international agreements, organisational and legal changes, peace and security are crucial (Brundtland, 1987).

There are at least 114 definitions for circular economy (Kirchher et al., 2017). The concept might be already inspired from the 'limits to growth' thesis of the Club of Rome from the 1970s (Winans et al., 2017). While there are many definitions of the circular economy, three main principles which are driven by design characterise it according to Ellen MacArthur Foundation:
i) design out waste and pollution;
ii) circulate products and materials (at their highest value);
iii) regenerate natural systems to decrease resource dependence and to increase system resilience (Ellen MacArthur Foundation, 2015).

The circular economy model (Figure 1) is based on analysing and considering the whole life-cycle of a product. By repairing, reusing, recycling of residues and materials, refurbishing, leasing and sharing the life-cycle of products are extended and waste generation is reduced to minimum (De Schoenmakere & Gillabel, 2017).

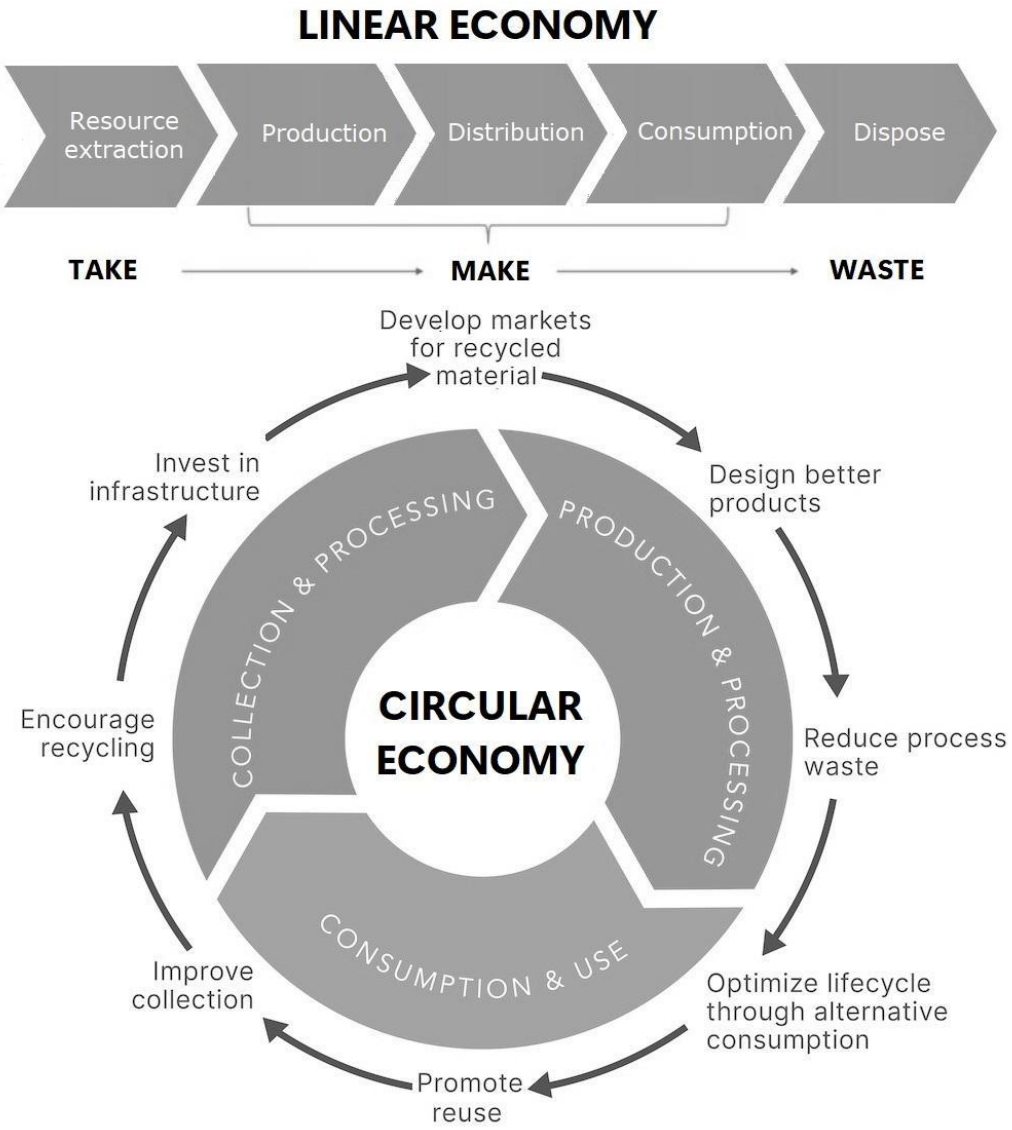


Figure 1. Comparison of linear economy model to circular economy model
Source: Linear economy model by Wautelet, 2018; Circular economy model by Circular Innovation Council, n.d., adapted by author.

Circular economy is often related to recycling, but it is beyond only finding better ways for end of life products and resources. Circular economy changes the whole life-cycle of products. With better design less raw materials can be used during production, their value maximised during use and products and services can be improved to eliminate waste. Circular economy principles improve the value of natural resources, reduce carbon emissions and eliminate waste. Innovation in product design and business models is needed to keep the material extraction lower and resources in circulation as long as possible. There are five business models that underpin the circular economy based on the principles of longevity, reuse, repairability, upgrade, share, and material reduction and recovery (Circular Innovation Council, n.d.).

## Leading the transition

More than 100 billion tons of resources enter the economy every year – including metals, minerals, fossil fuels and organic materials like plants and animals. The global economy is only 7.2% circular which means only 7.2% of the resources are recycled and it deteriorates over the years (it was 9.1% in 2018 and 8,6% in 2022). 90% of materials are either wasted, lost or remain unavailable for reuse for years as they are locked into long-lasting stock such as buildings and machinery. Material extraction and use is rising every year. Circular economy could reverse this by reducing global material extraction and use by one-third with four key circular actions: use less, use longer, use again and make clean. There is massive potential to transform the four key global systems with a circular economy — agrifood, mobility and transport, manufactured goods and consumables and the built environment (McGinty, 2021; Circle Economy, 2023).

The transition to a circular economy needs a change in the way we currently use raw materials. There should be a positive interaction between economic growth and the growth of natural resources in non-recyclable materials being used again (by cascading, repair/maintenance, reuse, remanufacturing and recycling) (Dutch Government, 2016).

The price of resources and goods do not always reflect the costs on the environment caused by extraction, production and transport. Products would be more expensive if the environmental damage and greenhouse gas emissions were priced in. The prices for raw materials should reflect the cost and damage on nature and climate (Norwegian Government, 2021).

Faced with a global scarcity of natural resources, the United Nations has developed The Sustainable Development Goals by 2030. Sustainable growth is one of the main objectives of the European Union as well. The European Union has introduced a whole range of policies and initiatives aimed at sustainable consumption and production. Facilitating resource efficiency, eco-labelling and eco-design and Green Public Procurement are one of the means for sustainable production and consumption (United Nations Foundation, n.d.; European Parliament, 2023).

Additionally, on European level a heightened attention is paid to critical raw materials that are needed for example for batteries and electrical vehicles and that are currently mainly imported from China, Turkey and South Africa. It is indicated that the European Union may need up to 18 times more lithium and five times more cobalt in 2030 for electric vehicle batteries and energy storage. Therefore strategies for recycling and secondary markets are created on the European Union level (Chataine, 2021).

In March 2020, The European Commission adopted the new Circular Economy Action Plan which is also an essential part of the European Green Deal. It aims at accelerating the transformational change required by the European Green Deal, while building on circular economy actions implemented since 2015. The Circular Economy Action Plan sets targets on how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is avoided and that used resources remain in the economy of the European Union for as long as possible. It consists of 35 actions that will be implemented by the Commission, such as enforcing new Ecodesign Directive, registering the European Union Environmental Technology Verification scheme, presenting 'Circular Electronics Initiative', providing guidance to achieve high levels of separate collection of textile waste, which Member States have to enforce by 2025 and many more (European Commission, 2020).

To evaluate the achievement of the goals of the Circular Economy Action Plan, the European Commission has worked out indicators to monitor the progress. The framework consists of ten indicators which can be divided into four thematic areas: production and consumption, waste management, secondary raw materials, competitiveness and innovation. Understanding the progress made toward a circular economy requires regular monitoring of the production and consumption phases. The amount of waste that households and economic sectors produce should be reduced. Long-term, this behaviour might help the European Union become more self-sufficient in some production-related raw commodities. Production and consumption area comprises indicators for waste generation, food waste, Green Public Procurement and self-sufficiency of raw materials for production. The European Union indicator framework will be further developed to see links between circular economy, climate neutrality and the ambition of zero pollution including new indicators, in particular: material footprint, resource productivity, consumption footprint, greenhouse gas emissions from production activities and material dependency (Eurostat, n.d.; Norwegian Government, 2021).

The transition to circularity requires shared responsibilities from all actors of the society, central government, municipalities and cities, research institutes, enterprises and citizens. Reconciling the social, economic and environmental agendas but also facilitating this shared responsibility among diverse actors will be crucial to further circularity transition. Stronger coordination among European, national and local levels can also amplify the respective policy efforts (OECD, 2022).

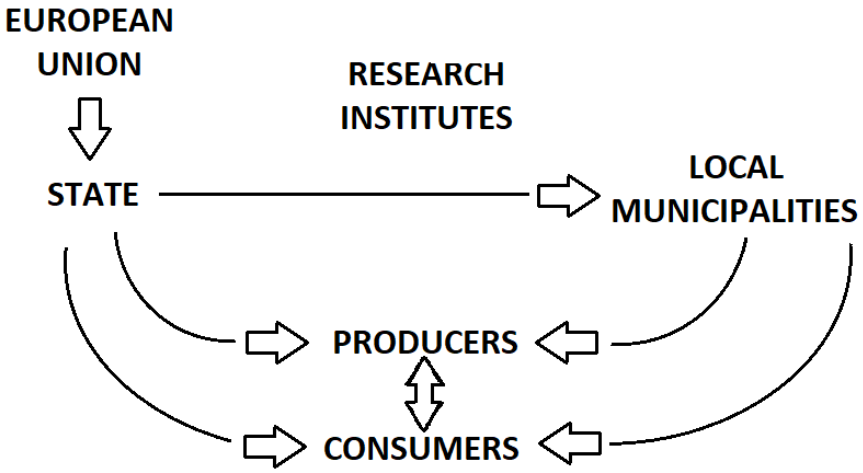


Figure 2. Circular economy interaction between different actors in society

Figure 2 describes multi-dimensional interaction and links between different parties of the society. State is influenced by the directions from the European Union and gives their directions to the local municipalities. Producers and consumers are influenced by all parties. Research institutes are required to assist all parties with relevant know-how.

To make the circularity transition a reality, a multidimensional approach is needed. That means that process is influenced by a diverse range of policy chains like innovation, fiscal, sectoral, environmental and educational policies. Horizontal coordination is needed on a national level to overcome the separated sectoral policies (Lazarevic et al., 2022).

The highest role in changing the paradigms and making the shift is on the government to develop a national cross-sectoral strategy (Metsaru, 2020).

The roles for the municipalities are favouring the use of sustainable products and services, promoting the sharing Economy, raising awareness, and implementing environmental management measures (Ministry of Environment of Estonia, 2022).

## Circular economy in cities and local governments

Cities are the centre of human activity. Today, over 55% of the global population lives in cities, generating 80% of global GDP (Gross Domestic Product). Currently, cities consume 75% of the world's natural resources, account for 50% of global waste production and emit about 70% of global greenhouse gas emissions in the linear system.

As it is estimated that two thirds of the population will be living in cities by 2050, it is crucial that cities tackle the issues of the current take, make, waste economy (Ellen MacArthur Foundation, 2017; Russell et al., 2019).

Cities could be uniquely positioned to drive a global transition towards a circular economy and could greatly benefit from the outcomes of such a transition. Cities and other municipalities share responsibility for promoting, facilitating, and enabling the circular economy with national governments and other stakeholders (Ellen MacArthur Foundation, 2017; OECD 2020).

There are many enablers to the transition in the urban areas. Firstly, as there is a high concentration of resources, capital and data in closeby areas, it enables smoother reverse logistics and material collection cycles and also enables sharing and reuse models. Secondly, as local governments have a large and direct influence on urban planning, the design of mobility systems, urban infrastructure, local business development, municipal taxation and the local job market. Therefore, local governments can play an active role in embedding the principles of the circular economy across all urban functions and policies. Thirdly, digital technology has the potential to identify the challenges of material flows in cities, outline the key areas of structural waste, and inform more effective decision making on how to address these challenges and provide systemic solutions. Finally, as new circular economy business models are more likely to emerge and succeed in the presence of both a large and varied supply of materials, and a high potential market demand for the goods and services derived from them, the cities give sufficient scale for effective markets (Ellen MacArthur Foundation, 2017).

Circular economy supports the objectives of the urban policies in a number of different ways. Firstly, by relieving pressure on municipal services and budgets by reduction of primary material consumption. Secondly, by increasing disposable incomes through the reduced cost of products and services and a conversion of unproductive to productive time. Thirdly, by encouraging an innovation-rich urban economy with finding new ways for keeping components and materials at their highest value. In addition, carbon emissions are reduced and a potential for positive impact on employment opportunities in the city is given (Ellen MacArthur Foundation, 2017).

The Ellen MacArthur Foundation has set out five universal circular economy policy goals that provide a framework for national governments, cities and businesses to accelerate the transition. Cooperation across the private and public sectors is essential for effective results. The key elements for the policies are collaboration, innovation, circular design, valuing resources and enabling circular economy solutions by regulations (Ellen MacArthur Foundation, 2021). Collaboration can be best established at a regional and urban scale, as local governments can play a very important role in launching new market interactions (OECD, 2020).

City governments have a key role to play in leading the circularity change by embedding circular economy principles into urban policy levers. The five main levers are vision (roadmaps, strategies), engagement (stakeholders across sectors), urban management (urban planning, asset management, public procurement), economic incentives (financial support and fiscal measures) and regulation (legislation). These policy levers are strongly interlinked. For example, in order to facilitate transition towards circular asset management practices, raising awareness amongst asset managers will be important, as well as ensuring that public procurement and financial measures are supportive (Ellen MacArthur Foundation, 2019).

It is suggested to monitor and evaluate the circularity transition actions in cities and regions. There is already one appropriate tool developed by OECD, a Checklist for action and a Scoreboard to evaluate each dimension of promoting, facilitating and enabling a circular economy. The 12 key dimensions from the promoting role are roles and responsibilities, strategic vision, awareness and transparency. From the facilitating role the dimensions are coordination, policy coherence, stakeholder engagement and appropriate scale. From the enabling role the dimensions are regulation, financing, capacity building, innovation and data and assessment.

In each of the 12 categories municipalities can evaluate if in the particulate dimension they are:
i) newcomers, when the governance condition is planned or in development, should be marked in red shades;
ii) in progress, when the governance condition is in place and not implemented, or in place and partly implemented, should be marked in yellow shades;
iii) advanced, when the governance condition is in place, functioning and objectives are achieved, should be marked in green shades (OECD, 2020).

Colour scheme on the scoreboard gives a quick and readily perceived overview of the current and past situation and results can be easily compared to evaluate progress.

The cities of Tallinn and Tartu have started to take the lead in circular transition among the cities and regions of Estonia. The circular economy roadmap of Tartumaa will be completed by 2024, and by 2030, Tartu County is expected to become a circular economy leader in Southern Estonia and a good partner for other circular economy regions in Estonia and abroad (Tartu Linnavalitsus, 2022). In cooperation with OECD the city of Tallinn is preparing a roadmap by the fall of 2022 for transitioning to a more resource-saving circular economy (Tallinna Linnavalitsus, 2021).

In addition circular economy roadmaps for each municipality of Estonia are currently being developed by Tallinn Technical University. The roadmap can be used to evaluate the current situation in each municipality as well as set goals and actions for the future.

# 3. CIRCULAR ECONOMY IN ESTONIA

## Main barriers for circular economy

There are many different barriers at various levels for making the transition to circularity.

Barriers have been analysed in 2020 among policy makers, interested non-governmental organisations and private sector companies. It was found that policy measures should be well thought out and more binding for companies to apply circularity measures. On the other hand, fair and reasonable regulations could encourage adopting more sustainable business models, but funding and well targeted support measures are needed and lacking. It takes not only great courage from the entrepreneurs to change their current business model, but also technical and technological know-how in addition to capital.

The concept of circular economy and using secondary resources is not familiar for all stakeholders and current waste regulations restrain the use of secondary resources. The mindset should be changed for waste products to be seen as valuable secondary resources, so low-cost fossil based raw materials would not be preferred.

Entrepreneurs do not fully understand the holistic and systemic approach and benefits of circular business models. The lack of knowledge and skills is inhibiting innovation and there are not many suitable technological partners in Estonia, not even from universities. This also results in a very high price for changing the current business model which is not feasible for smaller companies.

Circular economy requires cross sectoral and inter-company cooperation. Manufacturing industry uses worldwide partners, which means that even though many are adopting sustainable measures, the material flow is not always transparent and the ecological footprint is higher (Metsaru, 2020).

The lack of knowledge, experts and innovative sustainable solutions is one of the greatest challenges for the circular economy in Estonia as well as well-working cooperation between stakeholders. The overall awareness about the importance of the circular economy and cooperation possibilities between customers, companies, local municipalities, research institutes and others should also be raised. There is a lack of elaborated financial instruments together with field specific knowledge (Ministry of Environment of Estonia, 2022; Taltech, 2021).

In comparison to the studies that have been carried out in Estonia, the barriers have been analysed worldwide as well. OECD has launched a synthesis report 'The Circular Economy in Cities and Regions' in 2020, based on a study with 51 cities and regions. The main obstacles to the circular economy according to the report are gaps in funding, regulatory, policy, awareness and capacity (Figure 3). A lack of holistic vision could lead to fragmented initiatives and inadequate regulatory framework hinder abilities to respond to emerging needs related to the circular economy. Awareness rising about the concept, cost and benefits is crucial. Currently the circular economy is often seen as a synonym for recycling (OECD, 2020).

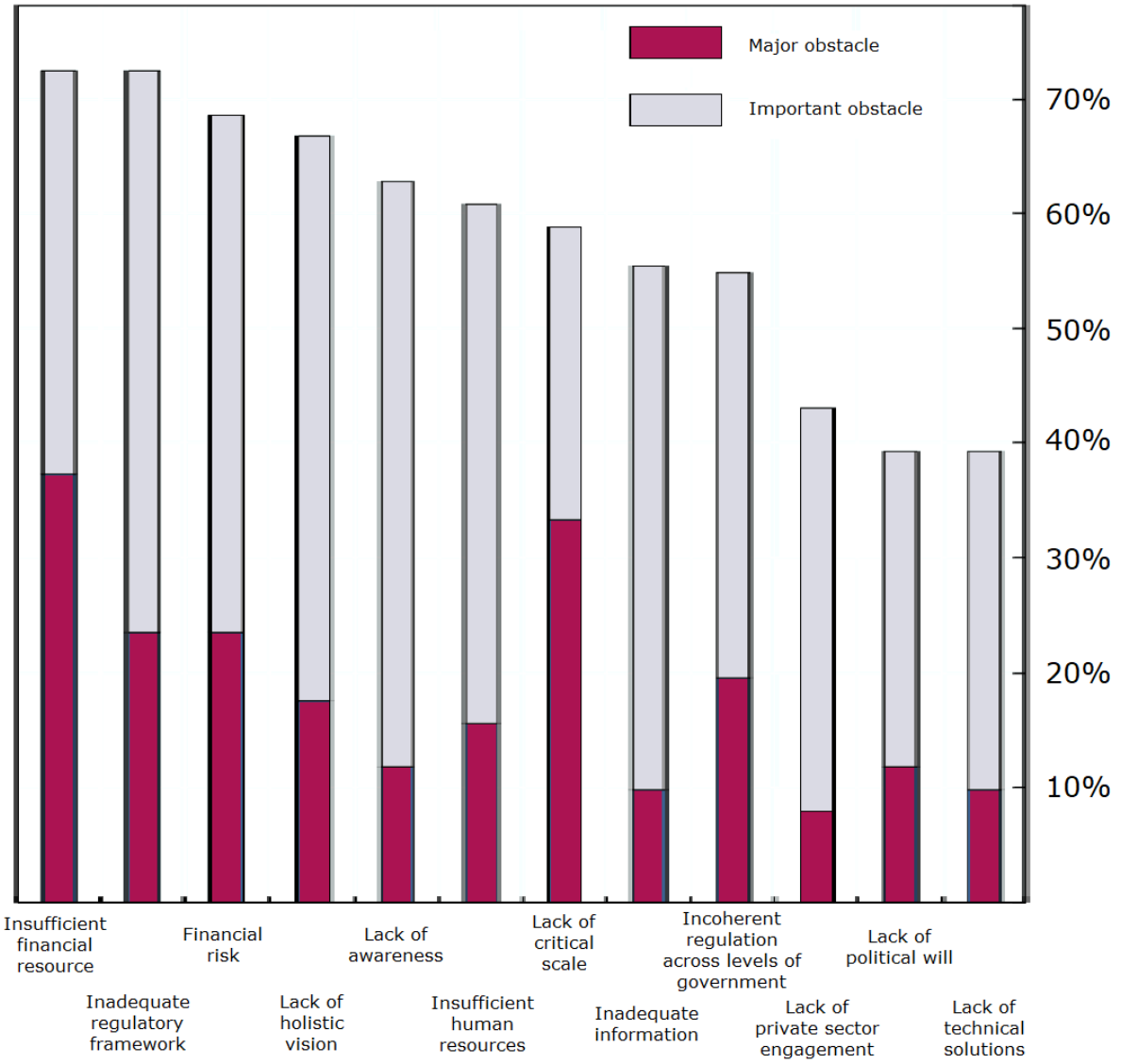


Figure 3. Main barriers to the circular economy in cities and regions
Source: OECD, 2020. The Circular Economy in Cities and Regions: Synthesis Report. Adapted by author.

The circular transition has many barriers that are considered major or important. It is important to make circular business models economically beneficial, but currently there is no efficient secondary market neither for most of the collected household nor production waste. Companies have no pressure to use secondary products if they are more expensive than virgin materials. That means it is hard to find economical benefits for companies which are needed for their interest and engagement. Circular economy initiatives are often mainly focused to improve downstream processes, but the focus should be more on facilitating well designed products which can reduce the waste generation in the first place (OECD, 2020).

Lack of technical solutions and knowledge is on the lower side of the scale of OECD graph, In Estonia the problem has been highlighted more strongly. On the other hand, well targeted funding is crucial according to all studies.

## Current situation

There is no national strategy or roadmap for the circular economy in Estonia at the moment, but many steps have been taken to facilitate the process on a national level and to overcome the barriers. After the European Commission adopted the first circular economy action plan in 2015, the circular economy has been in focus in Estonia in the form of creating financial support mechanisms, raising awareness and other various actions resulting with the White Paper and Action Plan for circular economy (Figure 4).

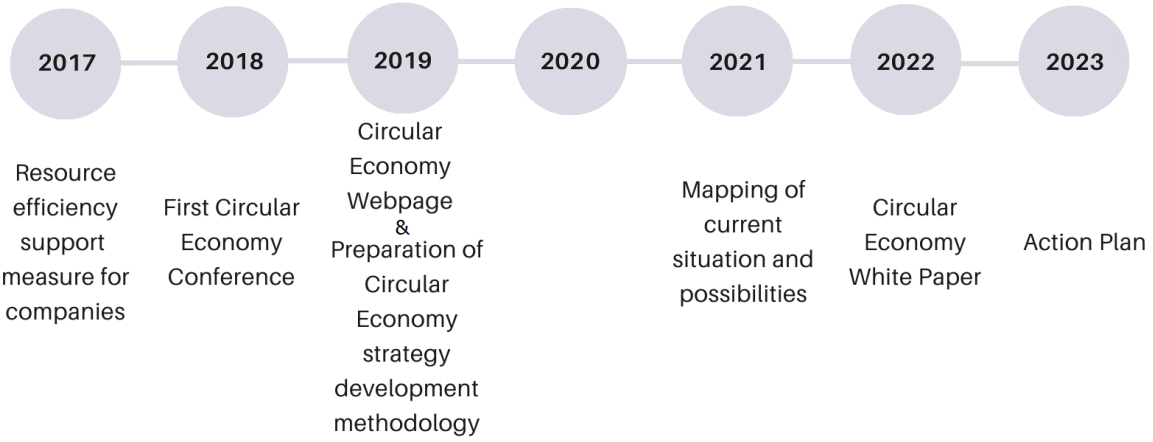


Figure 4. Timeline for national circular economy activities in Estonia
Source: Ministry of Environment of Estonia, n.d. Made by author.

First major activity was in 2017 with the launch of resource efficiency support measures for private sector companies. Mining and processing industry companies could apply for financial support for resource audits and for innovative investments that would increase resource efficiency. The amount of support per company was up to two million euros. By spring 2023, 178 projects were financed with a total support amount of 65 million euros (Environmental Investment Centre, n.d.). The resource efficiency measure was supported by the project of training energy- and resource efficiency specialists.

In 2018 The Ministry of Environment of Estonia organised the first national circular economy conference that gathered more than 400 participants and was also broadcasted online.

In 2019 The Ministry of Environment launched a national website for circular economy that gives information about circular economy, national activities, showcases best practices and gives notice about upcoming events.

In 2019 the preparation of circular economy strategy development methodology was started by developing an indicator framework for circular economy, followed by the mapping of current situation and possibilities for circular economy in 2021. The circular impacts and implementation level of the circular economy in Estonia were studied in the fields of construction, plastics, textile industry, industry and wood industries, and services sectors.

As the result of these studies and also by involving stakeholders, a strategic document in the form of the Circular Economy White Paper was released in 2022. The Circular Economy White Paper was developed in close cooperation with all Ministries of Estonia and sets the vision and developmental goals for the circular economy in Estonia. The White Paper is designed to support different stakeholders – the state, local municipalities, entrepreneurs, and individuals – in mainstreaming the principles of circularity in production, consumption, policies, lifestyle, culture, and values. Principles of production, consumption, promotion and so on are stated in the White Paper for the stakeholders to be followed in their activities. The White Paper also describes strategic actions that are needed for achieving circular economy vision with roles for the different stakeholders. The White Paper also highlights the importance of business, sustainable production and consumption, digitalisation, skills, economic and regulatory frameworks, and awareness about the circular economy (Ministry of Environment of Estonia, 2022).

The latest national activity has been the release of the Circular Economy Action Plan for Estonia by the Ministry of Environment with development goals until 2029. The Action Plan is based on the White Paper and has specific measures, actions and deadlines which are gathered in table 1. (Ministry of Environment of Estonia, 2023). Development goals can be found below table 1.

Table 1. Circular Economy Action Plan for Estonia

| Action | Time of action | Development goal* |
|---|---|---|
| Preparation and implementation of requirements and instructions for Green Public Procurement and environmental management systems | continuous | 1-2,5-6 |
| Encouraging the Circular Economy in legislation | continuous | 1-6 |
| Implementation of projects from resource efficiency and waste management support measures from 2014-2020 | 2014-2023 | 1-2,6 |
| Implementation of project PACKGDEPO | 2021-2023 | 1,3,5-6 |
| Supporting the Circular Economy capacity of local governments and implementing pilot support measure projects | 2022-2024 | 3,5-6 |
| Application rounds for green turn support measures | 2022-2026 | 1-3,5-6 |
| Reconciliation of product requirements arising from the Ecodesign Regulation at the EU level and preparation for its implementation in Estonia | 2022-2024 | 1-6 |
| Implementation of the National Waste Plan 2022-2028 | 2022-2024 | 1,5-6 |
| Implementation of the real-time economy waste project | 2022-2025 | 4-5 |
| Preparation of conditions for Circular Economy support measures 2021-2027 and opening of application rounds | 2022-2029 | 1-6 |

Source: Ministry of Environment of Estonia, 2023. Adapted by author.

*The development goals for circular economy in Estonia are:

1. Resources are used responsibly and based on demand, resource use is elaborated and waste generation is minimised;
2. The business models of Estonian companies are forward-looking and circular;
3. The presence of necessary know-how and experts for the implementation of the circular economy and effective cooperation between different areas and sectors;
4. Functional digital solutions to support the circular economy have been created and quality data is ensured to monitor the situation;
5. The circular economy is well coordinated at the national level, legal and economic environment has been created to support the circular economy;
6. An environmentally conscious way of thinking and environmentally friendly behaviour has taken root.

To support the circular economy In Estonia some financial support measures are already in action and some are under development. In addition to the resource efficiency measure for companies there is the Greentech Investment Programme by SmartCap in place, providing direct investments up to 20 million euros until the end of 2024. SmartCap co-invests with private investors into innovative and/or research and development intensive early-stage Estonian green technology companies that are developing breakthrough technologies, products or services to help to solve environmental problems and to achieve a climate-neutral circular economy including transition to a circular economy (SmartCap, 2022).

From the European Economic Area (EEA) and Norwegian Financial Mechanisms programme Green ICT is financed through EAS (Ettevõtluse Arendamise Sihtasutus - Estonian Business and Innovation Agency), where 23 million euros is aimed for the growth of the added value of companies through resource efficiency projects (Riigi Tugiteenuste Keskus, n.d.).

In 2022, there was also a EEA finance programme for local municipalities to apply for funding for circular economy projects with a total support amount of 900 000 euros. Three municipalities received funding for circularity projects - municipalities of Tallinn, Tartu and Rae (Environmental Investment Centre, 2022).

Additionally, the European Commission established The Recovery and Resilience Facility (RRF) to lessen the economic and social effects of the coronavirus pandemic and to improve the sustainability, resilience, and readiness of European economies and societies for the opportunities and challenges of the green and digital transitions. The Estonian Recovery and Resilience Plan is one of the annexes and action plans of the national strategy "Estonia 2035" with one main goal to invest in the green and digital transition. Within the framework of the digital transition, the plan is to support investments for the digitalization and automation of company processes, as well as the creation of an e-platform for the construction sector and the prototyping of innovative digital solutions related to it, together with the development of digital skills. More than 600 million euros is aimed for the green and digital transformation (Riigi Tugiteenuste Keskus, n.d.).

As acknowledged by the national strategy "Estonia 2035", the transition to a circular economy can contribute to environmental objectives. "Estonia 2035" recognises the key role of the private sector in reducing waste generation and increasing material recycling, the importance of raising awareness across society to adopt sustainable practices and digital solutions to enable reliable data to measure progress (Eesti Vabariigi Valitsus, n.d.).

Estonia is the European Union leader in terms of digital public services and is among the top European Union countries for digital skills (ranked fifth in the European Union, with almost two-thirds of citizens having at least basic digital skills) (Paraskevopoulos, 2021).

Digital technologies, such as the Industrial Internet of Things (IIoT), big data and data analytics are key elements towards the circularity transition, especially in the manufacturing industry sector. Digitalization helps to use production assets, resources and materials intelligently. Managing resources wisely and using fewer natural resources is the goal of circular production (Rantala et al., 2023).

For instance, radio frequency identification (RFID) tags and QR codes uniquely identify products, while sensors and digital cameras record data about them. Artificial intelligence also analyses data, and digital platforms or IoT technologies enable data sharing. The last helps to solve the problem of companies having a lack of information about transforming used materials into new products (Findik et al., 2023).

There is also work going on with enhancing Green Public Procurement in Estonia. The share of environmentally friendly public procurements is still small among all public procurements. It is primarily associated with the fear for higher costs and more time spent for the procurers which are not actually justified fears as environmentally friendly products and services are economically beneficial in the long run.

In 2020, 8,323 public procurements were carried out in Estonia. Official statistics show that only 4.5% of the total number of procurements and 16% of the total procurement cost were Green Public Procurement (Keskkonnaministeerium, n.d.).

Since 01.01.2022 Green Public Procurement is mandatory for furniture, cleaning products and services, office IT equipment and copy and drawing paper (Riigi Teataja, 2022).

Additionally since 24.02.2023 environmentally friendly criteria and conditions for road vehicles have been implemented (Riigi Teataja, 2023).

Green Public Procurement is one of the main tools for local municipalities to promote a circular economy by setting standards for companies and also acting as a role model and raising awareness. Public procurement can also create market demand and showcase innovative resource-efficient business models (The Ellen MacArthur Foundation, 2021). Due to its high importance, the Ministry of Environment of Estonia is planning to widen the list of product categories with mandatory criterias.

# 4. CIRCULAR ECONOMY IN EUROPE

According to the European Circular Economy Stakeholder Platform which is a joint initiative by the European Commission and the European Economic and Social Committee, there are currently 64 existing strategies for the transition to a circular economy adopted at national, regional or local level by public authorities. More than ten are active in Finland, eight in the Netherlands and in Belgium. The Netherlands and Finland are the few countries which are implementing their strategies on a national level with the full support from the government. Belgium does not have a national strategy, only a regional one (European Circular Economy Stakeholder Platform, n.d.). That is one of the arguments for choosing The Netherlands and Finland as front-runners of the circular economy in Europe.

In addition, Denmark, the Netherlands and Sweden are the leaders in the green turn in the European Union. As well as Finland who has set outstandingly ambitious goals (Czarnezki, 2019). Denmark has been chosen as one country to showcase also due to their salient example of industrial symbiosis in Kalundborg.

From Europe, but out of the European Union, Norway also has created and implemented a national circular economy strategy. Main areas of the strategy are sustainable production and product design, sustainable ways to consume and use materials, products and services, non-toxic circular loops and innovation. The goal for the Norwegian government is for Norway to become a pioneer in the development of the circular economy. Norway understands the importance of cooperation and mutual goal setting and is therefore following the ambition and goals of the European Union circular economy action plan (Norwegian Government, 2021).

Norway's economy in 2022 was only 2,4% circular which is below the global average. Nevertheless, Norway has the ability to increase its circularity up to twenty times and establish itself as a leader in the circular economy with the appropriate actions. By restructuring the construction and forestry industry, food systems, transitioning to clean energy, facilitating strong repair, reuse and recycling economy and enabling green transport systems, Norway can become over 40% circular (Circle Economy, 2023).

# Current situation and best practises in the Netherlands

In 2016, the government-wide programme for a Circular Dutch Economy by 2050 was released. The goal is for the Dutch Economy to be completely circular by 2050. By 2030 the consumption of primary raw materials (minerals, fossil and metals) should be reduced by half. The Dutch government is mainly focused on three goals, to be more resource efficient, to use sustainably produced renewable and widely available raw materials and eco-design (Ministerie van Infrastructuur en Waterstaat, 2022).

The Netherlands have a good starting point for accelerating a circular economy, they have good infrastructure, major ports and airports, strong chemical industry and agri-food sector. In addition they are advanced in high-tech systems, logistics and recycling. The Netherlands already leads the way in the biobased economy and reducing the use of raw materials.

It has been estimated by The Netherlands Organisation for Applied Scientific Research that with the use of a circular economy The Netherlands would gain extra turnover of €7.3 billion and 54 000 jobs annually.

"A Circular Economy in the Netherlands by 2050" programme is mainly focused on biomass and food, plastics, the manufacturing industry, construction sector and consumer goods. These are sectors which are crucial to the Dutch Economy and also have a high impact on the environment (Dutch Government, 2016).

Common goals across all levels of government are essential to move from a linear to a circular economy. In the Netherlands, the national programme and regional (Amsterdam and Rotterdam) strategies all share a common goal of reducing raw material consumption by 50% between 2016 and 2030 and achieving 100% circularity by 2050 (City of Rotterdam, 2019; Circle Economy & City of Amsterdam, 2020).

Higher capital requirements for circular innovations and the lack of knowledge and experience are considered the main barriers for the circular economy in The Netherlands. To support innovative projects and circular transition the financial instruments have high importance and in The Netherlands there are many. City Deals is a coordination mechanism established by the national government in 2016 through the circular economy programme to facilitate the exchange of best practices and knowledge sharing. City Deals is a good instrument for the government to cooperate with cities to put the circular economy programme into practice. Nevertheless, it has been found that so far learning experiences within the City Deals have been largely social, rather than organisational. In addition, high-level organisational commitment has remained limited. (Dignum et al., 2017; Dignum et al., 2020; Holland Circular Hotspot, 2020).

Tax schemes such as MIA (Environmental Investment Rebate) and VAMIL (Arbitrary depreciation of environmental investments) give a significant boost to investments in environment-friendly operating assets. In addition to their standard investment tax deductions, businesses can use MIA to write off up to 45% of the investment costs for an environmentally friendly investment. With Vamil, companies can decide when to write off 75% of their investment costs. However, it is analysed to restrict freedom of choice for companies (Cagno et al., 2014).

In addition, there is The Smart Regulation programme (*Ruimte in Regels*) to help companies overcome legislation barriers when planning and implementing innovative investments. Programme has removed over 80 barriers and fostered circularity in businesses. For example, to overcome a barrier of restrictive regulation that inhibited reuse of plastic turbine blades of windmills after replacement. Due to the Smart Regulation Programme, plastic can now be used as a resource in the car and ship industry (OECD, 2020).

To help the public sector with sustainable procurement there is a public procurement competence centre PIANOo. PIANOo trains, advises and informs public authorities. It provides procuring authorities with a variety of green-enabling resources and tools: web search, $CO_2$ performance ladder, and more. PIANOo mediates and facilitates dialogue between procuring government agencies and private sector companies. The organisation works with a network of approximately 3,500 public institutions (Tazelaar, 2010).

It is essential to have active circular economy knowledge networks on both national and regional level. Dutch knowledge institutes collaborate with many foreign knowledge institutes, such as the Ellen MacArthur Foundation, the World Resources Institute, the Green Growth Knowledge Platform, the OECD and the UNEP International Resource Panel (Dutch Government, 2016).

In the Netherlands there is a circular economy 'Acceleration House' - *Versnellingshuisce* - which is a competence centre for companies who want to change their business model to circular. *Versnellingshuis* helps to overcome legislative barriers by helping to understand the legislation better in terms of what can and cannot be done within the legislation. In addition, they give knowledge and expertise needed for the transition (Versnellingshuis Nederland Circulair, 2023).

There are numerous circular economy projects and practices in the Netherlands. Already on the European Stakeholder platform over 90 are published, but there are many more. From regional practices there is an example from Rotterdam of encouraging entrepreneurs to supply circular products or services by setting requirements in public procurement (City of Rotterdam, 2019).

In Amsterdam a circular city roadmap was published in 2016. In the roadmap construction and organic waste chains are identified as potential drivers of the Amsterdams transition to circularity. The roadmap plans to improve the circularity of the construction sector by application of circular principles in the construction of new buildings until 2040. Strategies for construction waste include smart design, efficient dismantling and separation, high-value recycling, enhancing cooperation with a marketplace and resource bank. For the organic waste also four strategies to enable the higher-value recycling were developed. These strategies include a central hub for bio-refinery, smart waste separation and return logistics, cascading of organic flows and retrieving nutrients (Circle Economy, 2016).

Another regional project is for using secondary resources as material. Groningen has opened a tender for a ten-year service of refurbished furniture for the municipality and since 2018, all plastic bins within the municipality are made of recycled plastics (OECD, 2020).

The city of Amersfoort has also implemented circular public procurement since 2016, with a tender volume of approximately 100 million euros per year. In addition to the renovation of the town hall and the construction of new circular road projects in Amersfoort, various initiatives have been launched through the project. For example, an online knowledge platform where project managers can share experiences related to circular procurement has been founded (Municipality of Amersfoort, 2017).

The Netherlands is leading the way in Europe's transition to a circular economy, with their active national programme which is under development to become more efficient with sectoral measurable indicators, financial and knowledge providing support mechanisms and regional projects that contribute to achieving the goals of the national strategy.

## Current situation and best practises in Finland

In 2016, the world’s first national road map to a circular economy was published in Finland. In 2019, an updated version was published that also includes descriptions of the essential circular economy measures to which Finnish stakeholders have already committed themselves (Sitra, 2016; Sitra, 2019).

The Finnish roadmap contains 4 strategic goals, 4 visions for the key players and 29 actions. The roadmap is based on mapping of the current situation of the circular economy, specialist interviews, workshops and collection of ideas and comments (Sitra, 2019).

The Roadmap was worked out and published by Sitra, which is operating under Finnish Parliament. Returns on endowment capital and capital investments are used to fund Sitra. The circular economy vision is implemented by three themes and hundreds of projects. Finnish Roadmap is based on strong cooperation between different stakeholders, private and public sector. The development of educational materials for the circular economy is aided by the Finnish National Agency for Education. There is a Sustainable Lifestyle Commitment from the Prime Minister's Office. SYKE and Motiva promote the sharing of good practices in the municipal networks.

The growth of the circular economy requires large scale investments and in Finland there are many different investment schemes to businesses involved with the circular economy. In addition there is optional agreement of "Green Deals" in the public and private sector piloted by the ministries.

There are a vast number of good practices and projects in Finland to support a circular economy.

Finland has many projects for decreasing construction and demolition waste. One of those is the project ReCreate: Innovate and develop novel technological solutions for deconstruction and reuse. The aim of the project is to deconstruct used concrete elements without damage and reuse them in new buildings (European Circular Economy Stakeholder Platform, 2022 (*ReCreate:)*).

The City of Helsinki had a project for supporting the reuse of excavated soil in construction projects. Excavated land masses were re-used through better coordination. The City of Helsinki saved 32 million euros during the project due to no longer needing to purchase new land masses for the foundation of public construction projects (European Circular Economy Stakeholder Platform, 2022 (*The City of Helsinki))*.

In addition, most of the demolished concrete in Finland is crushed and used for backfilling in the infrastructure construction and in building foundations (Mäkipää et al., 2021).

To foster development and innovation including the circular economy there is VTT Technical Research Centre of Finland (VTT) which is owned by the state and is one of Europe's leading research institutions. One of many VTT projects is building a tool for modelling urban circular economies. In Espoo's Kera district, scientific theories are being tested. The project 'Smart and Clean - Collaborative Kera 2022-2023' aims to transform the Kera industrial area into a smart and circular district, consisting of repurposed buildings and new circular buildings for housing and a physical hub. This hub, supported by a digital platform, will facilitate the co-creation of new circular ideas through networking, experimentation and prototyping. Circularity in this project district is possible for example by utilising biomass and using biogas that is produced from organic waste as transportation solution for gas vehicles. Nevertheless, it was found that high-level circulation requires massive increases of production within the city, which is unlikely (Paiho, 2019; Paiho et al., 2021).

VTT is also working on a digital design platform for companies, which helps its users to understand the disadvantages and advantages of different circular design options by using for example life-cycle assessment (LCA) and cost (LCC) simulators, business models and materials performance models (ProperTune ICME) and offering customers access to all these interlinked domains in one platform (Majaniemi & Kivikytö-Reponen, 2021).

Finnish Innovation Fund Sitra and Deloitte have compiled a Playbook to Circular Economy for Tech Industry which is a practical guide that provides insight, examples and hands-on tools to help businesses in this endeavour. There are five circular business models presented in the guide which are circular inputs, sharing platforms, product as a service, product use extension, resource recovery and how to apply them (Sitra & Deloitte, 2022).

Another example of using digital tools to enhance circularity is from the Municipality of Mikkeli in Finland. They used circular material management methods to undertake a circular demolition of the Pankalampi Health Care Centre and the Tuukkala hospital. Following a selective demolition procedure, salvaged materials were incorporated into a digital databank developed by the South-Eastern Finland University and a construction materials marketplace developed by the private company MIKSEI. The use of the marketplaces is being promoted to both private and public actors who are interested in obtaining secondary construction materials (Haapea & Soininen, 2021).

From Lapland in the region of Kemi-Tornio is a project for a competence and training system for industrial symbiosis. The Kemi-Tornio industrial symbiosis was created to improve the region's use of resources and energy. National networks of eco-industrial parks are created based on the model, training and competence will be improved in the industrial circular economy nationwide. Project is based on cross-sectoral industry cooperation consisting of five biorefineries, 32 sawmills, 16 mines, five metal refineries, aluminium smelters, a liquid natural gas (LNG) refinery and two chemical plants. Symbiosis is fostered by providing expert assistance, funding, linking operators, creating networks and promoting pilots and scales (Intereg Europe, 2018; Preisner, 2020).

From the Lahti Region there is an example of Kujala waste symbiosis. Kujala Waste Centre collects bio waste and bio residues and processes it into biogas, biofuel, compost and fertiliser. The centre also collects hazardous waste and electrical waste for further processing. In the mechanical sorting plant fibres, plastic and metals are separated for recycling. Only a fraction of waste is disposed of in the landfill and from the landfill produced methane is partially used at a local brewery for process steam and the rest is turned into electricity and heat by Lahti Energy. The Waste Centre provides services for 12 owner municipalities (Datsa, 2016).

Since 2017, the Finnish organisation Sitra is organising the annual circular economy conference World Circular Economy Forum which takes place in different parts of the world each year. It is considered the world's biggest global gathering on circular economy solutions bringing together thousands of business leaders, policymakers and experts from around the world to discuss future visions (Doran et al., 2018).

Finland can also be considered as one of pioneers of the circular economy in Europe with their active approach and continuous work with improving their national road-map, stakeholder engagement and raising awareness.

## Current situation and best practises in Denmark

Denmark started their journey towards a circular economy with the help of the Ellen MacArthur Foundation. In 2015, they created a toolkit for policy makers to describe a methodology for circular economy policymaking. Toolkit identifies circular economy opportunities, barriers and policy options in the country (Ellen MacArthur Foundation, 2015).

In 2016, a White Paper on Circular Economy in Denmark was released by the State of Green. The Paper was mainly inspirational with practical examples of how Danish companies are already contributing with innovative solutions to help the progress (State of Green, 2016).

In 2018, based on recommendations by an Advisory Board for Circular Economy, the Danish Ministry of Environment and Food and the Danish Ministry of Industry, Business and Financial Affairs launched a Strategy for Circular Economy. The Strategy is focused on design, consumption and recycling. Well functioning market for waste and recycled raw materials may have a catalysing effect on the circular economy, since it gives enterprises better access to valuable wastes. It means that waste should be classified as recyclable or suitable for incineration in all municipalities similarly. Harmonised waste collection of household waste is important instead of each municipality designing their own collection schemes (European Circular Economy Stakeholder Platform, n.d.; The Danish Government, 2018).

In 2021, the Action Plan for Circular Economy was released by the Ministry of Environment of Denmark. Focus areas of the Danish Action Plan are reducing waste and improving recycling, better use of resources and biomass, sustainable built environment and plastics (Ministry of Environment of Denmark, 2021).

To support the national Action Plan, the LIFE project "Circular Economy beyond waste" has been implemented for the period of 2022-2029. The project consists of 26 sub-actions and is divided between 39 partners and is mainly aimed at increasing recycling and reuse and keeping material in use (European Commission, 2022).

Denmark also has a leading example of industrial symbiosis in Kalundborg. Industrial symbiosis is one option of fostering a circular economy as it is an effective green business model that reduces production costs and increases competitiveness and growth potential for industries. Industrial symbiosis takes time and resources and requires data, mutual trust and knowledge sharing between the partners as well as network regulations, facilitation and support (Lasthein et al., 2021).

The largest companies in the region collaborate across industries in Kalundborg Symbiosis to share leftover energy, water, and materials and reduce waste. Active as industrial symbiosis since 1972, it is the world's first industrial symbiosis with a circular approach to production. There are 16 partners in the symbiosis with more than 4500 employees. The partners include power plant, plasterboards, bioethanol, biopharmaceutical and other biological solutions producers, refinery and utility. The Municipality of Kalundborg is also part of the symbiosis.

The Kalundborg Symbiosis aims to be the world's leading industrial symbiosis with a circular approach to production and to be carbon neutral within the next decade (European Circular Economy Stakeholder Platform, 2021).

Denmark has implemented several national activities promoting the circular economy. Some studies indicate that Denmark is one of the leaders in the green turn in the European Union, on the other hand others suggest that Denmark is perceived to be in the beginning of their circular economy agenda. Nevertheless, there are already a lot of Danish companies that have understood the importance and concept of a circular economy. They are leading the way in Denmark with innovative business models, increasing resource efficiency and reducing their environmental footprint by reducing the use of minerals and raw materials, ensuring responsible sourcing of their raw materials and/or shifting consumption to renewable resources. In addition, many Danish companies have understood the Eco-design concept and are taking it into effective use (Dakofa, n.d.).

# 5. METHODOLOGY

The current chapter describes the methodology that was used to conduct the research, to collect and analyse data. In addition to the above literature overview that has been gathered mainly from available online sources, in-depth interviews were carried out with five circular economy experts.

The experts were selected by different criterias. Firstly, as the thesis is also focused on European best practices and experience, experts from leading countries with circular economy practices were selected. The author reached out by email, LinkedIn and telephone to six foreign experts which resulted in two positive replies - from Denmark and from The Netherlands. Experts from Finland from Sitra and from the Ellen MacArthur Foundation were also selected and contacted by the author, but no reply was received. Secondly, it was important to involve expert opinions from the local municipalities of Estonia. The city of Tallinn, the city of Tartu and Harku municipality were selected for the interviews. Tallinn and Tartu as the biggest cities in Estonia and therefore with the highest capability to implement sustainable changes and Harku municipality as one of the fastest growing municipalities in Harjumaa in terms of population, municipality with an open mind-set for the change, but with less financial capacity compared to Tallinn and Tartu (see the list of experts in *appendix 1*).

Interviews were carried out mainly online with one exception of a face-to-face meeting and lasted from 50 minutes to an hour and a half. The interviewees answered almost the same questions with minor differences between foreign and Estonian experts (questions in *appendix 2*).

Questions were created by the author with the goal of gathering sufficient information to get a holistic understanding of what is lacking for facilitating circular economy on local municipalities level and what is needed to overcome the barriers. The objective was also to gather information and feedback directly from the source about local best practices.

The results of the interviews were interpreted according to which opinions overlapped the most with the additional explanations and recommendations from the experts.

For the final conclusions and recommendations both literature and interviews based data was analysed and taken into account. The conclusive figure for main barriers was made to illustrate experts' opinion and results from Estonian and OECD studies.

# 6. RESULTS OF THE EXPERT INTERVIEWS

## Roles in circular economy

### The role of central government

It was almost mutually agreed by the circular economy experts that the state has the biggest role in enhancing the circular economy. Nevertheless, the importance and mindset of the people cannot be underestimated. If the people do not want to buy more sustainable products and services then they will not and there will be no pressure on companies to become more sustainable. Therefore raising awareness is highly crucial.

State needs to have a strong role for taking action and creating the framework and regulations for the acceleration of the circular economy.

It was mutually agreed that the circular economy is a result of well working cooperation and the state cannot create it alone. State has the role of influencing municipalities and citizens. For positive impact, the state should have a concrete vision and knowledge of what inhibits the development and what facilitates it and should provide support mechanisms (expert and financial) accordingly.

The influence should be both by mandatory legislation as well as stimulating activities such as showcasing best practices, general awareness raising and offering financial support. Funds and expertise should be firstly directed to categories where the effect is highest, has the highest effect on most people and most companies to make the stimulation most effective and quick.

It should be clearly communicated why things need to be done and also force the change with corresponding legislation. To get the circular economy going the stimulating phase should be first and mandatory later, in addition financial support is most needed in the beginning phases.

Currently it seems that the state is looking for their exact role and how to share responsibilities.

## The role of local municipalities

It has not been agreed officially what should be the role for local municipalities in terms of enhancing the circular economy. Local municipalities are not producers nor therefore implementers of product design, in addition they generally do not need any raw materials (besides for construction). Nevertheless, the local municipalities should also fix their role and act systematically accordingly.

Currently the main activities for municipalities are communication, raising awareness and giving guidelines on why and how things need to be done. They can influence the field of waste management and instruct their citizens how to improve waste sorting by type and increase reuse. Municipalities are closer to the citizens and can start a dialogue with the people more easily compared to the state.

Local governments are also encouraging cooperation between local communities and companies on some level. Local municipalities can and should create opportunities for circular companies by offering premises, instructors, publicity and other means within the limits of their possibilities.

Local governments could be more standard setting for example through Green Public Procurement and by applying for Green Office certificate (European Green Office, 2013). They can make use of their assets and buildings, taking actions that are highly visible. Municipalities could also be more selective and demanding when giving permits to companies. Municipalities could also increase their role of information sharing between the state and companies, for example if there are legislative barriers for companies to corporate circular business models.

But as long as the state does not give stronger vision and (mandatory) guidelines, there is no real necessity for local municipalities to make concrete steps to circularity. Currently there are circular actions on some level, but they are more based on self-made enthusiasts. Circular economy needs to be pervasive throughout all levels of society and engage all stakeholders.

The people need to feel that everyone has their own responsibility, otherwise the real change to circular transition will not happen. There should be natural initiatives from the communities not only by the will and demand from the state and local municipalities.

## Barriers for circular economy

Figure 5 illustrates the main barriers for the circular economy according to the interviewed experts. As seen on the figure 5, legislation and regulation and private sector business interests (which are prioritised before environmental protection and sustainability) are seen as the main barriers.

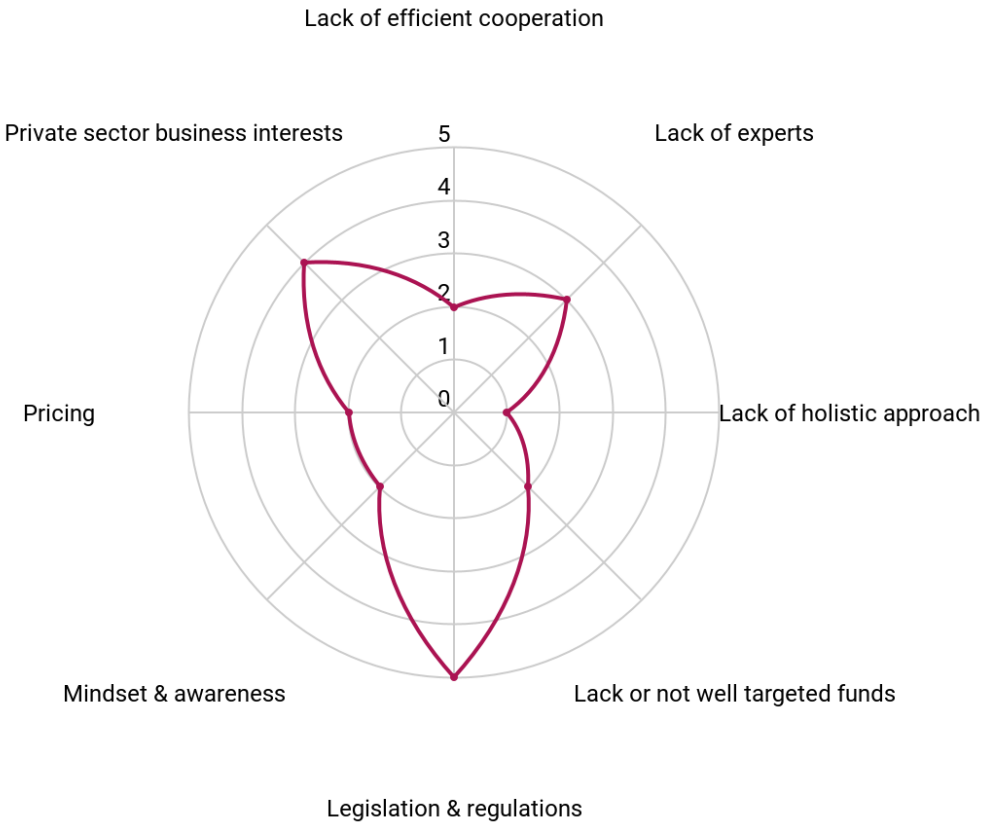


Figure 5. Barriers for circular economy according to the expert interviews
Scale 0…5, where 0 not relevant, 5 the most restrictive.

Legislation and regulations are seen as the highest barrier for multiple reasons. Mainly as long as there is no legal, including financial compulsion, then there will be no acceleration for circular transition. Waste management is constrained for Local Municipalities as they only have the role of organising procurements but not any substantive role. Additionally, one of the legal barriers that was mentioned is the definition of waste in the legislation. Currently it is difficult, if not impossible to reuse secondary resources if they have already been referred to as waste.

Worryingly it seems at times that the needs and demands of the private sector are prioritised before environmental protection in the law making. As there is no price set for environmental impact, fossil based raw materials should not be cheaper than sustainably produced materials. Therefore, currently being circular is not always the most efficient way from an economic perspective. It is cheap to produce from fossil based materials and it is too cheap to pollute. More responsibility should be put on the shareholders of companies by taxing. The price for mixed waste should also be remarkably higher to put pressure on people to sort waste by type.

The lack of well targeted financial instruments and funds were also pointed out as main barriers.

Circular economy needs to be pervasive through all levels of the society and state, that requires open mindset and awareness about the importance and opportunities of the circular economy. Currently in Estonia there are still a lot of perspectives from the soviet-era, especially among the older generation and raising awareness is crucial. Situation is much better among children and the younger generation who are now taught from a young age about waste sorting and the importance of sustainability.

Lack of circular economy experts is also one barrier for local governments. In the best case, there is one environmental specialist working in the municipality whose responsibilities start with detailed plans and end with environmental permits and has everything related to environmental issues including waste management in between. There is no manpower for fostering circularity and cooperation. Usually advice is asked and given by research institutes, but there could be separate circular economy specialists or competence centres to whom to turn to.

The lack of efficient cooperation and lack of holistic approach were mentioned as barriers for the circular economy as well.

## Facilitators for circular economy

According to the interviewed experts the main facilitators for circular transition are obligation by legislation and regulations and changed mind-set through raised awareness and knowledge sharing (Figure 6).

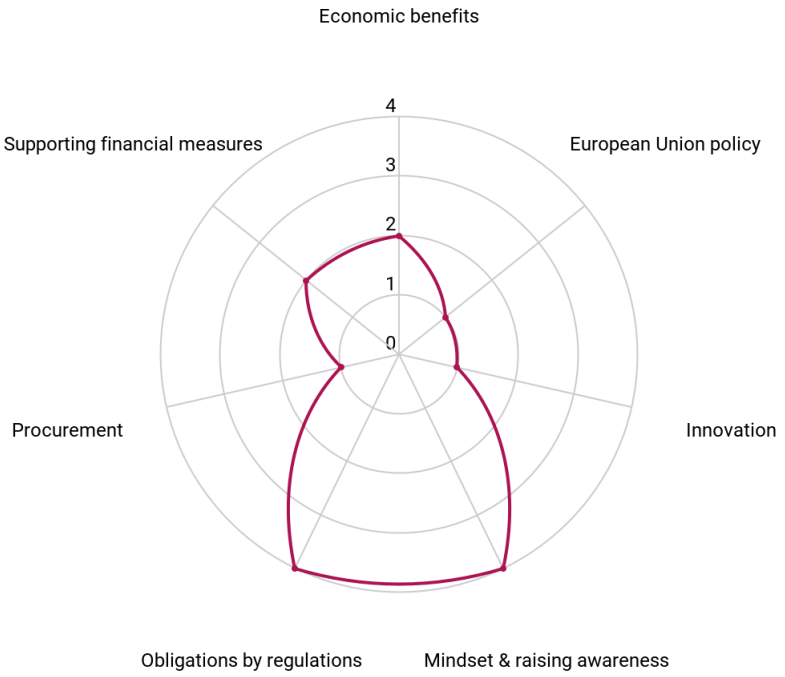


Figure 6. Facilitators for circular economy according to the expert interviews
Scale 0…4, where 0 not relevant, 4 most effective.

If the state has a holistic view and has set goals on circular economy actions, then the state can facilitate the change by creating mandatory obligations. If something is made mandatory then it is obliged to happen. Government should make business opportunities a reality by setting standards that companies have to comply with, therefore legislation is very important. If the business model is economically beneficial, then companies are interested in it anyway as for the companies the biggest facilitator is cost saving. To promote and accelerate the necessary changes, purchase of innovative technological solutions for example, appropriate financial support measures are needed.

There is a change in mind-set happening and the willingness of people to become more sustainable is one of important facilitators for circular transition. The people and companies are actually quite ready in their mind-set to be more sustainable, to make more sustainable choices, to change their business models, but the know-how is low and there is no one teaching how to redesign current processes for example.

Therefore raising general awareness, show-casing best practices and training experts is of high importance for facilitating the circular economy in Estonia. That can be done both by state and by local municipalities or in cooperation.

In addition, European Union climate policy, procurement and innovation were mentioned as facilitators for circular transition in Estonia.

Estonia is a small, but innovative country with a flexible economy, with numerous start-ups offering specific digital solutions which could give a good ground for fostering circular economy principles if the above mentioned facilitators have been applied.

## Cooperation between state and local municipalities

The basis of the cooperation between the state and local government in terms of enhancing the circular economy should be a national plan (road map or action plan) for a circular economy with a definite goal and timeline. These clearly defined goals and principles should be supported and embedded in the law. Only then can the local municipalities implement it.

There could be region specific roadmaps created in cooperation with local municipalities as the regions are very different in terms of population, resources and other. Therefore the requirements cannot be exactly the same for each region. It should be a local effort as the government does not always know what the main problems and barriers as well as possibilities are on a local level. The overall goal of strategies should be mutual. Nevertheless, setting realistic circularity goals is challenging. Goals are often political and more visionary, but should be realistic and measurable. It would be best if the goals were set by product categories to be understandable and easily followable to companies.

The overall cooperation between state and local municipalities could be improved by organising regular purposeful meetings. Efficient cooperation would help to overcome barriers and bottlenecks together. For example textile waste should not be an individual problem of any municipality nor could one municipality solve it on its own. Cooperation is needed between state and municipalities, for example in Finland five local municipalities have made a joint fibre plant. Currently local municipalities are often acting independently and the cooperation and involvement with the state is lacking, including in the lawmaking process.

## Cooperation within and between local municipalities

As Estonian local municipalities are rather small and most have low capabilities, the municipalities should cooperate for action. A well-functioning cooperation network facilitates problem solving, sharing knowledge and experiences and starting mutual innovations and ambitious plans.

For example for developing a network of waste treatment plants, for finding solutions for valorization of waste (using waste / residue as resource) and / or turning waste into energy (incineration, biogas production). Municipalities could map production residues by county or other reasonable region. After mapping where what and how much is left over and new usage / new users should be mapped/found accordingly. This could be a local municipalities initiative or by the state request, but either way would need financial support from the state.

In addition there could be regional (circular economy) competence centres that are initiated by nearby municipalities. Through these centres municipalities could make joint innovation projects, procurements, hire and train circular economy experts that would help the municipalities. These centres could also be responsible for supervision and fining if needed.

In addition, administrative cooperation agreements could be made - for example for using waste stations and circular economy centres across multiple municipalities under the same conditions for all municipalities citizens that have signed the agreement.

Local Municipalities can also implement circular economy activities into their development plan (as has been done in Tallinn). For achieving the most efficient plan, different factors across the value chain should be gathered. For efficient implementation of the actions there should be a well elaborated communication plan to citizens (as the City of Tallinn has) by online social media and on local and national media. Otherwise the citizens might not be aware of the possibilities the municipality has created nor of the obligations they should follow.

## Cooperation between stakeholders

Engaging different stakeholders, especially private companies, is one difficult but highly crucial task in the process of circular economy transition.

As mentioned before the private companies are mainly interested in economical benefits. Not all of them are interested in sharing the information about their production, residues, nor cooperating with other companies and local municipalities.

Local municipalities should initiate the process of cooperation. The most effective way would be to gather everyone behind the same table to collectively discuss what are the main areas of concerns, what could be solutions and what could be done overall to achieve a circular transition. Based on these meeting(s) local municipalities can compile regional roadmaps / action plans, which could also be input for the national one. These meetings would both raise awareness among the companies and also give more responsibility to each party, as the goals were set together.

Most importantly, the engagement and sharing of responsibilities cannot be dictated, it needs to be a cooperation, collaboration as partners.

In addition to developing a circular economy plan together, local municipalities can organise workshops and seminars with experts, bringing different stakeholders together to talk about their problems, issues and learning from each other and finding solutions mutually.

For better engagement, local municipalities should create cooperation networks, help to pilot projects and foster the businesses. Companies should be able to come to local municipalities with innovative ideas to get both financial (if possible) and promotional support. Local municipalities should also have an open mind and interest to find new ideas and companies who could help to reach goals and solve problems.

Raising awareness of the citizens is a crucially important part of engagement and getting everyone to strive towards a common goal. There could be regular meetings with society groups to discuss local problems and working groups for citizens to participate in local development plans. In addition to seminars, workshops and campaigns in the media should happen.

## Regulations and incentives

Circular transition needs supporting framework, legislation and obligations can work as the biggest barrier or main facilitator. There should be a combination of obligations setting regulations with well targeted financial support.

Regulations should be national, it would not be efficient if each municipality has completely different regulations and rules. National requirements could be adapted according to local needs, but it is very difficult to push through additional requirements within the municipality and there is no political will either. Nevertheless, the regulations should consider all municipalities and be reasonable. If there are requirements in place for local municipalities to follow then the state should also provide the financial means if necessary. There should be one common goal and regulations should work for the goal. The state has its own responsibility for the European Union to fulfil the set requirements, for example in rates of waste sorted by type.

In a circular economy perspective Estonian local governments currently have mainly waste management activities and regulation experience. Waste management regulation should be more binding for both companies, municipalities and citizens. The main goal should be basically zero waste. Creation of legislation and designing new support mechanisms should facilitate the achievement of this main goal. The price for mixed waste should be significantly higher. Waste carriers could also have an obligation and possibility to fine for wrongly collected and thrown away waste.

Regulations should facilitate circular products and product design for minimising different package layers and to encourage mono packaging to make packages easily recyclable and /or reusable. There could be a tax for composite packaging and a functioning system of producer responsibility (currently not as effective as should be).

The state could encourage industrial symbiosis with a legal framework by forcing companies to find buyers for their residues and leftovers or to find solutions for using these themselves. For example by making waste handling more expensive and giving advantage to the companies who use the platform for secondary resource databases (for example like Materialivoog). Currently not all companies want to share their data.

First phase of the circular transition should be stimulating the circularity. Which means giving financial support for investments, innovation and research, supporting and working with front runners. Financial support could be given when purchasing environmentally friendly assets (machinery, inventory, tools) or to support circular projects cooperation within the supply chain. Investments is a non-mandatory method, it is a stimulating method. According to European Union rules, if the law says you have to be circular then the government cannot stimulate it financially. Therefore making things mandatory by law should happen in later phases of the transition. For example taxing or fining cheap production from fossil based raw materials that have high environmental impact.

In addition, the local municipalities can create demand for circular solutions with procurements.

## Green Public Procurement

Green Public Procurement is one effective tool for local municipalities to set a standard and facilitate circular mindset and actions. Nevertheless, it is a tool that is more used in larger municipalities as smaller municipalities neither do not have enough human capacity to work with setting special criterias nor are the procurements large enough. For smaller municipalities with lower budgets the main criteria for procurements is the price and as they do not have many public procurements they are not always obliged to set sustainability criterias. Here a lesson should be taken from the Netherlands where there is a separate organisation (PIANOo) to help local governments with sustainable procurement.

If the municipality has a procurement department or specialist then applying circular, innovative and environmentally friendly principles is more in focus. There are many categories that could be put in focus in addition to the mandatory ones, for example road and building construction, maintenance, office supplies, public space, catering and transportation.

## Circular economy practises in the interviewed municipalities

It became clear during the interviews that there are already many circular economy related initiatives and projects in progress in Estonia. Mainly the focus is on increasing waste collection by type, reducing waste by facilitating reuse and repair and by banning the use of disposable dishes at public events, finding solutions and initiating cooperation for using residual heat and residues. In addition, there are facilitating impacts from the municipalities of Tallinn and Tartu on new circular economy projects and initiatives.

The Council of Sustainable Development of Tartumaa ("Tartumaa Säästva arengu kogu") is creating a regional roadmap by 2024. The idea of the circular economy roadmap is to enable the creation of new business models and companies in the region and to keep the ecological footprint of production and consumption as small as possible. With priority areas: co-creation and communities, renewable energy, sustainable food system, transport and mobility, industry and service. In addition the Council is working on improving repair shops business models to become profitable and creating a community platform for mapping of different sustainable development projects that are in progress by different parties within the municipality, to find synergies and to improve cooperation.

The residual heat from cooling the printing press of the printing house Kroonpress is directed to the Tartu district heating network.

Tartu has received funding from the Environmental Investment Centre for a circular economy project that includes circular renovation and construction material information digital bank for circular usage. In addition, the city of Tartu plans to install bicycle pavilions made of construction material leftovers from renovation of public space (Environmental Investment Centre, 2022).

Tallinn and Tartu have a joint project for biowaste platform, which is originally created and already used in Finland. Tallinn is the front runner in banning the use of disposable dishes at public events, which will become nationally mandatory from 2024.

Tallinn is planning to draft a circular economy action plan by the end of 2023 which will be based on the OECD report "The Circular Economy in Tallinn, Estonia".

Tallinn is actively creating circular economy houses and centres in all parts of Tallinn. Creation of a network of circular economy centres is also partially financed by the Environmental Investment Centre. Tallinn has a project for turning traditional waste stations into circular economy centres with repair shops, giving citizens the possibility to reuse and repair their products that otherwise would become waste. They also have facilities for reusing construction waste and metal waste.

The municipality of Harku has 11 waste houses in different places across the municipality to make sorting waste by type more convenient and a reuse centre at the waste station. There are also multiple textile waste collection points across Harku municipality. Municipality of Harku is progressive in road construction by reusing the excavated soil material in construction.

Considering the elaboration of circular economy roadmaps and various initiatives and projects that facilitate circular transition, the cities of Tallinn and Tartu could be considered front-runners of the circular economy in Estonia. In the future, their knowledge and competence should further other municipalities to promote the circular economy as well.

# CONCLUSIONS

Circular economy is seen as a possible solution to the increasing demand of resources and depletion of the environment. Circular economy aims to design out waste and keep raw material in use as long as possible. As the material extraction and use is rising every year, to make a transition there needs to be a change in the way the materials are currently used.

On the European Union level the Circular Economy Action Plan is in focus and the results are expected from all member states. Finland and the Netherlands are one of front runners in the European Union countries with national programmes for circular economy. Estonia has created a national Circular Economy Action Plan with goals and activities until 2029. Circular Economy is mentioned in Estonia's national strategy, but the holistic approach and national strategy for Circular Economy is lacking.

Local governments have a substantial role in enhancing the circular economy. Even though the state has the highest role by creating a holistic approach and cross-sectoral strategy with supportive regulatory and financial framework, the local governments are the implementing force by raising local awareness and cooperation. Cooperation across the private and public sectors is essential for effective transition. *C*ollaboration can be best established at a regional and urban scale, as local and regional authorities can play a very important role in launching new market interactions. The other essential elements of circular economy policy are innovation, circular design, valuing resources and enabling circular economy solutions by regulations.

Local governments can enhance the circular economy by having a local strategy (which is ideally based on the national one) and defining roles and raising awareness accordingly. Local municipalities can facilitate the transition by increasing cooperation and collaboration and engaging stakeholders and can enable it by efficient regulations and support.

Among the local governments the cities especially could be positioned as the driving force towards the circular transition due to the high concentration of resources, capital, knowledge and data in approximate areas enabling smoother reverse logistics and material collection cycles and also sharing and reuse models.

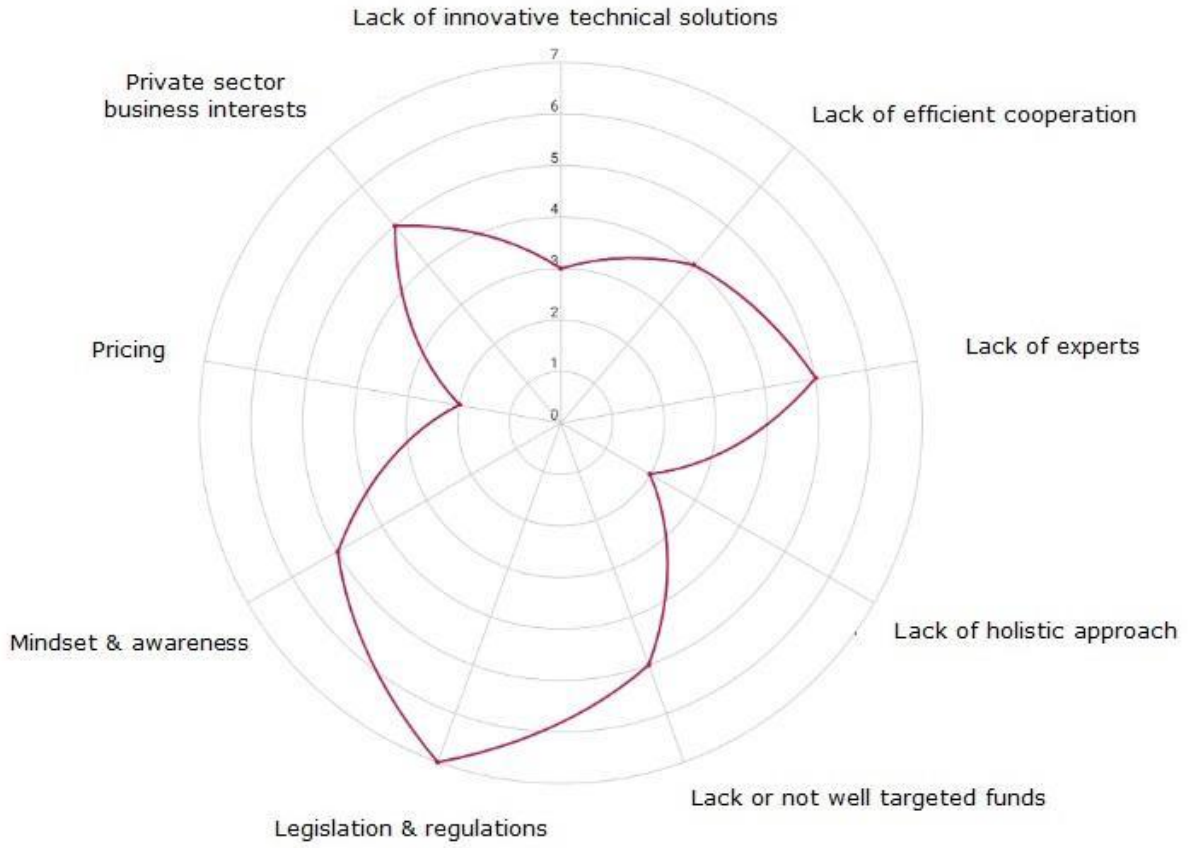


Figure 7. Barriers for circular economy according to interviews and studies
Scale 0…7, where 0 not relevant, 7 the most restrictive.

Even though a circular economy would reduce the pressure on raw material extraction there are many barriers to overcome to make the transition. The main barriers that were highlighted by the interviewed circular economy experts are visualised again on figure 7 with the amplification and input from the barriers that have been evaluated in other studies in Estonia and by OECD. In addition to the barriers mentioned by the experts, the lack of innovative technical solutions have been found as a barrier for implementing circular economy models.

It is evident that if circular economy solutions are not regulated by law then the implementation level is low. There is a lack of holistic view, supportive regulatory framework and coherent financial support in Estonia. Creation of national strategy or roadmap is essential, but the goals should be realistic with measurable targets not only visionary. Regulations should support the goals and be coherent across levels of government then the local municipalities can implement the strategy.

Obligations by regulations are considered as one main facilitator for circularity activities, if something is made mandatory it is obliged to happen. On the other hand, as for the companies the main force for action is economical benefit then raising awareness about the incentives of circular economy and providing financial and technical support is essential. Enabling better cooperation between companies and knowledge sharing is important as well. This is where the local municipalities can make a significant contribution.

Local governments should be more proactive and strengthen networking with local businesses across the value chain. Currently circular economy actions in local municipalities are mainly based on organising waste management, improving waste sorting rate, reducing waste and finding more effective solutions to reuse and repair. There is a lack of wider networking across the circular value chain, but there is a shortage of specialists for any additional activities besides essential waste management and issuance of permits, especially in small municipalities. The solution would be cooperation of environmental specialists across municipalities, which is already operating in some regions, for example in Harjumaa. Another suggestion is the creation of competence centres that could have either national and / or local support, but would operate regionally and according to local needs. These centres could consolidate the technical and financial know-how and help with information sharing, organising and as well procurement if needed. The cities of Tallinn and Tartu could take the lead here by becoming the driving force and role model for circularity transition by positioning themselves the core for competence in the North of and in the South of Estonia respectively.

Well targeted financial measures are important for facilitating new circular economy projects and for enhancing existing processes. Current support mechanisms are scattered among different providers with different rules and processes for applying. It would be more efficient if provision of support or at least related information would be concentrated in one place.

Digital technologies, such as the Industrial Internet of Things, big data and data analytics are key elements towards the circularity transition, especially in the manufacturing industry sector. Estonia is the European Union leader in terms of digital public services and it is among the top European Union countries for digital skills. Local governments could for example initiate and lead projects for secondary resource platforms that would enable better information sharing and cooperation between companies. There are also many examples of construction and demolition waste sharing and selling digital platforms from Europe that could be implemented at our country level.

It is suggested that for supporting higher rates of sorted waste, which is required by the European Union and also facilitates recycling, the price for mixed waste should be significantly higher. Waste carriers could also have an obligation and possibility to fine for wrongly collected and thrown away waste.

Circular economy is often seen as a synonym for recycling, but well designed products can reduce the waste generation in the first place, which is why circular design or eco-design is one key element for circularity transition. Regulations should facilitate circular products and product design for minimising different package layers and for encouraging mono packaging to make packages easily recyclable and /or reusable. There could be a tax for composite packaging and a functioning system of producer responsibility. Currently virgin materials are less expensive than secondary products, the damage to the environment is not priced and that inhibits the usage of the latter. The prices for raw materials should reflect the cost and damage to nature and climate.

There are some good examples of circular economy projects in operation or under development in Estonia, but best practices from Europe could also be taken under evaluation and into practice at local or regional scale. Enhancing industrial and/or waste symbiosis could be one field of action where local municipalities can take an organising role. Industrial symbiosis could also include partners from waste management, but mainly possibilities of sharing material, energy and water should be evaluated further. Waste symbiosis could be organised regionally with a holistic approach for sorting, incineration, biogas production and hazardous waste collection and electrical waste further processing. Even the methane from landfills could be reused in production companies or for energy for example.

Public procurement is one tool for local governments to facilitate circularity principles. There are mandatory criteria set nationally, but local municipalities can be more progressive by setting their own additional requirements. A competence centre for public procurement like in the Netherlands would enable an increase in the number of green procurements. There are multiple region based examples from Europe where local authorities enhance circularity by setting according requirements in procurement, either for construction, furniture, waste bins or supply of circular products and services for entrepreneurs among other examples.

For ensuring continuous work on implementing circularity actions and effectiveness for the process, the current situation and results should be constantly monitored and changes implemented according to the results. For example, OECD checklist and scoreboard could be used to evaluate which actions are functioning effectively and which objectives are achieved, what is planned and implemented and what should be planned and applied additionally.

In conclusion, the transition to a circular economy is based on cooperation and change in all levels of the society and sectors. At the individual level, it is important to change the mentality for which raising awareness is essential. To change the business models both will and pressure is needed. The will would again come from awareness and knowledge increasing, the pressure would come from the demands from consumers with the changed mindset and regulations from the government. State support is needed in the form of financial aid and providing relevant know-how. The enhancement of the circular economy needs a holistic cross-sectoral approach which currently is lacking. The local municipalities are awaiting for a national binding strategy to implement the regulations into local activities. There are multiple countries with different approaches and best practices to learn from as well as wellworking initiatives in Estonia that could be developed further and more broadly.

# SUMMARY

The change towards a circular economy is essential for a sustainable future. With the implementation of the principles of circular economy of designing out waste and pollution, keeping materials in use as long as possible and regenerating natural systems, raw material extraction is lowered and waste is eliminated. It is important to change the notion of circular economy being mainly about recycling into a comprehensive understanding about the whole system with its benefits (both environmental, social as well as economical) and the change that is needed for the transition. Hence raising overall awareness and training experts plays a crucial role in enhancing the circular economy.

The transition is led on a global level by the United Nations with setting the Sustainable Development Goals and on the European Union level with the Green Deal and Circular Economy Action Plan and the requirements it sets on the member states. But above all a national holistic view and cross-sectoral approach is needed for the creation of a circular economy strategy that the local municipalities can implement and thereby enhance the circular economy. Local governments have a substantial role in enhancing the circular economy, mainly in the form of raising local awareness and facilitating cooperation across private and public sectors.

Local governments have the ability to embed circular economy principles into urban policy levers such as vision by local strategy, engagement of stakeholders across sectors, urban management including public procurement, economic incentives like financial support and regulation. For effective results, local municipalities should also monitor their progress and implement new activities if there is lack of progress in some categories, for example OECD checklist and scoreboard could be used or a national road map for local municipalities (if one is created).

Denmark, Finland and the Netherlands have created a national strategy (programme, roadmap) to implement actions for circularity transition. In addition there are multiple practices at regional and local scale that have been successfully implemented and enforce the transition. Estonia has actively started facilitating the circular economy since 2017 and has developed the Circular Economy White Paper and Action Plan. Nevertheless, it is perceived that holistic vision and more incentive regulation is still lacking.

To have a profound understanding of the circular economy implementers view on what is the current situation with the circular economy and how to overcome the main barriers, in-depth interviews were conducted with five experts from Europe and Estonia. In the interviews subjects of circular economy roles, barriers, facilitators, creating a strategy, enhancing collaboration, stimulating and regulating and Green Public Procurement were discussed. Both the results of the interviews and the analysis of circular economy related research articles were the basis for final conclusions.

Inadequate regulatory framework which is incoherent across levels of government and lacks a holistic vision is seen as the main barrier to circular transition. Lack of elaborated financial support, circular economy experts and efficient cooperation are also essential obstacles that need to be surpassed. To enhance the transition to circularity and overcome the barriers there are many best practices from the front-runners of the circular economy to learn from. From creation of competence centres, practical toolkits for companies to circular regions and Green Public Procurement projects with successful industrial and waste symbiosis practices in between. In Estonia, the front-runner cities Tallinn and Tartu could be the core of competence centres to centralise and share available knowledge and best practises and facilitate collaboration across municipalities of North and South of Estonia.

Further analysis could be conducted about elaborating financial aid measures that are feasible and well targeted and facilitate knowledge exchange and purchase of innovative technical solutions as well as the possibilities of creating competence centres in Estonia.

Transition to a circular economy is a multi-level process with both bottom-up and top-down activities. On a ground level the transition needs a change in mindset and raising overall awareness, on the high level the change requires strictly defined obligations and roles through a comprehensive legislation. Local municipalities are the implementing force in between, with the ability to enforce facilitating local regulations, implement and promote best practices from front-runners and enhance collaboration between public and private sector and stakeholders.

# KOKKUVÕTE

Üleminek ringmajandusele on jätkusuutliku tuleviku jaoks hädavajalik. Ringmajanduse põhimõtete, nagu jäätmete ja saaste välja disainimine, materjalide võimalikult kaua ringluses hoidmine ja looduslike süsteemide taastamine, rakendamisega saab vähendada ressursside kasutamist ja jäätmete teket. Tähtis on muuta arusaama, et ringmajandus seisneb peamiselt jäätmekäitluse edendamises. Oluline on terviklik arusaam kogu ringmajanduse süsteemist koos selle eelistega (nii keskkonnaalaste, sotsiaalsete kui ka majanduslike) ja üleminekuks vajalikest muutustest. Seega on teadlikkuse tõstmisel ja ekspertide koolitamisel ringmajanduse edendamisel ülitähtis roll.

Jätkusuutlike muutusi juhib globaalsel tasandil säästva arengu eesmärkide seadmisega ÜRO ning Euroopa Liidu tasandil Euroopa Komisjon roheeppe ja ringmajanduse tegevuskava loomisega ning nende kaudu liikmesriikidele esitatavate nõuetega. Ringmajanduse strateegia loomiseks, mida kohalikud omavalitsused saaksid rakendada ja seeläbi ringmajandust edendada, on aga eelkõige vaja riiklikku terviklikku vaadet ja valdkonnaülest lähenemist. Kohalikel omavalitsustel on oluline roll ringmajanduse edendamisel, peamiselt kohalikul tasandil teadlikkuse tõstmise ning era- ja avaliku sektori koostöö suurendamise näol.

Omavalitsustel on võimalik juurutada ringmajanduse põhimõtteid kohaliku poliitika hoobade kaudu, nagu visioon läbi kohaliku strateegia, sidusrühmade kaasamine eri sektorite lõikes, linnajuhtimine, sealhulgas keskkonnahoidlike riigihangete kasutamine, majanduslikud stiimulid nagu rahaline toetus. Tõhusate tulemuste saavutamiseks peaksid kohalikud omavalitsused jälgima ka oma edusamme ja rakendama uusi tegevusi kui mõnes kategoorias on edusammud puudulikud. Näiteks võiks kasutada OECD kontrollnimekirja ja tulemustabelit või kohalike omavalitsuste riiklikku tegevuskava (kui see luuakse).

Taani, Soome ja Holland on loonud riikliku strateegia (programmi, tegevuskava), et rakendada meetmeid ringmajandusele üleminekuks. Lisaks on mitmeid piirkondlikke ja kohaliku tasandi projekte, mida on Euroopas edukalt rakendatud ja mis soodustavad ringmajandusele üleminekut. Eesti on alates 2017. aastast aktiivselt ringmajanduse temaatikat edendanud, välja on töötatud ringmajanduse valge raamat ja tegevuskava. Sellegipoolest leitakse, et terviklik visioon ja siduvad ning ringmajandust soodustavad regulatsioonid on veel puudulikud.

Mõstmaks ringmajanduse ekspertide nägemust ringmajanduse hetkeolukorrast ja peamiste takistuste ületamise viisidest, viidi läbi süvaintervjuud viie ringmajanduse eksperdiga Euroopast ja Eestist. Intervjuudes käsitleti ringmajanduse rollide, barjääride, soodustajate, strateegia loomise, koostöö tõhustamise, stimuleerimise ja reguleerimise ning keskkonnahoidlike riigihangete teemasid. Lõplike järelduste tegemise aluseks olid nii intervjuude tulemused kui ka ringmajanduse teemalise kirjanduse ja avalike andmete analüüs.

Ringmajandusele ülemineku peamiseks takistuseks leiti olevat ebapiisav reguleeriv seadusraamistik, mis on eri valitsustasandite vahel ebaühtlane ja millel puudub terviklik lähenemine. Läbimõeldud toetusmeetmete ja ringmajanduse ekspertide vähesus ning tõhusa koostöö puudumine on samuti olulised takistused, mis tuleb ületada. Ringmajandusele ülemineku kiirendamiseks ja takistuste ületamiseks on eesrindlikelt ringmajanduse edendajatelt mitmeid praktikaid millest õppida: alates kompetentsikeskuste ja ettevõtetele praktiliste ringmajanduse juhendite loomisest kuni ringsete linna- ja rohehangeteprojektideni, mille vahele jäävad veel edukad tööstus- ja jäätmekäitluse sümbioosid. Eestis võiksid Tallinn ja Tartu olla kompetentsikeskuste tuumikuks, mis koondaks ja jagaks olemasolevaid teadmisi ja parimaid praktikaid ning soodustaks koostööd Põhja- ja Lõuna-Eesti omavalitsuste vahel.

Täiendavalt võiks analüüsida toetusmeetmete väljatöötamist, mis on kergesti kättesaadavad ja läbimõeldult sihitud nii, et hõlbustavad ekspertteadmiste jagamist ja uuenduslike tehniliste lahenduste soetamist, samuti kompetentsikeskuste loomise võimalusi Eestis.

Ringmajandusele üleminek on mitmetasandiline protsess, mis hõlmab nii alt-üles kui ka ülalt-alla tegevusi. Alumisel tasandil vajab üleminek mõtteviisi muutust ja üldise teadlikkuse tõstmist, kõrgemal tasandil nõuab muutus rangelt määratud kohustusi ja rolle kõikehõlmava seadusandluse kaudu. Kohalikud omavalitsused on nende tasandite vahele jääv rakendav jõud, millel on võimalus ellu viia ringmajandust soodustavaid kohalikke regulatsioone, alustada ja edendada edumeelseid projekte ning tõhustada koostööd avaliku ja erasektori ning sidusrühmade vahel.

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# APPENDICES

## Appendix 1. List of interviewed circular economy experts

| Date of interview | Name | Place of work | Position |
|---|---|---|---|
| 07.04.2023 | Martijn Tak | The Ministry of Infrastructure and Water Management of the Netherlands | Project Lead for The Netherlands National Programme for Circular Economy |
| 11.04.2023 | Jaanus Tamm | Municipality of Tartu Urban Economy department | Project Manager |
| 13.04.2023 | Tomas Hemmer Hansen | Danish LIFE project Circular Economy Beyond Waste | Project Lead |
| 18.04.2023 | Ergo Eesmaa | Municipality of Harku Development and Administration department | Head of Department |
| 20.04.2023 | Lüüli Junti | Municipality of Tallinn Tallinn Strategic Management Office Circular Economy department | Head of Department |

## Appendix 2. Questions for the experts interviews

1. Your role and experience in enhancing the circular economy / Current situation and planned activities for the circular economy in Your Municipality?
2. What are/have been the main (legal and systemic) barriers and main facilitators for circular transition?
3. Who has the biggest role in enhancing the circular economy - the state, local municipalities, enterprises etc? What is that role (regulative, organisational, guiding, training etc)?
4. What should be the main focus points /first steps for local municipalities when starting with the circular economy action plan/strategy/framework? Can it be a municipality based plan or should it be a joint plan with other municipalities and/or the State?
5. What could be realistic goals and timelines?
6. How to increase and facilitate collaboration between stakeholders on a local municipality level? How to get everyone on board? / Existing platforms and collaboration networks?
7. Which works better as a driving force for acceleration of circular economy business models, either stronger regulations or supporting mechanisms? Or should it be a combination of both? Examples. Should the circular economy supporting regulations (for example in waste management) be national or local government based?
8. Green Public Procurement - tips and takeaways for Green Public Procurement. For example, easily and/or commonly applicable product and/or service categories / Which criterias are used in Your Municipality?