Waste Prevention in Danish Municipalities

By Emily Rose
Lloyd Krasuski

AALBORG UNIVERSITY COPENHAGEN

Aalborg University Copenhagen

Project title Waste Prevention in Danish Municipalities

Education Sustainable Cities

Semester 4th semester

Theme Master's Thesis

Time period November 2023 – March 2024

Hand-in date 8. March 2024

Supervisors Arne Remmen

Stig Hirsbak

Group member Emily Rose Lloyd Krasuski   20184717

Word count 18.821

Page count 75

Appendices 12

Abstract   A growing consumption of products and materials has led to an increased volume and amount of waste. For this reason, the aim for policy makers for many years has been to ensure that waste is managed in the most sustainable way possible. In Denmark, policy has had a main focus on fraction sorting, recycling, and improving the conditions for recycling instead of focusing on prevention.

In this thesis I map the waste prevention initiatives and activities that are currently active on a municipal level in Denmark. This is done with the use of desk research, the climate action map formulated by DN, Gate 21 and AAU, and with the support of interviews with municipalities in the Capital Region of Denmark. From an MLP perspective I analyze the current regime and landscape surrounding waste management practices and waste prevention. Using the terms slowing, closing, and narrowing from circular economy theory, I find that while Denmark's efforts should be reprioritized higher up in the waste hierarchy, their efforts regarding circular economy are theoretically on the right track. Based on this, I suggest three possible ways to improve the capacity for waste prevention in EU policy. Lastly, I conclude that although Danish municipalities cannot directly influence the international policy that makes up the framework for the national policy they work within, they can provide invaluable knowledge about local systems and capacity and as well as about where efforts should be focused to provide solutions for the most pressing problems.

Acknowledgements

Summary

This master's thesis explores the concept of sustainable cities with a focus on waste management or more specifically waste prevention. With society's growing rates of consumption and subsequent increasing volumes of waste, waste prevention should be the main focus in policy and legislation pertaining to waste management. Against this background, I posed the following research question:

What are the niche innovations for waste prevention in Danish municipalities, and how are they able to change the landscape and regime of waste production and management?

To answer this question, I mapped municipal niche innovations and initiatives currently active or in the pipeline in Denmark. I interviewed four municipalities in the Capitol Region of Denmark, as well as the waste and energy company Vestforbrænding. In these interviews, I expanded on the knowledge I had already gained through study of the climate action map and additional desk research. My research revealed barriers and hindrances to the municipal activities within waste prevention, and I gained knowledge on current projects and collaborations between the municipalities. This resulted in a table showing a number of initiatives focusing on addressing the knowledge gap about waste prevention among consumers as well as initiatives focusing on promoting reuse and secondhand shopping.

Furthermore, I analyzed and mapped the socio-technological regime and landscape of waste management in Denmark, which is focuses primarily on recycling despite repeated statements in action plants about the importance of a circular economy and preventing waste production. Here, my research revealed that waste management legislation and policy in Denmark are vague and messy, characterized by disjointed and unorganized implementation. Additionally, the current active legislation from both the Danish government and the EU prioritize recycling and do not expand on how to go about ensuring waste prevention in a broader sense. From here, I spotlighted the windows of opportunity created by a resource crisis and the increase in knowledge readily available and easily communicated through advertisements and social media. Although a clear path and policy on waste prevention may be lacking, consumer behavior and the market are starting to show signs of change, including the advent of a growing number of secondhand shopping platforms.

With the waste hierarchy serving as the basis for waste management, another evolved from my research: If circular economy is the goal, is the waste hierarchy in its

current state the optimal foundation for national and European policy regarding waste management?

This led me to discuss three possible solutions: a modified waste hierarchy, modifications to the extended producer responsibility schemes (PRS), and the establishment of a legal framework for products. With the rapid development in EU legislation governing waste management and circular economy, it is clear that in coming years, the EPR schemes will be expanded and tightened to force producers to implement changes to ensure that the products they put on the market are sustainable and designed in a way that the life time of the products can be prolonged, and they can be disposed of in a sustainable manner. Additionally, the need for a legal framework for products will be met in part with the upcoming Eco-design regulation, focusing on transparency and availability of information about the product for the consumer.

My examination of the reevaluation of the current EPR scheme and the upcoming Eco-design directive call attention to another important cornerstone of waste management legislation that could also do with an update. The waste hierarchy in the EU's waste framework directive has been effective since 2008, but as times are changing and the focus is shifting to a circular economy centering on repair and reuse, there is a need to define new roles for the current actors.

I conclude that the municipalities' ability to enforce waste prevention is limited primarily to reuse and communication. But since even more change is desired, it would be prudent to reevaluate the legislation regarding waste management with a central focus on waste prevention and circular economy.

Table of Contents

1 Introduction

With a growing consumption of materials comes a growing amount of waste. Denmark has the highest waste production per capita of ay country in Europe (DN, 2023). Hence, it is only reasonable that stakeholders in the waste sector in Denmark should be working hard to prevent the production of waste and ensure that waste management is at the most sustainable level. With Denmark also being at the forefront of waste recycling (OECD, 2019), it raises the question is it enough? Denmark's work with waste prevention is all but non-existent, despite the creation of a national strategy for waste prevention in 2015 (Miljøministeriet, 2015). Recycling has been at the center of Danish waste management since the implementation of the national resource plan, Denmark Without Waste in 2013 (Miljøministeriet, 2013), despite several plans and regulations stating the need to move further up in the waste hierarchy. Demark's policy regarding waste management is formulated on the background of legislation set out by the EU, showing that not only is a change to policy necessary at the national level, but also on an international level. With Denmark having the highest waste production in Europe, it stands to reason that the country should seek to influence legislation as much as possible to help prevent this production.

Denmark is far from being the only country lagging behind in the areas of waste prevention and more sustainable waste management practices. To combat this and the additional growing problems of the international climate crisis, the C40 was created.

1.1 C40 cities

C40 is a *"Global network of mayors of the world's leading cities that are united in action to confront the climate crisis."* (C40 Cities, n.d.)

C40 is a partnership across cities, countries, and cultures to unite against the global problem of climate change and all that comes with it. To ensure that membership is due to action rather than checking off a box, membership is not payment based but performance based. This means that only members who work to make a change and achieve results can be a part of the partnership. (C40 Cities, n.d.)

The partnership began in 2005 when representatives from 18 cities agreed to work together to reduce pollution in all its forms and thus created the C20 partnership. Subsequently, another 22 cities were invited to become members in 2006 and in 2007 the total number of members was 36. As of 2023, there were almost 100 member cities. (C40 Cities, n.d.)

Since membership is performance based, the C40 leadership has formulated a standard which cities need to live up to before qualifying as active members. This standard consists of five principles that the city and local government need to follow: Plan, deliver, mainstream, innovate, and lead. (C40 Cities, n.d.) See the text box for the five principles.

> **C40 leadership standards:**
>
> 1. **Plan**. City has adopted a resilient and inclusive climate action plan aligned with the 1.5 °C ambition of the Paris Agreement, and updates it regularly;
>
> 2. **Delive**r. In 2024, city remains on track to deliver on its climate action plan, contributing to increased resilience, equitable outcomes, and halving C40's overall emissions by 2030;
>
> 3. **Mainstream**. City uses the necessary financial, regulatory, and other tools at their disposal to address the climate crisis and mainstreams their equitable climate targets into the most impactful city decision-making processes;
>
> 4. **Innovate**. City innovates and starts taking inclusive and resilient action to address emissions beyond the direct control of the city government, such as those associated with goods and services consumed in their city;
>
> 5. **Lead**. Mayor and City demonstrate global climate leadership and inspire others to act in support of The Paris Agreement.

To help cities create and develop climate action plans (caps) with the necessary level of ambition, C40 created the Deadline 2020 report in 2016.

The Deadline 2020 report presents a pathway to making the Paris Agreement a reality. It outlines how ambitious the C40 cities need to be and which role they should play in the transition necessary to limit temperature rise. The report states that what happens in the four years from 2016 to 2020 *"[...] will determine whether or not the world's megacities[1] can deliver their part of the ambition of the Paris Agreement"* (C40 Cities, 2016, p. 18). Additionally, it also states that if all cities worldwide adopted the setup set forth in the report, it would result in the 40% reduction of emissions necessary to realize the Paris Agreement. (C40 Cities, 2016)

> "**The Paris Agreement** is a legally binding international treaty on climate change" adopted in 2015.
> The overall goal of the agreement is to make sure that the global average temperature is less than 2 °C above pre-industrial levels and if possible, limit the rise in temperature to 1.5 °C above pre-industrial levels. (UN, n.d.)

---

[1] A megacity has a population of at least 5-10 million people. (Ferreira, et al., 2021)

Following the Deadline 2020 report the C40 Climate Action Planning Framework (CAPF) was published in 2020. It is *"an extensive programme of support to help cities align their cap with the objectives of the Paris Agreement"* (C40 Cities, 2020, p. 3). This framework rests on the three pillars visualized in figure 1.

To start at the top, **Commitment and Collaboration** covers governance and coordination of the plans. This includes how it interacts with national policy as well as the local community and businesses, through the developmental and implementation phase of the plan. (C40 Cities, 2020)

Challenges and Opportunities look at the current state of the city, including the evidence baseline for emissions as well as the desired trajectory for 2050. (C40 Cities, 2020)

Acceleration and Implementation sets out the plan for transformation and implementation, hereunder prioritization for actions, methods of monitoring, evaluation, reporting, and last but not least revision of the plans. (C40 Cities, 2020)

Figure 1: The three pillars of the climate action planning framework (C40 Cities, 2020)

This framework can be used in any way the city wishes. It can be used at the beginning of the planning process during a strategic appraisal of the plan or later in the process to review draft plans to decide whether the plan meets the criteria and is ambitious enough. (C40 Cities, 2020)

1.2 DK2020

The DK2020 project began in 2019 based on the C40 report Deadline 2020 released in 2016 by Realdania, with the support of KL (Local Government Denmark), CONCITO and C40 Cities. (Realdania, n.d.) The project provides counseling and professional sparring for municipalities, to develop local caps. The caps are developed under a modified version of C40's CAPF. This project marks the first time that this framework has been used for caps in smaller cities and municipalities. (CONCITO, n.d.)

When the municipalities apply to participate in DK2020, they sign a letter committing them to developing and fostering political processing of a cap which lives up to the 2015 Paris Agreement. (CONCITO, n.d.) The project uses its resources to help municipalities ensure they meet international best practices within climate planning.

The project was finalized at the end of 2023. Subsequently, KL, Realdania and the five Danish regions have entered a five-year partnership called Klimaalliancen. (KL, 2023)

> **Klimaalliancen** is an alliance between the Danish municipalities and regions that works with transverse development and demonstration projects, also called climate development tracks, where municipalities, regions etc. explore and develop ambitious solutions for concrete problems.
> The alliance seeks to implement municipalities' caps within a common framework, which optimizes actions across municipalities and regions and documents the effects of the actions.
> "*Klimaalliancen supports the work with evaluating and reworking the climate action plans.*"
> (translated 06.11.2023) (KL, 2023)

This alliance will take over and continue the work from the DK2020 project and help the municipalities reach net-zero by 2050. Furthermore, it will aid in identifying which actions can be taken to ensure that the municipalities are robust enough to withstand climate change. (KL, 2023)

1.3 Climate action map

In preparation for the conclusion of the DK2020 project, Gate21[2], The Danish society for Nature Conservation (DN), and Aalborg University (AAU) have pooled their resources to create a map visualizing all the Danish municipalities. The map shows the municipalities grouped into 4 categories of climate planning. (DN, n.d.)

Each municipality on the map links to a page which sums up the given municipality's goals, ambitions, and actions in their waste management plan and DK2020 plan. The intended

> **Category 1:**
> The municipality does not have concrete initiatives in their waste management plan or DK2020-plan about waste prevention and preparation for re-use that reach beyond the requirements set forth by the national waste directive.
> **Category 2:**
> The municipality has concrete initiatives in their waste management plan or DK2020-plan about waste prevention and preparation for re-use that reach beyond the requirements set forth by the national waste directive. The municipality has not updated their waste management plan after 2019.
> **Category 3:**
> The municipality has concrete initiatives in their waste management plan or DK2020-plan about waste prevention and preparation for re-use that reach beyond the requirements set forth by the national waste directive. The municipality has updated their waste management plan after 2019.
> **Category 4:**
> The municipality has concrete initiatives in their waste management plan or DK2020-plan about waste prevention and preparation for re-use that reach beyond the requirements set forth by the national waste directive. The municipality has updated their waste management plan after 2019. The waste management plan or DK2020-plan contains concrete quantitative goals for waste reduction and/or re-use.
> (translated 10.11.2023) (DN, n.d.)

---

[2] Gate21 is a partnership for municipalities, regions, companies, and knowledge institutions who will work together to ensure climate action. (Gate21, n.d.)

goal of this map is to serve as a tool for the Danish municipalities to find inspiration in each other's work and to foster more collaboration across municipalities as well as to start conversations, both professionally and personally, about waste prevention and re-use. (DN, n.d.)

The main focus of the mapping, which has led to the creation of the climate action map, has been to identify actions related to waste prevention as this is the highest tier of the waste hierarchy. Waste prevention has previously not been a part of the municipal caps. (DN, n.d.)

> *"Some municipalities do not even mention it and others reason that the national waste directive of the statutory order on waste does not impose on the work with preventative actions in the municipalities, and these actions cannot be financed by the waste fees either." (translated 6.11.2023)* (DN, n.d.)

These actions cannot be financed by waste fees (taxes), and this fact means that the work of waste prevention falls outside of the normal work with waste management the municipalities are able to conduct. Additionally, the municipalities' ability to work with waste prevention is limited, unless the politicians in the municipality have made it a priority and allocated funding to it. (Ranfelt, 2024)

1.4 Waste prevention

Waste prevention is the top tier in the waste hierarchy created by the EU in 2008 (European Commission, n.d.). As seen in figure 2, the waste hierarchy has five tiers.

Figure 2: Waste hierarchy. (European Commission, n.d.)

This model serves to visualize the priority order of waste management. Preventing waste is at the top, as has the greatest impact on minimizing the strain on resources, whereas preparation for re-use is right below as this is the next best solution. From there, the impact on resources for processing and reworking of the waste becomes greater further down the hierarchy, with disposal being at the bottom as this includes landfills. (European Commission, n.d.)

There are also levels of the hierarchy which are easier to work within with the current setup of the Danish waste management system. There has been a long tradition of incinerating waste for heat and power production in Denmark, which the government is working to change by putting a limit on the capacity of the incineration plants (Energistyrelsen, n.d.). Additionally, the government has implemented fraction sorting to enhance the system within the recycling tier. Here waste is sorted into 10 fractions by households and other waste producing entities and is further processed and redistributed for recycling (Miljøministeriet, n.d.). What is new is working more within the top two tiers. The work with waste prevention has been lacking previously as the majority of the efforts in that area is required by citizens. A knowledge gap is seen here between professionals educated within the field and private citizens, therefore, there may be a lack of ability and willingness among the citizens and municipality workers to work together within these tiers in an optimal way.

Until recently, there has not been a political mandate for the local governments to work with waste prevention, and there is still no direct political mandate in Denmark. (DN, n.d.) Additionally, the national Statutory Order on Waste does not define prevention as it does the rest of the tiers in the hierarchy. It also includes a different waste hierarchy than the one shown above created by the EU. As seen in Section 4 of the Statutory Order on Waste, it only includes preparation for re-use, recycling, recovery, and disposal (Miljøministeriet, 2021). The national circular economy action plan does not mention prevention directly either. It mentions preventative measures like banning take-away packaging and single-use plastic, however even in their visualization of the circular value chain it only shows design and production → consumption and use → recycling (Miljøministeriet, 2020). There is no mention of re-use, second-hand or prevention in this value chain, despite these areas being key aspects of the original idea of circular economy (Ellen Macarthur Foundation , n.d.).

Partnerships and organizations like C40, Gate21, Klimaalliancen, and DN have the ability, along with the support and cooperation of knowledge institutions, think tanks and the like, to foster the development of actions to help municipalities, and citizens

work together to find new ways and solutions for the prevention and preparation for re-use tiers.

Even though organizations and partnerships like these can make a difference, their work is made more difficult by the lack of resources and prioritization of the area. The climate action map is a prime example. The map was created as a tool to share the knowledge of work within waste prevention to help municipalities create ways of working within this new area. And yet, for this tool to work, it requires a thorough introduction and interdepartmental thinking and collaboration to avoid a silo effect. With the completion of the project, it was, however, only possible to introduce the map to the municipal waste partnership and Dakofa. Additionally, it has been difficult to attract the attention of the media when making updates to the map, despite their best efforts. (Ranfelt, 2024) The result has thus been that municipalities either have no knowledge of the maps existence or have no knowledge of how it can be used in their work (Christensen, 2023; Granholm, et al., 2023; Nielsen, 2023; Sehested, 2023)

1.5 Why this field of research?

As mentioned above (see section 1.3 and 1.4) actions and work within waste prevention have previously not been a priority on a national level or even on a local level. The fact that projects like DK2020 and partnerships like C40 and Klimaalliancen are working to help identify preventative actions is creating a vacuum in the work with waste management and waste prevention and minimization. The DK2020 project has a goal that all plans of the participating municipalities should be completed by 2024, which means that they are wrapping up planning at the time of completion of this thesis. However, implementation does not necessarily happen right away. The vacuum between planning and implementation as well as the vacuum between implementation and result provide a perfect opportunity to analyze:

- what actions are being planned;
- how the municipalities seek to implement them;
- how they will change the way waste is managed and processed in Danish municipalities and;
- the influence this will have on how national and international goals are achieved.

It is on this basis that I will seek to answer the following two-part research question:

1.6 Scope

Waste prevention is an important focus to have in all aspects where waste production is possible. The two sectors that dominate waste production in Denmark are construction, with 40% and households, with 28% (Winkler, 2021). With the construction sector responsible for the majority of national waste production, it seems a clear choice to work with this sector. However, projects such as City Loops (Gate21, n.d.), Circular Builders (Gate21, n.d.), and Structural Reuse (Gate21, n.d.) are already working on this area. Additionally, the construction sector cooperation Værdibyg is working to determine why the use of new and more sustainable materials in construction is affected by greater risk, and potential solutions to this problem. (Noldus & Holst-Olesen, 2022)

In this context, I recognize that several municipalities and organizations are working with waste prevention within construction, that many projects already exist, and that progress is already being made. Additionally, several municipalities describe waste prevention initiatives for municipalities as an institution. These make up part of the 14% waste production in the service sector (Winkler, 2021). Because making changes in the municipality as a work place will not have a large impact on the national waste production, I choose to limit the focus of this thesis to waste prevention initiatives that target households and citizens.

2 Project design

Figure 3 visualizes my design for this project. The design shows my use of the methods of desk research, semi-structured interviews, and unstructured interviews (brown squares), as well as how Multi-Level Perspective (MLP) theory (green squares) is used as a theoretical framework throughout the different parts of the project (blue squares).
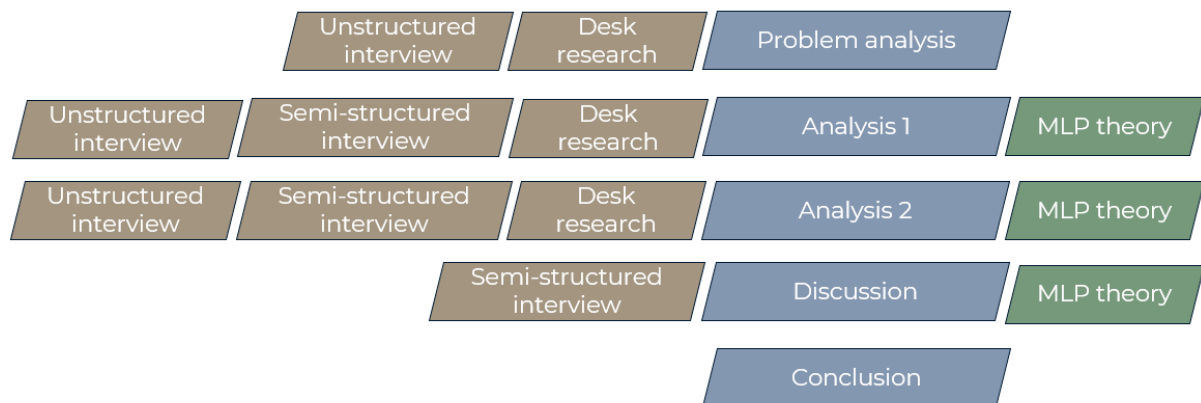

Figure 3: Project design (own creation).

I began with data collection through desk research. I gathered background knowledge on the C40 partnership and the actions that led to the creation of the Danish DK2020 project and the subsequent mapping conducted by DN. From there, I gathered information past on municipal efforts in the area of waste prevention and found it a lacking area. I then posed the following research question, which I seek to answer through further analysis and discussion:

What are the niche initiatives for waste prevention in Danish municipalities, and how are they able to change the landscape and regime of waste production and management?

MLP has provided the framework for my project and thus is part of the entire thesis, both directly and indirectly. Additionally, my knowledge of MLP, transition theory, and circular economy in general provide the point of departure for the work and analysis presented in this thesis.

Continuously throughout this thesis desk research has been used to further elaborate on the knowledge which gained through interviews. I utilize the points of view expressed in the interviews with the Municipalities of Frederiksberg, Albertslund, Gentofte, and Rødovre, supported by the interview with Denmark's largest waste

management and energy company, Vestforbrænding, to build upon the mapping conducted by Gate21 and DN. This revealed niches within waste prevention as well as the current state of waste prevention efforts.

To build on this, I further use my knowledge of MLP theory to clarify the current socio-technical regime within waste management and analyze how the niches interplay with this regime in the window of opportunity to create a new regime.

Furthermore, I clarify the landscape within which the change in waste management is happening and how the niches and regime will influence this.

Lastly, I discuss whether the waste hierarchy is still the best foundation for EU waste management policy, considering the desire to transition to a circular economy. Here, I list three possible solutions or modifications to help support the circular economy in waste management policy.

I conclude this thesis by answering my research question, with the help of MLP, my analysis, and my discussion.

3 Methods

The following sections will describe my use of the methods of desk research, semi-structured interviews, and unstructured interviews. This section will show my deliberations while using the methods and my reasoning for choosing each of these methods.

3.1 Desk research

In the formulation of the problem area and the creation of a preliminary research question, I used desk research. I gathered information about the climate action map as well as the project and organizations connected to it. I used the search engine Google and limited myself to keywords such as: *Climate Action Plan*, *DK2020, The Paris Agreement* and *Klimaalliancen*. Additionally, I researched Gate 21 and DN as the creators of the climate action map, Realdania, CONCITO and KL because they are connected to the DK2020 project and C40 Cities as they created the CAPF, which is the background for the DK 2020 project.

For my research, I focused on sources from the organizations mentioned above, as well as from the European Parliament and the European Commission, to ensure the highest reliability and validity of information. (van Thiel, 2014)

Throughout the process of mapping waste prevention initiatives, I focused on the information given through the climate action map or the plans connected to the individual municipalities. I relied on news articles only when I could not find any other information on the given subject of waste management plans and caps. For instance, I studied local newspapers when researching the new re-use stations in Lyngby-Taarbæk and Herlev municipalities, to get an idea of how far along they are in the building and implementation process. While researching this, I also found the architectural plans for the building and was able to ensure the validity and reliability of what I found in the local newspapers. (van Thiel, 2014)

3.2 Interviews

Initially, I had trouble deciding which municipalities to interview. Ultimately, I utilized the climate action map to gain an overview of the different waste prevention

initiatives referenced in it. After reviewing all of the notes on the map for each munic-
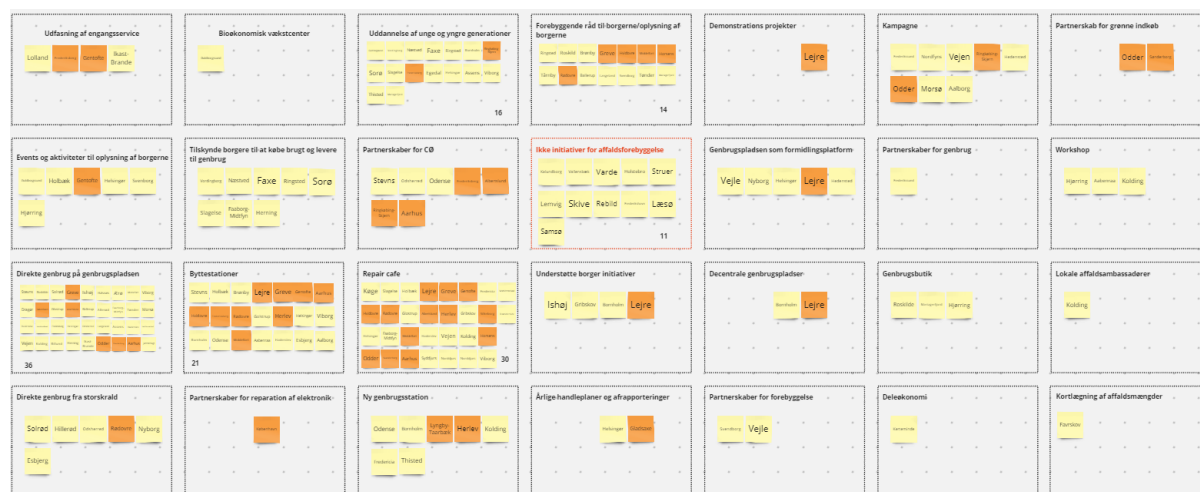ipality, I gathered the data in an affinity diagram[3] as seen on figure 4.

Figure 4: Affinity diagram visualizing waste prevention initiatives and the municipalities that work with them. See appendix A for full-size diagram.

I created categories for the different initiatives to visualize which and how many mu-
nicipalities are working with each of them. To differentiate the category 4 municipali-
ties from the rest, I used orange post-its for category 4 and yellow for the rest.

Very quickly it became clear that there were six dominant categories: Direct re-use at
the re-use stations (direkte genbrug på genbrugspladsen), swap-stations (byttesta-
tioner), repair cafés, education of the younger generation (uddannelse af unge og
yngre generationer), preventative advice/knowledge sharing with citizens (foreby-
ggende råd til borgerne/oplysning af borgerne) and no waste prevention initiatives
(ingen initiativer for affaldsforebyggelse).

My analysis of the DN mapping shows that 11 municipalities are not working with
waste prevention at all, and these are therefore excluded from this study. I then went
on to limit my focus to category 4 municipalities with quantitative goals for waste
prevention, municipalities with initiatives which focus on citizens and their practices
and municipalities with clearly defined initiatives about prevention in their waste
management and climate action plans.

---

[3] An affinity diagram is a tool used to organize larger amounts of data. (Beyer & Holtzblatt,
1997)

This gave me 16 municipalities as seen in figure 5.

Figure 5: Category 4 municipalities working with the six dominant waste prevention categories.

Figure 6: Category 4 municipalities working with the six dominant waste prevention categories, where capital region municipalities are highlighted in green.

From here, I further limited my scope to municipalities in the Capital Region of Denmark for the sake of geographic convenience. This resulted in seven municipalities, as visualized in figure 6. Because of their size and available resources, I chose to exclude Copenhagen Municipality from my interviews. Additionally, they have been a part of the C40 Cities partnership since 2006 (Bahn & Abrahamsen, 2019), which means they have been working for many years on a more ambitious scale than the rest of the Danish municipalities.

I sought to interview the Municipalities of Albertslund, Gentofte, Hvidovre, Herlev, Frederiksberg. and Rødovre. However, this proved to be more challenging than expected due to the time of year (December, right before Christmas break). I was successful in conducting in-person interviews with Hanne Hjetting Nielsen from Gentofte Municipality and Hannah Møller Christensen from Frederiksberg Municipality, as well as an online interview with Jens Granholm, Malte Harhorn, Anders Keldorff and Hans-Henrik Høg from Albertslund Municipality. Herlev and Rødovre Municipalities did not have time for interviews, however Lene Sehested from Rødovre did agree to attempt to answer my questions by email. Even though Herlev Municipality did not have time to participate, they referred me to Kristian Bjerregaard Hansen at

Vestforbrænding[4], as they are working on projects for re-use and waste prevention in collaboration with several municipalities. Lastly, I was unable to establish contact with Hvidovre Municipality despite trying for several weeks.

Even though I only interviewed these category 4 municipalities in the Capital Region, I included the remaining initiatives and municipalities in my mapping and analysis.

Additionally, I also conducted interviews with Mette Hoffgaard Ranfeldt from DN who spear headed the DK2020 mapping in collaboration with Gate21, and Lise Kusk from Nordværk who works with waste management and has knowledge on where prevention efforts should be focused with regards to where citizens produce the most waste.

Table 1, below, shows the final interviewees, their place of work and what type of interview was conducted.

Name	Place of work	Type of interview
Hanne Hjetting Nielsen	Gentofte Municipality	Semi-structured
Jens Granholm, Malte Harhorn, Anders Keldorff, and Hans-Henrik Høg	Albertslund Municipality	Semi-structured
Hannah Møller Christensen	Frederiksberg Municipality	Semi-structured
Lene Sehested	Rødovre Municipality	Email correspondence
Kristian Bjerregaard Hansen	Vestforbrænding	Unstructured
Mette Hoffgaard Ranfelt	The Danish Society for Nature Conservation	Unstructured
Lise Kusk	Nordværk	Unstructured

Table 1: Overview of interviewees

Semi-structured interviews

I chose to conduct semi-structured interviews with the Municipalities of Albertslund, Gentofte, Frederiksberg, and Rødovre to gain a better understanding of how invested the municipalities are in the success of their waste prevention initiatives. Additionally,

---

[4] Vestforbrænding is Denmark's largest waste and energy company. It is owned by 19 Danish municipalities and receives waste from both companies and citizens. (Vestforbrændingen, n.d.)

I desired to learn whether they use the climate action map and if so, how they use it. Lastly, I desired to gather knowledge on whether the municipalities collaborate on initiatives which may have already been implemented in other municipalities and whether they are working with other initiatives that are not mentioned in the waste management and climate action plans.

During the interviews, it was possible to further elaborate on points that strayed from the original questions and discuss other relevant topics, as some of the benefits of working with semi-structured interviews. (Brinkmann, 2014)

The interviews with Gentofte and Frederiksberg were conducted in-person to enable me to get a feel for the municipality as a workplace and ease the flow of the conversation. The interview with Albertslund took place online as this suited them better. I sought to record the interviews, with the plan to listen through them and take notes after the fact with the aim of being more present while conducting the interviews. Unfortunately, the recording failed during the Gentofte interview, so for that interview I made notes from memory. To ensure that these were somewhat correct, I emailed them to Gentofte, so they could approve them. Consequently, this means I will not be including any quotes from my interview with Gentofte Municipality in this thesis, and I will solely rely on my notes when referencing them as a source.

As mentioned earlier, I conducted the interview with Rødovre by email as they did not have time for an in-person or online interview. This means that the interview only reflects the interviewees understanding of the questions asked and there was little opportunity for elaboration or to ask follow-up questions. However, one advantage of the email interview was that Lene Sehested had the opportunity to think about and formulate her answers carefully, which made it possible to use her answers for direct quotes. Furthermore, the email interview required less time for processing than the other in-person and online interviews.

The quotes taken from the interviews with Albertslund and Frederiksberg were transcribed out of context and subsequently sent to the interviewees for approval.

The interviews were conducted in Danish to ensure optimal understanding and flow of conversation with the interviewees. As a result, the quotes used in this thesis have been translated into English. The translations seek to convey meaning in a grammatically correct language, rather than provide a word-for-word translation. To ensure as little as possible becomes lost in translation, the quotes have been checked by a professional Danish-English translator.

The notes and quotes for these interviews can be found in appendix C, D, E, and F.

Unstructured interviews

I chose to conduct the interviews with Vestforbrænding, DN, and Nordværk as unstructured, because their aim was to gather broader knowledge within certain topics.

The main purpose of the interview with Vestforbrænding was to gain knowledge about their project, "Vejen mod 30.000 ton genbrug" (the road to 30,000-tons' re-use) and other efforts within waste prevention, re-use, and waste minimization.

I decided to interview DN to expand my background knowledge about the DK2020 mapping and waste prevention in general. To give me a professional point of view on my analysis, I interviewed Nordværk, specifically Lise Kusk, as she wrote her master's thesis on the waste sector's transition to circular economy with a focus on Northern Jutland (Kusk, 2020)

In contrast to my process with the semi-structured interviews, the unstructured interviews were not recorded, and I took notes in Danish while conducting them. The purpose of these interviews was to gain additional knowledge, not statements which could be used as quotes in my mapping and analysis. Additionally, I did not have any specific questions prepared, only an overall topic for the interview. Thus, I left it up to the interviewee to steer the conversation as is common in unstructured interviews (Brinkmann, 2014).

The interview with Vestforbrænding was used in my mapping and analysis to provide more knowledge about initiatives and work with waste prevention and re-use, while the interview with DN was used in the introductory paragraphs, specifically sections 1.3 and 1.4. The Interview with Nordværk was used to give perspective in my discussion.

The notes for these interviews can be found in appendix G, H, and L.

Coding interviews

After the interviews with Frederiksberg, Gentofte, Albertslund and Rødovre Municipalities, and Vestforbrænding were conducted, I began processing them to obtain an overview of the empirical data gained through them. I began by coding each interview by going through my notes and searching for keywords and topics such as initiatives, DK2020 map, and future work with waste prevention. Additionally, I also marked transcribed quotes from the interviews. In the appendices, the notes and quotes have been marked such that each interviewee has its own color.

After coding my notes, I decided to set up my chosen notes and quotes in a table and make preliminary translations. This was to make it as easy as possible to utilize my notes and quotes in the writing of my analysis. This method of working with interviews allowed me to utilize them in my writing without having to stop the writing process to translate the notes and quotes.

I decided to use the method of an affinity diagram again in this instance, to make it possible to visualize all of my notes and quotes from each of the interviewees all at once. Additionally, it allowed me to make observations about my empirical knowledge at a glance.

Figure 7: Legend for affinity diagram.

Figure 7 shows which interviewee belongs to which color of post-it note in the affinity diagram shown in figure 8.
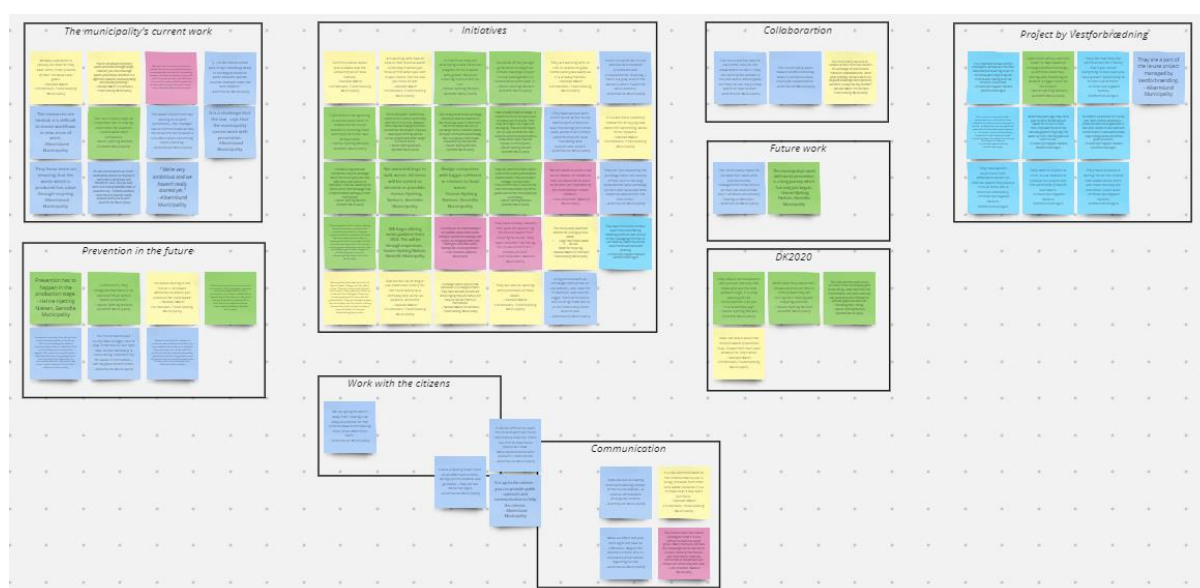
Figure 8: Affinity diagram of notes from interviews (full size can be found in appendix J)

While observing my affinity diagram, it is not surprising to see that the biggest category of notes and quotes is the one labeled initiatives, followed by the category for the municipalities' current work and prevention in the future. There is also a clear overlap between work with the citizens and communication. This stems from the fact that communication regarding waste prevention is primarily directed at citizens. Additionally, the category of project by Vestforbrænding is a stand-alone category. This

contains notes regarding initiatives, collaboration, and prevention in the future. As the project by Vestforbrænding is an initiative in and off itself, it is most logical for the writing purpose to keep the notes regarding this together. If I had conducted more interviews, it would also have been beneficial to create sub-categories within initiatives to illustrate which initiatives the municipalities talked the most about. As I have only the opinions of four municipalities, it would not add any additional value to visualize my notes in that way.

I chose not to code the interview with Mette Hoffgaard Ranfelt from DN since this interview serves solely as background knowledge to further elaborate on the climate action map created in collaboration with Gate 21, see section 1.3 for further information.

4 The multi-level perspective theory

To analyze the waste prevention initiatives in Danish municipalities and what the future might look like if they succeed, I chose to utilize multi-level perspective (MLP) theory.

The MLP approach has been developed to help explain why both flurries of change activity and standstills can be observed in a landscape at a time of transition. MLP is a *"[...] heuristic framework that guides the analyst's attention to relevant questions and issues"* (Geels, 2012, p. 474).

This framework views transitions as *"non-linear processes that result from the interplay of multiple developments at three analytical levels: niche [...], socio-technical regimes [...], and exogenous socio-technical landscapes"* (Geels, 2012, p. 472). It is the notion that change is not created by just one action but comes from a wave of pressure and actions that makes this theory relevant when analyzing the transition of a systematic way of acting and thinking with regard to waste.

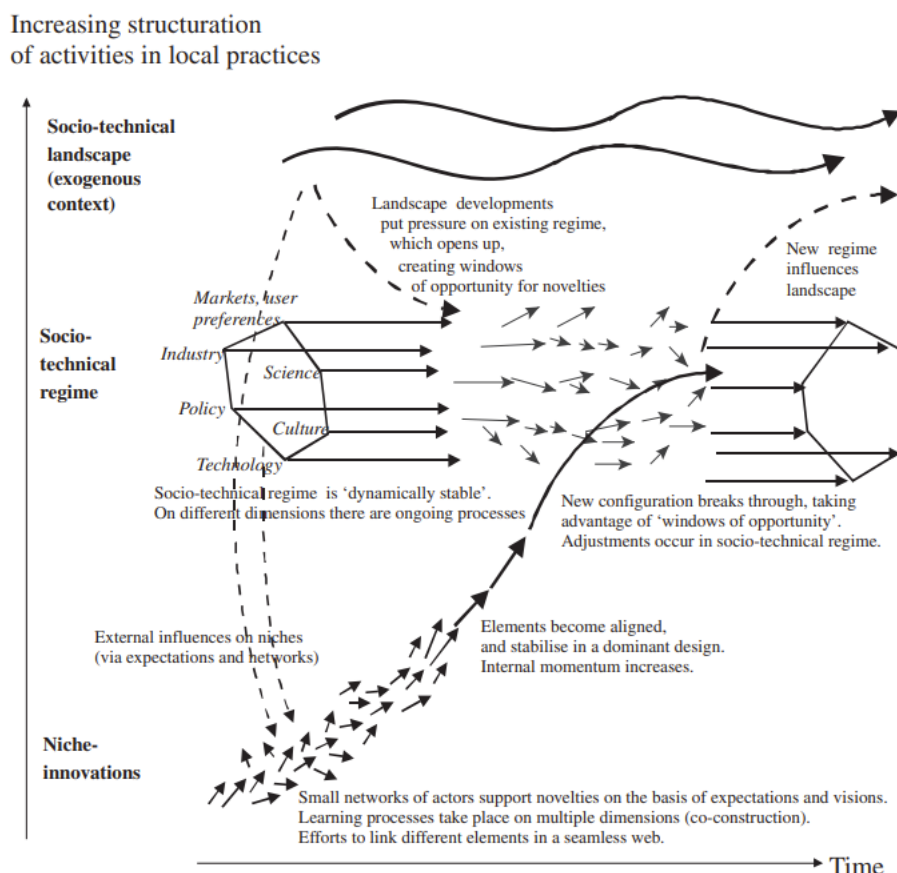Therefore, there are three key parts which interact in a transition as visualized in figure 9.

Figure 9: Multi-level perspective on transitions, from (Geels, 2012)

"[...] transitions come about through the interaction between processes at different levels: niche-innovations build up internal momentum, changes at the landscape level create pressure on the regime, and destabilization of the regime creates windows of opportunity for niche-innovations" (Geels, 2012, p. 473).

4.1 Niche innovations

The niche innovations are in brief terms, novelty approaches developed in protected spaces such as experimental or demonstration projects. These radical innovations are crucial for transitions to happen, as these are what help develop new regimes and change the landscape. (Geels, 2012)

Niches are characterized by learning processes such as market demand, user behavior, adjustment of expectations through guidance and direction, and developing and expanding social networks by enrolling new actors and hereby expanding the resource base. (Kemp, et al., 1998; Hoogma, et al., 2002)

Within waste prevention, niches can be found in the initiatives and activities being developed and tested by the municipalities and their citizens. Specifically, partnerships, such as The Municipalities' Waste Network and the 4k Collaboration along with The Circular Economy Partnership, are characterized as networks that help foster the development of niche innovations. Additionally, the municipalities are learning from the experiences of each other through these partnerships and subsequently adjusting their plans and expectations.

The work with waste prevention initiatives is becoming more broadly accepted in Denmark through the DK2020 project and thus the vision for these initiatives is becoming increasingly precise, and the social network supporting this development is slowly growing and well on its way to creating a potential new regime. (Geels, 2012)

4.2 Socio-technical regime

The socio-technical regime is, in short, *"the alignment of existing technologies, regulations, user patterns, infrastructures, and cultural discourse [...]"* (Geels, 2012, p. 473). Within waste prevention, it is the practice of prioritizing recycling in waste management and planning, the idea that fraction sorting and common sense can minimize

the ever-growing volumes of waste, and the fact that waste prevention actions cannot be funded by waste fees on a municipal level.

This practice is an example of a lock-in mechanism which has kept the regime in place for years. Other mechanisms include political regulation and laws, which point to waste prevention and re-use are the optimal tiers of waste management to work within but fail to elaborate on how to begin working within them. Lock-in mechanisms are the low costs associated with keeping the current system running rather than investing money and resource in new initiatives. And ultimately, a mechanism is that citizens are less likely to make a change if that change varies too much from their usual practice. (Geels, 2012)

"The notion of a regime introduces a structural element in the analysis, by assuming that actor behavior is constrained by rules located at the micro-levels of individual action" (Geels, 2012, p. 473).

4.3 Socio-technical landscape

The socio-technical landscape is *"the wider context which influences niche and regime dynamics"* (Geels, 2012, p. 473). The landscape is the world we see around us, which we seek to influence with niche innovations and regimes. Within waste prevention, the landscape is made up of the increased focus on recycling rather than re-use, fractured and unclear policy on waste management, a lack of political mandate for waste prevention, and a general knowledge gap regarding consumption and waste generation. (Rip & Kemp, 1998)

4.4 Interaction with circular economy

In this thesis, the MLP framework will be combined with the framework of circular economy. As circular economy has many different definitions and descriptions, this thesis will focus on the Ellen Macarthur Foundation's definition:

"The circular economy is a system where materials never become waste and nature is regenerated" (Ellen Macarthur Foundation , n.d.).

This definition will be supported by the circular economy terms defined by Bocken et al. (2016): slowing, closing, and narrowing.

According to Bocken et al. (2016), slowing is extending the product lifespan through design in an effort to slow the flow and use of resources. Meanwhile, closing is halting the flow of resources through recycling and narrowing is the reduction of the resource consumption of product and production processes (Bocken, et al., 2016, p. 310).

Figure 10 illustrates the terms slowing, closing, and narrowing in a regenerative economy.
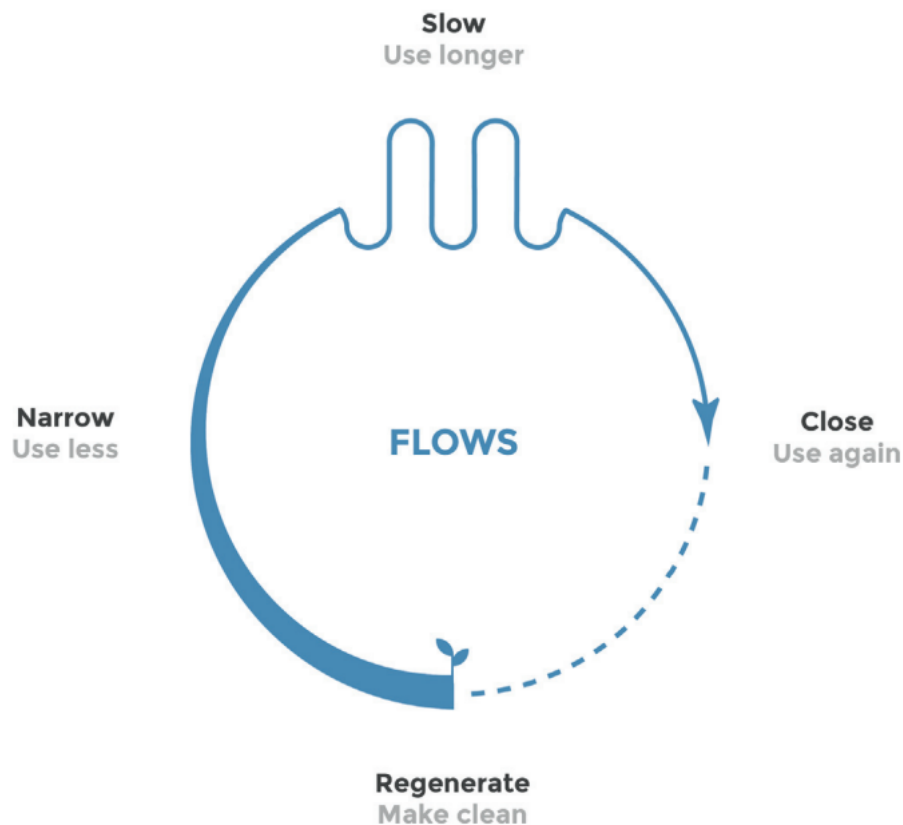
Figure 10: A circular economy: narrow, slow, close, and regenerate (Konietzko, et al., 2020)

With a circular economy being the goal, this figure visualizes the importance of prioritizing all aspects to succeed. As stated in the introduction (see section 1.4), activities within waste prevention and subsequent narrowing of the flow of materials is all but non-existent at the moment. I use the terms slowing, closing, and narrowing to add perspective to my analysis and to clarify the opposing prioritizations of the wish for a circular economy and the use of the waste hierarchy to prioritize waste management efforts. Moreover, my use of circular economy will add perspective and clarity to my use of the MLP framework and increased understanding of the Danish waste management efforts.

4.5 Why MLP?

This theory enables me to look at the potential development resulting from the wave of waste prevention initiatives currently in the works in Danish municipalities. I will use it to further map the niche initiatives within waste prevention and analyze how these impact the window of opportunity and thus create a new regime. I will use my knowledge of the MLP theory to analyze how this new regime will develop and change the landscape and compare it to the future landscape described in national plans.

Figure 11 visualizes an initial impression of how the niche innovations within re-use and waste prevention interplay with the social-technical regime and landscape of waste management.
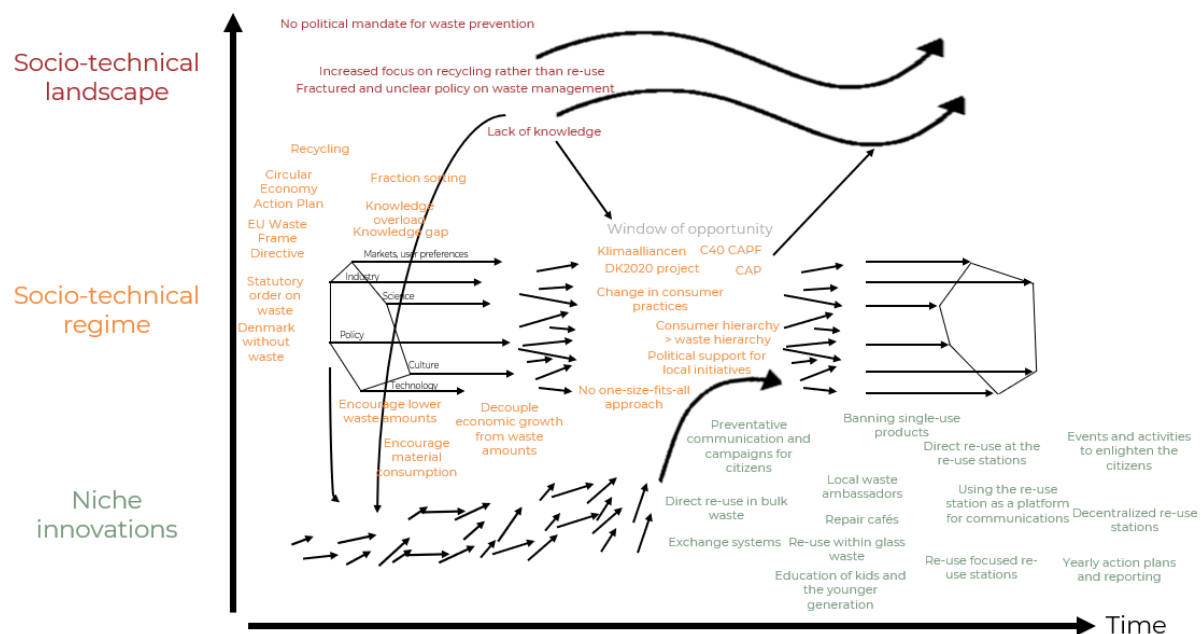
Figure 11: Multi-level perspective on re-use and waste prevention. Own iteration of figure 2 from (Geels, 2012). Full size version can be found in appendix B.

Here we see a window of opportunity being created by a lack of knowledge combined with an increased focus on recycling rather than re-use. Within this window of opportunity a number of things are working to influence the socio-technical landscape supported by the networks and niches. With the work within this window of opportunity, the socio-technical regime will be changed and modified, which in turn will change and modify the socio-technical landscape of waste management and the definition of waste.

I will be using the MLP framework to map the innovations and niche networks within waste prevention and waste minimization on a municipal level. Additionally, I will use my empirical knowledge gained through desk research and interviews to analyze the window of opportunity in the socio-technical regime and how this changes the existing regime. Lastly, I will discuss, based on my mapping, analysis, and additional research, how these changes will influence the socio-technical landscape of waste management, with a focus on the future work with the waste hierarchy.

5. Niche innovations and initiatives

As described previously, niche innovations are novelty approaches (Geels, 2012). They are characterized by learning processes, adjustment of expectations and expansion of social networks (Kemp, et al., 1998; Hoogma, et al., 2002).

In the following, I will elaborate on the current innovations and initiatives described in the climate action map and the municipalities' caps and waste management plans. I will use the interviewed municipalities to clarify what these initiatives can entail and what the municipalities expect the results to be. Lastly, I will summarize my findings in a table showing the initiatives and a short description of them, as well as an overview of which municipalities work with which approaches.

5.1 Citizen-centered initiatives

The following will cover the citizen-centered initiatives. First the category of communication aimed at citizens will be elaborated. Then preventative communication and campaigns for citizens is described. From here events and activities to enlighten the citizens are elaborated upon. Lastly local waste ambassadors will be discussed as a bridge to the next section on educational initiatives.

Communication aimed at citizens

Communication is an essential tool to bridge the knowledge gap between professionals within the field of waste management and citizens. The interviews conducted for this thesis show that the approaches to communication with citizens vary significantly from municipality to municipality. The approaches range from not informing the citizens that changes will be made to the bulk waste collection to include re-use, as it is a mistake that citizens put re-use items in with bulk waste (Christensen, 2023), to wishing that they could require more of an effort from citizens with regard to waste sorting and re-use (Granholm, et al., 2023).

Both Rødovre and Albertslund Municipalities have experienced difficulties when communicating with and to citizens regarding waste and sorting initiatives that require an effort from citizens in the form of changing their practices. (Granholm, et al., 2023)

Albertslund found that when making an effort with signage in 2022, they saw little to no difference in citizens' practices. However, when they took more of an outreach

approach to citizen contact at the re-use station, they achieved a positive and productive atmosphere. However, the problem with this approach is that it requires more resources than they have on a daily basis, and they are not able to keep up this level of communication. (Granholm, et al., 2023)

Lene Sehested from Rødovre Municipality also says:

"Most citizens do not seek out knowledge on the [municipality's] website or printed media by themselves, and information materials distributed to households are often thrown out before they are read." (translated) (Sehested, 2023, p. 12)

This is also the experience of Albertslund Municipality. Sending out too much informational material can make it difficult to reach citizens as there is a limit to how much they are willing to read. (Granholm, et al., 2023)

While these two municipalities have experienced such difficulties, Frederiksberg has chosen a different route: not to send out information to their citizens that when picking up bulk waste there will be an additional category og re-use (Christensen, 2023). This is so as not to make it more difficult for citizens to sort their bulk waste and dispose of re-use items if the household does not have a means of transporting it. That lack of communication is the municipality's way of recognizing that in a city like Frederiksberg, where most of the citizens do not have a car and therefore do not necessarily have a means of transporting items to a central re-use station, there is a limit to how much the municipality can expect of the citizens if they want to reach their re-use and sorting goals. (Christensen, 2023)

Despite communication being a challenge at times, most municipalities have stated in their caps or waste management plans that they will run information campaigns about waste and prevention aimed at citizens.

Preventative communication and campaigns for citizens

This communication is mainly conducted through pamphlets delivered by standard mail to citizens and via the municipality's website (Sehested, 2023). However, campaigns may also be communicated through social media and on posters. Topics of such citizen-centered campaigns include consensual sex (Copenhagen Municipality, 2023), safe driving (Lemvig Municipality, 2023), and motivating participants for climate marches in relation to the 2021 municipal election (Olesen, 2021).

Deciding which information to communicate has been difficult. It is important that the citizens feel the information is directly relevant for them, and as Rødovre

Municipality stated, this can be a challenge at times (Sehested, 2023). Because households currently sort their waste into 10 fractions, Frederiksberg Municipality is in the process of finding ways to increase the quality of sorting in their municipality. They have set the task of working to ensure that residual waste is not the fraction that the citizens think of first when throwing out trash in their homes, but the one they think of last. Initiatives and ideas to this effect, however, have not been explicitly put into words and communicated. (Christensen, 2023)

Frederiksberg Municipality is also sending out communication about textile waste and the impact that consuming virgin textiles has. The aim is to increase the background knowledge of citizens to help them make conscious consumer choices. (Christensen, 2023)

Both Frederiksberg Municipality and Gentofte Municipality state that they either are sending out or will be sending out information regarding food waste and will be implementing campaigns in an effort to the lower the amount of food waste the municipalities produce (Christensen, 2023; Nielsen, 2023).

Events and activities to enlighten the citizens

Events and activities are also common ways to reach citizens and share knowledge. For instance, from September to November 2023, Gentofte Municipality, in collaboration with We Do Democracy, arranged a citizens gathering focusing on the climate and sustainable transition within the municipality. The gathering consisted of 28 citizens representing the demography of the municipality. They met five times, including a public meeting, inviting the municipality's other citizens to hear about their work and progress and asking for input for the final product to be given to the local politicians. (Gentofte Municipality, 2023)

The final product consists of six sustainability recommendations for the municipality. These can be seen in table 2, below.

Bedre viden, bevidsthed og fællesskaber om klima – Better climate knowledge, awareness, and collaboration	Their vision for this goal is to give citizens, workplaces, and associations: concrete knowledge on climate friendly practices, the opportunity to track their climate friendly practices, knowledge about the progress of the transition in Gentofte Municipality, an offer to participate in a yearly local climate summit, and an offer of an online learning program.

Bygning, Energi og Forsyning – Construction, Energy and Supply	Their vision for this goal is a municipality with access to free and safe, non-polluting energy. A municipality that is better at exploiting electricity, heat, rain and drinking water. A municipality that only builds new when renovation is not an option.
Hvordan ændres folks forbrugs mønster? – How do citizens consumer patterns change?	Their vision for this goal is to consume less and subsequently reduce the amount of waste produced. That is, to make it as easy to buy secondhand as it is to buy new and to make it as easy as possible to prolong the lifetime of products. And to open more repair shops.
Handle lokalt og spis efter klimakostrådene – Shop locally and eat according to the sustainable dietary advice	Their vision for this goal is to reduce the climate footprint of food. To make a plant-based diet the norm, resulting in reduced consumption of animal products.
Mobilitet - Mobility	Their vision for this goal is to make it more attractive to use climate-neutral modes of transportation within Gentofte Municipality.
Et Gentofte i fuldt flor – A Gentofte in full bloom	Their vision for this goal for Gentofte Municipality to be a first mover within biodiversity and seize the opportunity to establish more outdoor recreational areas. (Gentofte Municipality, 2023)

Table 2: Gentofte Municipality's six sustainability recommendations

This is an example of an event or an activity designed to give the best chances for a lasting change. It creates ownership and agency among the participating citizens for the sustainable transition within their own municipality. As Hanne Nielsen explained, it is a place where the municipality is only there to listen and take notes. (Nielsen, 2023)

Local waste ambassadors

Citizen-centered events and activities create ownership and agency among the participants and can also create what many municipalities characterize as local waste ambassadors. Waste ambassadors have many definitions among the municipalities, but in short, they are ordinary people that have gained knowledge about waste and sorting through some type of course or learning process and have committed

themselves to communicating their knowledge to their family and peers. (Andersen, 2022; Ugeavisen, 2015)

About 10 years ago, Frederiksberg started employing university students as re-use guides. Primarily, they work at the re-use station where they provide guidance on sorting their waste and ensuring that what is re-useable goes to the re-use area and the rest is placed in the correct recycling containers. They can also be found at the local flee market outside Frederiksberg City Hall, where they initiate a close and direct dialogue about sorting, waste, and various municipal initiatives. In addition, they visit schools and daycare centers to talk and teach about waste and what happens to the waste they throw away. In short, they provide a communicative bridge between the municipality and the citizens. (Christensen, 2023)

Kolding Municipality also has a similar initiative. Through their communications service, Re:lab, they offer two-hour visits to the re-use station. They also visit schools, associations, and workplaces to provide baseline knowledge about waste management, why sorting is important, and what happens to the items and materials that are dropped off at the re-use station (Kolding Municipality, n.d.).

5.2 Educational initiatives

The following section presents a several initiatives pertaining to education of children and youth, followed by a study of how municipalities are or are planning to use the re-use station as a platform for communication.

Education of children and youth

To create lasting change, it is vital to include the younger generation in the necessary changes of the future. In this regard, several different municipalities mention this it in their waste management plans and their caps, including Ringkjøbing-Skjern (2022), Frederiksberg (2021), Sorø (2022), Faxe (2022), and Egedal (2019).

Gentofte Municipality is also working with education of the younger generations, specifically through the project Climate Challenges Now (KlimachallengesNU) in collaboration with Gate 21 (Nielsen, 2023). The purpose of this project was to *"put the climate in an everyday setting and set a frame of reference for climate action, where the students could experiment with changing concrete habits in their everyday lives over a time period"* of two weeks, explains Lea Knudsen in an article about the project (Jørgensen, 2023). Eight other municipalities also participated in the projects:

Odsherred, Næstved, Halsnæs, Greve, Solrød, and Albertslund. Line Bech, program director for Circular Economy at Gate21, also states that it is her impression that several of the participants continued using the teaching materials after the project ended. (Bech, 2024)

Kolding Municipality has also developed an approach to engaging younger generations in the area of sustainability and waste prevention. They have developed an educational online computer game called Aloria where students follow Azra and Alex into their fantastic universe of waste and resources (Kolding Municipality, n.d.). This game has been incorporated into the seventh-grade curriculum in Kolding Municipality to ensure that they have some information about sorting and materials. (Stub, 2024)

When educating kids and youths, it is also important to show them where waste ends up, so they can fully understand what happens to it. This is where re-use stations come into play as a platform for communication and education and not just a place to dispose of and sort larger waste items.

Using the re-use station as a platform for communication
Re-use stations provide good opportunities for encouraging citizens to handle their used items and waste more sustainably (see section 5.3). They also provide a good opportunity to show what happens to the waste and why sorting is important.

Lejre (2023) and Halsnæs (2019), among other municipalities, have started deliberating which steps to take at the re-use stations to create a framework for expanding the re-use stations from a place to drop off waste to a place to learn about waste and different initiatives. Similarly, Rødovre Municipality states: *"We are about to build a new re-use station. In relation to that, we would like to focus on facilities for education of the municipality's school children"* (translated) (Sehested, 2023, p. 13).

5.3 Re-use and product life-prolonging initiatives
The following sections will cover repair cafés, exchange systems, direct re-use of bulk waste, and direct re-use at re-use stations.

Repair cafés
A repair café is an initiative arranged by local volunteers in various cities and municipalities. Most are united under the umbrella of Repair Café Denmark, with the first repair café opening in 2014 (Repair Cafe Denmark, n.d.). The repair café's volunteers

provide guidance and skills to help locals repair their items, to prolong their lifetime. The citizens are expected to provide all the materials necessary for the repair while the volunteers provide tools and know-how. A repair café is a place of education on maintenance of the products and items.

Several municipalities mention their local repair café in their waste management plans and/or caps, including Lejre (2020), Greve (2022), Gentofte (2021), Middelfart (2022), and Aarhus (2021). They touch on providing resources and facilities for the repair cafés and their volunteers, as well as finding ways of communicating about the local repair café as a free alternative for repairing items. (Nielsen, 2023)

Exchange systems

Exchange systems are an easy and inexpensive way to prevent waste. They can be implemented almost anywhere provided that someone is available to be in charge of them.

Gentofte Municipality has book exchanges driven by the library, in several locations in the municipality. They also have an exchange system in place in a daycare center at the special request of parents. It is run by the parents themselves but was set up with support and resources from the municipality. (Nielsen, 2023)

Albertslund Municipality has also received requests for help in setting up exchange systems. Their public housing associations are particularly interested in this type of solution. (Granholm, et al., 2023)x

Generally most municipalities express a willingness to help and provide guidance with setting up exchange systems, even if they cannot spare the resources to run them themselves (Christensen, 2023; Granholm, et al., 2023; Nielsen, 2023). Frederiksberg Municipality has even gone as far as to provide a written setup guide in the waste handbooks they send out to the local housing associations. The guide has been translated in the text box below.

Guide for exchange sheds:

1. Placement: Make sure the area is dry and accessible to everyone who might use it. The area can be close to the wastebins or the bulk waste areas to make it easier for the citizens.

2. Find a responsible party: Find one or more person(s) to be responsible for the area. It will be their job to keep it tidy and remove things that there are no takers for. They will also be responsible for drafting the rules for use of the area to ensure a rotation in items and that the area does not get crowded.

3. Order: Organize the area with shelves and bookcases to help keep order and provide spaces to place objects. Consider also setting up a bulletin board so citizens can post flyers for bigger household items they no longer use.

4. Clarification: Make sure it is clear that it is an exchange area, so the trash collectors do not mistake it for trash or bulk waste. Also, clearly communicate to people that it is free.

5. Information: inform people about the new exchange systems and the applicable rules. Consider setting up a Facebook group so people can post if they have bigger items, a large volume of items, or items of high value they wish to pass on.

Translated January 2024 (Frederiksberg Municipality, 2023)

Direct re-use of bulk waste

With the new national plans for waste management and circular economy, several municipalities are making changes to and modifying their bulk waste collection programs. Gentofte Municipality is still in the process of determining exactly how they can modify their bulk waste collection program to ensure more re-use of the resources. Their first priority, however, is to ensure that all of the items in bulk waste are sorted as detailed as possible. (Nielsen, 2023)

Frederiksberg Municipality, on the other hand, has already taken a big step by dividing their collection of bulk waste into three fractions. They have three different vehicles out at the same time: one to collect items for re-use, another to collect wood for recycling, and a third to collect the rest, also known as large flammable waste. (Christensen, 2023)

Direct re-use at re-use stations

Citizens bring their larger amounts of trash and items they no longer wish to use to re-use stations for recycling; however, more and more municipalities have started setting up areas, sheds, or containers for the items that can be re-used og re-sold. There are signs as well as employees at the re-use station to help and encourage citizens to think about what they are throwing in the recycling containers and whether it would be possible for anyone else to use their items again.

Several municipalities have created secondhand stores at their re-use station with great success (Nielsen, 2023; Plusbutikken, n.d.; Odense Renovation, n.d.). Additionally, Albertslund has establisehd two exchange sheds at their re-use station: one for smaller household trinkets and another for larger householde items like furniture and building materials. These have also proven very popular, with many visitors only coming to the re-use station for the sole purpose of looking through their re-use area. (Granholm, et al., 2023)

The re-use station provides a good opportunity to encourage citizens to give their used items new life through exchange or re-use, if possible, instead of through recycling. Several municipalities are therefore finding ways in making re-use stations more accessible and more re-use-centered rather than being centered on sorting in preparation for recycling.

5.4 Initiatives regarding re-use stations

In this section, I will elaborate on decentralized re-use stations and the new re-use stations that are being built.

Decentralized re-use stations

To make it easier for citizens to sort the waste that belongs at re-use stations, several municipalities have created public waste collection points or decentralized re-use stations (*nærgenbrugsstationer*).

Copenhagen Municipality has eight decentralized re-use stations, which do not feature as many fractions as the "standard" re-use stations. Additionally, these decentralized re-use stations are not accessible by car and rely more on direct re-use of items than on sorting into fractions for recycling. (Copenhagen Municipality, 2019) The decentralized re-use stations cover the following fractions: re-use, dangerous/toxic waste, electronics, large electronics (refrigerators, freezers, etc.), large household

(furniture, etc.), metal, paper, cardboard, glass, PVC, outdoor wood (wood that has been chemically treated), indoor wood (from furniture, flooring, etc.), plastic and card-board food containers, and textiles (Arc, n.d.)

Copenhagen Municipality writes that *"the re-use stations and decentralized re-use stations play an important role in the plan to achieve the ambitious goal of increas-ing [read tripling] the volume of re-use."* (translated) (Copenhagen Municipality, 2019, p. 29). Additionally, they conducted a survey which showed that four out of five visi-tors primarily visit the decentralized re-use stations because of the exchange facilities. (Copenhagen Municipality, 2019)
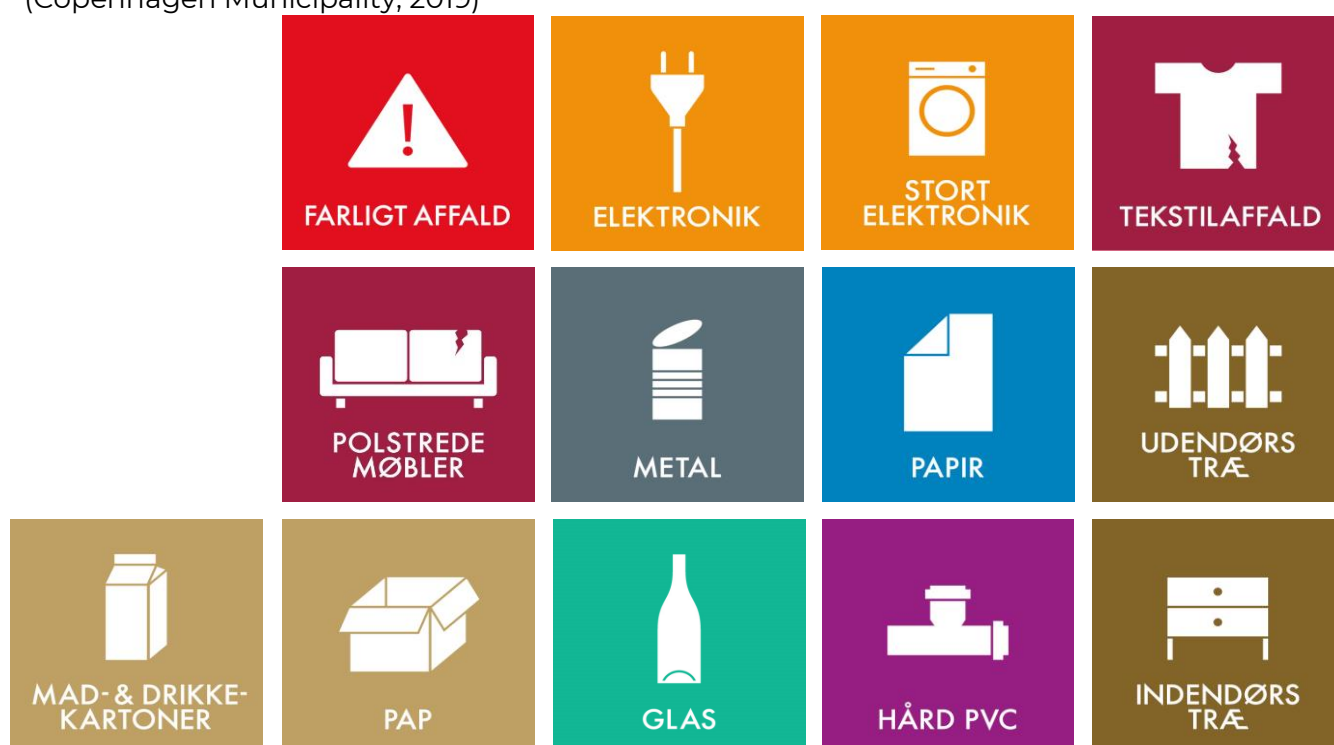
Figure 12: Fractions sorted at decentralized re-use stations in Copenhagen Municipality (own visualization)

Because of the high demand for the decentralized re-use stations, they plan on es-tablishing three additional stations, built primarily using reclaimed and re-used mate-rials to meet some of the demand and to observe where there is the greatest need for establishing future permanent decentralized re-use stations. (Copenhagen Municipality, 2019)

Aarhus Municipality is testing a similar system through their waste management company, Kredsløb. The space provides an exchange space as well as the option for dropping of items for recycling in the following fractions: cardboard, textiles, glass and mirrors, hard plastic, soft plastic, wood, iron and metal, electronics, flamingo, waste for landfill, and dangerous/toxic waste (Kredsløb, n.d.)

Figure 13: Fractions sorted at the decentralized re-use station in Aarhus Municipality (own visualization)

Municipalities with wider geographic catchment areas that also includes summerhouse areas, such as Frederikssund, Assens and Northern Funen have also created versions of decentralized re-use stations. In Frederikssund, they collect: paper, glass, metal, plastic, carboard, and batteries. They also have environmental stations where you can turn in used batteries, light bulbs, and small electronics like watches, cell phones, etc. (Frederikssund Municipality, n.d.)

Figure 14: Fractions sorted at decentralized re-use stations in Frederikssund Municipality (own visualization)

Assens and Northern Funen sort into cardboard, paper, glass, metal, plastic, and plastic and cardboard food containers (Assens Forsyning, n.d.; Northern Funnen Municipality, n.d.).

Figure 15: Fractions sorted at decentralized re-use stations in the Municipalities of Assens and Northern Funnen (own visualization)

In Randers Municipality the a decentralized re-use station is considered a place near apartment complexes to sort bulk waste. The municipality provides containers for small burnable waste, iron and metal, waste for landfill, electronics, and cordboard. There is also an area for appliances andlarge TVs (Randers Municipality, n.d.).
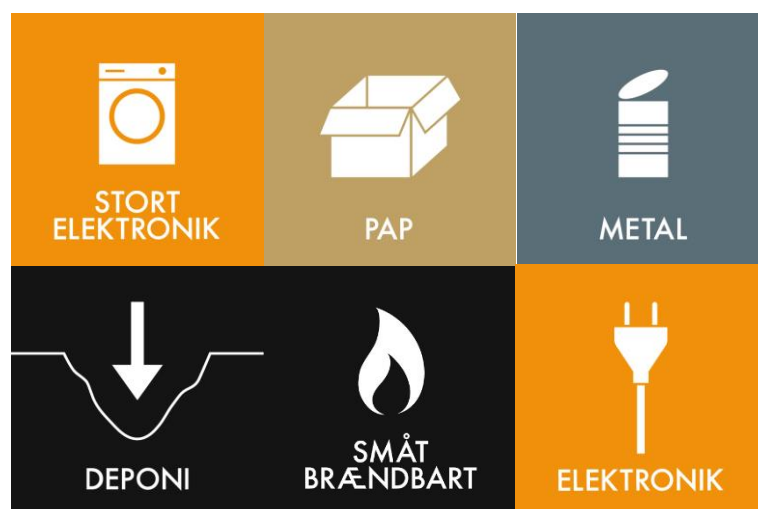
Figure 16: Fractions sorted at decentralized re-use stations in Randers Municipality (own visualization)

New re-use stations

With the DK2020 project focusing on climate change adaptation and waste prevention, several municipalities have mentioned refurbishing and modifying their re-use stations as well as building new re-use stations to replace existing ones.

Gentofte Municipality write that their current re-use station is doing a great job with ensuring increased recycling of waste, however, with the increased focus on re-use,

they wish to replace their re-use station and the bulk waste collection system with a concept they call Re-use Park Gentofte (Genbrugspark Gentofte). The primary focus here will be direct re-use. (Gentofte Municipality, 2022)

Herlev Municipality writes that their new re-use station will be: "*a flagship for circular economy in Herlev and ensure better facilities for direct re-use*" (translated) (Herlev Municipality, 2022). The re-use station will also be a place for communicating about sustainability in the municipality and will seek to increase the lifetime of re-useable items. (Herlev Municipality, 2022)

Lyngby-Taarbæk Municipality writes that they will build a: "*new re-use station, which should be more user friendly, have room for increased sorting into more categories of waste for recycling, and function as a physical platform where circular economy can be communicated to citizens of all ages*" (translated) (Lyngby-Taarbæk Municipality, 2022, p. 18).

To sum up, we see that both Herlev Municipality and Gentofte are aiming to create re-use-centered re-use stations instead of recycling-centered re-use stations. It seem however, that Lyngby-Taarbæk Municipality will continue to have a recycling-centered re-use station, despite having plans to build a new re-use station.

5.5 Other

This other paragraph will cover several stand-alone categories that I did not feel could be grouped in one of the above sections. The first concept I will discuss is the municipalities banning single-use products. I will then elaborate on Frederiksberg Municipality's work with re-use of glass waste and initiatives aimed as reducing food waste. Then I will examine the municipalities that have yearly action plans and reporting. Finally, this section will conclude with a consideration of the category of projects, which describes the different large- and small-scale projects mentioned by the interviewees.

Banning single-use products

Single-use items are, as the name suggests, the opposite of a circular economy, which relies on using items over and over again (Ellen Macarthur Foundation , n.d.). Single-use cutlery and packing is therefore an optimal place to start efforts to prevent and reduce waste.

Both Frederiksberg and Gentofte have made clear efforts to limit their municipality's consumption of single-use items. Gentofte has made it the responsibility of the entire

municipality as a work place to cut down on their use of single-use products and has have already stopped using them in relation to events. They are currently working on finding suppliers with clearly defined sustainable value chains to replace current products. (Nielsen, 2023)

Frederiksberg has established an all-out ban on single use products such as cups, plates, etc., and the municipality is working to limit the use of single-use napkins, tablecloths, and food packaging. Efforts are still underway to identify solutions for events with an open invitation, where the number of attendees is not known ahead of time. (Christensen, 2023; Frederiksberg Municipality, n.d.)

Re-use of glass waste

To address their growing waste amounts, Frederiksberg Municipality started with its biggest waste category, glass waste. Glass is a heavy fraction and thus moving it to re-use instead of recycling would result in a significant decrease in waste volume (Christensen, 2023). The municipality has started sorting wine bottles for re-use from the rest of the recycling waste and reports that by doing that they are halfway towards their goal of re-using 1,392 tons of materials in 2026. (Frederiksberg Municipality , 2023)

Food waste

Following the Danish support of the proposed revision of the waste framework directive by the European Commission (Miljøministeriet, 2023), several municipalities are putting food waste on the agenda. Gentofte Municipality is working on nudging companies with large cafeterias to reduce their food waste (Nielsen, 2023) and Frederiksberg Municipality is developing actions dedicated to motivating their citizens to reduce their food waste (Christensen, 2023). This is in anticipation of the reduction goals for food waste that will likely be coming soon (Miljøministeriet, 2023).

Yearly action plans and reporting

Yearly action plans and reporting enable municipalities to reevaluate their waste management and cap goals from year to year.

Frederiksberg Municipality conducted a midway evaluation of their waste management plan in January and found that their goal of preventing 6% of waste production was achieved in 2022, when they prevented 9% of waste production. In addition, they have reached 48% of their goal for quadrupling their re-use. They also found that their work within recycling had stagnated, as their goal is 72% recycling by 2026 and

they are currently only at 50%. They are also debating the different initiatives that have been implemented since the publication of the waste management plan, like the re-use lab, which is the creation of a lab-district to serve as a kind of living lab to test new modes of collecting waste and other changes. Additionally, they are proposing changes in actions and initiatives to better ensure their chances of achieving their 2026 goals. (Frederiksberg Municipality , 2023)

Gladsaxe Municipality's waste management plan spans a nine-year period from 2015 to 2024. To make it easier for their citizens and politicians to follow the progress toward their goals and assess whether their goals are still relevant or need modification or updating, Gladsaxe Municipality conduct yearly action plans. Their latest evaluation of the yearly action plan shows that they achieved the national goals of 50% recycling in 2022 but are still a ways off from reaching their goal of 58% recycling by 2024. They have realized that the 58% goal is no longer realistic for several reasons. They found that most of the activities planned for 2022 went off as planned, although a few were delayed or postponed. As with Frederiksberg Municipality, they also propose actions to be taken in the coming year to ensure that they progress towards their goals. (Gladsaxe Municipality, 2023)

Projects

In relation to the concrete initiatives within waste prevention, there are several projects in the works.

Gentofte Municipality has executed a project in collaboration with IKEA in which they collected IKEA furniture specifically and returned it to IKEA, which is located only 2 kilometers away from the re-use station. They found, however, that they were not able to collect enough furniture to continue the project. This has led them to experiment with a similar project with other larger household items. Additionally, they are also part of a project aimed at procurement with a sustainable balance, where they are project manager of the Green Procurement track. The focus of this project is on the environmental footprints of the items and of the municipality as an enterprise. (Nielsen, 2023)

Rødovre Municipality is also in the midst of a project about better waste sorting in apartments *"[…] with a focus on changing habits (like beginning to sort waste) when moving into a new apartment"* (translated) (Sehested, 2023, p. 12).

While writing their waste management plan, Copenhagen Municipality conducted a survey which revealed that while their citizens are good at sorting their waste correctly at the re-use stations, 3,500 tons of small burnable waste was sent to incineration. Their research shows that 40% of this waste can be re-used or recycled, so in an effort to find out what the remaining 60% consists of, they are removing the small burnable containers at their re-use stations. (Copenhagen Municipality, 2019)

"The project will show what the last 60% of small burnable waste consists of and what needs to happen for it to be handled correctly for recycling." (translated)
(Copenhagen Municipality, 2019, p. 30)

Vestforbrænding has previously carried out several smaller projects, including a project in collaboration with the online supermarket Nemlig involving collection and pick-up of their packaging from the re-use stations. This project is based on similar projects they have done in collaboration with food manufacturers Arla and Kohberg. However, they have shifted their focus away from smaller scale projects toward bigger scale projects like the one described below. (Hansen, 2023)

Vestforbrænding has established a central depository and marketing for larger re-use items with the participation of Gentofte and Albertslund Municipalities, among others. (Granholm, et al., 2023; Nielsen, 2023) This project springs from inspiration drawn from Odense Municipality where they have a similar system in place. (Hansen, 2023) Henrik Vinther Nielsen explains that in Odense *"the things that citizens drop off which are too good to be thrown out are driven to Zirkel's central depository"* (translated) (Nielsen, 2024).

Through this project, Vestforbrænding seeks to prove their theory that if you collect everything in one place you have a greater opportunity to further use of them, i.e. to redeem the potential for re-use, you need a central depository. Through their work, Vestforbrænding has realized that it is essential to have enthusiastic employees working on projects like this, as they are the ones who need to be willing to put in the extra work of guiding and helping the citizens who bring in waste and materials for re-use and recycling at the re-use stations. They have therefore prepared a sorting list telling citizens which items and materials they are interested in and want and distribute this list to the re-use stations that are a part of the project. (Hansen, 2023)

Kristian Bjerregaard Hansen from Vestforbrænding states that they want to expand to more re-use stations with regards to upscaling the project and finding additional products and takers. (Hansen, 2023)

5.6 Summary

As the above shows, there are a range of waste prevention initiatives in the works. As this analysis of niche initiatives within waste prevention focuses on the municipalities that have participated in interviews, it is not a complete list. However, some municipalities have been mentioned that were not interviewed. These were found through the initial mapping conducted to determine which municipalities to interview and they have been featured here to support and further elaborate different approaches to the various initiatives. One type of niche initiative that is glaring it its absence in the above is the different partnerships within waste management and circular economy. It is clear that there are many, and that these play a big part in communication and collaboration across municipal borders. While it was not possible to find a complete list of these partnership, four such partnerships were mentioned by the interviewees: The Circular Economy Partnership, Circular Economy Beyond Waste (a Gate21 project that has a large network connected to it), The 4K collaboration, and The Municipalities' Waste Network (Christensen, 2023; Nielsen, 2023; Sehested, 2023).

Table 3, below, provides an overview of the initatives described above. It also includes a non-exhaustive list of the municipalities that are either planning on or already working within the given initiativ.

Initiative	Description	Municipalities
Preventative communication and campaigns for citizens	Pamphlets for distribution to households. Signs at re-use station to help guide citizens. Local competitions. Making specific knowledge and tools available to combat everyday problems regarding waste management in households. Encouraging citizens to buy secondhand and donate used items	Ringsted, Roskilde, Brøndby, Greve, Hvidovre, Middelfart, Horsens, Tårnby, Rødovre, Ballerup, Langeland, Svendborg, Tønder, Frederiksberg, Gentofte, Frederikssund, Nordfyns, Vejen, Ringkøbing, Skjern, Odder, Morsø, Aalborg
Events and activities to enlighten citizens	Citizen gatherings. Creating ownership and agency among those who participate.	Holbæk, Gentofte, Helsingør, Svendborg, Hjørring, Aabenraa, Kolding

Local waste ambassadors	Re-use guides as seen in Frederiksberg and Kolding municipality. Educates and promotes agency among the younger generation. Education of those who pick-up waste.	Frederiksberg, Kolding, Copenhagen
Education of children and youth	The climate challenge project by Gate 21. Visits to schools to talk about and work with waste. Field trips to see local re-use station and hear about how it works and what happens to the waste.	Næstved, Faxe, Ringsted, Ringkøbing Skjern, Sorø, Slagelse, Frederiksberg, Copenhagen, Egedal, Gentofte, Viborg, Thisted
Using the re-use station as a platform for communication	Presentations and tours of the facility showing how it works, what happens to the waste and why a change in practice matters.	Vejle, Nyborg, Helsingør, Lejre, Lyngby-Taarbæk, Halsnæs, Rødovre
Repair cafés	Arranged by locals where the municipality provides a space. Citizens can bring their items in need of repair and the materials to repair them. Local volunteers arranging the repair cafés provide help and guidance in repairing the items, so the citizens can learn to do it themselves in the future.	Lejre, Greve, Gentofte, Middelfart, Aarhus, Køge, Slagelse, Holbæk, Hvidovre, Rødovre, Glostrup, Herlev, Gribskov, Silkeborg, Helsingør, Faarborg-Midtfyn, Middelfart, Vejen, Kolding, Odder, Aarhus, Syddjurs, Norddjurs
Exchange systems	At re-use stations, schools, daycares, workplaces, and other centralized local spots like the local library.	Kerteminde, Stevns, Holbæk, Brøndby, Lejre, Greve, Gentofte, Aarhus, Hvidovre, Frederiksberg, Rødovre, Glostrup, Herlev, Helsingør, Viborg, Odsherred, Middelfart, Aabenraa, Esbjerg, Aalborg
Direct re-use of bulk waste	Creation of collection scheme that allows for more detailed sorting of bulk waste	Gentofte, Frederiksberg, Solrød, Hillerød, Odsherred, Rødovre, Nyborg, Esbjerg
Direct re-use at re-use stations	Often seen as a second hand store on the premises that sells waste which has been dropped off for re-use and not recycling, or comes from exchange stations or sheds.	Roskilde, Stevns, Solrød, Greve, Ishøj, Halsnæs, Ærø, Viborg, Dragør, Morsø, Vejen, Kolding, Hjørring, Ikast-Brande, Odder,

		Albertslund, Gentofte, Odense, Frederiksberg
Decentralized re-use stations	Provides easier access to re-use stations for citizens unable to transport bigger re-use items.	Bornholm, Lejre, Copenhagen, Aarhus, Frederikssund, Assens, Nordfyns, Randers
New re-use stations	Re-use stations centered on re-use instead of recycling.	Odense, Bornholm, Lyngby-Taarbæk, Herlev, Rødovre, Kolding, Fredericia, Thisted, Gentofte
Banning single-use products	Primarily changes made by the municipality as a work place, in their departments and at events organized by the municipality. A ban with exceptions for areas where single-use is necessary for hygienic and safety reasons.	Frederiksberg, Gentofte, Lolland, Ikast-Brande
Re-use of glass waste	Sorting reuseable wine bottles from the glass waste fraction to ensure they get re-used instead of recycled	Frederiksberg
Food waste	Provision of information on food waste to encourage citizens to think about the food they throw out and ways to reduce their food waste	Frederiksberg, Gentofte
Yearly action plans and reporting	Evaluation of waste management plans and caps during the planning period to ensure the municipality is on track and to provide information for citizens to communicate that their behavior has an impact.	Frederiksberg, Gladsaxe, Helsingør
Projects	Pilot projects for testing new technologies. Projects for testing new procedures. Projects for gathering information about practices and why certain initiatives and actions are not having the expected effect.	Rødovre, Gentofte, Albertslund, Lejre, Copenhagen

Table 3: Summary of municipal initiatives

6. The socio-technical regime and the socio-technical landscape

As described in the Theoretical Framework chapter (see section 4) the socio-technical regime is *"the alignment of existing technologies, regulations, user patterns, infra-structures, and cultural discourse"* (Geels, 2012, p. 473). Furthermore, the socio-technical landscape describes the context within which the niche innovations and the socio-technical regime develop and exist.

In the following I will explore what the current regime entails. I will then elaborate on how the niche initiatives described in the previous chapter interact with the existing regime to create a new regime during the window of opportunity.

6.1 The current socio-technical regime

In this section I take a closer look at the different aspects of the socio-technical regime, as it is seen now within waste management. A spotlight will be shined on the industry as it looks today and on the policies that are in place. Additionally, I will touch on the culture surrounding waste and how the market is responding to the new policies and culture. Lastly, I will consider the window of opportunity created for a change of practices and what this entails.

Industry

To better understand the current state of the industry regarding waste and waste management, I have primarily relied on the OECD environmental performance review of Denmark from 2019 and Lise Kusk's Master's thesis from 2020 on the transition to a waste sector relying on circular strategies. Lise Kusk has interviewed, among others, Henrik Riisgaard from AVV, who is an expert within the field. My primary focus is on his knowledge and what she has gathered from her interview.

The industry primarily consists of recycling and fraction sorting, with some incineration and some landfilling. For many years, the Danish government and Danish policy has prioritized transitioning from waste incineration to energy recovery, from incineration and, now, to recycling of waste, moving up the waste hierarchy (for further information see the section on Policy, below).

The OECD states in their performance review that Denmark has achieved impressive results within recycling from 2005 to 2017 (OECD, 2019). In 2017, Denmark recycled about 27% of leftover household waste and 19% of household food waste (OECD,

2019), whereas the Danish Environmental Protection Agency states that Denmark reached a recycling level of 56% of household waste in 2021 (Miljøstyrelsen, 2023).

According to Henrik Riisgaard, the roll-out of the recycling and sorting regime has been fractured and messy, which the OECD also noticed (Kusk, 2020; OECD, 2019). Riisgaard explains: *"This level of recovery is where a lock-in has happened [...]"* (translated) (Kusk, 2020, p. 62). The effort to change the waste management infrastructure to increase recycling came before the streamlining of household sorting and waste collection. This resulted in different sets of rules regarding waste depening on which municipality you were in (Kusk, 2020). It was not until 2018, when the Danish Government presented their circular economy strategy, that streamlined household fraction sorting and waste collection for all Danish municipalities was proposed and implemented (Regeringen, 2018). This has caused problems for the municipalities as they had already signed contracts and agreements for the recycling and sorting regime they rolled out in 2013 in connection with the Denmark Without Waste report (Miljøministeriet, 2013). Consequently, the roll-out of the streamlined sorting and recycling regime was delayed in the majority of municipalities (Kusk, 2020).

This means that the current state of the waste management industry in Denmark is a system centered around recycling, which Denmark does well according to the OECD, and fraction sorting, which Denmark has improved on since 2018.

Policy

In the previous section, several reports from the Danish Government and the Danish Environmental Protection Agency were mentioned. This section will further elaborate on the different reports and plans which make up the current status-quo within waste management and analyze their impact on the industry. The section will first re-view the Waste Directive from the European Commission, as this represents the framework for Danish waste management regulation. I will then look at the Statutory Order on Waste in Denmark, which is the main national legislation for waste man-agement. Finally, the resource management plans and the circular economy action plans will be examined.

EU Waste Frame Directive

The EU Waste Frame Directive describes the waste hierarchy as a prioritization of how the Member States should manage waste. However, it also states:

"When applying the waste hierarchy referred to in paragraph 1, Member State shall take measures to encourage the options that deliver the best overall environmental outcome." (The European Parliament and Council, 2008)

It is therefore up to each Member State to determine where it will be most beneficial for them to prioritize their efforts on waste management in the waste hierarchy. The directive goes on to state that in some cases it may be necessary to differ from the waste hierarchy in order to achieve the overall most sustainable result from a life cycle perspective. (The European Parliament and Council, 2008)

The Statutory Order on Waste

As stated previously (see section 1.4 Waste Prevention) The Danish Statutory Order on Waste does not include the correct waste hierarchy as set out in the EU Waste Directive (Miljøministeriet, 2021). However, after looking through various older waste and resource management plans, it became clear that the full waste hierarchy has not been featured in waste management plans since the Denmark Without Waste plan in 2013. It's almost as though the Danish Government forgot the top tier of the waste hierarchy. (Miljøministeriet, 2013)

In interviews conducted with municipalities, several mentioned the waste tariffs as an obstacle for their work with waste prevention (Christensen, 2023; Granholm, et al., 2023; Sehested, 2023). The reason being that the waste tariffs are defined by the Statutory Order on Waste (Miljøministeriet, 2021). But because the Order does not cover waste prevention , the waste tariffs naturally do not either.

Denmark Without Waste

Denmark Without Waste and Denmark Without Waste II were Denmark's first resource management plans, with Denmark Without Waste II being the first waste prevention strategy (Miljøministeriet, 2013; Miljøministeriet, 2015). Despite its title, the resource management plan from 2013 is centered around recycling (Miljøministeriet, 2013). In the waste hierarchy, the product is defined as waste as soon as it moves below the level of prevention (European Commission, n.d.).The successor from 2015 does elaborate on waste prevention strategies, but the overall goals for waste prevention are formulated in vague terms, using words like *less* instead of concrete numbers. The goals are followed up by key indicators on how the government plans to measure the progress, and with initiatives they plan to implement. (Miljøministeriet, 2015)

Follow up research on several of the different concrete initiatives the government planned to implement has revealed that efforts to get them up and running were started in 2015, but nothing could be found about them after that. This shows that although the plan and initiatives sound good on paper one should be ciritical about them (Nielsen, 2023), as there is no legal binding for the government to live up to their plans unless they are put into law, which these were not.

Circular Economy Action Plan

In 2020, the Danish Government gathered together to draw up a Circular Economy Action Plan (Regeringen, 2020). This plan aims to be the national plan for prevention and management of waste, according to the document released when the plan was in public hearing (Miljøministeriet, 2020).

A careful review of the actual plan showed that there is no mention of waste prevention anywhere, despite it being one of the main pillars of circular economy (Ellen Macarthur Foundation , n.d.). For example, the plan says:

"Luckily waste has gone from being a problem to a valuable resource, which companies all over Europe are demanding to recycling into new products." (translated)

(Regeringen, 2020, p. 2).

It is clear that this plan is centered around recycling which is the outermost ring of the Ellen Macarthur Foundation's circular economy diagram (Ellen Macarthur Foundation, n.d.). Put simply, the EU policy surrounding waste management is generally open to interpretation while the Danish Government's policy is centered around recycling. After reviewing the different documents it has become clear that one of two things is true. Either the Danish Government is more interested in using the right words than following up, or they have misunderstood the concept of circular economy and its benefits.

Culture

The culture surrounding waste is largely influenced by the culture surrounding the consumption of products.

Advertisements are everywhere in our daily lives, both in the physical surroundings and digitally. In Denmark, they are even distributed to the households' mailbox every week. And of course, they all encourage consumers to buy their products and lots of them, so that the company can make money. In the EU, the legislation regarding advertisements is fairly vague, except for the fact that the Member States are prohibited

from limiting free trade across the borders of EU countries in their national legislation (The European Parliament and Council, 2005). As a result, all the Danish government can do is encourage consumer to think about which products they consume and how much they consume, they cannot legally help the consumer to know which products are better than others when they are viewing advertisements.

In its national action plan for a sustainable waste sector and circular economy, the Danish Government states: *"the waste curve needs to be broken – less trash, less waste and more re-use"* (translated) (Miljøministeriet, 2020, p. 2). Thus, the government is encouraging consumers to think about what they throw out and through that, what they consume.

As less consumption leads to a drop in the national GDP, it is desirable to decouple economic growth from the increasing volumes of waste and consumption of materials. From 2008 to 2014, Denmark had been successful in achieving this decoupling, however the consumption of materials began to rise again in 2014 (OECD, 2019).

With this increase in consumption of materials, consumers are encouraged to re-use products and buy secondhand. As stated above (see section 5 Niche Innovations) secondhand options and exchange systems are gaining in popularity. So much so, in fact, that the Environmental Protection Agency had originally included a section stating that re-use shops would be a requirement at re-use stations within a specific set of rules. This is, however, is not in the interest of the many actors that sell virgin products to consumers, whose goal in the end is to make at least as much money as the year before but preferably more.

Thus, it is clear that the goal at the moment is not to consume less overall, but to reduce the output of waste. To help achieve this, efforts aimed at developing eco-design manuals, standards, and legislation. These set out requirements for product design to ensure they can be a part of a circular economy and consumers can prolong the lifetime of the product through repair and maintenance. (European Parliament and Council, 2009; The European Commission, n.d.; Dansk Standard, 2023)

Furthermore, it becomes clear that the culture surrounding waste and consumption is full of contradictions as well as possible solutions for working within and around these contradictions.

Markets, user preferences

The market is made up of the retailers and consumers. Because retailers have to adhere to national and international legislation about products, production, and

services, they need to have some level of knowledge of sustainability, materials, and circular economy. However, consumers do not necessarily have any knowledge within these areas unless they are educated within the field. This is where municipalities need to bridge the knowledge gap between the two, because they set up the systems and put into effect the legislation and goals from the government.

After speaking with the municipalities, it has become clear that the approach to this role varies greatly from municipality to municipality. While some municipalities acknowledge that not all citizens have the necessary understanding about why sorting, recycling, re-use, and prevention are important and consequently work around this (Christensen, 2023), others believe it is up to the individual citizens to make sense of why these plans are coming into play and why the given changes are necessary (Granholm, et al., 2023).

As mentioned above (see the Industry and Policy sections) the roll-out of legislation and plans has been rapid, fractured, and disharmonic. As it is not in the government's interest to explain to citizens that the current plan is being replaced by a new one only a few years later, because it was discovered that we were still not doing enough, the citizens only hear that yet another plan about waste and sustainability is being released and they need to change their practices yet again, only this time they need make even more changes. This leads to the subject of a sustainable transition and sustainable consumption being unmanageable for the average citizen trying to get a sense of what they should be doing to live up to the many different plans and legislation (Buch, 2017). Additionally, as the municipalities are implementing the requirements of one plan, they are also trying to figure what exactly they should be doing under the new plans (Kusk, 2020).

In short, both citizens and the market are experiencing knowledge overload, making it difficult to make head or tails of what is good consumer practice and what is bad, and all the while retailers continue advertising their new and improved products.

6.2 The window of opportunity – developments in the socio-technical landscape

As more and more of the educational initiatives are taking effect and the younger generations are starting to change their practices, more and more digital platforms like Vinted, Reshopper, Trendsales, and Recraft for reselling items for re-use are appearing. Companies are starting to base their business models on more sustainable

behavior, and subsequently consumers are also starting to change their consumption practices.

Frederiksberg Municipality postulated in their interview that increased sorting in the future would increase attention on what waste citizens produce the most of (Christensen, 2023). But maybe it is not increased sorting in the future that is needed, but more time with sorting waste at the current level, as it seems that the current sorting regime is increasing the demand for change and sharpening the focus on materials and material consumption (Regeringen, 2020).

It has been clear from the first implementation of waste sorting and recycling that a one-size-fits-all approach was needed in the past to kickstart the necessary change. However, as the demand for change is increasingly visibly from bottom-up (from the citizens) it is crucial that local initiatives be supported. As stated above (see section 5), initiatives driven by and largely involving citizens create agency and a sense of ownership, so the citizens themselves encourage further change.

The shift away from a one-size-fits-all approach is also visible in the fact that the government, in full support of the municipal re-use shops and exchange areas at the re-use stations, had originally stated in the action plan for a sustainable waste sector and circular economy that all re-use stations should have a similar system following a set of rules. In short there was a desire to streamline and regulate these local initiatives. This was, however, retracted by the Minister for the Environment in December 2023, following complaints from KL, The Red Cross, The Circular Industry Association, Danish Industry, and The Danish Chamber of Commerce. (Miljøministeren, 2023). As the minister writes: *"We have decided not to green light the initiative and instead support the voluntary efforts at the municipalities' re-use stations"* (translated) (Miljøministeren, 2023, p. 1).

Thus, with these clear signs of change a window of opportunity for change has opened up.

6.3 Summary

The following is a summary of the analysis of the socio-technical regime and the socio-technical landscape within waste and consumption as well as an analysis of the window of opportunity created by the lack of resources, resulting in a change in policy and triggering changes in consumer practices.

- The industry within waste management is characterized by recycling and household fraction sorting.

- The road to reaching the current level of sorting and recycling has been chaotic and fractured.

- The policy regarding waste management and prevention is vague and lacking with regard to the waste hierarchy.

- The wording of the plans for waste management and circular economy is misleading and suggests a misunderstanding of the concept of circular economy.

- The culture surrounding waste is highly influenced by the consumer culture.

- The culture is characterized by the contradictions of advertisements encouraging the consumer to continue to consume more and the government and municipalities encouraging the consumer to become aware of what and how they consume and to prioritize consuming secondhand.

- The market is made up of consumers who may not have the necessary knowledge to equip them to make the correct and sustainable choice at every point.

- Knowledge on the area is unmanageable and confusing.

- Both municipalities and consumers find it difficult to figure out what to prioritize and how to work within the goals and plans within waste management.

- A window of opportunity has opened up with apparent changes in consumer practices and the advent of more and more platforms for secondhand shopping and reselling from the home.

- Another window of opportunity is the recognition of the fact the a one-size-fits-all approach to waste management is no longer enough and that it is increasingly important to support and foster local engagement and initiatives which create agency and ownership among citizens and ensure a better chance of a successful sustainable transition.

When do these windows of opportunity close? That question cannot easily be answered, as it depends on how quickly citizens and governments adapt and change their practices. It also depends on whether or not Denmark will keep developing goals and initiatives within waste prevention and changing their view on waste.

How long these windows of opportunity will remain open for and whether or not the landscape derived from the national and EU waste management goals is realistic will be discussed below.

7 Partial conclusions

As the two analysis above have introduced a plethora of terms, initiatives, policies, and activities, the following is a partial conclusion of the analysis and a bridge to the discussion.

As introduced earlier (see section 4), Bocken et al.'s notion of circular economy defines the terms of slowing, closing, and narrowing the flow of resources (2016).

Within this context, the initiative mapping in chapter 5 shows that most municipalities are working to slow the flow of resources, through initiatives such as exchange systems, repair cafés and re-use stores. Meanwhile, the analysis in chapter 6 shows that the national policy regarding waste management is more focused on closing the flow of resources through recycling. Furthermore, it is also clear that the government is using their influence to support extended producer responsibility schemes (EPR), which support the narrowing of the flow of resources, as well as encouraging producers to implement slowing design strategies, such as products made for easy maintenance, standardization of products and parts, and adaptable and upgradeable products (Bocken, et al., 2016).

Finally, both analyses present initiatives within each of the three terms of circular economy. However, when applying slowing, closing, and narrowing to the waste hierarchy, it appears that closing strategies only take place on tier three of the hierarchy, and below the line of when a product becomes waste, as defined by The European Commission (European Commission, n.d.). Despite this, closing the flow of resources is seen as an optimal way of achieving a circular economy. However, if the goal is to work according to the waste hierarchy, it would be more optimal to reallocate resources to increase national efforts within slowing and narrowing, as these would correlate with prevention, and preparation for re-use which fall within the two top levels of the waste hierarchy.

This begs the question, if circular economy is the goal, is the waste hierarchy in its current state the optimal foundation for national and European policy regarding waste management?

8 What then?

In the following I will discuss the question posed in the previous section: If circular economy is the goal, is the waste hierarchy in its current state the optimal foundation for national and European policy regarding waste management? The discussion will touch upon various possible changes to current waste management policy, hereunder, modifications to the waste hierarchy, modifications to the extended producer responsibility schemes, and the possibilities of a legal framework for products.

8.1 A modified waste hierarchy

As stated earlier, the basis for waste management policy is the waste hierarchy. However as the idea of a circular economy gains traction, the municipalities and waste sector are finding it difficult to define their changing role (see section 6.1). As Kusk mentions, the government's wish for municipalities and the waste sector to work with the prevention of waste production is close to impossible as what little they can prevent is just a drop in the water compared to what can be prevented if the government were to take charge and work on policy guiding and regulating the production of products. (Kusk, 2024)

The municipalities work within the waste hierarchy, but they have no means of holding accountable the producers of products that consist of composite materials which are not suited for recycling. (Kusk, 2024) As "*80% of a product's environmental impacts are determined in the design phase*" (p. 4), there is even more reason to turn away from making the waste hierarchy with the responsibility of the waste sector (Dansk Standard, 2023). In this way, the extension or modification of the waste hierarchy makes it clear that the waste sector is not the only relevant actor to operate within this hierarchy, and that the producer and consumer play significant roles with regard to the output of waste.

The draft for a new Danish standard *method to achieve circular designs of products* (2023) and the report by Jørgensen et al. on *strategies for prolonging product lifetimes* (2022) both mention a use-and-waste hierarchy as an alternative to the traditional waste hierarchy. This can be seen in figure 17.

Figure 17: Use and waste hierarchy (Jørgensen, et al., 2022, p. 69)

In this hierarchy, we see quite a few additional levels of product and waste management. Noticeable is also the relatively few levels below the line where a product becomes waste, marking the few acceptable options for waste management. Additionally, the use-and-waste hierarchy is much more specific in the make and use phase for preventing unnecessary material usage and waste production from a product.

Thus, it also clearly indicates which levels of the hierarchy would be relevant for the municipalities and the waste sector to work within and which should be kept out the waste sectors responsibility. Additionally, the wording of a use-and-waste hierarchy makes it clear that the use phase also plays a significant role in managing the volumes of waste produced. And this is where the producer comes into play as being responsibility for the types of products they put on the market. Additionally, this new hierarchy gives the consumer a clear responsibility to repair and maintain their products to the best of their abilities, while the producer is responsible for making this possible and providing the tools necessary.

Similarly Along similar lines, Maitre-Ekern and Dalhammer also sought to expand on what waste prevention entails in their article "Towards a Hierarchy of Consumption Behavior in the Circular Economy" (2019) in which they suggest the hierarchy illustrated in figure 18, to support the traditional waste management hierarchy.

Figure 18: Hierarchy of consumption behavior in the CE (Maitre-Ekern & Dalhammer, 2019, p. 10)
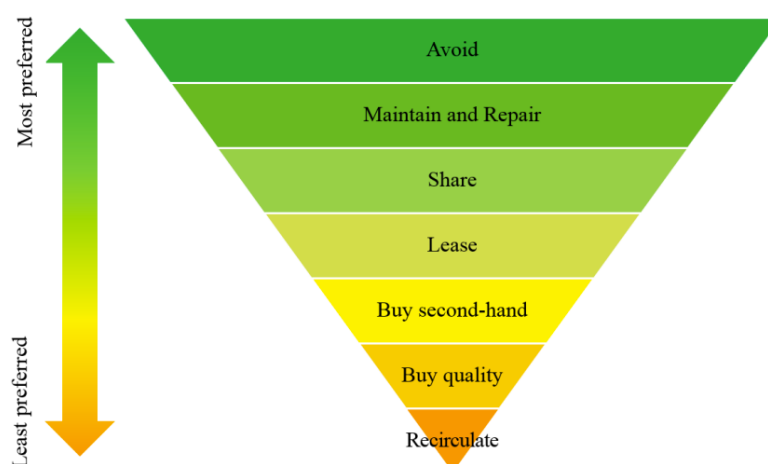
Here we see many of the same points as in the use-and-waste hierarchy only expanded and clarified even further. This hierarchy clearly has the consumer at the center and is lacking the producer responsible for the products put on the market.

With circular economy being a wide concept with many definitions and the national policy on circular economy being unclear and causing consumer to be in doubt as to how to act correctly, this hierarchy could help clarify exactly how consumers can help prevent waste and more importantly how they can change their consumption patterns. With specific levels such as "share and lease" and "buy second-hand", there are clear actions for the consumer to take, without having to gather a lot of knowledge themselves on what sustainable practices are.

As stated earlier, however, most of the environmental impact of a product is locked-in in the design phase, which makes the producer a crucial actor in preventing waste production and they should be a central player in an extended waste hierarchy.

8.2 Modified producer responsibility

With the producers being the first link in the product chain to decide the initial environmental impact of a product, extended producer responsibility (EPR) schemes have started appearing, and more are in the works. (Maitre-Ekern, 2021; Kusk, 2024)

As Maitre-Ekern states: *"[EPR] was expected to make a bridge between product and waste by providing incentives to producers to improve product design and ultimately save waste management costs. In reality, the scheme has had limited effect in that regard"* (2021, p. 2).

Thus, the original aim of EPR in 1990 was to work with product design and through that limit the need for waste management as much as possible. However, the EU is generally hesitant to impose direct responsibilities and regulation on the producers that are not linked to hazardous substances, so as not to inhibit production and the flow of products. (Maitre-Ekern, 2021)

With the emergence of the Eco-design directive in 2009, this changed, following by the directive on WEEE (waste electrical and electronic equipment) which took effect in 2012 (The European Parliament and Council, 2012). Years later, however, the intended effect – changes to electronic product design and producers taking responsibility for the end-of-life of their electronic products – has not become a reality (Kusk, 2024). The EU has used this unintended result as a learning opportunity in the

formulation a strategy for textiles that is to come in 2025 (The European Commission, 2023), in the amendment of the EPR directive for packaging in 2018 (The European Parliament and Council, 2018), and in the formulation of the upcoming Eco-design directive (Kusk, 2024).

While the EU is already learning from past implementations of EPR schemes, Maitre-Ekern points out that even if the EPR schemes have helped to increase collection and recycling rates, they have had a limited influence on product design. As she puts it: *"Those who have the decisive power over the key features of the product (i.e. designers) are not directly affected by the EPR scheme, and there are thus unlikely to be design changes"* (Maitre-Ekern, 2021, p. 11).

Despite these critiques of EPR, it is still a very necessary tool in the current climate to influence the producers and the products put on the market. Contrary to the current EPR schemes, the modification that Maitre-Ekern suggests is a: "*pre-market producer responsibility [that] shall aim to ensure that producers are responsible for the putting on the market of products and thus for impacting the environment*" (Maitre-Ekern, 2021, p. 12).

In her article, Maitre-Ekern gives four examples of possible pre-market producer responsibilities: No data no market, availability (and affordability) of spare parts, take-back scheme for repair and reuse, and secondhand and reused section in stores. (Maitre-Ekern, 2021)

Here she puts the notion of knowledge is power at the center with the demand that "*an essential starting point has to be to ensure that producers acquire and provide certain amounts of information as a precondition for placing their products on the market*" (Maitre-Ekern, 2021, p. 13). Implementing this change would result in more transparency for the consumer and make it easy for them to make educated choices. She also points to the importance of making spare parts and the repairability of products easy and accessible as this will increase the likelihood for the consumer extending the lifetime of their product through repair. Furthermore, she mentions take-back schemes like a modified version of the Danish deposit-refund system for plastic bottles and cans, that would require "*producers to set up a take-back system for broken items, for the purpose of repair, or preparation for reuse*" (p. 13). Lastly, she suggests "*requiring that second-hand and reused products be offered alongside new could be a step in*" (p. 14) the direction of mainstreaming reuse of products and making it more easily accessible when replacing products as a consumer. (Maitre-Ekern, 2021)

Even with the increased focus on products before they are even put on the market and on pre-market producer responsibility before they are permitted to put their products on the market, there is still a hole in the flow of products in the EU that any Eco-design regulative or EPR directive can fix: the flow of products from countries outside of the EU that are cheaply and unsustainably produced and not subject to EU legislation as they are sold through international websites like Shein or Temu (Kusk, 2024). These products will still flow into the EU and end up as waste that in many cases is not optimized for recycling, as they are not required to meet the same requirements as retailers within the EU are.

8.3 Legal framework for products

To further work to reduce the volume of waste produced and the resources consumed, it is important to focus on the products themselves. Setting up regulations and guidelines for the producers is important, but regulating the products themselves is also a possible way to go.

With the broad definition of waste as set out in the waste framework directive from the EU, an end-of-waste status has been introduced for when an item may go from being categorized as waste to being categorized as a resaleable product. Here, the guidelines and requirements are that a product should undergo full recovery to go from being considered waste to being a product again, i.e. end-of-waste actually results in new products and not reused products. (The European Parliament and Council, 2008)

To circumvent this, Maitre-Ekern suggests a legal framework for products with common definitions and principles similar to the set-up in the waste framework directive. The central focus should be on the responsibility of the producers to extend the lifetime of products and ensure the reuse of their products. (Maitre-Ekern, 2021)

A similar idea would be to develop sector- or product-specific hierarchies as has been done with textiles. An Danish extended hierarchy for textiles can be seen in figure 19.

Figure 19: Extended waste hierarchy for textiles. (Kristensen & Huulgaard, 2022)

Again, there are several of the same levels as seen in the traditional waste hierarchy, but additional levels have also been added, so the full figure reads: prevention, repair, direct reuse, modified reuse, recycling, downcycling, recovery, and disposal.

When discussing this possible solution with Lise Kusk, she also suggested an overall hierarchy with a ranking system. Within such an approach, the product would earn points depending on where in the hierarchy it falls when it becomes waste. This would also make it possible to hold the producers responsible through fees or fines if the product lands below a certain point in the hierarchy when it becomes waste. (Kusk, 2024)

However, Kusk pointed out that although this is a possible way to go, it would mean a lot of work defining the hierarchy for each product type og sector, and the result would not be available when it is needed (Kusk, 2024). While sector- or product-specific EPR are not currently available, several are on the drawing board, with the upcoming eco-design regulative making up a framework for production that will hopefully limit the need for separate EPR schemes for each product and sector. Additionally, the work process for creating EPR schemes is already developed and established, whereas the process for developing product- and sector-specific waste hierarchies is not.

With the upcoming eco-design regulative, the EU is working further to increase the number of sustainable products on the market and make it easier for the consumer to choose sustainable products (The European Commission, 2023). It is expected that from 2026, products such as textiles, batteries and consumer electronics will be required to have a digital product passport that clarifies not only the origin of the final product, but also the origin of all of the individual components of the product. This would improve the traceability of the product that will have global ramifications, even though the passport will only be required for products sold within the EU. The producers will have to disclose all of the links in the production chain, making it highly likely that producers with unsustainable links that were previously unregulated will change to more sustainable options to stay competitive on the market. (PSQR, 2023)

8.4 Solutions

Throughout this discussion the following changes and solutions have been suggested:

- A modification of the waste hierarchy not only expands the levels of waste management but also reaches beyond waste into the production and consumption links.
- A modification of the extended producer responsibility schemes to include pre-market responsibilities and make demands of producers before they are permitted to put a product on the market.
- A legal framework for products, including common definitions and principles, to foster daughter frameworks for specific products, which include product-specific hierarchies for waste management. The legal framework for products should also operate alongside the coming digital product passport and place clarification and transparency requirements on producers.

In this time of radical change regarding sustainable production and managing waste production and consumption, a number of new directives and regulations are in the pipeline at EU level. In the following sections, I will draw on these to shed light on any elements of the three solutions that are already visible in the changes to come.

When looking at the three solutions suggested above and reviewing the upcoming EU initiatives, it is clear that the future initiatives work primarily with elements from the two last suggested solutions: pre-market responsibility and a legal framework for products.

With pre-market responsibility, a desire was expressed for guidelines and rules that the producer and designer must meet before they are permitted to put a product on the market. Hereunder, Maitre-Ekern specifically suggests transparency regarding data on the product available and affordable spare parts for repair of the product, take-back schemes with focus on repair and reuse of products, and secondhand and reuse sections in stores. Whereas the legal framework for products would cover common definitions and principles to lay the groundwork for frameworks for the individual product groups.

Transparency is key to enabling the consumer to make the right choice when buying a product. That is clear from the EU focus in the new initiatives proposed to he European Parliament and Council at the end of 2023 and the beginning of 2024. The Ecodesign regulation will be a framework with specific demands for each concrete product group (Dakofa, 2024). Thus, we see the beginnings of a legal framework for

products as envisioned by Maitre-Ekern. The intention of which is to go through one product group at a time and create an appropriate framework for each to ensure relevant regulation of all products on the market and to ensure that it is completely clear to producer what applies to their products. Additionally, with the directive also paving the way for a digital product passport, data on the product's journey throughout the entire production process will be readily available to the consumer (The European Commission, 2023). To further increase the demand for transparency from the producers, the Commission is also proposing a Green Claims directive which would set out new criteria for thorough documentation of sustainability claims in an effort to limit greenwashing of products. (Dakofa, 2024; European Commission, n.d.)

With this proposal it also clear that the EU recognizes that the consumer plays an important role in shaping the market and that they cannot change their consumer behavior without knowledge and proper regulation of the producers (European Commission, n.d.). For this reason, the Commission has proposed a directive on empowering consumers for the green transition. This will prohibit producers from making broad claims about sustainability and will require the publication of information regarding product lifetime, such as how long the product is expected to support software updates. (European Commission, 2022)

An additional point in pre-market responsibilities is repair and the availability of affordable spare parts. The EU also recognizes this as lacking in the current landscape, thereby hindering repair of products and the prolonging of product life, The Commission is therefore proposing a "right to repair" directive (European Commission, 2023). This will require producers to repair products in any case unless it is more expensive than replacing it with a new product. Additionally, the proposal states that the producers have an obligation to inform consumers about how to repair and maintain the products on their own. The Commission is also aware of the consumers' role in this proposal, and therefore aims to create an online platform to match consumers with repairers and sellers of refurbished goods in their area. (European Commission, 2023)

It is therefore clear that the transition within legal frameworks is already in progress with regards to setting requirements and guidelines for producers and aiding consumers in changing their practices. With two of the three suggested solutions already well on their way to becoming a reality, it is even more clear that there is a serious lack of work aimed at the waste hierarchy.

Modifying the waste hierarchy that lays the groundwork for Danish and European waste management policy would require a rethinking and reformulation of this

policy. This is a big task, but fortunately there is an easier way around it. This entails creating supplemental frameworks that achieve the desired goal without changing the text of the policy that forms the basis for it all. In addition, taking into account that fact that rethinking and reformulating practices is what is asked of both consumers and producers and is what is stated as a requirement for achieving the desired level of change for a sustainable future, changing the hierarchy which guides waste management to also guide consumption would be another optimal place to work. Extending the waste framework directive to not just cover waste would also include the producer and consumer in the process of defining a product's journey from cradle to eventual grave.

Rather than developing a waste framework directive, however, a circular life cycle directive would be more prudent. This would make it possible to expand the waste hierarchy and combine it with the circular economy theory and approach, helping to define each role in a product's full life cycle. This would then help define the role of each participant and increase their ability to do their part by developing initiatives to ensure a sustainable life cycle for the product.

9 Conclusion

To conclude this project, the following is a brief summary of the results of the analysis. And based on this and the results of the discussion, the research question will subsequently be answered.

The analysis shows that niche innovations and initiatives active in Danish municipalities are primarily focused on *slowing the flow of resources*. Furthermore, it is clear that the municipalities currently play only a limited role in waste prevention, as they only come into contact with the products after they have become waste.

Furthermore, the analysis shows that policy regarding waste management is more focused on *closing the flow of resources* through recycling rather than on narrowing the flow or resources by using less materials for production. Thus, it is clear that the current trend in policy as pertains to waste management and products is not enough to fulfill the wish for a circular economy.

Three solutions are suggested in this thesis to influence policy surrounding waste management and production to expand to consumers and specify requirements for producers as integral players in determining the environmental impact and outcome for the products on the market.

So to answer the research question:

What are the niche innovations for waste prevention in Danish municipalities, and how are they able to change the landscape and regime of waste production and management?

As seen on figure 11 (See section 4 or appendix B) the municipalities are doing their best through niche innovations to create change and room for waste prevention and influence consumer practices in whatever capacity they are able to. In terms of how they are able to change the landscape and regime of waste production and management, their direct ability is limited as they have no say in what is decided at national and EU level. However, the municipalities are able to contribute with a very real view on where the specific problem areas are with regards to waste management and which products are the most difficult to manage sustainably when they become waste. Additionally, Figure 11 visualizes that the window of opportunity created is making room for their efforts to further visualize the need for a change in policy. Thus, they are able to provide politicians and decision makers with a picture of where their priorities should lie when discussing waste management. Additionally, the

municipalities are able to start a discussion about waste and waste production locally through their partnership Klimaalliancen, making the citizens and consumers aware of their own waste production and calling attention to the importance of change happening within the regulation of products and producer responsibility to help the consumers change their behavior towards a more sustainable version. Hereby, the municipalities will have the role of supporter, informer and demonstrator through their local knowledge and data, with the coming change in policy and areas of activities.

10 References

Aarhus Municipality, 2021. *På vej mod et cirkulært Aarhus,* s.l.: s.n.

Andersen, B. R., 2022. *Fremtidens skraldemand skal være affaldsambassadør.*
[Online]
Available at: https://vpt.dk/teknik-og-miljoe/fremtidens-skraldemand-skal-vaere-affaldsambassadoer
[Senest hentet eller vist den 22 January 2024].

Arc, u.d. *Nærgenbrugsstationer.* [Online]
Available at: https://a-r-c.dk/privat/naergenbrugsstationer/
[Senest hentet eller vist den 19 January 2024].

Assens Forsyning, u.d. *Nærgenbrugsstationer.* [Online]
Available at: https://www.assensforsyning.dk/affald/ordninger/naergenbrugsstationer
[Senest hentet eller vist den 19 January 2024].

Bahn, M. & Abrahamsen, S., 2019. C40-borgmestre lancerer 'Global Green New Deal': Vi kan ikke vente på regeringerne længere. *Information*, 10 October.

Bech, L., 2024. *Gate21* [Interview] (23 January 2024).

Beyer, H. & Holtzblatt, K., 1997. *Contextual Design: Defining Costumer-Centered Systems.* San Francisco: Morgan Kaufmann Publishers Inc..

Bocken, N. M. P., Pauw, I. d., Bakker, C. & van der Grinten, B., 2016. Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering,* 33(5), pp. 308-320.

Brinkmann, S., 2014. *Det Kvalitative Interview.* s.l.:s.n.

Buch, A., 2017. *Praksisteori og arbejdslivsforskning,* s.l.: s.n.

C40 Cities, 2016. *Deadline 2020,* s.l.: s.n.

C40 Cities, 2020. *Climate Action Planning Framework,* s.l.: s.n.

C40 Cities, u.d. *About C40.* [Online]
Available at: https://www.c40.org/about-c40/
[Senest hentet eller vist den 7 November 2023].

C40 Cities, u.d. *Our history.* [Online]
Available at: https://www.c40.org/about-c40/our-history/
[Senest hentet eller vist den 7 November¨ 2023].

Christensen, H. M., 2023. *Frederiksberg Municipality* [Interview] (6 December 2023).

CONCITO, u.d. *DK2020 Klimaplaner for hele Danmark.* [Online]
Available at: https://concito.dk/en/projekter/dk2020-klimaplaner-hele-danmark
[Senest hentet eller vist den 6 November 2023].

Copenhagen Municipality, 2019. *Cirkulær København - Ressource- og Affaldsplan 2024,* s.l.: s.n.

Copenhagen Municipality, 2023. *Kampagne skal informere unge om samtykkeloven.*
[Online]

Available at: https://via.ritzau.dk/pressemeddelelse/13693406/kampagne-skal-informere-unge-om-samtykkeloven?publisherId=13559194
[Senest hentet eller vist den 22 January 2024].

Dakofa, 2024. *Fire, nye EU-regelsæt spiller sammen om miljørigtige produkter og bedre forbrugervalg,* s.l.: s.n.

Dansk Standard, 2023. *Method to achieve circular designs of products,* s.l.: s.n.

DN, 2023. *Vi laver for meget affald - men du kan gøre en forskel.* [Online]
Available at: https://www.dn.dk/nyheder/vi-laver-for-meget-affald-men-du-kan-gore-en-forskel/
[Senest hentet eller vist den 05 February 2024].

DN, u.d. *Hvad gør din kommune for at mindske affaldsmængderne.* [Online]
Available at: https://www.dn.dk/vi-arbejder-for/baeredygtighed/cirkulaer-okonomi/hvad-gor-din-kommune-for-at-mindske-affaldsmaengderne/
[Senest hentet eller vist den 6 November 2023].

Egedal Municipality, 2019. *Affaldsplan 2019-2030,* s.l.: s.n.

Ellen Macarthur Foundation , u.d. *What is circular economy?.* [Online]
Available at: https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview
[Senest hentet eller vist den 8 january 2024].

Ellen Macarthur Foundation, u.d. *The butterfly diagram: visualising the circular economy,* s.l.: s.n.

Energistyrelsen, u.d. *Overblik over sektoren.* [Online]
Available at: https://ens.dk/ansvarsomraader/affald/overblik-over-sektoren
[Senest hentet eller vist den 9 November 2023].

European Commission, 2022. *Proposal for a Directive on empowering consumers for the green transition and annex.* [Online]
Available at: https://commission.europa.eu/publications/proposal-directive-empowering-consumers-green-transition-and-annex_en
[Senest hentet eller vist den 29 February 2024].

European Commission, 2023. *Right to repair: Commission introduces new consumer rights for easy and attractive repairs.* [Online]
Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1794
[Senest hentet eller vist den 29 February 2024].

European Commission, u.d. *Green claims.* [Online]
Available at: https://environment.ec.europa.eu/topics/circular-economy/green-claims_en
[Senest hentet eller vist den 29 February 2024].

European Commission, u.d. *Waste Framework Directive.* [Online]
Available at: https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en
[Senest hentet eller vist den 29 January 2024].

Faxe Municipality, 2022. *Faxe Kommune Klimaplan 2022-2050,* s.l.: s.n.

Ferreira, C., Kalantari, Z. & Pereira, P., 2021. Livable cities: Current environmental challenges and paths to urban sustainability. *Journal of Environmental Management,* p. 277.

Frederiksberg Municipality , 2023. *Midtvejsevaluering på ressource- og affaldsplan 2026,* s.l.: s.n.

Frederiksberg Municipality, 2021. *Affaldsplan 2026-2032,* s.l.: s.n.

Frederiksberg Municipality, 2023. *Affaldshåndbog,* s.l.: s.n.

Frederiksberg Municipality, u.d. *Tekst om engangsservice fra intra,* s.l.: s.n.

Frederikssund Municipality, u.d. *Nærgenbrugsstationer og miljøstationer.* [Online]
Available at: https://www.frederikssund.dk/Borger/Bolig--byggeri/affald/Naergenbrugsstationer
[Senest hentet eller vist den 19 January 2024].

Gate21, u.d. *Circular Builders.* [Online]
Available at: https://www.gate21.dk/circular%20builders/
[Senest hentet eller vist den 22 November 2023].

Gate21, u.d. *Cityloops.* [Online]
Available at: https://www.gate21.dk/cityloops/
[Senest hentet eller vist den 22 November 2023].

Gate21, u.d. *Om Gate21.* [Online]
Available at: https://www.gate21.dk/om-gate-21/
[Senest hentet eller vist den 6 November 2023].

Gate21, u.d. *Structural Reuse.* [Online]
Available at: https://www.gate21.dk/structural-reuse/
[Senest hentet eller vist den 22 November 2023].

Geels, F. W., 2004. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy.*

Geels, F. W., 2012. A socio-technical analysis of low-carbin transitions: introducing the multi-level perspective into transport studies. *Journal of Transport Geography,* pp. 471-482.

Gentofte Municipality, 2021. *Affaldplan 2021-2032 - sammen om mindre affald og mere genbrug,* s.l.: s.n.

Gentofte Municipality, 2022. *Handleplan for Klimaneutralitet,* s.l.: s.n.

Gentofte Municipality, 2023. *Anbefalinger - Klimaborgersamling i Gentofte Kommune,* s.l.: s.n.

Gladsaxe Municipality, 2023. *Status på mål i Affaldsplan 2015-2024, Afrapportering 2022 og Handleplan 2023,* s.l.: s.n.

Granholm, J., Harhorn, M., Keldorff, A. & Høg, H.-H., 2023. *Albertslund Municipality* [Interview] (4 December 2023).

Greve Municipality, 2022. *Affaldsplan 2023-2034,* s.l.: s.n.

Halsnæs Municipality, 2019. *Affaldsplan 2019-2030,* s.l.: s.n.

Hansen, K. B., 2023. *Vestforbrændingen* [Interview] (18 December 2023).

Herlev Municipality, 2022. *Affaldsplan 2022-2033,* s.l.: s.n.

Hoogma, R., Kemp, R., Schot, J. & Truffer, B., 2002. Experimenting for sustainable transport: the approach of strategic niche management. *Spon Press.*

Jørgensen, A., 2023. *Kommuner samarbejder med unge om grønne adfærdsændringer.* [Online]
Available at: https://gate21.dk/cirkulaer-omstilling/kommuner-samarbejder-med-unge-om-groenne-adfaerdsaendringer/
[Senest hentet eller vist den 17 January 2024].

Jørgensen, M. S. et al., 2022. *Strategier til forlængelse af produktlevetider som del af cirkulær økonomi,* s.l.: s.n.

Kemp, R., Schot, J. & Hoogma, R., 1998. Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management. *Technology Analysis and Strategic Management.*

KL, 2023. *Klimaplaner for hele Danmark.* [Online]
Available at: https://www.kl.dk/klima-og-erhverv/klima/dk2020/klimaplaner-for-hele-danmark
[Senest hentet eller vist den 7 November 2023].

Kolding Municipality, u.d. *Aloria.* [Online]
Available at: https://www.aloria.dk/
[Senest hentet eller vist den 17 January 2024].

Kolding Municipality, u.d. *Bliv klogere på affald og genbrug.* [Online]
Available at: https://www.kolding.dk/borger/affald-og-genbrug/besog-os-og-laer-mere-om-genbrug/bliv-klogere-pa-affald-og-genbrug/
[Senest hentet eller vist den 17 January 2024].

Konietzko, J., Bocken, N. & Hultink, E. J., 2020. Circular ecosystem innovation: An initial set of principles. *Journal of Cleaner Production,* Årgang 253, p. 119942.

Kredsløb, u.d. *Kom og besøg Godsbanen Nærgenbrugsstation.* [Online]
Available at: https://www.kredslob.dk/produkter-og-services/genbrug-og-affald/genbrugsstation/naergenbrugsstationen
[Senest hentet eller vist den 19 January 2024].

Kristensen, H. S. & Huulgaard, R. D., 2022. *Cirkulær økonomi og tekstiler,* s.l.: s.n.

Kusk, L., 2020. *Affaldssektorens Omstilling til Cirkulære Strategier,* s.l.: s.n.

Kusk, L., 2024. *Nordværk* [Interview] (14 February 2024).

Lejre Municipality, 2020. *Lejre Kommunes Klimaplan 2020-2050 - vores sted vores klima,* s.l.: s.n.

Lejre Municipality, 2023. *Plan for forebyggelse og håndtering af affald i Lejre Kommune 2023-2028,* s.l.: s.n.

Lemvig Municipality, 2023. *Røde plakater langs vejene skal redde liv.* [Online]
Available at: https://lemvig.dk/kommunen/nyhedsarkiv/roede-plakater-langs-vejene-skal-redde-liv
[Senest hentet eller vist den 22 January 2024].

Lyngby-Taarbæk Municipality, 2022. *DK2020-Klimaplan Lyngby-Taarbæk Kommune,* s.l.: s.n.

Maitre-Ekern, E., 2021. Re-thinking producer responsibility for a sustainable circular economy from extended producer responsibility to pre-market producer responsibility. *Journal of cleaner production,* Årgang 286.

Maitre-Ekern, E. & Dalhammer, C., 2019. Toward a hierarchy of consumption behaviour in the circular economy. *Maastricht Journal of European and Comparative Law,* 26(3), pp. 394-420.

Middelfart Municipality, 2022. *Ressourceplan 2023-2032 Middelfart Kommune,* s.l.: s.n.

Miljøministeren, 2023. *Tilbagetrækning af genbrugs udspil,* s.l.: s.n.

Miljøministeriet, 2013. *Danmark uden affald,* s.l.: s.n.

Miljøministeriet, 2015. *Danmark uden affald II,* s.l.: s.n.

Miljøministeriet, 2020. *Handlingsplan for Cirkulær Økonomi,* s.l.: s.n.

Miljøministeriet, 2021. *Bekendtgørelse om Affald.* [Online]
Available at: https://www.retsinformation.dk/eli/lta/2021/2512
[Senest hentet eller vist den 5 january 2024].

Miljøministeriet, 2023. *Grund- og nærhedsnotat til folketingets europaudvalg om Kommissionens forslag til Europa-Paralamentets og Rådets direktiv om revision af affaldsrammedirektivet,* s.l.: s.n.

Miljøministeriet, u.d. *Strømlinet affaldssortering.* [Online]
Available at: https://mst.dk/borger/affald-og-forurening/sortering-af-affald/stroemlinet-affaldssortering
[Senest hentet eller vist den 14 December 2023].

Miljøstyrelsen, 2023. *Affalsstatistik 2021,* s.l.: s.n.

Nielsen, H. H., 2023. *Gentofte Municipality* [Interview] (1 December 2023).

Nielsen, H. V., 2024. Winie Evers om knap 150 dage i spidsen for Odense Renovation "Handler ikke om at drive en virksomhed". *WasteTech*, 11 January.

Noldus, V. & Holst-Olesen, A., 2022. *Nyt projekt skal bane vej for mere bæredygtige materialer i byggeriet.* [Online]
Available at: https://realdania.dk/nyheder/2022/09/nyt-projekt-skal-bane-vej-for-mere-baeredygtige-materialer-i-byggeriet
[Senest hentet eller vist den 22 November 2023].

Northern Funnen Municipality, u.d. *Nærgenbrugsstationer i Sommerhusområdet.* [Online]
Available at: https://www.nordfynskommune.dk/borger/genbrug-og-renovation/indsamling-af-affald-ved-din-bolig/naergenbrugsstationer-i-

sommerhusomradet/
[Senest hentet eller vist den 19 January 2024].

Odense Renovation, u.d. *Zirkelbutik og fælleslager.* [Online]
Available at: https://www.odenserenovation.dk/om-odense-renovation/zirkel/zirkelbutik-og-faelleslager/
[Senest hentet eller vist den 16 January 2024].

OECD, 2019. *OECD Environmental Performance Reviews: Denmark 2019.* [Online]
Available at: https://www.oecd-ilibrary.org/sites/1eeec492-en/index.html?itemId=/content/publication/1eeec492-en
[Senest hentet eller vist den 29 January 2024].

Olesen, C., 2021. *Grønt valgstunt: Klimabevæelse vil hænge plakat af kendt kunstner op over hele landet.* [Online]
Available at: https://www.kommunen.dk/artikel/groent-valgstunt-huskmitnavn-plakater-bliver-haengt-op-over-hele-landet
[Senest hentet eller vist den 22 January 2023].

Plusbutikken, u.d. *Om os.* [Online]
Available at: https://www.affaldplusbutikken.dk/pages/about-us
[Senest hentet eller vist den 16 January 2024].

PSQR, 2023. *All You Need To Know About the EU Digital Product Passports.* [Online]
Available at: https://psqr.eu/publications-resources/all-about-dpp/
[Senest hentet eller vist den 21 February 2024].

Randers Municipality, u.d. *Nærgenbrugsstationer.* [Online]
Available at: https://www.randers.dk/borger/bolig/affald-genbrug/saerligt-for-etageejendomme-og-vicevaerter/naergenbrugsstationer/
[Senest hentet eller vist den 19 January 2024].

Ranfelt, M. H., 2024. *Danish Society for Nature Conservation* [Interview] (4 January 2024).

Realdania, u.d. *DK2020.* [Online]
Available at: https://realdania.dk/projekter/dk2020
[Senest hentet eller vist den 6 November 2023].

Regeringen, 2018. *Strategi for Cirkulær Økonomi,* s.l.: s.n.

Regeringen, 2020. *Klimaplan for en grøn affaldssektor og cirkulær omstilling,* s.l.: s.n.

Repair Cafe Denmark, u.d. *Find Repair cafe.* [Online]
Available at: https://repaircafedanmark.dk/repair-cafeer-i-danmark/
[Senest hentet eller vist den 16 January 2024].

Ringkøbing Skjern Municipality, 2022. *Affaldshåndteringsplan 2022-2034,* s.l.: s.n.

Rip, A. & Kemp, R., 1998. Technological change. I: *Human Choice and Climate Change.* s.l.:s.n., pp. 327-399.

Sehested, L., 2023. *Rødovre Municipality* [Interview] (12 December 2023).

Sorø Municipality, 2022. *DK2020 Klimahandleplan for Sorø Kommune,* s.l.: s.n.

Stub, M. P., 2024. *Kolding Municipality* [Interview] (17 January 2024).

The European Commission, 2023. *Circular economy for textiles: taking responsibility to reduce, reuse and recycle textile waste and boosting markets for used textiles.* [Online]
Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3635
[Senest hentet eller vist den 20 February 2024].

The European Commission, 2023. *Digital Product Passport.* [Online]
Available at: https://hadea.ec.europa.eu/calls-proposals/digital-product-passport_en
[Senest hentet eller vist den 21 February 2024].

The European Commission, u.d. *Ecodesign for Sustainable Products Regulation.* [Online]
Available at: https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en
[Senest hentet eller vist den 29 January 2024].

The European Parliament and Council, 2005. *Directive 2005/29/EC concerning unfair business-to-consumer commercial practices in the internal market,* s.l.: s.n.

The European Parliament and Council, 2008. *Directive 2008/98/EC of The European Parliament and of The Council on waste and repealing certain Directives,* s.l.: s.n.

The European Parliament and Council, 2009. *Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products,* s.l.: s.n.

The European Parliament and Council, 2012. *Directive 2012/19/EU on waste electrical and electronic equipment (WEEE),* s.l.: s.n.

The European Parliament and Council, 2018. *Directive 2018/852 amending Directive 94/62/EC on packaging and packaging waste,* s.l.: s.n.

Ugeavisen, 2015. *Mølleskolen som affaldsambassadør.* [Online]
Available at: https://ugeavisen.dk/forside/moelleskolen-som-affaldsambassadoer
[Senest hentet eller vist den 22 January 2024].

UN, u.d. *The Paris Agreement.* [Online]
Available at: https://unfccc.int/process-and-meetings/the-paris-agreement
[Senest hentet eller vist den 7 November 2023].

van Thiel, S., 2014. *Research Methods in Public Administration and Public Management.* s.l.:s.n.

Vestforbrændingen, u.d. *Om os.* [Online]
Available at: https://vestfor.dk/om-os
[Senest hentet eller vist den 14 December 2023].

Winkler, N., 2021. *Danskerne slår rekord i affaldssortering.* [Online]
Available at: https://cirkulaer.dk/nyheder/danskerne-slaar-rekord-affaldssortering
[Senest hentet eller vist den 22 November 2023].