IMPROVING CIRCULARITY OF FURNITURE IN GREATER COPENHAGEN

PARTNERSHIPS AND COLLABORATIONS FOR A TRANSITION TOWARDS THE CIRCULAR ECONOMY

MSC ENGINEERING IN SUSTAINABLE CITIES

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ANNA QUERALT FUENTES

AALBORG UNIVERSITET

Aalborg University (Copenhagen)

Improving Circularity of Furniture in Greater Copenhagen - Partnerships and Collaborations for Moving towards the Circular Economy

by

Anna Queralt Fuentes

Supervisor: Michael Søgaard Jørgensen
External Censor: Kim Christiansen

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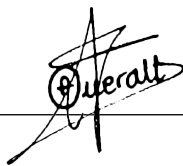Aalborg University Copenhagen

June   2017

Declaration of Authorship

I, Anna Queralt Fuentes, declare that this thesis titled, 'Improving Circularity of Furniture in Greater Copenhagen' and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at AAU-CPH.

- Where any part of this thesis has previously been submitted for a degree or any other qualification at AAU-CPH or any other institution, this has been clearly stated.

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Signed:

Date: 9th June 2017

"The secret of change is to focus all your energy, not fighting the old, but on building the new"

Socrates

Aalborg University (Copenhagen)

Abstract

The School of Architecture, Design and Planning (SADP)
Aalborg University Copenhagen

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The throw-away lifestyle is a problem directly related to air and waste pollution and resources scarcity. Even though furniture is supposed last long it has also been converted into an item that is easily found in trash containers and curbside. Copenhagen, is a city that supports the transition towards a Circular Economy model, and its neighbouring municipalities are home for new local initiatives that aim at going higher on the waste hierarchy while generating social benefits. The main RQ posed is *"How can the public and private sector improve circularity of furniture in Copenhagen?"* This research thoroughly analyses the enablers and barriers that each of the initiatives faces , as well as their roles in their networks. It also includes the opportunities that innovation and collaborations between actors could work in order to prevent the downcycling of furniture. The initiatives analysed come from public businesses, NGOs, municipalities and corporations. In addition, a summary of how the connections between disposal methods, the initiatives for CE and the level of resource management.

The conclusion points out the actions where public authorities and private sector can become stronger and bolder change makers. It also stresses the possibilities of new business opportunities and job positions that innovative solutions around the *storskrald* disposal method could bring if unlocked.

Acknowledgements

Contents

List of Figures

List of Tables

Abbreviations

AAU	**A**alborg **U**niversity
ANT	**A**ctor **N**etwork **T**heory
ARC	**A**mager **R**esource **C**enter
C-DIST	**C**enter for **D**esign, **I**nnovation and **S**ustainable **T**ransitions
CE	**C**ircular **E**conomy
DBA	**D**en **B**la **A**vis
EPR	**E**xtended **P**roducer **R**esponsibility
EU	**E**uropean **U**nion
FN	**F**olkekirkens **N**ødhjælp
NGO	**N**on-**G**overnmental **O**rganization
RG	**R**parations**G**uiden.dk
PPP	**P**ublic **P**rivate **P**artneship
PSS	**P**roduct **S**ervice **S**ystem
SC	**S**ydhavns**C**ompagniet
SHOP	**S**econd-**H**and **O**nline **P**latform
SPT	**S**ocial **P**ractice **T**heory
UN	**U**united **N**ations
WFD	**W**aste **F**ramework **D**irective
WRMP2018	**R**esource and **W**aste **M**anagement **P**lan 2018
WtE	**W**aste to **E**nergy

Dedicated to my parents, for their unconditional support in this journey named 'life'...

Chapter 1

Introduction and Background

INTRODUCTION: TOWARDS A NEW PARADIGM

Cities have become complex systems formed by different and dynamic sectors which depend one another. How these dynamics and inter-dependencies evolve during the coming few years will frame the quality of urban areas and the lifestyle of those who live in during the coming hundreds of years (EMAF, 2012). Moreover, there is currently a clear *momentum* for steering the roles of cities towards shaping a more sustainable future.

The Linear Economy

The continuous extraction of limited resources, over consumption and poor resource management systems are the main drivers of the "take-make-use-dispose" or linear economy - the economy model under which cities are currently locked in (UNEP, 2012).
This model was firstly introduced to society during the industrial revolution when the economic level of population was raising, ownership of goods became affordable for the vast majority of people and free time started to be seen as a valuable asset. In fact, the first source in which the "throw-away" concept was introduced is the article entitled "Throwaway Living - Disposable items cut down household chores". In this article, the use of single-use plastic products was promoted as main solution to the lack of free time. It literally claimed that *"The objects flying through the air in this picture would take 40 hours to clean - except that no house wife need to bother"* [...] *"they [these objects] are meant to be thrown away after use"* (LIFE Magazine, 1955).
The consequences of the normalisation of this throwaway model (including non-lasting and lasting products), together with an inefficient waste management system, have eventually become the causes of a constant devaluation of the resources and of a general environmental pollution. Besides, the fact that population is exponentially raising is an

extra element to consider when estimating the potential negative impacts of this linear model (Simon, 2015).

The Circular Economy (CE)

Although this shift of paradigm is a highly complex and global challenge, there already exist alternative models to build upon that are able to cope with linearity. The Circular Economy is growing as a restorative and regenerative model that tries to fix the social and environmental problems that linear economy has generated (EMAF, 2012).
On one side, the way products are designed and manufactured has to change. Meaning that, in the design stage, the end-of-life of the product must be considered so that products can last long, be repaired and ultimately, the materials can be reprocessed. The environmental footprint of all resources used during the value chain can easily decrease if the right mindset is established from the first stage of design (EMAF, 2015a).
The other side of the problem lays on our current consumption patterns. Our lifestyles values are influenced by the need of constant ownership of things and belong to a social status that triggers to compulsive consumerism and over-consumption (EMAF, 2013). Therefore, a shift of our lifestyles and the way we consume should simultaneously happen along with production changes (Vezzoli, C. et al., 2015). Further, institutions that nowadays support linear production and consumption patterns need to think how to address the waste issue so that a sustainable transition is simultaneously addressed by all actors involved (ibis).

BACKGROUND

The background section is used to contextualise and develop the problem analysis in order to lead to the specific problem formulation.
First, the laws and regulations that play a role in the development of CE (in Greater Copenhagen) are explained. Next, the problems of furniture and its end-of-life options lead to an explanation of the current situation in the Danish, and more specifically in Greater Copenhagen, context. Finally a brief explanation of how stakeholders of the furniture production are stepping towards the CE is exposed.

1.1   Policy Framework and Plans for the Circular Economy

Socio-technical transitions and changes of paradigms are complex and dependant on several factors, such as politics, geopolitics, culture, society, economics, environment... (Unruh, 2000). The purpose of this section is to explain the existing policy framework that embraces the Circular Economy in Copenhagen. It includes an explanation of how

the European, the Danish and the Municipal plans are designed as well as what targets and goals are set to move forward into the right -CE- direction.

1.1.1   Legislation at EU level

The European Union is striving to pave the route towards a Circular Economy through the redesign of laws and regulations. The EU designed the Circular Economy Package which is shaped, among other legislations, by the Directive 2008/98/EC (Waste Framework Directive). Throughout legislative development and a clear set of objectives and targets, the EU expects to improve the waste management systems, promote innovation in recycling, limit landfilling and encourage changes in the consumer behaviour in all member states, in order to facilitate the transition towards the Circular Economy (European Commission, 2008).

The focus of the EU in relation to waste management is based on the "waste hierarchy" (see figure 1.1), which sets the following priority order at its operational level: prevention, reuse and preparing for re-use, recycling (giving priority to upcycling), energy recovery from incineration (WtE) and, at the bottom, the one to avoid the most, disposal (which includes incinerating without energy recover and landfilling) (European Commission, 2008).

FIGURE 1.1: EU Waste hierarchy (European Commission, 2008).

The EU Waste Directive also introduces the need of applying both measures, the Producer Pays Principle (PPP) and the Extender Producer Responsibility (EPR) throughout the implementation of policy instruments that can trigger polluters to shift their production models and take responsibility of the waste, and environmental footprint in general, that their business models generate (European Commission, 2008).

Reuse and prepare-for-reuse, maintain, repair, remanufacture and upcycle, in this priority order, belong to the arrangement of actions that, if implemented in the strategies of businesses, can accelerate the shift towards the CE (EMAF, 2013). These steps, previously mentioned, are key drivers for European legislation consider when designing new

regulations -or redesigning old ones- so that Member States can translate them into bold national plans for the CE.

1.1.2 The Danish Context

The Danish government, in 2013, launched "Denmark Without Waste" strategy, which framed the transition towards the CE based on changes within the recycling target. Two years after, in 2015, the Ministry of Environment released a new strategy, the Waste Prevention Strategy II, setting more ambitious goals by targeting, fore example the reuse - going upper in the waste hierarchy (Evironmental Protection Agency, Ministry of Environment and Food of Denmark, 2015). This strategy aimed at answering questions such as *"how to produce and consume with few resources"*, *"how could reuse be more implemented?"* and *"how could Denmark accelerate the transition by creating a better waste management?"* (ibis).

1.1.3 Plans for Copenhagen

Following the national strategy, the City of Copenhagen has been ahead in their waste management plans, compared to the national ones which are less ambitious and concrete. In 2014, the "Resource and Waste Management Plan 2018" for Copenhagen was released with the goal of going higher in the waste hierarchy. Prevention, direct reuse and more efficient recycling are the main drivers of this plan (City of Copenhagen, 2014).

The plan divides the local strategies in four different topics: (1) less waste, (2) better separation by citizens and businesses, (3) more efficient and environmental friendly waste collection and (4) better waste treatment.
Under the first topic there are two measures that lead to the implementation of initiatives for preventing waste in general, but also furniture. *More Reuse* aims at favouring places to facilitate the exchange of reused items, such as in the recycling stations. And, *Flagship: Sydhavns Recycling Station*, which is further developed in the analysis, aims at becoming the first Danish recycling station with Circular Economy as the main driver (ibis.). It would include similar concepts as one built in Alelyckan, Sweden, such as recycling area, information offices, a second hand store, a workshop for repairs, an eco-cafe... (Campos and Zapata, 2014).
Preventing resources from being incinerated is also one of the goals set in the RWMP. Under the third topic, there is a measure to improve the recyclability of furniture products (number 29). Around 30-40% of bulk waste in Copenhagen comes from furniture, bookshelves or tables. And, taking into consideration that there are currently 22,000 tonnes of bulk waste coming from wood, the City of Copenhagen could increase in 5,000

tonnes the recyclability of wooden waste instead of recovering only its energy, so that it can eventually accomplish more circularity solutions than WtE. The aim of this measure is to increase the proportion of waste for recycle from a current 15% to a 50% by 2018 (City of Copenhagen, 2014).

1.2 The facts about furniture

Furniture products have historically been designed to last for long periods due its purpose and function. As a result of an association to a product that should last, its design was also made for lasting. However, linear depreciation and obsolesce were introduced and, as consequence, nowadays furniture's average lifetime is of 8 years per product (EMAF, 2015b). In addition, during their active life products, including furniture, are in average used less than a 50% of its time (EMAF, 2015b).

1.2.1 Disposal of furniture

The throw-away model has gained ground in the last years and societal practices have developed to a continuously habit of disposing of products and things, including furniture. A study carried out in England in 2012 concluded that the majority of furniture, more specifically a 77% of the items found at the curbside or containers were identified as "reusable". In relation to it, a study carried out by (Fortuna and Diyamandoglu, 2017) concludes saying that lack of knowledge about available disposal methods for unwanted furniture contributes to the disposal of reusable products as waste. Moreover, the proximity to disposal facilities is a factor that affects the method of disposal of furniture items (Curran, 2007).

The waste management infrastructure in Copenhagen allows citizens, who reject any type of reuse or repair of the products, to dispose products throughout the *storskrald* (*bulk waste* in Danish) room. This space is located in many buildings in Copenhagen in order to dispose of the bulk waste. In addition, Greater Copenhagen has a setup of recycling stations where citizens can bring their bulk waste for free. There are 15 recycling stations, which are owned by Amager Resource Center (a public company owned by 5 Danish municipalities), distributed across Greater Copenhagen (State of Green, n.d.) (see figure 1.2). There are two containers where furniture can be disposed. One is the container for pure wood, for items such as tables, shelves, chairs, etc. And, the other one, is used for the recycling of stuffed furniture such as armchairs or sofas (ARC, 2016).

A study released in 2014, in relation to the new conceptualization of recycling stations for the CE, exemplified with Alelyckan eco-cycle park in Sweden, revealed that *"the roles of recycling stations are important because the contemplation of unending waste flows entering does not leave visitors unaffected. The visual and physical contact with the materiality of waste in urban waste infrastructures has the ability to change beliefs, values and behaviours"* (Campos and Zapata, 2014). In other words, changes in the functioning of recycling stations are essential for transitions in order to promote the reuse, repair and keep resources in the loop.
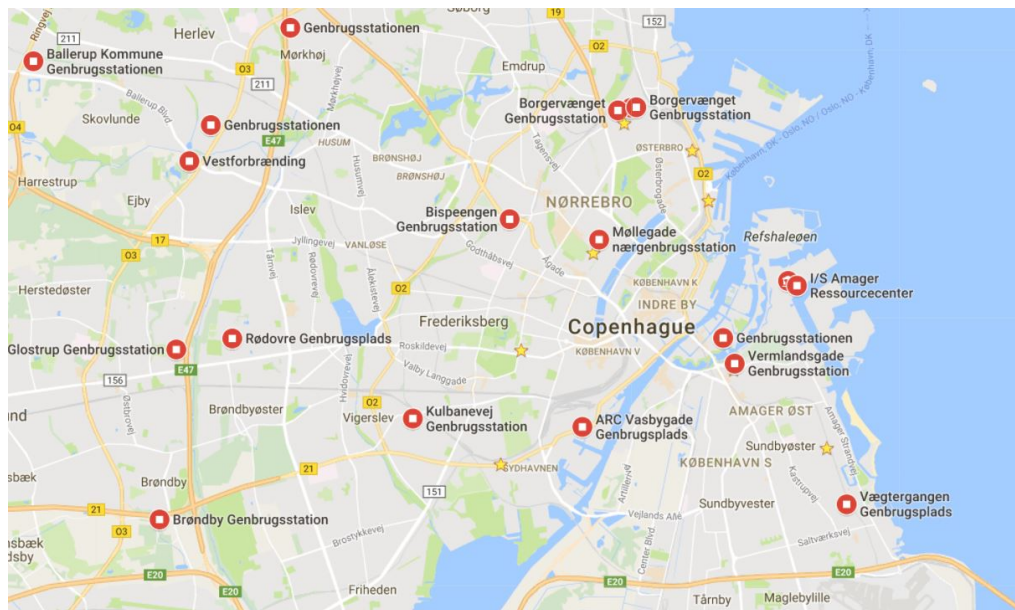
FIGURE 1.2: Screenshot of the map that shows the location of the different recycling stations in Greater Copenhagen (source Google Maps)

Even though great quantities of products are used for WtE solutions and recycling of materials, in Copenhagen there is a significant share of used furniture which is reused, and a small share which is repaired.

1.2.2   Reuse of furniture

There are other options, before deciding to dispose of furnishing items, that consumers can choose. These alternative options belong to upper solutions within the waste hierarchy pyramid: reuse and prepare-for-reuse.

- **Second-hand culture**. Post-consumer products have, throughout history, been stock for exchange and second hand markets. The trading of used products started in the 14th century when new garments were not affordable for the majority of the

population. The reasons for second hand consuming are dependant on the particular product, individual motivations and the objectives of the household involved. The majority of reused products were clothing, kitchen tools, furniture, bedding and luxury goods (Damme and Vermoesen, 2009). This shows that purchasing used furniture is not an innovative practice but a practice that has been repeatedly reproduced throughout the last centuries and modified by the development of society and technology evolution. Another common second-hand solution is to donate the used furniture products because, sometimes, its storage might be a burden due to its big volume and heavy weight. Donations are normally done to relatives, friends or charity (Fortuna and Diyamandoglu, 2017). In Denmark, the Red Cross, Folkekirkens Nødhjælp or Kirkens Genbrug are some of the charities which own second hand shops and resell used furniture for raising profits that are destined to social purposes.

In the last two decades, the *internet of things* has facilitated consumers to get rid of stuff by giving away for free or reselling them. In 2007, Curran et al. concluded that Second-Hand Online Platforms (SHOP) are an emerging market for the life-extension of products and goods (Curran, 2007). In the Danish context many platforms are currently working as enabler for the buying and selling of second hand furniture, among other product categories. Den BlåAvis (DBA), Gul og Gratis, Lauritz, Trendsales, Tradono... have facilitated the possibility to trade (by the resale or giving away of) with users across the whole country (DBA, 2016). The SHOP with a greater number of users in Denmark is DBA, which was bought by eBay in 2008. DBA was a printed newspaper, funded in 1981, which aimed at facilitating the connection between Danish buyers and sellers of used products (DBA, n.d.). The online platform was created in the era of the internet which has triggered to have on sale around 145,000 furniture items (indoor and outdoor) in Denmark (search at DBA website on the 17th May 2017). But also, social media channels such as Facebook have enabled users to create their own groups for the exchange and sale of use products (Daily Mail Science and Tech, 2015).

Besides reuse, a middle step sometimes is needed: repair or prepare-for-reuse (European Commission, 2008). Although the political framework does not currently facilitate this practice, Danish citizens are willing to repair their furniture if they have the know-how of where to go or how to do it (Miljostyrelsen, 2001). Repair is one of the biggest challenges due to cheap prices and quick old-fashioning of new products. Yet, repairing products becomes part of the solution that supports the Circular Economy due to the extension of products' lives (Bocken et al., 2016).

- **Benefits of Reuse**. Extending the life of our products with reuse or prepare-for-reuse contributes to slow down one of the biggest challenges from this century which is climate change (Campos and Zapata, 2014). A study shows that, the reuse of each single item of furniture brings environmental benefits such as natural resources savings, air pollution decrease, less deforestation, less waste generation... (Castellani et al., 2015). Castellani ensures that the *"promotion of the sales of larger items, such as furniture, would generate the highest environmental benets for units sold"*, compared to other products such as books or clothing (Castellani et al., 2015). Consequently, furniture issues should specially be addressed as the environmental savings from a good design and resource management could trigger to positive impacts.

1.2.3 Designers, producers and manufacturers of furniture

One of the biggest challenges for designers, producers, manufacturers and retailers is to create a shift in the entire business models. Successful changes in big businesses happen when education for the CE is done across-departments (EMAF, 2015b). Not all producers phase the change equally. The level of willingness for change and environmental management of organizations involved in the product chain and its networks depends on the following factors: internal competences and strategic interpretations of the companies involved across the value chain; the regulations at national and international level forcing businesses to invest for change and, the pressure from consumers, NGOs and public debate (Jø rgensen and Forman, 2009). The third factor, is many times highly effective, because big companies can have high economic losses, due for example, consumer changes of choice or negative reputation coming from lobbies created NGOs (Karlsson, 2012). Therefore, participating in non-environmentally friendly practices can be harmful for big corporations.

Besides designing business models based on the *"sell more, sell faster"* philosophy, designers, producers, manufacturers and retailers face many challenges in relation to product design. An example of it, is the excess of multi-material products, including glues, which hinders its disassembly and, ultimately the recyclability of its materials. Often, furniture products are made of too many materials and pieces. According to the Swedish Furniture Industry, in average and weight, furniture items contain 70% of wood (-based material), 15% padding materials (polyurethane or polyester foam), 10% metals and 5% other materials (plastics, textiles, glas...) (Tebodin, 2001). Trying to design for Circular Economy means rethinking all concepts from the beginning so that the management of resources can be facilitated at the end-of-life of products.

- **IKEA**. A hub of designers, producers, manufacturers and retailers of furniture.

  IKEA, as major seller of furniture across the world (Statista, 2016) and established retail company in Denmark, has the responsibility of transforming its business towards an environmental and social sustainable corporation. For more than 25 years, IKEA has been designing and implementing strategies and initiatives at business and product design level for becoming a sustainable corporation. In 1990, the first IKEA environmental policy was developed. In 1991, IKEA banned the use of tropical wood coming from non sustainable forests. In 2000, IKEA released a sustainable code of conduct for all its suppliers across the entire value chain (IKEA, 2010). In FY (Fiscal Year) 11, the implementation of the IKEA Product Sustainability Score Card started, which aimed at analysing how sustainable products were individually rated (based on different criteria) and see how the transition towards a more sustainable business model could work (IKEA, 2011). The latest strategies are focused on the CE. For example, in FY16, IKEA joined to a coalition for the CE (CE8) together with other seven international corporations and also joined CE100, a global platform built by the Ellen MacArthur Foundation (EMAF) for businesses that apply innovation for the acceleration of the CE (IKEA, 2016). However, there are still difficulties in meeting goals related to product design. For example, in the report of FY11, one of the goals for FY15 was to reach a 90% of products sales classified as more sustainable (IKEA, 2011). And, in the report of FY16, the same goal is set but, this time, the deadline is August 2020 (IKEA, 2016). This means a 5 years delay compared to the first time this goals was set. Hence, difficulties for accomplishing internal goals suppose a challenge for businesses. Product design is not something which is independent of its business. Product design is part a holistic vision which mirrors the business model behind it. This is why systemic thinking is necessary in order to reach goals that will allow businesses move towards the CE.

1.3 Summary

The background, or analysis of the problem, shows a scene where institutions at EU, national and local Denmark want to move towards the Circular Economy. However, the lack of more ambitious measures leave the responsibility of the end-of-life of furniture to the consumers. In Copenhagen, consumers have several options for getting rid of their furniture items. Resell and donations are common practices among citizens in Denmark. Nevertheless, a great amount of functioning furniture is downcycled due to the infrastructural setup and convenience among other causes. Municipalities of Greater Copenhagen, ARC, producers and retailers, local and National NGOs and researchers

are seen as partners who can take a role for the better management of furniture. This introduction leads to pose the problem formulation which can be read in the coming section.

1.4 Problem Formulation

This section aims at designing the main question and sub-questions that will lead the research process of this investigation.

1.4.1 Research Questions

Based on the problem analysis presented in this chapter, and the need to find solutions for increasing the circularity in furniture, the following main question is posed:

"How can the public and private sector improve circularity of furniture in Copenhagen?"

In addition, the following sub-questions are designed as a guide to carry out the analysis so that it can provide answers for the main research question:

- *Why does furniture become waste?*

- *How do the flows, loops and stock of furniture work in Copenhagen?*

- *What are the current initiatives to promote the reuse of furniture in Copenhagen?*

- *What are the barriers and opportunities for upscaling and replicating the recent experiences with reuse of furniture in Copenhagen?*

Given the above, the focus of this study lays on studying the consumption and production patterns, as well as the existing network of actors and their plans to implement projects for facilitating the reuse of furniture in Copenhagen.

Chapter 2

Theoretical Framework - Practices, Networks and Development

In order to find an answer to the RQ contemplated in this report, a theoretical framework based on different theories has been deployed. Social Practice Theory (SPT), Actor-Network Theory (ANT) and Circular Economy (CE), explained in the coming subsections, are the theory pillars above which the analysis (see Chapter 4) is supported.

2.1 Social Practice Theory (SPT)

To understand the relationship between production and consumption, it is necessary to loop upon the social environment and influences that triggers people to take a decision.

In this research, the Social Practice Theory (SPT) enables to understand the disposing or reusing of furniture as part of the social practices of furnishing apartments, houses or rooms (Shove and Pantzar, 2005).

Shove and Pantzar reflect upon the fact of carrying an action, the practice itself, and explain that consumers take decisions considering threse three different dimensions.

- **Meanings** refer to cultural conventions, expectations and socially shared meaning (Shove and Pantzar, 2005). In other words, the social construction of the consequences of recycling tends to influence the consumer's decision when it comes to deal with their waste.

- **Materials** are the objects, tools and the infrastructure built around a specific practice (Shove and Pantzar, 2005). In the case of this research, it is taken into consideration the existing possibilities that the consumers have in Greater Copenhagen for to disposing of the furniture they will no longer use.

- **Competences** refer to the knowledge and embodied skills that customers have acquired concerning a specific practice (Shove and Pantzar, 2005). Being aware of the fact that throwing away products which can be reused is not a sustainable practice cannot be taken for granted. Therefore, being mindfulness of the problem can trigger the user to do one practice (considered more sustainable) or another (considered more harmful for the environment).

Due to evolution and changes in the meanings, competences and materials of practices, people also change their habits (Shove and Pantzar, 2005). The action of disposing of furniture depends on different factors, not only habits and routines, but also the logistics and set up of the facilitates, availability of vehicle, economic situation... (Fortuna and Diyamandoglu, 2017). In Chapter 4, the SPT is used to partly analyse the unleashing elements that convert reusable furniture into wasteful material. The analysis also includes reflections about what are the triggering factors that lead consumers to resell, give away, bring to the recycling station or leave as bulk waste their old furniture once they do not need it anynmore.

2.2   Networks

The coming section develops on the Actor Network Theory to understand the processes of network creations and how roles are taken. It also includes the concept of Lock-in and how path dependency in actors can sometimes hinder or slow down the transition processes.

2.2.1   Actor Network Theory (ANT)

When it come to analysis of actors, both the relations between the actors and the organizational structure are highly complex. Thus, analysing the processes that shape each actor network and its stabilization is done with the Actor Network Theory (ANT) in order to understand how they have emerged and been developed.

Actors have different perceptions about the challenges and their future development due to their interests, roles, historical development and commitments. This leads to the

possibility of describing the issue in different ways and this is what Rittel and Webber named as *wicked problem* (Rittel and Webber, 1973). All these factors trigger to a wide range of solutions proposed by the actors that probably differ from one another. (Callon, 1986)

Understanding the viewpoint of the different actants part of the existing network of the reuse of furniture, as well as their interactions, is crucial to overcome the problem and try to find new solutions. Now is when Callon asks *"But, how should we describe and analyse these interactions?"* (Callon, 1986).

The Actor World

Detecting the involved actors that can play a relevant role in an Actor Network is the first step that will allow to develop an *actor world*. In an *Actor World* every agent (human or non-human) has a defined role, and these are also engaged to take different roles and specific tasks. The size and objectives of each actor is explained in an actor world (Callon, 1986).

Translation Process

The *translation process* in the ANT requires to see the scene from a broad scope and identify the different interests of each actor involved in the *actor world*. According to Callon this process of translation occurs in four different steps:

- **Problematisation**. In this phase, the problem is defined and the indispensable and different actors are set. It is relevant that the problem is well layed out as it will influence the next steps. Therefore, it is essential to look into the real problem and point out at the different issues to be solved, as well as how it can concern others.

- **Interessement**. In this stage, the primary actor (or group of actors) recruits the rest of necessary actors. These actors take different roles, within the network context, which are aligned with the problem and recognized by the primary or main actor. Creating interest among the involved actors to reach potential solutions is essential within interessment stage.

- **Enrollment**. When enrollment starts, the role of each actor is framed and defined. Therefore, actors accept their new roles and take a new position on what will be the new *actor world*.

- **Mobilisation**.The spokesperson of the primary actors activate the agents so that they take action within their goals and roles. It is in this stage when actors develop, design and implement initiatives so that a new actor world can exist.

A *translation process* is considered to be successful when the interests of the agents, who are part of the *actor world*, are aligned. For this to happen, negotiations to establish common interest are necessary to be done among the human actors and the representatives of non-human actors (Queralt, 2017) based on (Callon, 1986).

ANT in context

For an actor world to become consistent, representatives of all actors belonging to the network are being considered. Some are responsible of dealing with furniture waste, such as the public sector, some are lobbyists for regulations that promote the reuse, others become to organizations working for the reuse and upcycle and one belongs to the manufacturers of furniture.

The intention is to understand their main interests and the direction of their current and near future initiatives (Callon, 1986). Therefore, it can be possible to detect if some initiatives or future plans are common and partnerships to optimise the potentials of Circular Economy within the furniture sector in the are of Copenhagen.

The analysis of each initiative for the reuse of furniture, in Chapter 4, is built upon the information that actors bring, as they provide internal information about how does the post-consumer flow of furniture work in their organization, how do actors cooperate between each other, or how do they develop innovative solutions.

2.2.2 Lock-in

The reason why transitions are not overnight changes is because of its complexity at different levels and clashes of interests between actants involved. Implementing innovative solutions in large infrastructure systems, such as waste management, usually suffers of restrictions coming from lock-in mechanisms. These lock-in mechanisms tend to give priority to already settled technologies and organizational structures (Unruh, 2000). Therefore, examining the barriers that hold each of the actors from innovating and cooperate with others and redesign the existing system is a necessary process. Without understanding these barriers it is more difficult to overcome the existing problems and find potential solutions (ibis.) Particularly in this project, Unruh's theory will be used to detect the different lock-in situations that the current situation presents in order to leave behind the status-quo.

Table 2.1 presents a summary of some sources that Unruh 2002 refers as part of the evolutionary process.

Sources of lock-in

Lock-in source	Examples
Technological	Dominant design, standard technological architectures and components, compatibility
Organizational	Routines, training, departmentalization, customer-supplier relations
Industrial	Industry standards, technological inter-relatedness, co-specialized assets
Societal	System socialization, adaptation of preferences and expectations
Institutional	Government policy intervention, legal frameworks, departments/ministries

FIGURE 2.1: Lock-in Sources (Unruh, 2002).

Unruh 2002, uncovers five different lock-in sources. However, there can exist a combination of different as well as other sources not mentioned in figure 2.1 (Unruh, 2002).

In this research, two following factors are explored to detect whether the actors are locked in.

On one side, the internal system of each actor when it comes to face changes. In other words, ambitious plans and goals can always be set, however the reality is that, due to highly complex processes, these changes might suffer delays or changes of paths in many cases. In consequence, and due to continuous development within the same methodologies, the plans firstly setup and the reality might not coincide.

On the other side, external factors that prevent actors from moving up into the waste hierarchy, in this case the reuse and prepare for reuse of furniture, have to be analysed. These problems can arise due to regulatory frameworks, governance setup or organizational structure.

The lock-in theory helps to understand the difficulties that hinder some actors to move forward. And, by understanding them, it becomes clearer to pose potential solutions.

2.3   The theoretical framework for the CE

This last theoretical framework tackles, from different points of view, the issue of post-consumption options so that resources go back to or stay in the loop. In order to do so, a first introductory theory on the concept of flows and loops is introduced. Then, theories of business strategies and new models, as well as product design strategies, that can enhance the reuse and seek for opportunities in the existing infrastructure of waste prevention in Copenhagen.

Strategies can be redesigned for both business and products by addressing these three strategies for organising resource flows/loops:
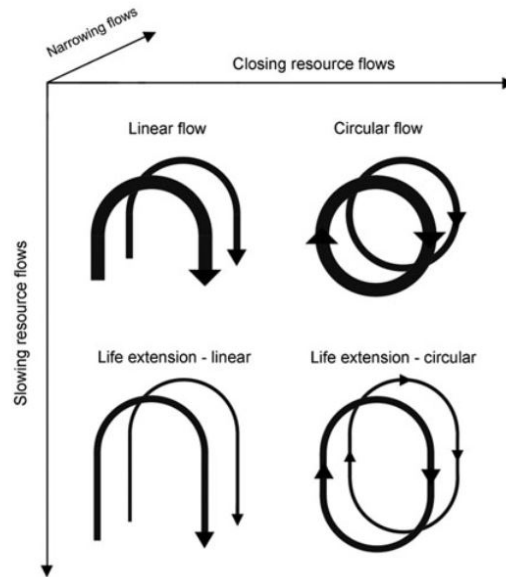
FIGURE 2.2: Categorization of linear and circular approaches for reducing resource use
(Bocken et al., 2016)

- **Closing Resource Loops**. Recycling materials is the step between post-use and remanufacturing. After multiple reuses, closing the material loop allow to re-use resources as secondary war materials (Bocken et al., 2016).

- **Narrowing Resource Loops**. Reducing the amount of resources used per product unit as well as developing energy-efficient products (ibis.).

- **Slowing Resource Loops**. In order to reach a slowdown of the resources used it is necessary to encourage the reuse, utilise long-life goods and extend the life of products with repairability options such as maintenance, repair, refurbish and remanufacturing (Bocken et al., 2016) and (Stahel, 1982).

This general distinction of ways to tackle the loops for the Circular Economy leads to the implementation of them with the *systems thinking* mindset (Bocken et al., 2016). This term refers to see the challenges seen from a holistic viewpoint. In other words, changes in one stage of the value chain will impact different levels across the whole value chain. Therefore and knowing this fact, it is essential to bear in mind that the combination of several solutions applied in different stages is what can trigger to, for example a relevant decrease in resource demand, and not single and disattached solutions.

In order to explain how the loops and flows for each process work at different stages of the supply chain, Stahel builds a three stage figure where it is possible to connect each process to the levels of action (local, regional or global).

Stahel 2017, differs between loops and flows depending on the waste treatment (resource recovery level) that the product suffers. When the whole product, part of the components or only the materials are being reused, the process is referred as loops. By contrast, if the process of post-consumer use has an ending, meaning that the product is suffering a downcycling poorer than recycling, the process is named as flow (Stahel, 2017).

Figure 2.3 is used for the analysis to look upon the initiatives that are currently being implemented to close the loops of furniture at different levels in the are of Copenhagen.
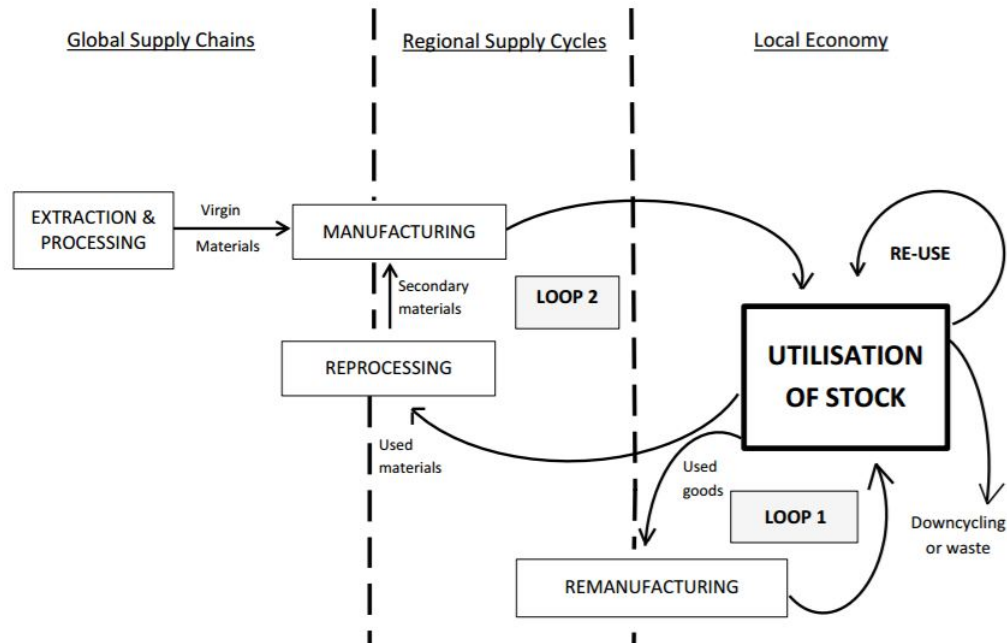
FIGURE 2.3: The basic loops of a Circular Economy (Stahel, 2017)

The basic loops of a CE, seen in figure 2.3, relates the concepts of loops and flows with the way production, consumption and management of resources works. The linear option would be where stock, after being used, is downcycled. This is the take-make-dispose situation where resources become waste after its use (Stahel, 2017).

The three different loop sequences are re-use, remanufacture and reprocessing. When reusing (direct reuse or prepare for reuse) existing products, and extending their lifespan, the extraction of new resources is being slowed down. In other words, there will be less demand for new. Loop 1, refers to the process of remanufacture. This process tries to use existing components from old products to manufacture new products by combining used and new components. The process will also contribute to a slow down of resources due to the reuse of parts of products that don't need to be manufactured from scratch (Bocken et al., 2016). Loop 2, is a two steps process in which materials of similar features are processed and then reused as secondary raw materials to produce new components so that, afterwards, new products can be processes (Bocken et al., 2016).

The environmental savings of this process are focused on the reduction of resources extraction. Therefore, even though the product needs to be manufactured, the materials used were on stock.

When remanufacturing new products, trying to optimise the amount of material per unit of product can contribute to narrow the resource loops. Therefore, more products can be manufactured with the same amount of resources (Stahel, 2017).

2.3.1 Businesses Closing the Loop

As mentioned in the introduction, the closing the loop concept is key. But, as Erwin van der Laan states, closed loop solutions can only work if there is a consistent business model that guarantees its long term profitability (TU Delft Online Learning, 2017). The importance of businesses transitioning towards the circular economy goes beyond technicalities. The real challenge often lies in designing the right business processes (ibis.).

Three steps have been spotted so that businesses can implement closed-loop solutions (see figure 2.4):
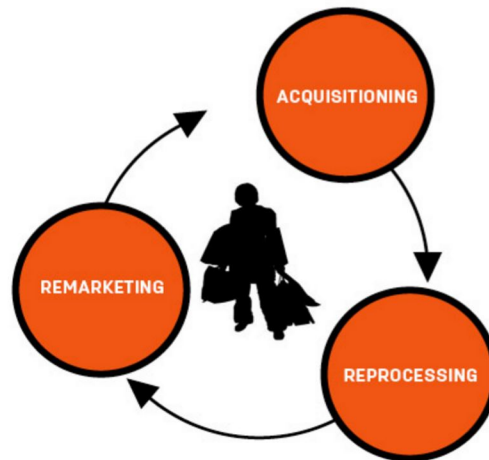
FIGURE 2.4: Business Processes to Close the Loop by Dr. Erwin van der Laan (TU Delft Online Learning, 2017).

- **Acquisition** of used products and materials by collecting the right volumes, of the right quality and for a reasonable price. Material recycling only works with large volumes due to the high costs of recycling facilities and the continuous functioning. In contrast, refurbishing can be feasible with smaller volumes, but only if the quality of returned products is sufficient (ibis).

- **Reprocessing** products, components and materials by refurbishing, remanufacturing and recycling methods, respectively and in this priority order, is the second step. According to van der Laan, reworking products and convert them of sufficient quality for a reasonable price is how more value can be gained (ibis).

- **Remarketing** means to identify existing or new markets that would be willing to buy the reprocessed products, components or materials (ibis).

In Chapter 4, the Analysis, there are exemplifications of new businesses that are exploring closed-loop (at products and components level) opportunities in the furniture sector in Greater Copenhagen. The added value created out of closing the loop is explained in the following subsection.

2.3.2   Business Value Creation

Creating and capturing value is what businesses need to do in order become successful within the parameters of the Circular Economy. Dr. Erwin van der Laan, professor at the EdX Circular Economy course, proposes four type of ways for businesses to capture value. The term of capturing value refers to learn how to create revenue by implementing new dimensions of the value chain such as selling the waste produced in an early stage as secondary raw material. Table 2.1 shows different sources of value creation where businesses could look upon in order to develop their strategies for closing resource loops.

SOURCING VALUE	All types of direct cost reductions and savings that can arise from closed loop business practices
ENVIRONMENTAL VALUE	Benefits that result from improved ecological footprints, for instance: ease of compliance and improved green image.
CUSTOMER VALUE	Increased customer loyalty, better customer satisfaction and superior brand protection.
INFORMATIONAL VALUE	Closing the loop generates valuable data on production and supply problems, failure rates, useful lifetime of the product and usage patterns.

TABLE 2.1: Business Value in a Circular Economy by Dr. Erwin van der Laan (TU Delft Online Learning, 2017).

In any case, closing the loop in a business model requires to bear in mind a holistic perspective of the processes so that rebound effects are prevented. Therefore, a need for a *systems thinking* approach is needed when transitioning from a linear to a circular business model (Bocken et al., 2016).

2.3.3 Shift of Business Models

How can companies move from a "sell more, sell faster" model to a business model that emphasizes selling services instead of products? (TU Delft Online Learning, 2017) Professor Arnold Tukker of the Leiden University Institute of Environmental Sciences untangles this question throughout the model in figure 2.5. This approach understands that when business gradually move from the sale of products to the sell of services these will become closer to the CE. The reasons, are explained after the figure.
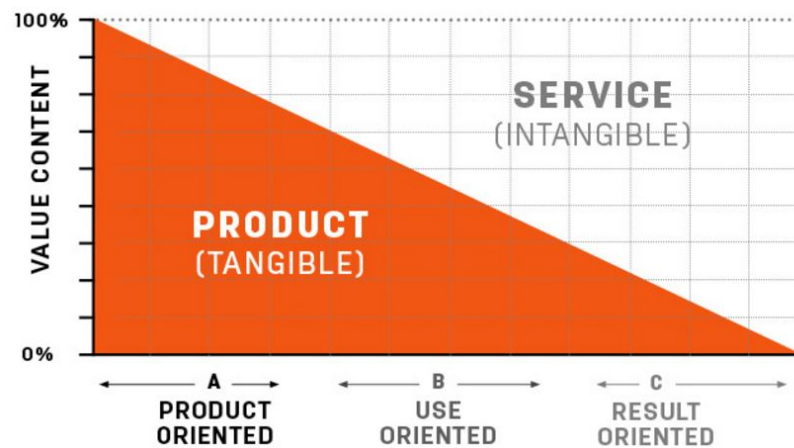
FIGURE 2.5: Three Types of Business Models (TU Delft Online Learning, 2017).

- **Product-oriented**. The business model is based on the sales of products, therefore, the more sales of products, the higher revenue. Extra services can be added to this business model, such as a maintenance contracts or repair services (TU Delft Online Learning, 2017).

- **Use-oriented**. The product still plays a central role. It is owned by a provider and is made available to a client. This is also referred to as an "access" model (ibis). Renting or leasing businesses are example or use-oriented models. There are singular occasions when people are in need of tools or products, but just for once. In these cases, customers can get the service they need and, at the same time, the demand of new products does not increase.

- **Result-oriented**. The client and provider agree on a result. There is no predetermined product involved. This is also referred to as a "performance" model (ibis). An example of result-oriented business model can be a laundry service which provides to the client with the washing machine, repairability and maintenance service, etc. but the owner of the machine will always be the business. On one side, the client does never need to deal with technical problems as the business

is based on a monthly or yearly contract. On the other side, the company has a constant revenue that allows them to create better products, learn about the functionality of their products and implement efficient solutions that will trigger to higher revenue. All these process, far from the sell-more, sell-faster model, contribute to extend the life of products, keep the resources running in the loops and preventing the generation of waste.

Product Service System (PSS) is another term to refer businesses that their model is not based on the sale of products but its use or performances. In order to fulfill the consumer demand and provide a high quality service, these types of businesses own high quality products, reinvest on research and development and innovate in order to become more competitive and find new ways of revenue not based on the *"sell-more, sell-faster"* model (Vezzoli, C. et al., 2015).

2.3.4   Long Lasting Products

Sell more, sell faster business models are far from fitting into the principles of the Circular Economy. *Products That Last*, a project carried out by Conny Bakker and Marcel den Hollander from TU Delft along with Philips, aimed at turning business risks, coming from the linear-based model, into business opportunities (Bakker and den Hollander, 2014). At the same time, the consequences of this shift would contribute to the three strategies (slow, narrow and closing loops) to keep the resource's value and not letting them become waste.

Bocken and den Hollander, explored the essence of design in order to identify strategies to create lasting products. Their research is based on maintaining the product integrity, i.e. preserve the product as similar to its initial state over time.

These 6 Design Strategies for Longer Lasting Products are key for companies to rethink the way they design, produce and manufacture their products to pursue a 100% CE model. Figure 2.6 shows the connection that each of the strategy design has to the product integrity.
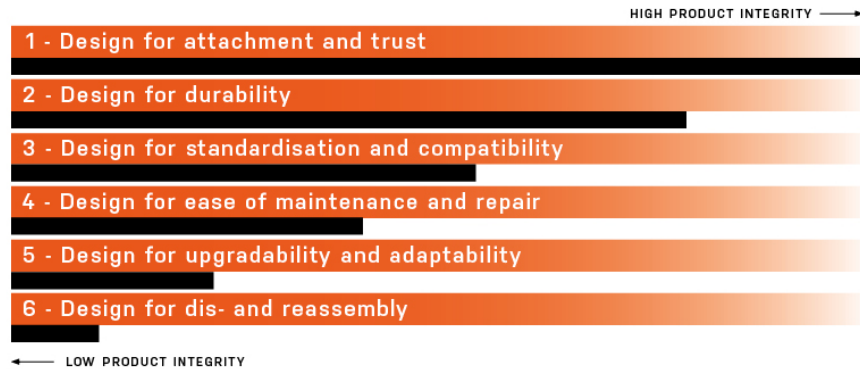
FIGURE 2.6: The Product Integrity Scale: 6 Design Strategies for Longer Lasting Products (Bakker and den Hollander, 2014).

- **Designing for Attachment and Trust**: it means to design products that will create a feeling of belonging and love to the owner. Emotional obsolescence can give make the owner to keep the product for longer time.

- **Design for Durability**: products that are resistant, and are designed for wear and tear and they are also resilient by themselves.

- **Standardization and Compatibility**: products that are designed to be expanded and their component parts are designed in a standard way. Therefore, designing for standardization and compatibility means to design pieces that can fit different products, or what is the same, products that can match pieces from other standard products. This strategy includes to make compatible products within a brand but also between different brands (Bakker and den Hollander, 2014).

- **Ease of Maintenance and Repair**: these products are designed to easily be taken care of so they can always be working in tip-top conditions. And, if the product, or a part of the product, breaks down, it can easily be repaired.

- **Upgradability and Adaptability**: designing resilient products which can adapt to the change of user's needs is an aspect that favours products' life span.

- **Dis- and Reassembly**: if a product is designed in such a way that parts can be separated it is easier to make sure that materials will be recycled (ibis). On top of it, this strategy facilitates the remanufacturing of products as some of the component parts might be useful for creating new products (Stahel, 2017).

2.4   Summary of theories

The three approaches developed in the previous sections of this chapter, shown in figure 2.7, are going to frame the analysis in Chapter 4. Broadly speaking, the interaction of social practices, local networks and circular economy, in the context of furniture-waste prevention in Greater Copenhagen, generates discussions around the existing barriers and potential opportunities for this *momentum*.

FIGURE 2.7: Three theory approaches to tackle the issues with furniture waste in the area of Copenhagen (created by the author)

Chapter 3

Methodology

This chapter displays the methodological approaches and decisions taken for the development of the project. The chapter is structured into different sections. An explanation of the literature used for this project can be found in the first section. The second one, the Research Design, aims to elaborate on the type of methods used to collect relevant data and justify the quality of the report by including a validity and reliability subsection. The Observation and Participation section includes different and relevant activities carried out for and during the period of this research. To conclude, the description of how empirical data has been collected is presented followed by the limitations of this analysis.

3.1 Literature Search

An overall understanding of the topic is given in the first chapter of this report by summarizing the literature reviewed. This literature consists of scientific papers, articles, relevant material such as reports by and about the actors, EU directives, governmental and municipal plans/strategies about waste, resources and the circular economy. Another part of the literature utilised belongs to theories of science (in Chapter 2) as the interest of the project lies into the understanding the current situation for the reuse of furniture in the city of Copenhagen and how it tackles circularity. There is also a review of social practices embedded into the use of furniture that provided deep understanding of the flows of furniture in people.

Reports, articles and relevant information provided by the actors like scientific papers, reviews, documents and reports from organizational or institutional actors is been analysed and thoroughly used.

The way sources are referred is done with the Chicago Manual of Style Author-Date system, usually used in the social science.

3.2   Research Design

The search of an answer to the main research question requires an approach that can only be provided throughout qualitative methods. The process to carry out a qualitative research allows to analyse the specific situation and context in depth (Bryman, 2008). Figure 3.1 represents the main six steps that Bryman recommends for qualitative research processes.
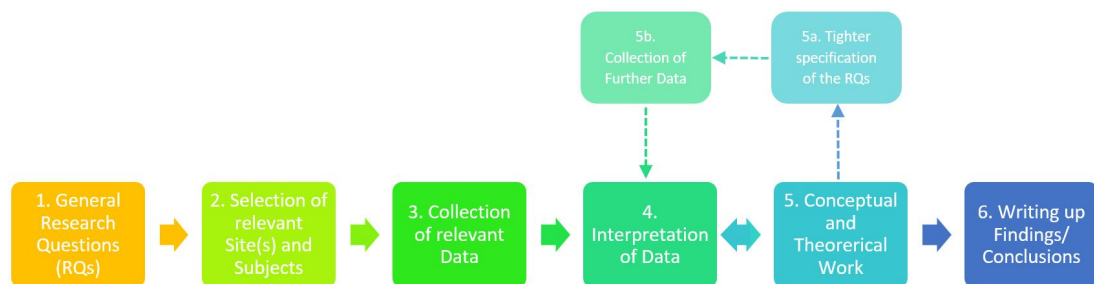
FIGURE 3.1: An Outline of the main steps of Qualitative Research. Designed by the author based on Bryman, 2008.

One of the main features of a qualitative research process is the iteration of the Research Question throughout the research period. Once new data is collected and interpreted the theoretical framework will be redeveloped and, therefore, that will also contribute to redefine, modify or slightly redesign the main research question or sub-questions (ibis).

The outcome of this process will not reflect a unique reality of the problem but different perceptions and interpretations of what the reality is by each of the actors included in the research (ibis).

3.2.1   Qualitative Methods

Understanding the view and approach of each actor regarding the existing infrastructure for reuse and prepare-for-reuse of furniture in Copenhagen has been done through qualitative methods. The interest of these methods lays on trying to see the world from the eyes of those being analysed by developing an exhausting contextual framework to explain the main issues and unravel the complexity of the problem (Bryman, 2008). Also, by looking at it from an external point of view, the dynamics around each actor and their interactions can be analysed and related to their interests.

The purpose of this study is to find new action points where public and private actors could develop new initiatives in order to improve the circularity of furniture in Copenhagen. Another objective of this study is to explain the different viewpoints that each existing or potential actor has in relation to the problems of furniture waste. A third objective is to find and analyse existing initiatives, as well as the actors behind, that promote the reuse of furniture. The purpose of this study is not to generalise with the results obtained but to develop expertise on this specific topic with the intention of bringing together the concerns, ideas and proposals for the future of each actor and initiative.

The qualitative analysis of each of the six selected initiatives is done following these steps: explanation of the initiative, actors involved in it, the product chain process of the furniture before its reuse, the regulatory network, the innovation process and the challenges of the current state of the initiative.

The qualitative research in this project provides a deeper understanding of each actor's worldview perception and, therefore, contributes to build knowledge on the role of each actor and the different possibilities where role could develop upon in a close future. These roles can be defined through interactions, which might imply that consumers are not an homogeneous group but a group formed by several profiles of people with different practices as the DBA 2016 study shows (DBA, 2016).

3.2.2   Validity and Reliability

In order to determine the quality of the research design, validity and reliability are two parameters that need to be argued (Yin, 2009).

Validity in qualitative research shows that what in first place was intended to be studied, is indeed the core of the investigation (Bryman, 2008). This means that validity is high when there is a connection or linkage between the research question and the results and conclusions of the investigation. In terms of social research methods, **reliability**, refers to the possibility for different researchers to respectively collect and obtain the same or similar data and results by employing the same research methods. In other words, a project gains reliability when it is thoroughly documented and the collection of empirical data has exhaustively been defined. In addition, it also requires a clear explanation of the development of the analysis (ibis).

To verify the reliability and validity of the project the trustworthiness criteria developed for qualitative research design has been used (Guba, E. G. and Lincoln, Yvonna S., 1994):

- **Credibility** (internal validity). In qualitative research, credibility refers to the confidence of data, which means that, the degree of credibility is high when the results reflect the views of the studied actors. Therefore, the actors participant on the research are capable to judge the level of credibility (ibis). By first studying the different actors and their viewpoints and, afterwards, arranging different interviews with them, the level of credibility of this report is meant to be high. The different spokesperson have been able to express the vision of their organization, and it has been accurately used in the analysis chapter in order to reach results and conclusions.

- **Transferability** (external validity). It refers to the degree of generalization of the research process into different contexts or time. To enhance transferability the researcher should thoroughly describe the context and main assumptions of the research (Guba, E. G. and Lincoln, Yvonna S., 1994). It could be difficult to apply transferability of this research because it cannot be assumed that the same institutional framework would define similar challenges in other sectors or locations that also experience the structural changes. Therefore, external researchers should consider whether the institutional and structural conditions of other cases are similar to the one studied in this report. Yet, these difficulties are common issues of qualitative research studies. (Bryman, 2008).

- **Dependability** (reliability). In qualitative research, the consistency of findings is associated with dependability. This term is defined as the stability of the data collected over conditions and time. Namely, dependability means submitting to evaluation the quality of the holistic processes of data collection, analysis of data and theory selection (Guba, E. G. and Lincoln, Yvonna S., 1994). The dependability of this report is accurately taken into consideration as the whole process of research design and collection of data is detailed explained. In other words, the reality of the existing challenges (the furniture-as-waste and reuse of furniture) that the are of Copenhagen is currently facing are thoroughly explained. And, this fact increases the possibility to convert the project into a prototype model.

- **Confirmability** (objectivity). Qualitative research often assumes that each author focuses the research from a unique perspective and therefore the replicability of the study is somehow biased by the researcher and the context of the research. The degree of neutrality on a research can be tested by realising the same research by different researchers that could corroborate and compare the outcomes. (Guba, E. G. and Lincoln, Yvonna S., 1994) In this case, the replicability of the

study would be difficult due to two factors. The first one is related to the fact that science is socially constructed, which means that the research is based on an already built perception of the problem and, therefore, can restrict the author from considering knowledge out of the scope of her interest (Sismondo, 2010). This project is based on the assumption that public and private sector should cooperate in order to accelerate the transition towards the circular economy, and, therefore, collaborate so that reuse rates of furniture can rapidly increase. The second factor, refers to the dependency between research and the conditions of time and space of the study. The author has had access to interview representatives of different organizations involved in the flow of furniture in Copenhagen. However, the institutional frameworks of these organizations might change over time, as well as the human resources that form them. Therefore, the replicability of the study could find several obstacles.

3.3   Observation and Participation

The role of the researcher is dependent on several aspects such as the problem being studied, the willingness of being studied by the insiders and the previous knowledge or involvement of the researcher in the insider's world (Baker, 2006).

For this research the author has taken both participatory and observation roles due to different activities carried out in order to gain knowledge of the specific situation of furniture collection in the city of Copenhagen.

3.3.1   Participatory Observation

When the researcher plays the *observer-as-participant* role, the main activity is focused on observing. Yet, short interviews can be conducted and, therefore, the insiders become aware of the fact that research is being done in their field (Baker, 2006).

Participatory observation has been done by attending to a panel debate with the focus on the Sustainable Development Goal (SDG) #12: *Ensure sustainable production and consumption patterns* (UN, 2016). On the 21st of February 2017 the author attended to the panel discussion entitled *Aligning sustainability with strategy - How do firms ensure sustainable consumption and production patterns?* hosted by CBS.MUN (Model United Nations organization at Copenhagen Business School) and the International Debate CBS.

The relevance of this activity is due to the announcement of Jonas Engberg, Sustainability Manager of IKEA Denmark, as panelist and representative of a corporation which has been implementing social and environmental business strategies during the last decades. The panel was shared with representatives from Arla, Novo Nordisk and UNDP. After the panelists had answered the main points of the event there was a Q&A session in which the author participated with the question *"What type of changes in policies at both, European and National level, would you ask to happen so that the implementation of Circular Economy strategies in your sector could be facilitated?"*.

At the end of the debate, a first unofficial one-to-one meeting took place with Jonas Engberg and the author of this research. This talk allowed the author to pose the interest on studying IKEA's sector as well as acknowledging that IKEA would collaborate on this research as their interest lays on developing strategies for the Circular Economy with a focus on the reuse.

The participation of the author in this panel debate was a key factor to accurately shape the approach of this research considering the real intentions of one of the biggest furniture manufacturers.

3.3.2   Complete Observation

When the researcher takes a role of complete observer is the same as taking a passive role. Even though the researcher is present on the scene but there is no participation nor interaction with the insiders (Baker, 2006).

The author, as researcher has been following some places where the flow of furniture after use is present.

- **Bulky Waste Room (*Storskrald)*.** In Copenhagen, household waste is collected by the municipality in each building or group of buildings. *Storskrald* literally means "bulk waste" in Danish. *Storskrald* rooms are the private space where neighbors from one or several buildings can leave the waste they generate. Inside this room there are containers for the different waste streams but there also tends to be a space for bulk waste which usually is filled up with furniture. During the research period, the author has weekly visited one of the buildings to observe the flow of furniture of the *storskrald* area.

- **Second Hand Online Platforms**. The author has subscribed to different on-line platforms in which the flow of used furniture is fluent. By receiving notifications of Facebook groups, the author has been able to keep track of the most common

type of furniture as well as the influx of products. The groups followed have been: "Salg af møbler og andet til boligen", "Second Hand Furniture Sale - Copenhagen" and "Salg af møbler og kun møbler". Research on Den BlåAvis, throughout the platform as well as the report of their recent study, has been useful to understand the profile of people that participate of this channel, as well as to look into the categories of products sold the most (furniture among them).

- **Recycling Stations (*Genbrugstation/genbrugpladser*).** Two field trips to the recycling stations have also been part of the research to see the functioning, operation and furniture left at the reuse corner as well as the one taken into the recycling containers.

3.3.3   Delftx's Circular

Starting from on the 5th of February 2017 and finishing on the 1st of April 2017, the author has been enrolled at the Delftx's Circular! education program - an 8 weeks MOOC (Massive Open Online Course) offered through the Edx educational online platform. This course is led by the Technical University of Delft, in The Netherlands, and co-created with the Ellen MacArthur Foundation and the Leiden-Delft-Erasmus Centre for Sustainability. The content of the course about is relevant for this project due to both, scientific and empirical approaches. The scientific approach focuses, among other topics, on strategies for sustainable business models and product design based on the *butterfly diagram* by the EMAF among other theories. The empirical content is based on showing existing businesses that have reached growth throughout the implementation of strategies for the circular economy. And, these both approaches are essential for addressing the research question and the analysis of this report. The content of the course can be seen in Appendix A.

3.4   Empirical Data Collection: Interviews and Actors

This section explains the methods used to identify the relevant actors within the reuse of furniture in Copenhagen in relation to the theory chapter. It also provides an explanation of the methods deployed to conduct the different interviews.

3.4.1   Identifying the different actors

This subsection contributes to the methodology by providing information about different actors that have been involved in each of the initiatives analysed in Chapter 4. All the actors being interviewed are presented in table 3.1.

NAME	TYPE OF ORGANIZATION	ABOUT	RELATION TO FURNITURE AND CE
Det Økologisk Råd (DØR)	NGO	Independent environmental organization working for a sustainable transition of society. With a focus on influencing both policy-makers (at national and EU level) and decision-makers in businesses.	Working for changes in policy for repair, Circular Economy, remove flame retardants form products... As well as part of the Repair Network (storskrald.dk, Repair Cafés...)
Center for Design, Innovation and Sustainable Transitions (C-DIST) at Aalborg University (AAU)	Research Center part of an Educational Institution	C-DIST gathers researchers from the humanities, the technical and social sciences to address sustainable transitions issues. Groups develop research on the socio-technical and economic dynamics of moving towards more sustainable societies and to developing modes of intervention that engage a broad array of actors. (C-DIST, n.d.) www.cdist.dk/Center	Researching, in collaboration with the Municipality of Copenhagen, for the conceptualization of the new recycling station in Sydhavn. Through the development of Guldminen KBH as pilot project it could be possible to search for solutions that will have previously be tried.
Folkekirkens Nødhjælp (FN)	NGO	Part of the Danish Church, FN's purpose is to empower the world's poorest people for a dignified life. Their range of operation is worldwide. In 1972, FN was the first Danish NGO to start creating revenue through the set up of second hand shop.	Within the department of Reuse, working on setting new partnerships and agreements with different organizations (ARC, Municipalities...) for increasing the amount of furniture products that can be sold at FN's second hand shops.
IKEA	Private Company	IKEA, a Swedish Company founded in 1951, is the World largest furniture retailer. In FY2016, IKEA had a global revenue of 35 billion euro. The first intention was to create access to furniture and design so that prices could be affordable. (Statista, 2016) www.statista.com/topics/1961/ikea	IKEA is changing its vision towards a more sustainable way of sourcing and producing by involving designers, customers and suppliers across the whole value chain. Joining the EMAF, designing for circularity, implementing internal 11 criteria for sustainability and creating an internal method (score card) to rate the sustainability of their products are some of the initiatives that show IKEA's willingness to become a frontrunner business for the CE.
Amager Resource Center (ARC)	Public Company	Owned by five municipalities -Dragør, Frederiksberg, Hvidovre, Copenhagen and Tårnby- in the Region of Sealand, ARC is responsible for managing ten Recycling plants and five local recycling stations.	ARC is transitioning towards the CE by implementing initiatives for the reuse of furniture, among other products. Bu also, ARC has developed collaborations with NGOs to encourage the reuse and upcycling.
Municipality of Frederiksberg	Governmental Unit	The section of Waste and recycle, from the City and Environmental areas, is responsible agent for the waste management (from households) of Frederiksberg area.	The Municipality of Frederiksberg is ensures the applications and compliances of the Waste and Resource plan, or Waste regulations. They also create partnerships with organizations for the reuse and extension of life of products.
Sydhavns-Compagniet (SC)	NGO	SC, since 2000, aims to ensure social and job-creating local initiatives and to work to promote networking and civic participation among vulnerable citizens in the local area in order to promote social inclusion. The work is categorized as value-based social (community) work focusing on empowerment, civic participation, networking and learning	SC is currently part of Guldminen KBH and their main focus is to get revenue for social purposes from upcycling furniture coming from the recycling station at Vasbygade.

TABLE 3.1: Basic information and current relation to the Circular Economy and furniture of all the interviewed actors. (Created by the author)

3.4.2   Spokespersons of each actor

The following list of representatives intends to easily contribute to know their roles inside the organization where they work or collaborate as well as to justify the quality of the research. A short description of the tasks each of them work on, in relation to this research, can be found in Appendix B.

- **Malene Møhl**, Advisor on Chemicals, Plastics and Circular Economy at The Danish Ecocouncil (Det Økologisk Råd). (See table B.1)

- **Peter Munthe-Kaas**, Centre for Design, Innovation and Sustainable Transition (C-DIST) Postdoc Researcher at Aalborg University in collaboration with the Municipality of Copenhagen working on the development of Guldminen KBH. (See table B.2)

- **Meta Palle**, Sydhavn's Second-hand Store Manager of Folkekirkens Nødhjælp Sydhavn's Store. (See table B.3)

- **Torben Engelbrecht-Vindnæs**, Regional Manager of Reuse at Folkekirkens Nødhjælp. (See table B.4)

- **Jonas Engberg**, Sustainability Manager of IKEA Denmark. (See table B.5)

- **Linda Rebien**, Development Consultant at Amager Resource Center (ARC). (See table B.6)

- **Mia Makne**, Waste Consultant in the Waste and Recycling department at Frederiksberg Kommune. (See table B.7)

- **Camilla Toft Sørensen** , Project Manager of Redesign, Reuse and Recycling at SydhavnsCompagniet. (See table B.8)

3.4.3   Interview Methods

Presenting the interview model as well as the interview design is the goal of this subsection.

The Interview Method

In order to justify the analysis, all interviewees have been recorded and transcribed. The eight interviews can be found in the Appendix (C). The sound files are attached in the online submission folder of this thesis.

The Interview Design

The core structure of the interviews aims at obtaining information of how the different actors face the problems and consider potential solutions, which is created throughout open questions (Kvale and Brinkmann, 2008). The form of a open-ended and semi-structured interview is similar to a flexible conversation due to the broad range of possible answers. With this method, discussions become flexible and allow the researcher to explore further in some questions if the previous answer provided can be developed further or in more detail. Due to different roles, a guide of common questions has been followed but also specific questions for each actor have been either planned or spontaneously asked along the interview.

In one of the cases, the interview was held with an external translator as the interview was answered partially in Danish partially in English.

3.4.4   Semi-Structured Interview

A guide has been designed in order to proceed with the interviews. This structure has been useful to frame the content of the qualitative data collected which is connected to the research question.

Due to factors such as the differences in role, as well as level of power in decision making, the structure of the interviews has been slightly modified. The spokesperson of each organization has been informed about the topic of the interview, as well as its design. This is done so that the interviewee can reflect upon the topic before the appointment and also to ensure a calm conversation (Kvale and Brinkmann, 2008). Due to unexpected last-minute notifications, it has not always been possible to deliver the interview before hand. In this case, a briefing of the topic has been given before starting the interview.

Interviews have been designed with open questioning words such as *"why"*, *"how"* or *"what"* so that the answers can be followed by explanations and the own perspective of each of the actors.

In addition, the interviews have been transcribed to ensure proper quotations from each of the actor's spokespersons (see Appendix C).

3.5   Limitations of the Analysis

Since the situation of post-consumer options for the reuse of furniture in Copenhagen is in constant progress, and sometimes plans do not develop as set, it is complicated to provide a full account of the exact picture. Accordingly, and because of the complexity of the network working for the reuse of furniture, the willingness of the research is to choose actors that represent different viewpoints and interests. For that reason, the author has selected one spokesperson of the municipality, recycling stations, NGO for policy change, social NGO, socio-economic company, private sector and the research sector.

One of the challenges of this research is to combine different theories that can help to construct a where potential changes or cooperations can take place. The intention when using the three theories (SPT, ANT and CE for P&B) is to reach different angles of the problem and take them into consideration for when answering the research question.

Part of the qualitative study aims at picturing the flows and loops of reused furniture. The amounts of volume or weight that each path contains is developed through an estimation. In order to create a more accurate project, and develop subsequent strategies or initiatives that can result into a greater positive impact, it could be interesting to look into the volume or weight quantities of furniture that each of the flows carries. This quantitative analysis could readdress the focus of where the biggest potentials for change lay.

Chapter 4

Analysis

4.1 Why does furniture become waste?

Even though furnishing products have historically been designed to last for good, or at least for long periods of time, the problem of furniture waste is currently a issue. Even if there are no estimations about the amount of furniture waste generated in Denmark, in 2011, a study showed that in France, a European country with a similar development of Denmark, *"an average of 33kg of furniture waste per person is annually generated"* (Affald Ressourcer, 2011). This number generates the need to seek for an explanation that can provide information about *why* this is currently happening. To summarise, this section seeks to answer *"Why does furniture become waste?"* by understanding the different factors and elements that unleash to, at some point, categorise furniture products as waste.

Based on the literature search and the explanations collected throughout the designed interviews, it has been possible to develop on different narratives or approaches that trigger the increase of furniture waste.

4.1.1 Lack of EPR for furniture

On of the relevant factors that triggers furniture to become waste is the lack of responsibility on the side of the producers or retailers once the furniture is owned by the consumer. One of the problems of linearity production and consumption is the management of throughput flows. And, the optimization of resources and energy embedded to products stops when the responsibility for and disposing of these is passed to the buyer or new owner (Stahel and Clift, 2016).

Going deeper into producers responsibilities, in the beginning of 2017, Zero Waste Europe released an article which included that only a 31% of the municipal solid waste was covered by EPR schemes. Improving the use of EPR schemes can ease the transition towards the CE. The first measure included was that*"EPR schemes should be expanded to cover more products"* (Zero Waste Europe, 2017), such as furniture. *Cover the full cost of products at the end of life* and *Drive eco-design* (ibis.) are the second and third measure, which to some extent are the consequences of the previous. These measures would force producers to design in a way so that materials would be recycled (close the loop). But, going higher in the waste hierarchy, it would provide information value on how to design furniture in a way so that products last longer and they do not become waste after few years of use.

The problem goes beyond the last step of retailer-to-consumer. It tackles the whole conceptualization of business models based, only, on the sales of products. If EPR would be applied, these models would shift as the business whould need to be profitable and due to bonus/malus instruments it could be that producers would have to destine great quantities to pay fines due to waste generation. One of the solutions that would make business rethink their models and the way they produce, so that furniture waste would be reduced, is suggested by Mia Makne, from the Municipality of Frederiksberg, and built upon the concept of PSS business models. *"We could have more furniture on a leasing or renting basis. So that you have something for a while because that would also make it more worth while making companies produce more long term and good quality stuff."* (Makne, 2017 C.6).

4.1.2   Emotional Attachment and Changes in Life

The consequence of the fact that producers get totally unattached to products once the purchase has been carried out, is that the consumer is the one who has the power to decide the next step. This decision, not only counts for the optimization of the product but also for all the resources used for its design, production and transport.

This decision is not taken randomly and it has been matter of study by scientists in the last years. Hebrok, in her paper *"Where furniture goes to die"*, identifies different elements that influence the consumer decision of post-options. These are key elements that will trigger to convert the furniture as a reusable product or, on the contrary, waste (Hebrok, 2016).

Emotional attachment is the main element defined as influential factor for the consumer to decide what to do of the piece. This is related to the fact that feelings or emotions

can be attached to an artifact and these influence how it is treated and the value that the owner gives to it (Hebrok, 2016).

This is the case of inherited furniture that has belonged to the family for many generations, and, therefore it has an extra value that prevents the product to be considered as something to get rid of. Instead, it is considered as something to be kept among the family. However, sometimes, this emotional attachment, for example in old inherited furniture, does not necessarily result in a longer use of the product (Chapman, 2010), which leads to the issue of storage a common problem mentioned by producers, consumers, retailers, etc.

Another reason why furniture is being disposed of or thought as "waste"at some point is because of **changes in life**. Moving out for first time from the parent's place, having a new financial status, having a child, moving in together or getting divorced are examples of life situations in which the change involves furniture as product and meaning. (Hebrok, 2016) For example, it can happen that when people move out they decide to *"get rid of the whole thing so we don't need to unscrew all screws out, take it all apart and move it."* They *"just go and buy new stuff."* (Engberg, 2017 C.4) New personal preferences, obsolete style or unmatched with the rest of owned furniture are other common reasons why people decide to get rid of furniture (Hebrok, 2014).

When these changes happen, the owners of the furniture with emotional attachments will first try to pass it on to their relatives or store it for a long time in a basement or attic. (Hebrok, 2016) Storing it, is a common option that some people use to wait for an opportunity. For instance, when a son or daughter moves out from the parental home, parents or other relatives will try to provide him or her with used old furniture inherited in by the family. (Hakala et al., 2015)

4.1.3 Economic Growth

An observation throughout history made by ARC, proves that *"Waste generation is a sign of economic growth"* (Rebien, 2017 C.5). Rebien explains that *"We can see the development with the generation of waste. When there is economic growth we get much more waste at the recycling stations. On the other hand, when we had the economic crises we saw it in the amounts of waste (decreasing) immediately"*. In addition, she exemplifies by adding, *"when there are good economic times, people would, for example, replace their kitchen. And it's not because something is wrong -as it might function perfectly- but, they might not like the colour or the exact model, so they will replace a totally functional kitchen room for a new one, which is not necessary. And this only*

happens if you have the economic resources for it. So, that's why when there's economic growth we [ARC] *receive more waste."* (Rebien, 2017 C.5).

In line with the arguments of unnecessary changes that Linda Rebien poses, Mia Makne, from the Municipality of Frederiksberg, argues that the main factor that contributes to create waste furniture is also related to consumer behaviour and the constant "need-for-new". The main problem of furniture waste is that *"people get tired of it* [furniture] *and they want to have something new."* (Makne, 2017 C.6).

4.1.4   Local Logistics and Infrastructure

Unlike in the rest of Europe, in Denmark, the municipalities are only responsible for collecting and managing the household waste (industrial and commercial waste is, therefore, collected by private companies). Municipalities, through ARC, also provide treatment facilities and recycling stations for citizens so that each fraction of waste can be recycled.

The 10 recycling stations and 5 smaller recycling stations are spread all over Greater Copenhagen but still, furniture is a heavy product which needs of a special method of transportation in order to deliver it to one of them. Users need to travel around 2km (max) to dispose of their used furniture at the existing facilities (seen in the screenshot in Chapter 1).

A study carried out by Curran et al. about disposal of bulk waste (book, clothes and furniture) revealed that collection charges and proximity to recycling stations where factors that affected the way residents disposed of their used products (Curran, 2007). For disposing of furniture products at the recycling station residents usually need a vehicle. And, in Copenhagen, the capital of the 6th country in Europe with less cars per capita (Association, 2014) most of the people commute by bike due to urban infrastructure development for bikes. Hence, renting a car would add a cost to the action of disposing of furniture. Part of the problem is that *"most of the time, when people want to throw away furniture they want to do it "now"* (Munthe-Kaas, 2017) and, many times, they look for the easiest way to get rid of it.

A fast way citizens can dispose of their furniture products is by leaving it at the waste room. Normally, buildings in Copenhagen include a space in the basement or the backyard for the different waste streams. But also, it can happen that, as seen in figure 4.1 a small building facility is built outside the street so that the neighbouring buildings can use it to dispose their waste in different containers of waste streams.

FIGURE 4.1: Picture of a building for disposing of waste (waste room) in Østerbro, one of the neighbourhoods of Copenhagen (Taken by the author on the 30th April 2017)

The *Storskrald* corner (see figure 4.2) is a space inside the waste rooms where neighbours can dispose of furniture, electronics and all types of bulk waste that do not fit in any of the waste fractions. Once products or components are left there, the ownership of the products is passed to the municipality where the building is located (Møhl, 2017 C.1).

FIGURE 4.2: Pictures of one of the Storskrald's room in Østerbro, one of the neighbourhoods of Copenhagen (Taken by the author on the 30th April 2017)

The difference between leaving the products at the *storskrald* or at the recycling station is the waste management operation. At the recycling stations, components and materials are sorted out so that a reprocessing of the materials can convert them into secondary raw materials. Moreover, in some recycling stations, the recovery is done at product level as there is a new initiative implemented by ARC to promote the direct reuse of things (see section 4.2.2). On the contrary, products that are collected from the *storskrald*, *"will be shredded down into pieces. The iron will be melted and recycled as metal but the products that can be incinerated, they will be incinerated"* (Rebien, 2017 C.5).

4.1.5   Product Design

Designing furniture that is meant to last for a short period of time is a way to ensure its fate as waste. Bakker and den Hollander address some strategies that can lead products lasting longer. The actors interviewed for this research have contributed to specify the design issues that concern to furniture products and are related to the ones mentioned by Bakker and den Hollander.

Designing with products whose materials and components can be separated is one of the requirements mentioned by Malene Møhl. *Once it is dumped, they need to disassemble the product and reuse its parts. And, usually these materials do not become part of what they had once been.* She adds how designing for reprocessing is necessary in order to recover the value of materials and not mixing materials which are difficult to separate *"we would like to see that materials can become again part of products of the new type - with a same value"* (Møhl 2017, C.1).

One of the issues addressed is the repairability of products. Producers should be *making their products repairable.* However, the problem lays when *whole business model is built upon designing with bad quality wood, and designing things that break easily. . .* (Munthe-Kaas, 2017 C.2).

Camilla Toft Sørensen, from SydhavnsCompagniet, comments that the 90% of products they can sell is due to the high quality of the materials and the durability of the products per se. She comments that it is difficult to find (in the recycling stations) products from cheap materials which are in good conditions to be reused but that tables and chairs from, for instance the 1960s, are totally reusable and easy to sell even though they might have some scratches. (Toft Sørensen, 2017 C.7) They cannot resell furniture from IKEA because, one of its main problems is related to the joints of each product. Once people have dissasembled more than twice or three times, they become worn-out. Designing better joints would extend the life of products more and these would not be found in the containers of the recycling stations (ibis.).

Another cause of waste, arisen within the product design topic and the Circular Economy, addresses the use of chemicals, such as flame retardants, in furniture. *"Flame retardants increase costs in production, while lowering the quality of products. This is a serious challenge to the furniture sector in Europe, putting jobs and growth at risk."* (Zero Waste Europe, 2016). One of the statements, by Joan Marc Simon, directly addresses the implications of the use of flame retardants for the CE by commenting that *"creating a real circular economy will be impossible for Europe as long as toxic chemicals enter the cycle and are recycled into new products"* (Zero Waste Europe, 2016) This is also one of the issues that Malene Møhl, from Det Økologisk Råd mentioned as barrier

for furniture products (in general) to be reused within the framework the a Circular Economy. *"If you have flame retardants in computers you can have it back with the "Producer Pays Principle (PPP)?" But, if there are flame retardants in a mattress and you want to recycle that into a circular economy model, then you remove all the fluffy part and you use it to fill in jackets or other products that are not supposed to contain flame retardants. That's the problem. So, who's responsible to for that? Because it is not a raw material anymore."* (Møhl, 2017 C.1).

4.2   Initiatives for the reuse of furniture

This section of the analysis addresses the second and third sub-questions: *How do the flows, loops and stocks of furniture work in Copenhagen?* and *What are the current initiatives to promote the reuse of furniture in Copenhagen?*. Six different initiatives for the reuse of furniture in the Greater Copenhagen area have been identified (see figure 4.3).
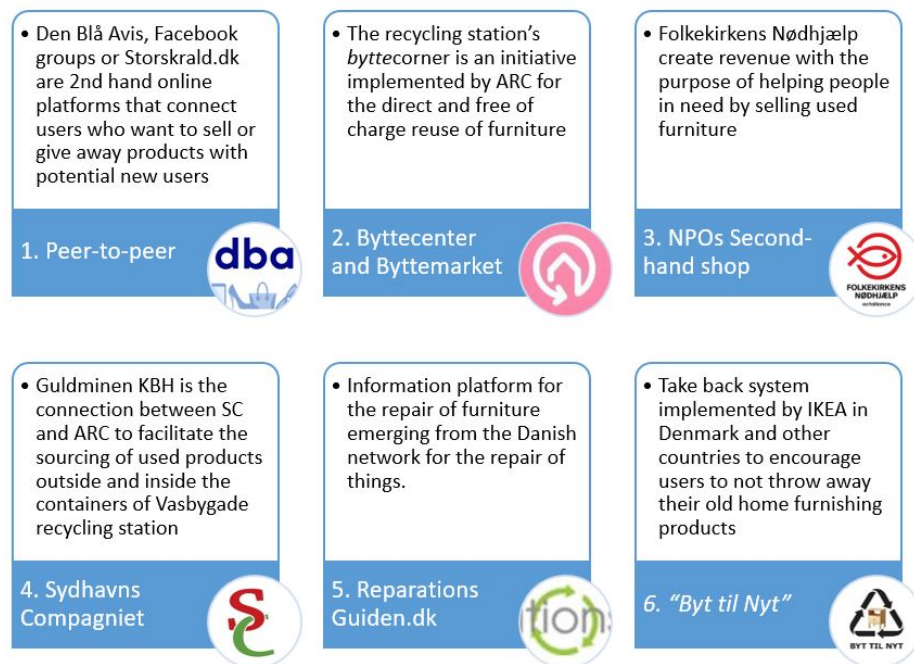
FIGURE 4.3: Introductory explanation of the six initiatives analysed (Created by the author)

The analysis of them aims at looking into detail each of the initiatives with the purpose of understanding its processes (flows, loops and stocks), actors involved, the regulatory network, the innovation process, as well as the challenges that each of them faces. Before exploring them one by one, a short description of each of the initiatives is made in figure 4.3 to introduce them.

4.2.1   Peer to peer

Peer to Peer sell of used products is not a new trend nor an activity exclusive in the area of Greater Copenhagen. However, the Danish infrastructure setup for this to happen has developed and become popular with the penetration of internet into society. Den BlåAvis (DBA), Gul og Gratis, Tradono and or the "Second Hand Furniture Sale - Copenhagen"Facebook group are facilitators that connect individuals interested in selling or buying used furniture, among other products. The influence of social media channels, such as Facebook, has empowered individuals to use their existing profiles and accounts to resell or give away their products, such as furniture. Actually, in some contexts, Facebook has overcome eBay on product sales one of the biggest second hand facilitator companies due to ease for users (Daily Mail Science and Tech, 2015). Moreover, neighbors that share a waste room, backyard or belong to the same community have created Facebook groups to exchange information but also to give away furniture before leaving it at the waste room or in the streets.

In the Danish context, through the DBA platform, the 22% of products sold belong to the "furniture and lamps"category, which is the third most popular. Moreover, four out of the five most searched words in this platform belong to the furniture category (sofa, dinner table, garden furniture and sofa table). (DBA, 2016) More than 98,000 furniture products for sell can be found at DBA in the Greater Copenhagen area (search at DBA website on the 17th May 2017).

- **Actors Involved**

   The "peer-to-peer"way of practising the reuse of furniture is special in the sense that the old-user and new-user are the only ones interacting. The method throughout which they can connect is the one providing information about who users of these platforms are. Therefore, e.g. DBA is the facilitator or the tool needed in order for "peer-to-peer"reuse to happen.

   This initiative entails, not a specific actor profile or group of actors with the same features and interests but, several types of profiles that reproduce the same practice. For example, in their last report, DBA have identified five different profiles of *personas* who are users (buyers and sellers) of their platform and hereunder are described (DBA, 2016):

   - The **neutral**, 24% of Danes (primarily men of 18 - +60 y/o), focuses on money savings and sees the reuse as a trade opportunity more than as a lifestyle.

   - The **critical**, 24% of Danes (men and women of any age), is not a regular user of second hand platforms, they fear about security and theft goods. Also, they are

skeptical of buying second hand because they consider that products are of bad quality and it is not an hygienic practice.

- The **social and aesthetic**, 23% of Danes (women of 18-59 y/o). With a primary focus on the good deals, affordability and uniqueness, this profile also cares about the environment and likes the creation of the local community that each trade triggers.

- The **environmentally conscious** profile, 14% of Danes (women of 18-59 y/o), has a focus on saving money and doing something positive for the environment at the same time. This profile is the one that seeks the least for social aspects within the trade.

- The **uncertain** re-user accounts for the 13% of Danes (men and women of any age). This profile has not been a user of the second hand market for several barriers such as security, fear of buying stolen items or unreasonable prices.

- **Product Chain Before Reuse**

  Even though it can slightly differ from facilitator to facilitator, the process for selling and buying second hand products throughout online platforms is quite similar. Figure 4.4 is used to graphically show the product chain procedure since the old user until it is reused.
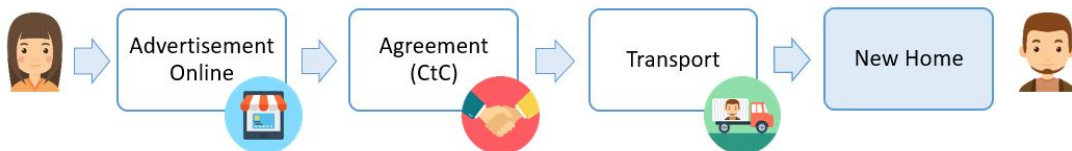
FIGURE 4.4: Process for selling or giving for free furniture through DBA. (Figure created by the author based on own experience)

Before starting the process itself, the owner has to have an account or profile created at the specific platform he wants to sell through.

Then, the first step consists on posting a description of the product and its price. Usually, the transport method is also included; for furnishing items the seller tends to ask the buyer to pick it up. Uploading pictures can speed up the process of selling as the buyer can get a visual idea of the product (see figure 4.5) (DBA, 2016).

The buyer can contact the seller and ask questions by sending private or public messages within the framework of the platform, as well as by calling or seding SMS texts. Once both, seller and buyer, have agreed upon a date for the pick-up the furnishing item will be transported to the place where its reuse stage will begin.

FIGURE 4.5: Screenshot of an advertisement of a furniture item from DBA (DBA website 24/05-2017)

- **Regulatory Network**

  Security and lack of trust are the main barriers that prevent users from deciding to make a purchase in second hand platforms (Fortuna and Diyamandoglu, 2017). However, at DBA, both buyers and sellers have to provide their personal details, which enhances the trust towards the platform and increases its use among other less secure platforms. Hence, actors have a feeling that this site might be more secure due to the requirements stated before (DBA, 2016).

- **Innovation Process**

  The problematisation and interessement are steps that, in this initiative, might have been decided by actors long time ago. There are users who are regular practitioners of the sell and buy of second hand furniture, therefore, the interessment of joining this type of platforms is not something new.

  Due to the fact that users have a specific need (in this case, getting rid of furniture or acquiring used furniture) the mobilisation is when user decides to become seller or buyer and takes the role. It can be that the role changes from practice to practice (being user and buyer is common in online platforms) (DBA, 2016). No spokesperson is needed to work on activating the agents as the user can already think about it as an option instead of an alternative.

The initiative for reusing, is taken by both old-owner and new-owner and no external agent intervenes on the trade. Thus, this fact eases the process for the reuse of the furnishing item.

The stability of this initiative depends on the pace of users repeating the practice of buying and selling through the DBA platform. Whether a seller will choose this method as way to deal with their unwanted furniture depends on factors such as changes in life (mentioned in section 4.1) or the user experience within the online platform framework (DBA, 2016).

- **Challenges**

  Having different platforms where users can become sellers or buyers of second hand products hinders the possibilities to unify the market, and therefore lowers the chances to match buyers and sellers in the same platform. DBA counts with 1.6 million users (DBA, n.d.), Gul og Gratis with 1.4 million users (Gul og Gratis, n.d.), there are around 108,000 users in Facebook groups (estimation done by counting the users in the different groups) and Tradono counts with more than 750.000 users (Tradono, n.d.). Only these four online channels for the sell and exchange of used product, together account for 3.85 millions of users. Even though some might have registered in all of the platforms, others might be unique of one or two. This would enhance the chances of finding new users for used furniture products. Since there are plenty of online platforms for the reuse in Denmark they are king of competing between each other and, one of the biggest challenges the enhance the accessibility to all of them could be to unify them.

4.2.2 *Byttecentre* and *Byttemarkeder*

Bytte means "*exchange*"in Danish. *Byttecentre* and *byttemarkeder* are two initiatives implemented in four of the recycling stations that Amager Resource Center manages in the are of Copenhagen since 2016. The difference between byttecenter and byttemarket is the opening hours for pick ups. Users can all the time deliver used furtniture, among other products, but while byttecentre are always open (within the RS opening hours), byttemarket only opens on Saturday or Sunday (ARC, 2016).

Kulbanevej and Varmlandsgade Genbrugstationer are the two recycling stations with the byttecenter working. The ones that create a second hand market on the weekend are the one located at Borgervænget (every Sunday, 12-16h) and the one at Dragør (every Saturday, 10-14h) (ARC, 2016). These types of initiative push the flow of unwanted goods to be transformed into second hand products instead of recyclable materials (Campos and Zapata, 2014).

The project consists on creating a space in a corner, inside the recycling stations, where products that are still reusable and, it is too soon to recycle the materials as the lifetime of the product has not arrived to an end yet, are stored until someone else needs them (Linda Rebien, 2017 C.5).

Figure 4.6 is a picture that was taken on a Tuesday afternoon, and it is possible to see that a great amount of products belong to the furniture category.

FIGURE 4.6: Pictures of the Byttecenter at Varmlandsgade recycling station. (Pictures taken by the author on the 2nd May 2017)

- **Actors Involved**

  The actors involved with the *byttecentre* and *byttemarkeder* initiatives are ARC (public company which started the project) and the users who bring or pick up items. Behind ARC there are the municipalities that own this public company, which means that they are active actors who shape the development of the initiatives taking place at the recycling stations through their plans and regulatory frameworks.

  The *bytte*corners for the direct reuse of furniture are dynamic because citizens from the areas nearby, where the specific recycling stations are located, have become active users and practitioners (Shove and Pantzar, 2005). As Linda Rebien (from ARC) states, these Circular Economy initiatives are *"direct reuse for free"* and anyone can be a user of it - *"you can come and give stuff while others will come and take them home"* (Linda Rebien, 2017 C.5). Through these initiatives, ARC is the responsible actor for communicating about these possibilities (*bytte*), as well as, for storing the products while there is not a new user.

  Although both projects, *byttecenter* and *byttemarket*, are conceived and implemented by ARC, they could not be running if citizens would not have acquired the [new] practice of giving it to the reuse corner. By thinking about these solutions as

an alternative and delivering the goods they no longer need, they contribute to the existence of the initiatives. And, as Shove and Pantzar mentioned, it is about the habit of repeating a practice that keeps it alive. In this case, the fact that consumers think about bringing their products to the recycling station, and leaving them in the reuse corner, as well as thinking about picking up free reusable products, is what keeps the initiative running. If there would not be practitioners, the initiative implemented by ARC, could not survive nor exist (Shove and Pantzar, 2005).

- **Product Chain Before Reuse**

  Figure 4.7 shows the spatial process that the furniture products suffer before they are available at the Byttecenter or Bytter markets.

FIGURE 4.7: Process for disposing of furniture from old user's location to *Bytte*corner. (Figure created by the author based on the interview with Linda Rebien from ARC C.5)

  The owner of the furnishing product is the responsible of delivering it to the recycling stations.

  Once the furniture belongs to ARC, the employees of the recycling stations will guide the users around and inform them about how to sort their items so that they can leave the furniture products which are in good conditions at the *bytte*corner of the station.
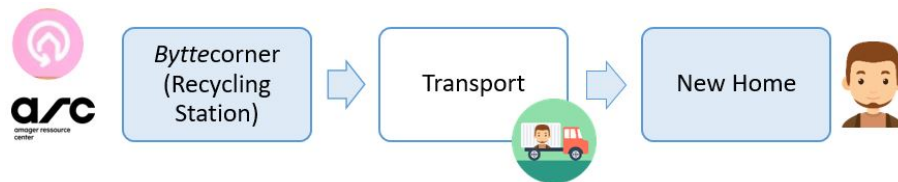
FIGURE 4.8: Process collection of furniture from the *Bytte*corner to the new user's location. (Figure created by the author based on the interview with Linda Rebien from ARC C.5)

  Once the furniture items belongs to the *bytte*corner of the ARC recycling stations, individuals are allowed to pick them up and bring it home with them (see figure 4.8). As ARC provides the furniture and the space to store it but not the delivery method, the new users need to find out the way to transport the items from the recycling stations to the new location (Rebien, 2017 Interview C.5).

- **Regulatory Network**

  As previously stated, ARC is a public company owned by the Municipality of Copenhagen, among others. The projects designed and implemented by ARC, are therefore following the plans and guidelines set at both local and national level. One of the main objectives that the Municipality of Copenahagen included in the *Resource and Waste Management Plan 2018*, released in March 2014, was to increase the direct reuse (City of Copenhagen, 2014). One of the ways to catalyse this objective was by the implementation of *bytte*corners in the recycling stations, which begun in 2016. For these reasons, if changes are applied to public plans, initiatives started by ARC or their owners might also suffer changes or develop towards the direction that Municipalities set their waste plans.

  For example, the Municipality of Frederiksberg, one of the ARC owners, is studying "how could products that are left at the *storkskrald* be reused, instead of being used as feedstock for energy recovery solutions?". The solution is complex due to issues such as ownership of waste or legal access to the *storskrald* room (Makne, 2017 C.6). A new initiatives as such could reconfigure the existing network of actors working for the *Bytte* initiatives.

- **Innovation Process**

  Byttecenter and *Byttemarket* are two new concepts of projects implemented since 2016 and these have reached a mobilisation stage in which actors have already assumed their roles. The fact that the *bytte*corners are in constant change (products coming in and out) is the consequence of an interessment process where ARC has been able to arise interest among citizens in this new initiative. Mobilisation process can be tested by the fact that each week different products are being brought and these are being picked up. Users from both sides, have therefore assumed the role of this new practice of reuse from recycling stations' facilities. In the current state ARC and both users, the ones who deliver and the ones who pick up for free, understand what their roles are. And, it is through the repetition of this practice, that ARC can use it as prototype for new projects such as the new recycling station in Sydhavn (Rebien, 2017 C.5). These *bytte*corners have allowed ARC to detect two main issues or challenges that they need to face and are explain in the following bullet point.

- **Challenges**

  Yet these four recycling stations have implemented a project to extend the lifetime of furniture, there are still challenges and problems to solve so that the impact could be bigger. Linda Rebien, mentioned two main problems that hinder the reuse of

more products throughout the *bytte* corners. Peter Munthe-Kaas, also comments on big barriers for the reuse at recycling stations.

First of, the lack of space prevents the bytte-market/center to allocate a greater amount of furniture. *"We have a lack of area. There is such a little space in the recycling stations for direct reuse... If we had a bigger space we would be able to collect more furniture for the direct reuse"* (Rebien, 2017 C.5). In addition to the problem of the space, Peter comments that challenges lay on the fact that *"it takes so much space... and no one has really space for that. Also because it's bulky and hard to move around."* (Muthe-Kaas, 2017 Int2).

The second issue is related to the meantime period when the furniture is disposed of at the recycling station and a new user picks it up for reusing it. *"As soon as it has been rain on the furniture it of breaks or ruins. So it really need to be stored under a shelter and these are usually not the conditions at the recycling stations."* (Muthe-Kaas, 2017 Int2).

Another problem is the information gap between the *bytte* initiatives and the user of recycling stations arises due to lack of human resources. *"Most people will probably don't bring it to the places where furniture can be recycled and will put it in the containers for incineration or if it's wood, they might leave it to the wood container. Instead if they would leave it in the byttecenter, we could then reuse it"* (Rebien, 2017 C.5). There are two employees in each recycling station, working at the same time, who are responsible of guiding the people to sort the waste correctly. And, *"they are very busy, so they cannot be in contact with everyone, even though they try to"* (Rebien, 2017 C.5). The problem is that *"we (ARC) are not able to be in contact with everyone who come [to deliver products] and therefore they leave the furniture in the wrong places."* (Linda Rebien, 2017 C.5).

The consequences of a lack of human resources are a lower level of resource recovery as the life of the product arrived to an end. When the furniture is placed at the *bytte*corner it can be directly reused but if it is left inside the containers for recycling, it will be categorized as "waste"(Rebien, 2017 C.5) and the recovery will be not as product or component but as material. It will contribute to close the loop (loop 2) by recovering the primary materials and reprocess to use them as secondary raw materials (Stahel and Clift, 2016).

Ultimately, including these types of initiatives and rethinking the concepts of recycling to move up the waste hierarchy can trigger to consequences such as an eventually evolution towards a lock-in. "Waste infrastructures with a sustainable record may evolve over time into a lock-in, slowing the emergence of still more sustainable urban infrastructures and innovations (Campos and Zapata, 2014).

4.2.3 Folkekirkens Nødhjælp's Second Hand Stores

Folkekirkens Nødhjælp is, among other Danish NGOs, an organization that has developed a second hand business model as source of revenue to support social projects for people in need. FN was funded in 1922 but it was not until the beginning of 1970s that the sale of used products, including furniture, became part of the organization. *"We were the first ones to start having second hand shops, in 1972"* (Engelbrecht-Vindnæs, 2017 C.3.2). At the beginning the main source of furniture products was through individuals, but, nowadays they have five sources from which they collect the furniture that, later on, will be sold in some of the 125 second hand shops they own across all Denmark (Engelbrecht-Vindnæs, 2017 C.3.2). Ordinary people, a recycling station, loppemarket, retailers and heritage are the different sources mentioned by Torben Engelbrecht-Vindnæs when asked about *"where does the furniture sold at FN's second hand shops come from?"*. These different sources are explained in detail in the coming subsections.

- **Actors Involved**

  Deciding to giving away pieces of furniture to charity are part of the social practices that individuals face from time to time. Specially when relevant changes in their life arise (Hebrok, 2016). The reasons are because of personal believes or due to a storage of the item for a long time. But, when the decision of thinking about an NGO when getting rid of their furniture, these individuals become practitioners of a bigger initiative (the reuse at FN). For this initiative to keep running FN needs to count with practitioners that are users of second hand furniture. The groups of actors, formed by different profiles of people contribute to maintain the initiative alive. Customers, as donors, become practitioners of giving the furniture to charity due to their believes. It can be because of money savings or due to sustainability (social or environmental) believes (Fortuna and Diyamandoglu, 2017) that practitioners decide to become active actors, that is why the group is heterogeneously represented.

  Besides collecting used furniture from individuals, FN has developed other methods throughout the time. These consist on agreements between public institutions or companies so that the organization is allowed to pick up used furniture, among other categories of items.

  Apart from collecting used furniture from individuals, FN has developed other methods throughout the time. These consist on agreements between public institutions or companies so that the organization is allowed to pick up used furniture, among other categories of items.

One of the agreements consists on an annual contract that gives permission to the organization to pick up furniture left at the Bispeengen recycling station. This collaboration is signed between FN and the Municipalities of Copenhagen and Frederiksberg, as the location of the recycling station is placed in the middle of both areas (Engelbrecht-Vindnæs, 2017 C.3.2)

The second agreement consists on a seasonal contract with the Municipality of Frederiksberg. *"From May until mid-October Frederiksberg Kommune organizes a Flea Market every Saturday. We have an agreement with them for some weekends. In the afternoon, when the Loppemarked finishes, there are always some leftovers from people who don't want bother taking their stuff back home. They leave them in a container and we are there to choose what we want that can be reused"*, explained Torben during the interview, when asked about the different sources of furniture that FN could have access to. (Engelbrecht-Vindnæs, 2017 C.3.2)

- **Product Chain Before Reuse**

  The product chain of furniture items that FN work with depends on the source of the product. The different ways of collecting the furniture are hereunder explained in detail considering the methods and agreements between FN and other actors.

  - The traditional method FN has sourced its second hand furniture products has been from ordinary people who wanted to collaborate with the organization by giving them the items they did not need anymore. Figure 4.9 shows the possibilities for individuals to give their used furniture to the NGO.
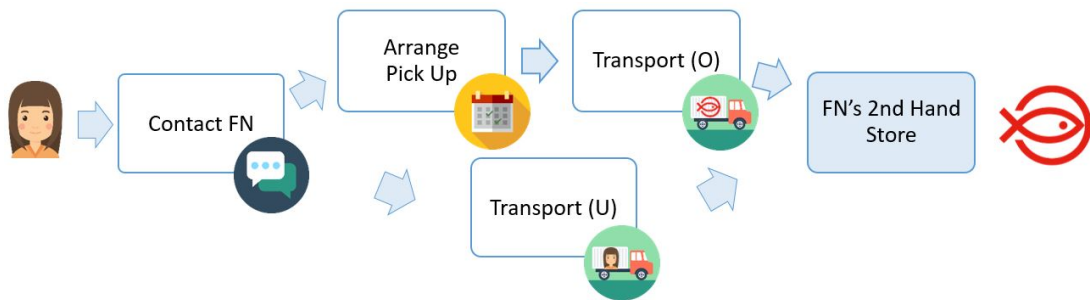
FIGURE 4.9: Process to donate furniture: from old user's location to FN's second hand store. (Figure created by the author based on the interviews C.3.1 and C.3.2)

First, and in order to transfer the ownership of the product, the current owner has to contact FN, explain what products they can provide and agree on the delivery method if FN agrees on collecting the furniture. It is estimated that *"we [FN] take around the 75% of the furniture we are offered"* (Engelbrecht-Vindnæs, 2017 C.3.2), thus sometimes, the user will need to find another way to dispose of the products.

Secondly, and in order to transport the furniture, FN and the owner find the method os transport that is more convenient (regarding needs and availability of the truck). When the donor does not have any way to transport the goods, they can arrange a pick up so that FN can go to the venue, collect the furniture and transport it to the second hand store with their own vehicle. If the donors have access to a vehicle, they can transport it themselves and unload the items at one of the FN's store where used furniture is sold (Engelbrecht-Vindnæs, 2017 C.3.2). - Another source of furniture items to sell at the FN's second hand stores arises through the two different collaborations previously mentioned. The product chain processes, which are similar, can graphically be followed with figure 4.10.

The first cooperation involves the Bispeengen recycling station (owned by ARC) and the Municipalities of Frederiksberg and Copenhagen. A contract signed between all parties allow FN, and two other NGOs (Projekt Hjemløs and Diakonissestiftelsen), to collect furniture which has been left in the a corner for direct reuse at a specific recycling station. *"In the region of Copenhagen, we have an agreement with the [...] Bispeengen recycling station"* (Engelbrecht-Vindnæs, 2017 C.3.2), where FN is allowed to periodically take furniture from the station and bring it to their stores.

Once FN has selected all goods that they consider can be resold, the organization transports them to their second hand store where they are stored until they are valued *"For example, this chair here [there was an old chair in the room where the interview took place] could be very valuable but we don't know yet. So, we need to call a specialist that can look at it"* (Palle, 2017 C.3.1). Before it can be on sale the price of the item is fixed and a tag is displayed. Afterwards, it is moved to the store where customers will be able to purchase it and give it a new use.
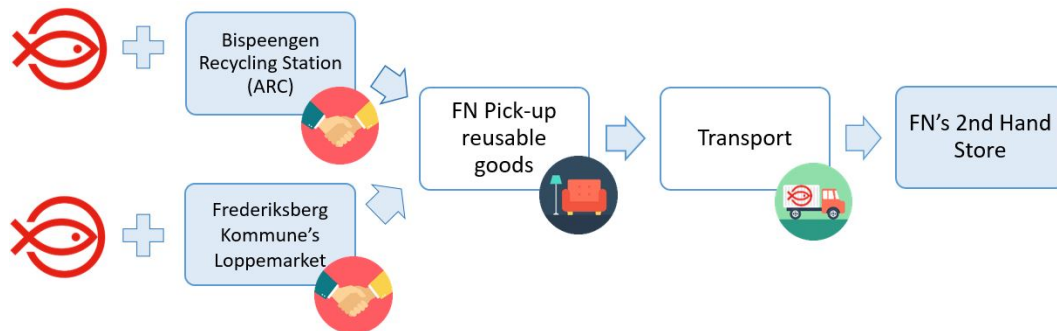
FIGURE 4.10: Process for the collection of furniture: from recycling station or flea market to FN's second hand store. (Figure created by the author based on the interviews C.3.1 and C.3.2)

- Years ago, *"people could bring furniture and, at the same time, they could also take furniture with them if they wanted. But now, they can only bring the furniture and*

leave it there" (Palle, 2017 C.3.1) And, buy from us if they need extra. Nowadays, in order for the furniture in sale to be reused, new customers need to purchase them. And, it is the customer the one who needs to find how to transport the furniture from the store to the new location. See figure 4.11 for a graphic explanation.
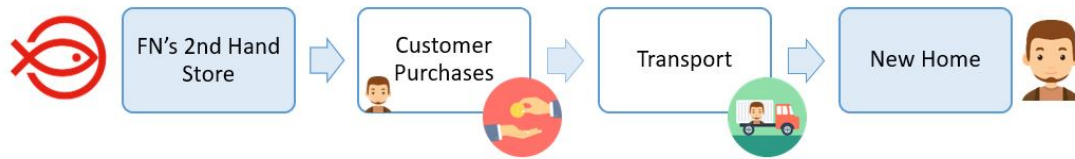
FIGURE 4.11: Process for the reuse of furniture: from FN's second hand store to the location where it will be reused. (Figure created by the author based on the interviews C.3.1 and C.3.2)

These sequences of steps for the reuse of furniture show that the more steps in between the old user and the new user, the more likely the furniture will suffer damages. All the transport processes also contribute to lower the product functionality in case some components break.

- **Regulatory Network**

  The regulatory network of FN's second hand stores is attached to on one side, the internal goals and development of the organization and, on the other side, the agreements between other parties.

  The main focus of Folkekirkens Nødhjælp is the improvement of social status of people from Denmark and other parts of the world. *"We are focused on keeping our organization very slim because our main job is to create funding for poor people in this world. So we don't have a large organization of people being paid with a monthly salary. We are dependent on volunteers"* (Engelbrecht-Vindnæs, 2017 C.3.2) This mission frames the coming projects and, therefore, it creates dependency on the holistic vision of the organization. As Torben states *"we are very keen on not spending too much money on new infrastructure because it takes focus and money away from our main target. So we are very conservative when it comes to investments"* (Engelbrecht-Vindnæs, 2017 C.3.2). This means that, the department of FN that develops the initiatives of reuse depend on the general objectives of FN.

  Besides the internal regulatory framework, the agreements with other actors entail a constant review so that the projects can be improved every time. The yearly contract with ARC permits that FN takes furniture, among other products, for resell. Torben explains that FN *"has an annual contract with them* [Bispeengen recycling station owner actors] *and every year is renewed if we do our job properly"*. But, FN is not the only NGO with a similar agreement. *"There are other organizations*

who also have this agreement, so there are weekly shifts to pick up the furniture." (Engelbrecht-Vindnæs, 2017 C.3.2).

The seasonal agreement with the Municipality of Frederiksberg . As long as it is on force and renewed the will keep contributing for FN obtaining furniture and create benefits for the purpose of the organization, as well as for reducing the environmental impact due to the extent of furniture products.

In these agreements, the contract states that *"we can limit our efforts to take the furniture that we are able to resell"*. For example, *"we don't pick mattresses from beds or similars... Because we cannot resell that"*. Also they don't pick up products which contain an electronic issue because *"We* [FN] *"are obliged, after repairing them, to give a guarantee, and we can't do that"* (Engelbrecht-Vindnæs, 2017 C.3.2).

- **Innovation Process**

  Looking for new sources of used products needs of collaboration between other actors that agree on having a new role, for instance as donors of second hand furniture. For example, FN second hand shops are established options in the Danish context for donating products. When users conceive *"giving furniture to the charity"* and *"buying furniture from charity shops"* as an alternative it means that the process has been stabilised.

  Establishing new agreements with the public sector requires of a process in which interessment int he new actors needs to arise. When ARC decided to create a cooperation with different Danish NGOs they had to come up with an idea and an applealing contract so that Folkekirkens Nødhjælp, Projekt Hjemløs and Dia-konissestiftelsen would be willing to engage. Nowadays, these three organizations have totally assumed their roles as they can weekly source for products at Bispe-engen recycling station (following internal shifts). Therefore, it can be said that this initiative has evolved and reached a level of stability. In addition, it can be further developed in the future, and open new doors if regulations are reinterpre-ted. For example, adding the option of sourcing from the inside of the containers of Bispeengen station.

- **Challenges**

  The reuse department of FN, in terms of resell of furniture, has to cope with some issues. One, is related to the lack of space. *"Last week, for Easter, we had a big donation, and came for four times with things that we pick up and allocate in here. This means, that sometimes we have too many things, that require space."*

(Palle, 2017 C.3.1). Another problem tackles the topic of product design. When furnishing items are not designed so that they can be assembled and disassembled, problems with finding spare parts arise. *"One big help would, of course, be if all furniture were knockdown furniture, which can be disassembled. Because then, you can get spare parts. But it's only IKEA and few others who knockdown furniture (flat packed furniture)"*. However, Torben also states that *"When it comes to IKEA furniture, most of the furniture is not resellable because when you purchase it for the first time the price is so low. So, when it's been used for 3 or 4 years, and it is more or less broken, if we have to sell it in our second hand shops... the quality would be so low that we cannot sell it"* (Engelbrecht-Vindnæs, 2017 C.3.2).

4.2.4   SydhavnsCompagniet

In order to develop on SydhavnsCompagniet's initative, a brief introduction is needed. The Resource and Waste Management Plan 2018 set by the Municipality of Copenhagen tries to rethink the concept of the recycling stations. The way to test potential solutions for the recyling station is done throughout the test of Guldminen KBH, which is a project that began in 2014 and aims at looking for innovative initiatives (SydhavnsCompagniet among others) that could be implemented in the new Recyling Station of Sydhavn (still under construction). The idea of opening the Sydhavn Recycling Station is to create a Flagship center that can separate for direct reuse the 10% of the 22,000 tonnes of annual waste that it expects to collect (City of Copenhagen, 2014). This recycling stations is the first one designed for the Circular Economy since its conceptualizations.

SydhavnsCompagniet (SC) is an innovative and community-based project that was established as an independent value-based NGO since 2004 and located in Sydhavn (SydhavnsCompagniet, n.d.). What SC does, in collaboration with Guldminen KBH, is a project that creates positive environmental impact by reusing and upcycling products and components and, the focus of the economic benefits are earmarked to their main purpose: social projects. Camilla Toft Sørensen, from SC, developed on it *"We are a local NGO or Social Economic Enterprise. All our profits will be reinvested in our work with socially vulnerable people in Sydhavn"*. Social benefits come from within the structure of the NGO by including volunteers and employers in social risk. Camilla added that *"We have volunteers and also users from a community center (at the next street)"* and *"We are also in unemployment projects so people who have been sick or out of work for long time and they are under the social services they will be coming to us guided by the municipality or the job center. Then, they will come to work here and try to help them also. Trying to get them an internship or employment."* (Toft Sørensen, 2017. C.7).

- **Actors Involved**

As SydhavnsCompagniet initiative arises from a complex network of human and non-human actors, figure 4.12 has been designed to show both, the actors involved and the linkages between them.
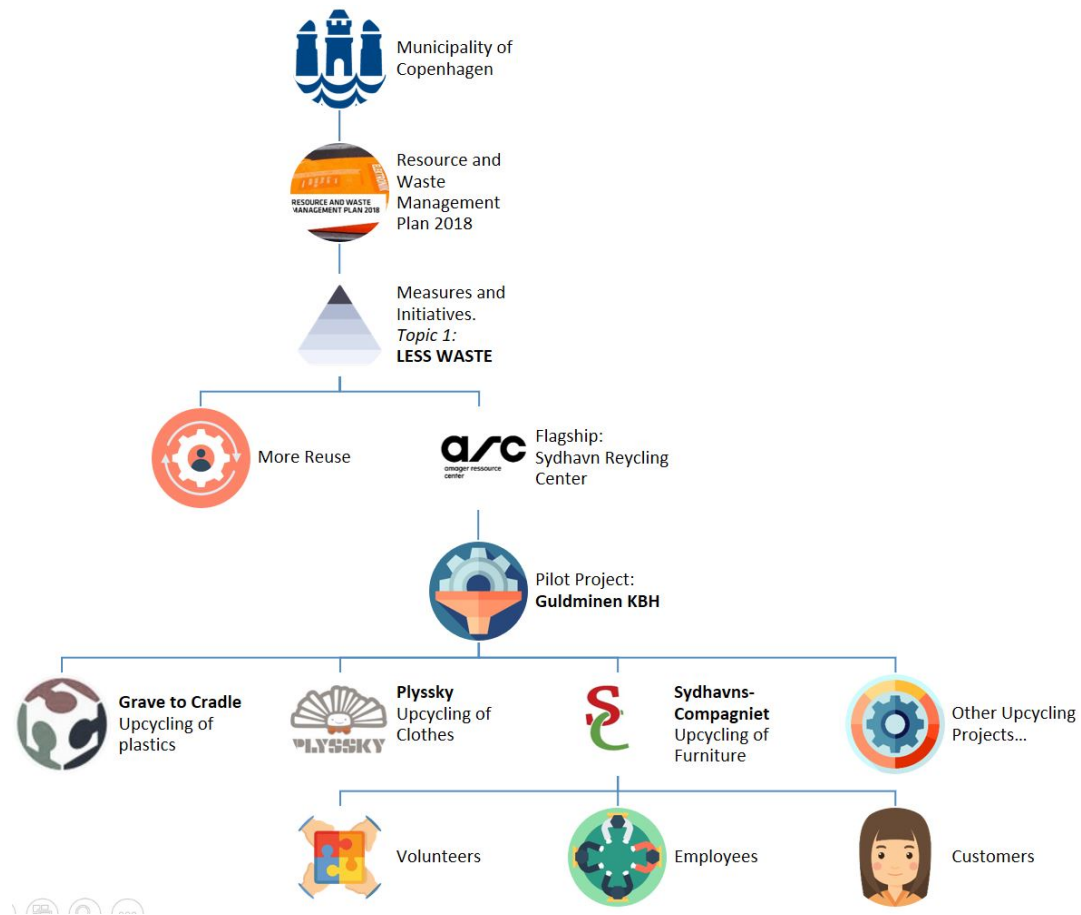
FIGURE 4.12: Actor network of SydhavnsCompagniet's initiative (Figure created by the author based on the interviews with Peter Munthe-Kaas C.2 and Camilla Toft Sørensen C.7)

- Human and non-human actors part of the regulatory framework and innovation of SydhavnsCompagniet

As commented in the introduction, within the *Resource and Waste Management Plan 2018*, the **Municipality of Copenhagen** set goals within four of the five levels of the waste hierarchy. The plan addresses different operational levels of waste management, and the first one, targets waste reduction (*Less Waste*). Among the four measures established the *Less Waste* target, there has two initiatives, **More Reuse** and **Flagship: Sydhavn Recycling Center**, that promote the increase of reuse as well as redesigning the concept of waste within recycling stations. This is a new approach for the Circular Economy that SydhavnsCompagniet intends to catalyse in the framework of their project.

- SydhavnCompagniet, part of the Guldminen KBH

SydhavnsCompagniet is an initiative part of the Guldminen KBH pilot project. Guldminen KBH is an experiment initiated by the Technical and Environmental Administration, Unit for Sustainability in Copenhagen in collaboration with C-DIST (Center for Design and Innovation and Sustainable Transitions) at Aalborg University (AAU) in Copenhagen.

Peter Munthe-Kaas, postdoc at AAU, worked for rethinking the way recycling stations should be configured. On the way, Guldminen KBH arose from the insight of the actors as an innovative potential solution for the new recycling station of Sydhavn.

It consists on a collaboration with 12 different initiatives (the *Goldseekers*) and ARC (Guldminen KBH, 2017b). Each of these initiatives aim at developing a new business models out of upcycling different "waste", or in this case "resources", categories. For example, *Grave to Cradle* is a project that studies ways to re-incarnate disposed materials so that they can be used as secondary raw (and cheap) materials for FabLabs (Guldminen KBH, 2017a). *Plyssky* is another example project that focuses on the sale (in physical stores and through a webshop) of upcycled (sewed and repaired) clothes for kids (from 0 to 6 years old) (Guldminen KBH, 2017c). Like *Grave to Cradle* and *Plyssky*, SydhavnsCompagniet have developed their business focusing on the "waste as resource"concept, but having the furniture as main resource.

Even though the idea of Guldminen KBH is to be tested so that the successful practices can be implemented in the new recycling station, at the moment and as pilot project, Guldminen KBH has a physical room at Vasbygade recycling station (see figure 4.13) which is also managed by ARC. Guldminen KBH collects reusable items from all categories for each of the 12 initiatives that work within the framework of this pilot project. As each of the initiatives seek for different types or categories of sources there is no competition between them, and therefore it is more of a cooperation (Toft Sørensen, 2017. C.7).

FIGURE 4.13: Picture of the physical space for furniture that Guldminen KBH has allocated at Vasbygade Recycling station for SydhavnsCompagniet (Picture from Guldminen KBH Facebook page)

- **Product Chain Before Reuse**

  The process furniture suffers, from the old user until SydhavnsCompagniet becomes the owner, is similar to when users dispose the items at the recycling stations (see figure 4.14). Once someone has decided to bring their furniture products to the recycling station, he or she needs to transport it and deliver it in the opening hours.
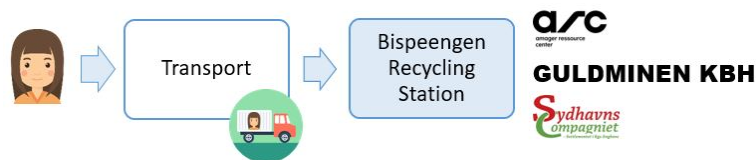
FIGURE 4.14: Process of furniture disposal from old user's location to Bispeengen recycling station. (Figure created by the author based on the interview with Camilla Toft Sørensen C.7)

  If the furniture item is reusable, the area for Guldminen KBH's project will allocate space for storing the products. As Linda Rebien from ARC mentioned, sometimes the workers of the recycling stations are busy and cannot interact with each user (Rebien, 2017 C.6). Therefore, some products might end up inside the containers which, supposedly means that those products will become secondary raw materials for reprocessing. Albeit, an agreement between Guldminen KBH (and the 12 projects part of it) and Amager Resource Center allow the different businesses, such as SydhavnsCompagniet, to take out materials and products from the inside of the containers.

  Figure 4.15 shows the process that both reusable products and upcyclable components undergo until they reach SydhavnsCompagniet venue in Sydhavn. Furniture

that get to Guldminen KBH space is selected before taken it to the transport vehicle. Camilla Toft Sørensen explained that products and components from the containers are well selected as they need to be in good conditions so that there is not need to a long and costly reparation. In addition, she estimated that *"around 50% of things we sell are from inside the containers. The other 50% comes from donations to the Guldminen KBH or others"* (Toft Sørensen, 2017. C.7).

Once all products are selected they are transported by the organization to the venue of SC, in Sydhavn, where they have a second hand shop and a cafe, where all furniture (picked up from the recycling station) is on sale and ready to be reused.
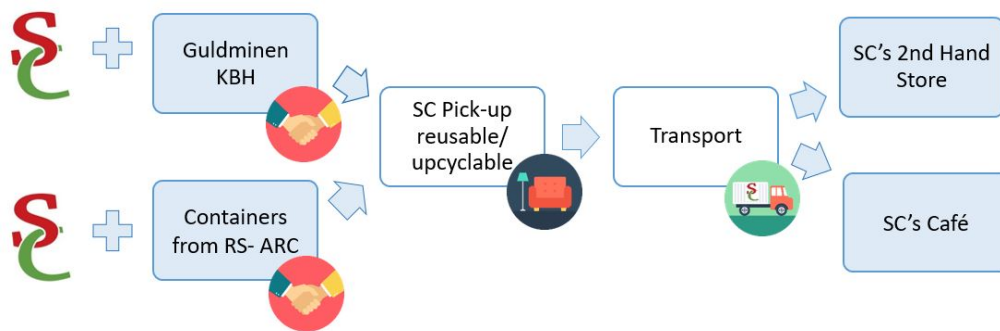
FIGURE 4.15: Process of furniture from Bispeengen recycling station to SC's venue in Sydhavn. (Figure created by the author based on the interview with Camilla Toft Sørensen C.7)

When the furniture products and components or pieces of wood arrive to the SC's venue these are cleaned and repaired, if needed, by workers and volunteers of the organization. Preparing for reuse sometimes might need of new components (for example adding a leg to an old sofa as it can be seen in figure 4.16). As it was difficult to find a spare leg for this sofa, the idea that Camilla got is to remove all the legs and add wheels instead. This way, the sofa can be reused and, moreover, there is value added due to the fact that it becomes easier to move it around. As this example shows, slightly broken products picked up at the recycled station can be reused for its initial purpose. Adding new components to already produced and manufactured products, it is a environmentally sustainable solution than manufacturing a whole new one.

FIGURE 4.16: Picture of broken-leg sofa picked up at Vasbygade recycling station and used as furniture for the SydhavnsCompagniet cafe (Picture taken by the author).

Ultimately, the pieces are priced and used as furniture in the cafe until someone buys them. Also, products can be placed inside the second (see figure 4.17) hand shop or stored in a room ready to be sold (Toft Sørensen, 2017. C.7).

FIGURE 4.17: Pictures of the SydhavnsCompagniet second hand shop (From left to right: Picture 1 and 2 taken by the author. Picture 3 taken by Camilla Toft Sørensen)

- **Regulatory Network**

  The Danish regulation states that, once products or materials have been introduced inside the containers of the recycling stations, these become waste and cannot be taken out from them. The city of Copenhagen, together with ARC, are running the Guldminen KBH project, which includes a reinterpretation of the law previously explained. This new way to understand how laws can accelerate the transition towards the Circular Economy, is done, in this case, through an agreement with Guldminen KBH (and the twelve project part of it). The agreement

consists on an exclusive daily access (2 hours a day) to the containers of different waste streams at Vasbygade recycling station (Toft Sørensen, 2017. C.7). Rethinking the features of waste as concept and its opportunities as resource is a process that has been part of ARC and the Municipality of Copenhagen's plans. It has been a crucial element that has enabled the initiatives of Guldminen KBH, including SydhavnsCompagniet, to happen.

- **Innovation Process**

  SydhavnsCompagniet's initiative is the result of an engagement process that involved different actors encouraged for the development of solutions for the Circular Economy within the waste sector. The need to search for a know-how process that could be implemented in the new recycling station, took the Municipality of Copenhagen together with a AAU, as reasearch institution, to seek for solutions that could be tested. Peter Munthe-Kaas mentioned that *"Guldminen was an initiative made because Katrine O. Rasmussen* [Project manager and development consultant at the City of Copenhagen, Department of Sustainability] *and I wanted to figure out what content should be included in the recycling plant* of Sydhavn *and how it should work. We had a lot of unsolved questions like, "what do you do with the waste?", "how to clean it?", "what fraction will there be? who is going to buy it?", "what companies will there be around the project?"... So, the whole idea of Guldminen KBH was to create a prototype that could explore all these questions before the recycling center was built."* (Munthe-Kaas, 2017 C.2) . After problematising the situation, the next step was to recruit the 12 different initiatives that could be part of Guldminen KBH. Once the new actors had showed interest for the project supporting the Circular Economy model, these were provided with how their roles would look like, the agreements to access the resources and how they would evaluate the success (Munthe-Kaas, 2017 C.2).

  Despite the fact that SC is still in an early stage, the collaboration with different actors can allow the organization to test new ways to create revenue out of upcycled innovative ideas. One of the collaborations has been carried out with a Danish educational institution. Camilla, from SC, developed on the goals of the projects: *"We made a collaboration with a Design School who made the visual identity for us. In this project they made examples of upcycling: they created a catalog of upcycling ideas (including furniture). The students created this model* (see figure 4.18) *of furniture from wood found inside the containers of the recycling station. And, they created the design guidelines so it can be re-produced and assembled. The wood was taken from the wood-containers of Bispeengen Gengrustation, within the Guldminen project"* (Toft Sørensen, 2017. C.7)

FIGURE 4.18: Pictures of the upcycling project's exhibition in collaboration with a Danish design school at SydhavnsCompagniet cafe (Pictures taken by the author)

- **Challenges**

  Despite the fact that SydhavnsCompagniet is almost ready to open, the organization faces still some challenges directly related to furniture and others related to bureaucracy and legal issues.

  Problems related to the furniture tackle matters of space for storage, as well as the issue of poorly designed products. Camilla explained during the interview that they (employees and volunteers of FN) need to be very selective with the furniture taken because they have a small space for storing it. They barely take products that need a lot of repair because there is a great quantity of furniture that can directly be reused and, accordingly, there is no need to spend resources on repairing or upcycling. Camilla also commented that they find that it is challenging to reassemble products that are made of low quality materials, coming from fast-furniture companies, and, which the procedure to reassembly are unclear (Toft Sørensen, 2017 C.7).

  The other problem related with furniture addresses the different qualities of furniture and designs. Furniture that can be dis- and re-assembled is many times manufactured with low quality materials and badly designed systems for connecting the different pieces. Then, when we try to reassemble them, we find difficulties because some of the pieces have been damaged on the process and the value of the product is almost lost (Toft Sørensen, 2017 C.7). . Even though the cafe area is ready to be used, SC is in the process of waiting for the legalization of the rest room, as well as for confirming that it can be opened the date they have planned, which is three weeks since the interview with Camilla Toft Sørensen took place.

4.2.5 ReparationsGuiden.dk

One of the consequences of "throw away"and bad quality products is the no-need for repair. *"There have recently been some analysis about how many repairs have been done in Denmark on different product categories and it's just going down. And, the amount of outlets (repair shops), where citizens can go and get their products fixed, is also decreasing"* (Møhl, 2017 C.1).

ReparationsGuiden.dk is one of the initiatives that emerged from the *Reparations Netværk* (Network for repair in Danish) group. This group is formed by different organizations, individuals, businesses and institutions and, it arose with the purpose of promoting the need for repairing stuff (and extend their life) with the intention to reduce the generation of waste. The result of addressing the "waste reduction"target was the development of different initiatives. Among others such as Repair Cafes (where individuals can get their products repaired for free) or the Storskrald.dk platform, ReparationsGuiden.dk flourished.

Despite the fact that *Reparations Netværk* has a special focus on electronics, the ReparationsGuiden.dk initiative aims to *"ease people the access to the repair of things"* (Møhl, 2017 C.1). The online platform contains information of repair workshops around the whole country and it gathers twelve categories of products, including furniture and fixtures (see figure 4.19).

FIND REPARAT Ø R

- Other
- Electronics
- Precision engineering
- Recycling and rental
- Hobbies and Sports
- Art, music and porc.
- Kitchen and electrical equipment
- Furniture and fixtures
- Optics, photo and watches
- Textiles
- Transportation
- Tools etc.

FIGURE 4.19: The twelve different categories of product repair that ReparationsGuiden.dk facilitates. Screenshot from the 29th May 2017. (ReparationsGuiden.dk, 2017)

The idea is to facilitate the search of a business that is capable to repair specific products without need of guarantee or purchasing in that shop. Owners of workshop stores that facilitate the repair of things can register their business and write a description of their expertise or specialties on the repair (see figure 4.20).

Figure 4.20: Some furniture repair shops, in the area of Copenhagen, where furniture can be fixed. Screenshot from the 29th May 2017. (ReparationsGuiden.dk, 2017)

- **Actors Involved**

  ReparationsGuiden.dk is an initiative which was started by different organizations together with Danish municipalities and institutions (see figure 4.21). Some of the founders and supporting actors of ReparationsGuiden.dk are the Danish Ministry of Environment, The Municipality of Copenhagen, ARC, The Copenhagen Resource Institute or Det Økologiske Råd NGO.

  The intention behind this project was to bring on board all Danish private companies that have developed a business model based on the repair of things. The key of these types of businesses is not to sell products but unique services - due to specific skills. Consequently, by enabling a free promotion of existing repair shops, this public private partnership (PPP) encourages users to seek for alternatives before disposing off their products (ReparationsGuiden.dk, 2017).

Figure 4.21: Names of actors who have worked for the ideation and development of the ReparationsGuiden.dk initiative. Screenshot from the 29th May 2017. (ReparationsGuiden.dk, 2017)

ReparationsGuiden.dk is a 24/7 information platform for those individuals who have the will of keeping and extending the life of their own furniture. For this reason, they are the user-actors engaged on the reuse, from the beginning until the end of the reparation or prepare-for-reuse process.

- **Product Chain Before Reuse**

  ReparationsGuiden.dk is the only initiative, from the six ones analysed, in which the product will remain being owned by the user who decides to repair it.

FIGURE 4.22: Process of furniture in need of a repair until it can be reused. (Figure created by the author based on the interview with Malene Møhl C.1)

The ReparationsGuiden.dk is not an actor *per se* within the product chain. However, it is an important agent that will provide the user with information so that the process of repair can become less troublesome.

Once the user has found and contacted the optimal repair shop, the furniture will need to be transported to the workshop (normally by the user). Afterwards, it will also need to be transported to the place where it will be reused which implied two transpositions to be supplied by the user.

- **Regulatory Network**

  The main constrain that this initiative faces are the currently imposition of a throw away lifestyle along with cheap prices. The costs of repairing a furniture item can easily be higher than buying a new one (without taking into consideration features such as personal attachment or quality of the materials used). Malene Møhl, explains that *"the 25% of value of anything you buy goes for taxes (sales tax). In Sweden, for example they are testing to have lower sales tax for any kind of repair so it becomes cheaper. Because the problem now is that the price of new and getting something repaired is almost the same."* (Møhl, 2017 C.1)

- **Innovation Process**

  The initiative of ReparationsGuiden.dk involves different agents such as public authorities (Municipality of Copenhagen, among others), NGOs (Det Økologiske Råd), research institutes (CRI) or public companies (ARC) (ReparationsGuiden.dk, 2017). No furniture producers or manufacturers have become part of this

network but, the fact that the network freely promotes all the outlets and re-pair workshops across Denmark, benefits these agents who have indirectly become actors of the initiative. An interesting evaluation method would be to ask the consumers who participate of the repair of their furniture whether they have rea-ched the outlet store throughout ReparationsGuiden.dk or other tools. Surveying the consumers could be a method to evaluate the success of this initiative and afterwords create improvements based on the results.

- **Challenges**

  The last decisions taken in Sweden, previously commented by Malene Møhl, to accelerate the transition towards the Circular Economy was to half (from 25% to 12%) the taxes on repair so that prices can be competitive compared to new products (Orange, 2016).

  Redesigning policy instruments so that more repair activities are promoted is one of the targets that Det Økologiske Råd is pushing for. *"We are working with legislation so that it can be more cost-efficient for the consumer to repair their products, and consequently, it would create new jobs and small businesses as well. And it will also keep the product in the loop. That's what we think it has to be part of the Circular Economy."* (Møhl, 2017 C.1).

4.2.6   *"Byt til Nyt"* by IKEA

Although the geographical focus of this research is Copenhagen, *"Byt til nyt"* (*"Switch for new"* in Danish) the initiative that IKEA implemented as take-back system for selling as old, was tested in other Danish cities such as Odense, Aarhus or Aalborg.

Due to a limited success caused by a low level of participation, the initiative is no longer available in Denmark. Yet, it was used to test potential solutions that could follow Circular Economy business principles, such as kind of a take-back system. (Engberg, 2017 C.4). And, for that reason, it is analysed as initiative for reusing and, extending the life of furniture products.

- **Actors Involved**

  This initiative is not unique in Denmark. In Spain (*Salvemos los muebles*) (IKEA, n.d.c) or France (*Sauve les meubles*) (IKEA, n.d.a), among other countries, the *"Let's save the furniture"* initiative was introduced two years ago - and still run-ning. Even though the title of the initiative changes, the concept is the same as the Danish *Byt til Nyt* initiative.

IKEA Denmark also decided to try, influenced by other country's strategies, whether this initiative could be successful in the Danish context.

In Denmark, the *Byt til Nyt* initiative targeted the IKEA Family members, which is a specific group of registered customers who benefits with special offers and discounts. The *Byt til Nyt* initiative conceptualised by IKEA (as designer, manufacturer and retailer) Denmark was a triangle actor network initiative. The actors involved were the company, the IKEA Family members and the customers who decided to become practitioners of the *Byt til Nyt* by acquiring used products a the IKEA retail store.

- **Product Chain Before Reuse**

The procedure for taking back the furniture from the first user to the IKEA store consisted on two phases with different steps each phase and it could differ from one store to another. To start, the online contacting method is explained (see figure 4.23):
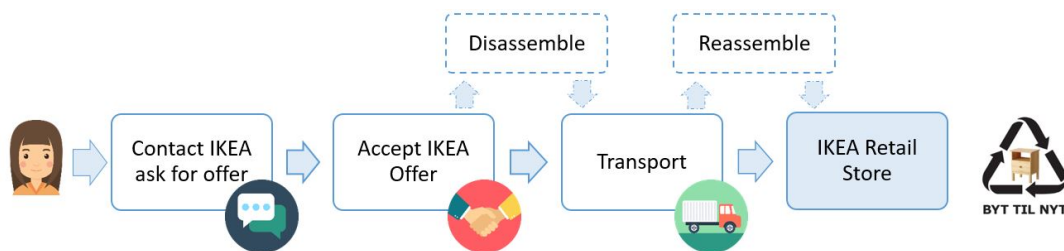
FIGURE 4.23: Process of furniture from the end-of-use of the first user until it reaches the IKEA retail store. (Figure created by the author based on the interview with Jonas Engberg C.4)

The first phase is to agree upon the sale details. The second consists on delivering the furniture to the IKEA store which participates of the *Byt til Nyt* initiative.

First of all, the user who had chosen this option had to contact the company through online methods (email). In this first contact the users had to explain what product they wanted to sell and send pictures of it. Also specifying the current state (damage wise) of the item. IKEA would reply with an offer and the seller could either accept it or reject it.

If the price was agreed, the user had to transport it to the store and deliver it to corner of opportunities section inside the IKEA retail store (physical space to allocate the products part of *Byt til Nyt* initiative. The furniture had to be assembled before IKEA took the responsibility and ownership of the product. Therefore, some middle steps could be that, before transporting it, the user had to disassemble the item. And once they arrive to IKEA, assemble it again, as one of

the requirements was to deliver the item assembled. IKEA could provide all tools needed in case the owner did not have access to them. In case the user has access to a vehicle big enough to fit the furniture assembled the time of disassemble and reassemble would be saved.

Secondly, the direct contact method, used for example at IKEA Odense, is explained. Unlike the previous channel, in order to receive a voucher with a dicount for IKEA, the user had to first bring the furniture item to the warehouse (assemble it and clean it), where the product would be valued (the assessment of the furniture would be done by an employee from IKEA and the value could be from a 10% to a 50% of the price-as-new) (IKEA, n.d.b). If the customer would not accept the offer they would have to take the products back home.

In both methods, direct contact or online contact, the last step before closing the deal was to receive a voucher that could be spent at IKEA for the value agreed on the first stage of the process. This would be the same value that IKEA would get from the buyer that wanted to purchase the second hand product.

For its reuse, a new customer will have to go to IKEA and be interested in the purchase of a used IKEA furniture. The new user will have to provide the transport methods to the new space.

- **Regulatory Network**

  The implementation of initiatives for the Circular Economy in big corporations such as IKEA are long processes that have to be thoroughly designed, fitting in the legal boundaries, so that the initiative is economically profitable and positive for the business (Engberg, 2017 C.4). Some of the issues in relation to regulatory network address the legal rights and obligations that the company has to follow then selling used products.

  One of the biggest issues that currently companies face in Denmark is the possibilities for retailers to resell used products. The expert on waste policies Malene Møhl, from Det Økologisk Råd, develops on that: *"one of the obstacles that we see, in terms of reusing and repairing, is that shops that sell are not allowed to take their old products for disassembly themselves"*. According to Møhl, this Danish regulation says that used products have *"to be handled as waste -under the Waste Directives- and you need to be a waste handling facility rather than an outlet shop"in order to be allowed to collect waste."* (Møhl, 2017 C.1).

  Fortunately, there are possible solutions which could be to *"work together with waste facilities or waste handling businesses"* in order for retailers to have *"that part covered. So, they* [waste facilities] *"can be your outlet and re-source you with*

"raw"materials and products that will no longer be under the Waste directive" (Møhl, 2017 C.1).

- **Innovation Process**

  Interessment is one of the essential steps that can determine whether an initiative will work or not. In the case of IKEA, the fact that in other countries the *Byt til Nyt* take-back system had worked could be a factor to think it could also work in Denmark.

  Jonas Engberg, from IKEA comments on other initiatives which they are trying to developed (further explained in the next section) and he emphasises that these new initiatives *"we think that could create more excitement and perhaps more penetration"* among the users' habits (Engberg, 2017 C.4).

  One of the reasons that *Byt til Nyt* was a failure project was due to a bad lay out of the problem. One of the problems it would have created if it had been successful is related to space for storage the used products on sale. *"If Byt til Nyt was a big success we would not have room. Our stores are not built for a take back and resell."* (Engberg, 2017 C.4). *"The only reason we can do it is because it has a limited success. We don't have the logistical set up in order to really engage in that"* [...] *"We would need an IKEA store the size of an IKEA store if we would do a total take-back and resell."* (ibis.)

  As a result, a wrong problematisation approach might have brought to IKEA think that more people could engage in their *Byt til Nyt* initiative. But, not taking into consideration the existing methods for getting rid of furniture in Denmark might be part of the cause of this limited successful initiative.

- **Challenges**

  "The conclusion with *Byt til Nyt* is that, it is a good initiative but it is not a natural part of people's decision journey towards "How to get rid of their stuff"(Engberg, 2017. C.4). There are so many ways they can get rid of things already: Facebook, social media, Den BlåAvis, take it to the *storskrald*... They do all these things before they get into their car taking their things to IKEA. Because it is a lot of handling."

  Even though *Byt til Nyt* has not been as successful in the Danish context as in other countries, IKEA Denmark is looking into new strategies and initiatives that could create bigger impacts. There are still some challenges to face for implementing new initiatives, though.

Namely, the challenge is to find a spot in collaboration with exiting platforms where IKEA products are being sold. This challenges are deeper developed in the coming section.

4.3   Future plans and Visionary actions

It is uncertain whether the initiatives previously analysed will be running for long or short period of time. However, the different actors interviewed have contributed to develop a section which shows some short and long term plans that follow are based on Circular Economy model and are built in a systems thinking mindset.

These are hereunder shortly explained due to the fact that, many of them, are just drafted by the organization and therefore, not much specific information is available. Both barriers and enablers for becoming copying different ideas are found

4.3.1   Need for new roles

Finding new sourcing methods, using the existing stock of products and finding new forms of revenue are challenges that internally arise in all the actors who are seeking for circular solutions. But, solutions are probably not possible to be only built from within each entity but looking out of the box and finding new links. The researcher Peter Munthe-Kaas, who co-developed the concept of Guldminen KBH, points at "finding new links"as one of the main challenges for saving reusable furniture from going to waste.

"I've noticed that there are Facebook pages where people give things away for free. And, there's a lot of furniture advertised and it actually moves pretty fast because people want furniture. So, it seems to be a missing link somewhere that could connect people that need furniture with the people that need to get rid of furniture. The problem is that, most of the time, when people want to throw away furniture they want to do it "now". So this link should be someone that could store it for some days until someone wants it."

The DBA second hand online market, is one of the targets where IKEA is looking into. The wicked problem is in relation to the *how* to create this so both actors, DBA and IKEA, can take profit of the new agreement, which still has not happened. A bigger problem than addressing the existing second hand market lays on how to save all the reusable furniture that goes into the *storskrald* (and becomes waste) and is never part of the second hand online platforms. Consequently, and, as Munthe-Kaas comments, future actors whose new role would be sourcing into waste-to-be furniture have a big potential for existing within the CE model.

4.3.2   Overcoming Legal Obstacles

Laws and regulations, as seen in the previous section, are relevant non-human actors that can determine whether companies or organizations can or cannot implement their initiatives. Overcoming these type of obstacles is essential to pave the road so that the different actors can develop future plans with the law on the side for the transition towards circular economy and not hindering it.

- The **Det Økologisk Råd**, as organization that lobbies at EU and National level, has included in their agenda to work for the extension of product's life by claiming the right to repair things. Among other things, analyse what are the legal obstacles and barriers that hinder the repair of a greater quantity of things.

  "The campaign has a focus on legislation on the right to repair. The Repair Campaign addresses the promotion of repair and longevity of products. And for it to work, it should be done at EU level" (Møhl, 2017 C.1). To start with, DØR is engaging other actors at Nordic level with the intention of learning from each other and to be stronger to bring it at EU level. *"We were the idea-makers of this project and we invited collaborators (other Nordic environmental NGOs) on board to work on the promotion of Repair"* (Møhl, 2017 C.1).

  "Why can so many things be used for such a short period of time and be thrown away?" Malene develops on the inquiry explaining that *"when you buy an item you need to be able to get manuals or instructions, but also spare parts. So if you own a product you have to be able to replace pieces and do yourself simple repairs. We believe that if you buy something and you don't have access to repair it then you don't own it."* (Møhl, 2017 C.1).

- The **Municipality of Frederiksberg** is aware of the fact that resources are lost when the bulk waste is placed at the **storskrald** rooms. And, they are looking upon long term solutions which could drastically reduce the amount of reusable products left at the storskrald. *"it could be great if we could have the organizations, such as Folkekirkens Nødhjælp, to make the first "trip" of waste collection from the storskrald."* (Makne, 2017 C.6). However, there are legal issues that the Municipality of Frederiksberg should overcome for this potential initiative to happen. For example, they are the legal agent who have access to the backyards (96% of them are locked) where the *storskrald* rooms are placed and keys cannot be given to organizations.

- **Recycling stations** face a legal problem due to the fact that items cannot be removed from the containers. A big problem regarding law is that *"when something*

has been left at a recycling station it can't be taken out again because it's classified as waste" (Munthe-Kaas, 2017 C.2). However, there are spotted potential solutions for it as well: *"to avoid this, is to take it before the products are put inside the containers. So you could have an extension of the recycling station where people could leave their furniture for a specific company (the one that would prepare it for the reuse). That would be a hard intervention"* (ibis.)

- One of the product design **IKEA**'s problems is related to the nonexistent disassembled guidelines for when, for example, people need to fold and store the products or transport them. IKEA is aware of it and they have been shuffling different options such as creating section inside their website where all the products would have a tutorial for disassemble them so that they do not break, can keep being functional and ultimately, last longer - contributing to the prevention of waste.

  However, the multinational is facing a huge barrier in relation to legal issues. If they would provide a guideline or tutorial for disassemble their products, they would become the last responsible agent for the integrity of the product (if it would break following those steps). And, IKEA could be easily sued by consumers and it would be an economically unfeasible strategy. Still, IKEA, from the departments of laws and regulations, is working to overcome these type of barriers that prevent them to be facilitators of the disassembly of the products they design.

4.3.3   New business opportunities

Moving towards the Circular Economy is challenging for existing businesses whose model is based on the *"sell more, sell faster"* principle. Changes on one side of the value chain affect other steps of the value chain or the business plan. However, transforming barriers into opportunities is where businesses have a chance to stand for circularity and become frontrunners of their sector.

- **Collaboration with DBA**

  Innovative solutions involving new actors, through collaborations with existing successful actors in the big market of second hand products, are included on the list of solutions that IKEA is looking for. After the interview with Jonas Engberg, it seems that the idea IKEA is currently looking at the most and the one IKEA thinks can become more successful is this collaboration for becoming a stakeholder in the existing online second hand market.

  When searching for IKEA products at DBA one can find more than 14,000 items containing the key word "IKEA". This makes IKEA think that DBA, as the biggest

second hand online platform for products, is one of the targets for partner-shipping so that IKEA can also become a stakeholder of the second hand market.

"Specially in a Country like Denmark, people get rid of their things in many different ways. There are so many platforms. We want part of this, so we would rather facilitate it. So, DBA.dk, we [IKEA] know that a lot of IKEA sofas are sold everyday there. What if we [IKEA] engaged with them? We could give tips and ideas on how to repair and how to assemble and disassemble products that people want to get rid of. Helping them with providing spare parts... This is the way to go forward and it would create more excitement and penetration than telling people to come to the IKEA store" (Engberg, 2017 C.4) to deliver their own used furniture.

The new role of IKEA would be more based on following the changes of furniture products more than creating a take back system. *We want to be part of an IKEA 20 years old sofa more than take it back and resell it, because people have already many ways of doing that. So we would help people with tips and ideas in the different shifts they make (to the sofa). For example, new sofa covers."*

The idea of being agents who facilitate the repair and disassemble of products so that these can have a longer life is in competition with the IKEA business model which is based in the sale of products. Therefore, the company will need to find a model of revenue in which being an agent for prolonging the life of products can be economically feasible and profitable. Another issue would be to catch DBA's attention and think about how to create interest on DBA to partner with IKEA. Jonas comments that *we would need to find answers for questions such as "How to add extra value to this existing business?"* so that the partnership would be appealing for DBA (Engberg, 2017 C.4).

- **PSS for office furniture**

  In Finland and Sweden, a pilot project based on the leasing of IKEA furniture office has been running. The PSS business model is based on the monthly fee that the customer pays to IKEA.

  The advantages is that IKEA is in charge of bringing and taking back the projects so the user just needs to care about the use of them. On the other hand, this system presents some problems that affects IKEA's structure. The logistics is something that has to be carefully thought as this is a type of take-back system and IKEA needs to provide a service for it. Another option that IKEA should include is a repair service so that the product could be reused as new with the purpose of being leased again to a new user. In order to be successful, the client needs to see economic gains coming from a PSS in furniture. And, one of the main barriers is

related to demonstrating this economic benefits. The "difculty in comparing the price of buying furniture to the total cost of renting it"hinders the possibilities to catalyse these types of projects (Besch, 2004).

- **IKEA vintage**

Another business concept, in a very long term, that IKEA Denmark is shuffling is to build an IKEA vintage market. It would be a space where all furniture since IKEA started would be sold so that customers can furnish their homes with 20 or 30 years old IKEA design furniture. But again, one of the main problems for it to happen would be the space, as the size of one full IKEA retail store would be needed to upscale a project with these dimensions. (Engberg, 2017 C.4)

- **SydhavnsCompagniet**

Thank to the agreements with ARC and the collaboration with Guldminen KBH, SydhavnsCompagniet, as NGO is now expanding. Even though they have not opened yet the flagship store in Sydhavn they are planning on opening another cafe soon with the same purpose so that the same concept can be replicated in another neighbourhood of Copenhagen (Toft Sørensen, 2017 C.7). The replicability of this project is one of the main takeaways that is taken into the discussion.

Chapter 5

Discussion

This chapter tackles the methodology used for this research as well as each of the questions formulated in Chapter 1. Each different section includes a discussion addressing the different sub-questions whilst commenting on the main research subject, leading to the conclusions in Chapter 6. The discussions in each section are based on literature found on the topic and the data collected by the author for this research.

5.1   Methodological reflection

Collecting qualitative data about each of the actors has required a previous research of the defined plans and strategies of each actor. Unfortunately, in real life, some obstacles prevent plans to be implemented, thus, impeding the research. According to the WRMP 2018, the new recycling station in Sydhavn should have been finished in 2015 and currently be functioning. However, due to political issues and administrative work it is uncertain when it will finally open. If it would have been running, it would have been possible to use the recycling station as actor. Moreover, it could have been possible to evaluate the success of the initiative from an experienced point of view rather than only as a theoretical project.
A similar situation can be found with SydhavnsCompagniet's initiative which cannot be neither evaluated nor analysed whether it works as expected, due to delays with bureaucracy and licenses needed for its running.

Another issue is the uncertainty in terms of quantities of furniture saved from being downcycled. The Municipality of Copenhagen, through ARC, has numbers related to the recycling of wooden products but there is still no specific data about how to measure it. If there was data it could be possible to test how effective each of the initiatives are, and

where in the infrastructure of the city (e.g. repair shops, recycling stations, *storkrald...*) urgent action is needed the most (in terms of tonnes of furniture being downcycled).

5.2 Causes of furniture waste

This section aim to summarise the most relevant factors that trigger furniture to become waste. One of the problems that prevents furniture or wooden components from being directly reused or upcycled is that there are currently many factors that favour the linear model instead of facilitating its circularity. The reasons found are related to social, technical, cultural, infrastructural, economic, legal and traditional factors.

FIGURE 5.1: Summary of reasons that cause the end-of-life of furnishing products. (Figure created by the author based on literature search and interviews)

Emotional attachment for products is an outstanding factor that can prolong the life of furniture (Hebrok, 2016). This is consequently the reason why consumers in first option try to pass furniture to friends, relatives or acquaintances before trying any other method for disposing of it (Fortuna and Diyamandoglu, 2017). After asking to relatives, some users will contact charities (such as FN) and ask them to pick up the rest of the products they don't feel attached to and that the organization can reuse. There is a common agreement between interviewed actors that IKEA products are more likely to be thrown away because people don't feel attached to them. Jonas Engberg, argues that, the way IKEA products can become attached to users is by personalising them by, for example, letting one's children paint the product. It will become unique and at the same time loved, so it will be less likely to become waste (Engberg, 2017. C.4). However, this reasoning has not been perceived in previous studies nor among the other interviewed actors.

When students move out from their parents place, due to **changes in their lives** they tend to inherit furniture from their parents which sometimes has been stored for years (Hakala et al., 2015). Moreover, other situations that imply a change in someone's life such as moving together with a couple, changing to a furnished place or when babies become kids lead to potential furniture waste (Hebrok, 2016). Camilla also argues that when people own furniture which has a story behind it is less likely that they will throw it away and will try to keep it until they find out. But, sometimes the **lack of space** force them to bring them to the **recycling station** and that's why they find valuable old furniture (Toft Sørensen, 2017. C.7). In the worst case, and easiest option for the consumer if they do not want to sell it or donate, the infrastructure of Copenhagen offers the possibility to leave it at the *storskrald* room where products will be taken to the incineration plant afterwards (Rebien, 2017 C.5.

Designing businesses that do not become fully responsible of the waste they produce and the resources they use generates a big issue that leads to furniture waste. Creating different business models, such as PSS (Fortuna and Diyamandoglu, 2017), that **take back** their products is one solution repeatedly mentioned in the literature analysed but also commented by the actors interviewed. *"The ideal solution would be a **shift of business model** towards the leasing and renting"* (Makne, 2017 C.6). A study carried out by Besch, points out that the **legal framework** in Europe is one of the main problems for businesses to take responsibility of their products as **EPR schemes** do not apply the furniture sector and manufacturers do not think it will change soon. This suggests that, it is currently complicated for any type of PSS to become successful (Besch, 2004) (for office furniture). But, it can be seen that some producers are already trying and seeing PSS as an opportunity of potential businesses for the CE. IKEA, willing to become a front-runner for the CE, has created a pilot project based on the leasing of office furniture, not in Denmark but in Finland and Sweden (Engberg, 2017 C.4). These types of initiatives can help businesses in two ways. On one side the acquisition of its own products plus assembling and disassembling them will provide informational value to the company which can help enhance the **product design** (Bakker and den Hollander, 2014). On the other side, the generation of less waste due to a PSS business model is helping the business to gradually create shifts so that if legislation becomes stronger they can be prepared beforehand.

These solutions based on the transformation of the whole business model address also the requirements that product design should follow in order for furniture to not become a wasteful product. High **quality** is one of the most repeated features for furniture to last, and therefore it could be part of a PSS business model (Besch, 2004). In all the open-ended interviews carried out with the representatives of each organization, two or more design strategies for designing longer lasting products were mentioned. The most

commented issue was the need for finding new ways that would allow products to be assembled and disassembled more than few times and provide the **know-how for its disassembly**. (Rebien, 2017 C.5; Toft Sørensen, 2017 C.7; Møhl 2017 C.1; Palle, 2017 C.3.1; Engelbrecht-Vindnæs, 2017 C.3.2).

Another issue related to product design that causes the waste of furniture is the **access and willingness to repair**. Many times, the possibilities to repair depend on the proximity to an outlet shop which provides the specific service and the method to transport the furniture. A facilitation has been done throughout the years as this information is currently available thanks to the ReparationsGuiden.dk initiative. Yet, studies ensure that it is also required that the user has some type of emotional attachment and meanings for the furnishing products in order to choose reuse or repair over disposal (Bakker and den Hollander, 2014). In addition, economic savings from repair need to be clearly quantifiable for users to think about this option. If it is cheaper or equally expensive to buy new than repairing, people will choose buying new and throw away the old (Møhl 2017 C.1). A new legal framework, such as for EPR, should arise to incentive the repair of things. (Miljostyrelsen, 2001).

5.3   Itinerary of used furniture in Copenhagen

This section, through figure 5.2, aims at showing the links between the disposing methods of furniture chosen and the existing initiatives arisen due to the local infrastructure and the social disposing practices. Ultimately, an arrow connects each of the initiatives with the level of resource recovery. The different levels of resource recovery are at product, component, materials or energy level. These mirror the reuse, prepare-for-reuse, recycle and incinarating with energy recovery.

(C) stands for collaborations between different actors such as PPP or public-public partnerships. ReparationsgGuiden.dk and Storskrald.dk belong to the Network for reparations which is an already functioning and established Danish network of actors in favour of reuse, repair and circular economy in general.
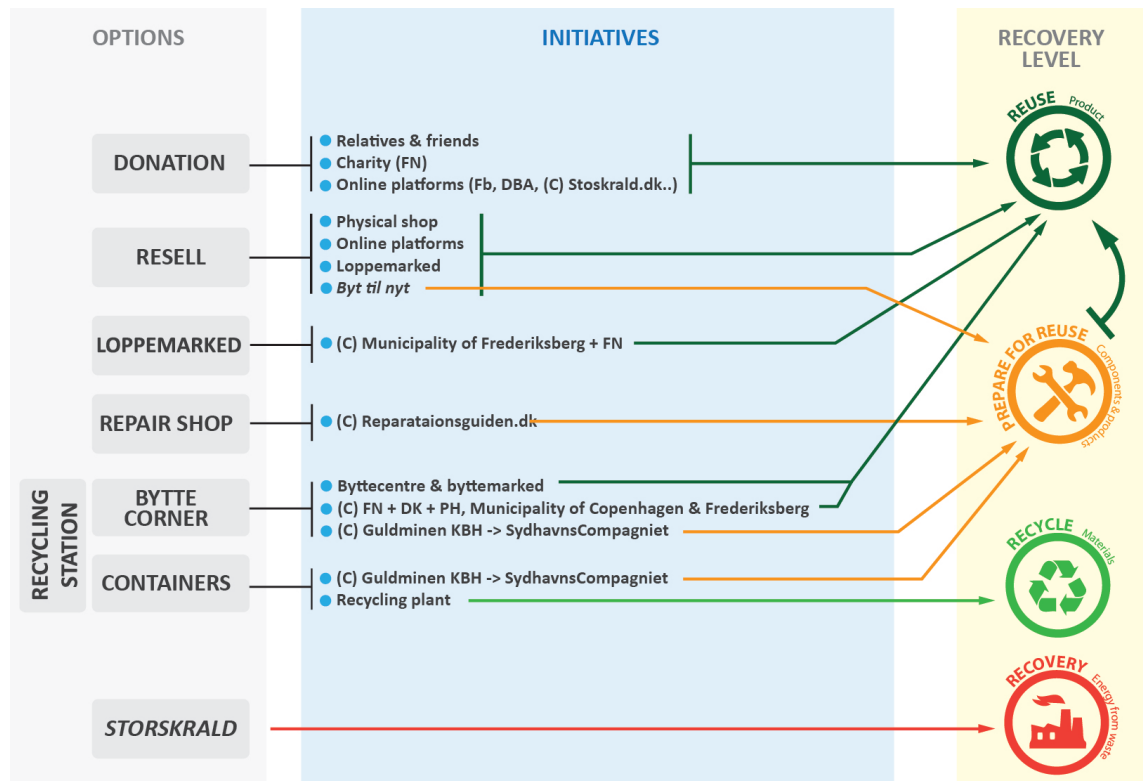
FIGURE 5.2: Links between disposal options, the different initiatives taking place in Copenhagen and the level of resource management intervention as result of each initiative (Created by the author as summary figure for section 4.2 of this Chapter 4)

- **Reuse**

  When the consumer takes the decision of donating or reselling a piece of furniture they are contributing to the direct reuse of products. Donations to relatives and friends, to charities that collect used furniture (such as Folkekirkens Nødhjælp), second hand shops or using second hand online platforms (such as DBA, Facebook groups, Storskrald.dk or "Gul og Gratis") are initiatives that tend to be local and successful it terms of use of existing resources (on stock).

  Byttemarkeder and *Byttecentre* or *Byt til Nyt* by IKEA are initiatives that also contribute to reusing furniture. However, these are not directly reused as the products pass through a previous step which is the storage in the recycling stations or the IKEA retail store. And, there needs to be someone interested who picks the product up. Therefore, sometimes the product damages before someone takes it home.

  The agreement between Frederiksberg Kommune and FN facilitates the reuse of furniture products. Before this agreement, that furniture was put in a container and picked up by the waste management company who was transporting it to the waste-to-energy plant. And, by picking products up and reselling them, FN work

for keeping the products in the loop instead of recovering only the energy out of its incineration.

- **Prepare for Reuse**

  The preparation for reuse is a middle step needed for furniture products which are not in perfect conditions but still can be reused if small reparations are being made.

  Deciding to repair a piece or furniture with "do it yourself"methods or by bringing it to a specialist (through, for example, information websites such as Reparations-Guiden.dk) leads to extending the life of products and, therefore, preventing waste generation.

  SydhavnCompagniet contributes to the preparation for reuse as they collect furniture that might need an easy repair. This reparation increases the value of the product as it can again be reused with the same purpose as it was manufactured. Reusing furniture that was disposed of in the containers for recycling is a clear example of circularity as all the resources embedded to the manufacturing of the product will be kept in the product once it is reused instead of only recycling the material.

- **Recycling**

  By bringing furniture which can still be reused to the recycling stations can trigger to a downcycle of the product. If the person who brings them, does not know about the *byttecorner* and it is not reached by any of the employees from the station the product will be introduced in the container number 35 or 15 which are dedicated to wood and other furniture products relatively.

  Once introduced inside the containers, products, components and all materials will normally be compressed and used as secondary raw materials for industrial purposes. Yet these furniture products have a small chance to be upcycled- only, at Vasbygade recycling station where Guldminen KBH and SydhavnsCompagniet have access to the containers (2 hours a day). If they pick product from the container, they will contribute to a recovery at product or component level instead of a recovery at material level.
  Unfortunately, there will still be a big amount of products and components which are reusable that will be destroyed and reprocessed.

  Concluding, closing the loop by recycling materials is an optimal solution when repairing or remanufacturing is not an option. Furniture products and components which are used for material reprocessing are, thus, suffering a downcycling.

- **Incinerating with energy recovery**

  Leaving furniture at the *storksrald* room is the disposal method to almost ensure that products, components and materials will be downcycled. From the *storskrald*, the waste management system implemented by the municipalities transports the content available from the *storskrald* room to the incineration plant. There, metals will be removed through magnet methods, then melted and recycled but the rest of materials will be incinerated with energy recovery (Rebien, 2017 C.5).

  In conclusion, the *storskrald* disposing method is part of a linear model (take-make-use-dispose) because products will always be downcycled and used as feedstock for the incineration plants. Therefore, resources embedded to these products in their whole value chain are instantly lost once they are burnt and converted into energy for heating or electricity.

  The *Storskrald* could be a source of new potential initiatives in order to rescue the still reusable products. This matter is further developed in the coming section.

Building links between the disposal methods, the different initiatives and the final operational management visually how the current situation is built. But, it also helps to detect those initiatives which contribute to reuse processes and see what are the actors behind. In the case of the *storskrald* room, there is clearly a lack of initiatives for reuse of products, even though, and as seen in Chapter 4, municipalities are conscious of this fact. The lack of current initiatives for it, can be seen as an opportunity to find potential solutions.

Even though other initiatives for reusing and upcycling furniture are being implemented and, CE is more present in the Danish agenda, there are still some obstacles which are hindering the transition. Fortunately, there are also opportunities which have been highlighted during the analysis and are discussed in the coming section that could eventually overcome the barriers.

5.4   Barriers and Opportunities

Even though the second hand market is big, the initiatives based on collaborations can help to tackle the reuse of products from other points (e.g. recycling stations) and, in consequence, prolong their lifetime. This section aims at identifying existing pitfalls and finding potential opportunities that could allow these initiatives to be copied or scaled up in the area of Greater Copenhagen. Building initiatives around the *storskrald* this have also been included responding to the fact that in the previous section there has

been seen a big potential. Reflections regarding the potentials and barriers for circularity are also built upon this disposal method.

5.4.1 *Byttecentre* and *byttemarkeder*

These two initiatives implemented by the five different municipalities, through ARC, are only running in four of the fifteen recycling stations. It could be, therefore, that this initiative would be implemented in all the facilities so that a greater amount of furniture could be reused.

- **Barriers**.One of the main problems that ARC faces is the lack of budget for human resources. There is a lack of employees and the ones who are working *are not able to be in contact with everyone who come and therefore they leave the furniture in the wrong places"* (Rebien, 2017 C.5). Whether this is an item that should be covered by ARC or not, is also part of a discussion. However, increasing the number of employees could favour the system to be implemented in new recycling stations. Another obstacle is the lack of space, which could be solved with a redesign of the stations by prioritizing a space for the reuse instead of an add-on to the containers for recycling.

- **Opportunities**. Since 2016, four recycling stations have implemented these initiatives. Therefore, there is some experience behind this process that could provide information about how to improve them if they have to be copied in other recycling stations. For example, one of the issues is that *"as soon as it has been rain on the furniture it kind of breaks or ruins. So, it really needs to be stored under a shelter and these are usually not the conditions at the recycling stations. Furniture is often left outside on a corner without a shelter, in a too small space."* (Munthe-Kaas, 2017 C.2) Building proper spaces in the recycling stations so that the furniture can keep its value is one of the things to consider if the projects are to be replicated. Another way to create feedback could be to collect information through the observations done by the employees inside the recycling stations and build a new strategy from their experience.

5.4.2 Collaborations with charity

The agreement between FN and the recycling station of Bispeengen (ARC) is an example of a type of initiative which could be replicated in other recycling stations and with other non-profits. It is a win-win situation because ARC, as company owned by the

municipalities can contribute to reach the goals set in the municipal plans and, at the same time, the charity organization creates profits that can be destined to their social purposes.

- **Barriers**. One of the obstacles that the charity faces is to be able to provide the logistics to transport the products from the recycling station to their second-hand stores. FN, one week before doing the interview with them, got their van broken and that would have become a potential problem if they would not have had resources to access a new one. Another impediment is related to the renovation of the annual contract. If the contract is not renovated for the following year, the charity would lose the access to a stable method of resource sourcing and that would become an issue when it comes to raise money for their purpose.

- **Opportunities**. Municipalities could create new bonds with new or existing actors interested in the reuse of products which are left at the recycling stations, and track the amount, type and features of each product saved. This could be used to create a data base of information on where new business (not only for charities) opportunities lay together with the recycling stations.

5.4.3   SydhavnsCompagniet

The reason why SydhavnsCompagniet could begin a new project based on the sales of used products was due to the involvement of different actors. Being a local initiative, the chances of upscaling are not likely. However, a good approach would be to replicate it in other neighbourhoods or municipalities. The public sector, ARC and the municipalities, play an important role and, for it to be replicated in other recycling these would have to pave the route and authorise the access to restricted areas such as containers for recycling.

- **Barriers**. The existing second hand market is one of the main barriers when it comes to this initiative. And, its success needs to be evaluated before any replication arises in order to apply changes to improve the different processes. Although the project is a stage close to be functioning and, great amounts of furniture are ready to be sold, it can not be said that SydhavnsCompagniet second hand shop and cafe will be successful. There would need to be a period of time in which both the shop and the cafe are open and evaluate how successful it is (after some months of opening the doors) because they have still not opened the doors yet. A potential barrier for its replicability would be a change of political party at municipal level

which would not support the CE as transition. Therefore, the agreements between ARC, access to the containers, could be stopped.

- **Opportunities**. Based on the experience and functioning of the first SydhavnsCompagniet flagship store and cafe, a tool to evaluate the success of the project could be done. This would provide information about weight and type of furniture saved, brands found, products repaired, most broken items, volunteers and employees working on it... Being able to monitor this information would be key to replicate this system and bring the results to, for example Det Økologisk Råd and use them to lobby and push legislation towards more ambitious targets. Another opportunity lays on the side of municipalities. It could be beneficial to replicate this formula in different recycling stations, not only to promote the reuse of products but also to support local organizations and demonstrate how circularity initiatives can create new jobs for socially vulnerable people. It could be used as example of how sustainability can be tackled from both environmental and social sides.

5.4.4   ReparationsGuiden.dk

The summary, conclusions and recommendations report from 2001 concludes by saying that in order to reduce the amount of furniture waste, among other categories, there needs to exist two criteria. The first is the possibility for repair and the second the consumer's willingness to repair as well as to buy second hand products (Miljostyrelsen, 2001). This platform includes workshop stores from all over Denmark where consumers could bring their broken furniture products to be repaired. Therefore, scaling-up or replicating this initiative would not be the right approach. However, its popularity is less known than online platforms for second hand products.

- **Barriers**. It is uncertain whether this platform is well known enough among Danish citizens, therefore the lack of communication to consumers about the existence of ReparationsGuiden.dk might be a blocking element for its success. Another barrier for repair is the increasing consumerism of low quality and cheap furniture. And also, the fact that *storskrald* is the most convenient disposal method for the consumer due to savings on time, transport and money.

- **Opportunities**. One of the next steps for the repair to become more successful would be to address political instruments that would incentive users to repair instead of buying new. Since 2001, in the (Miljostyrelsen, 2001) this issue has been covered and the topic of redesigning the taxes for repair products was addressed.

Still Denmark has not modified them, but the Danish government could use the example of Sweden to apply similar reductions so that the prices to repair are lower and citizens have economic reasons to choose this practice.

5.4.5   Byt til Nyt

Initiatives based on the take-back of furniture can provide designers, producers and manufacturers to rethink the way they create the products. Byt til Nyt is not only tried by IKEA but also by other shops in Copenhagen who take back the furniture, prepare it for the reuse and sell it through DBA. Creativity can help develop businesses new strategies that can bring innovative models of revenue.

- **Barriers**. One of the main problems, seen by the author, that IKEA Denmark faces is the fact that the sustainability department is just formed by one employee (Jonas Engberg). During the interview Engberg stated that around 300 employees work at IKEA Taastrup and sustainability is applied from within all the departments. However, changes in business models for the CE are difficult and therefore it is seen insufficient to create a force that accelerates the transition from within with less than a 1% of the employees pushing for the change in the Danish context. If more employees would be working in teams it could become more effective for IKEA Denmark to seek for opportunities, build partnerships and work for circularity taking the most of the different plans, initiatives and project in which the actors in Greater Copenhagen are immersed.
  Another barrier IKEA (globally) faces is the fact that the whole business model was built, since the beginning, based on the sale of affordable furniture, or the "sell-more, sell-faster" principle. *"From the point of IKEA, their interest is to sell as much as possible. And with this principle is very difficult to come up with sustainable solutions. But, they could, for example, making their products repairable"* (Munthe-Kaas, 2017 C.2) As Unruh mentions, path dependency is one of the problems for transition as businesses tend to repeat the same processes when trying to reach new goals (Unruh, 2002). Even though it might be complex, creating new solutions from within requires of a change of mindset from all departments so that changes are thought as systemic and holistic strategies.

- **Opportunities**. There is a clear opportunity for big companies to learn from small start-ups and projects which are working due to the waste=food concept. It might not be a take-back system, but there are other options were to loop upon which could bring economic growth as well as contribute to a better management of the

resources, such as:

- Case Competitions with students from Danish universities working for transitions, sustainable design, circular economy, CSR businesses...

- Cooperations with small start-ups willing to co-create with big businesses so that creative solutions for reducing the environmental impact can arise. For example, IKEA Sweden is now releasing a challenge to build new sustainable ideas coming from startups (IKEA, 2017)

5.4.6 *Storskrald*

Most of the products going to the *storskrald* become feedstock for the WtE plant. And, it has been seen that there are many furniture products ending up there due to the infrastructure and also, sometimes, the low value of furniture. For these reasons, there could arise different initiatives to favour the reuse of furniture left in these corners.

- **Barriers**. The main barrier that prevents any actor to start an initiative that its source of revenue comes from *storskrald* is the legal framework. The law says that the owner of products left at the *storskrald* room is the municipality.

- **Opportunities** As it has been done with the with Guldmninen KBH (allowing to seek into the containers for 2 hours a day), a new interpretation of the law could be applied for the *storskrald* room as well. Peter Munthe-Kaas mentions that there is a link missing between people who need to dispose furniture (and they leave it at the *storskrald* room) with people who need furniture (people who are users of second hand products).

  Therefore, there is currently a big opportunity on creating businesses based on the source of waste or close-to-waste products. But, collaborations need to happen between the public and private sector because the ones who can modify the understanding of the laws are the municipalities.

  Municipalities could organise monthly local flea or exchange markets so that the neighbors could have the opportunity to take furniture for free as well as to get rid of what they do not need anymore.

5.5   Unlocking actors

One of the main potentials of creating partnerships between different actors, not only public-private but also private-private or public-public, is that experience and knowledge

can be shared and transferred. Also, benefits and profits can ultimately be shared so that the alliance becomes stronger. Enlightening the actors with different ideas and best practices coming from an outsider can help breaking barriers and move away from lock-in situations. Breaking the path-dependency will help the actors to build more ambitious and creative initiatives. Therefore, collaborations as well as constant updating of new knowledge will enhance the quality of circularity for new initiatives.

Chapter 6

Conclusion and Recommendations

The main objective of this research was to discover new ways for improving the circularity of furniture in the area of Copenhagen, including both private and public sectors. Another goal was to identify how the different initiatives, designed for the reuse of furniture, contribute to the Circular Economy. The last goal was to identify barriers that hinder and opportunities that push initiatives for the reuse of furniture. And, eventually, argue whether these could be replicated or upscaled.

6.1 Conclusion

Both public and private (for, non- or social profit) sector have several approaches from where to tackle circularity for the furniture sector. Not all the initiatives can be replicated or scaled-up but the know-how can be shared to innovate around circularity practices. The different action points from where to improve circularity have been divided into three sections. First, the points that the public and private sector, separately, should address are explained. Ultimately, a set of recommendations of collaborations between actors are posed.

Municipalities and ARC (public company):
- Recycling stations should have enough human resources to prevent reusable furniture to be thrown inside the recycling containers. However, it is not certain whether ARC, the municipality or producers should cover this extra expense.
- All recycling stations should allocate a sheltered space, such as *bytte*corners, for used products so that these could be protected from possible damages until a new user picks

them up for their reuse.

- Municipalities should promote, encourage, enable and facilitate initiatives around the *storskrald*. And, as consequence, rethinking the way legislation can be reinterpreted so that waste can also be seen as resource.

- Increase the cooperation with existing initiatives, in order to find potential circular projects.

- Allowing more exceptions, such as the one created for Guldminen KBH, so that organizations can have access to waste and use it as a resource for innovative business model.

- Share best practices from different local initiatives, like SydhavnCompagniet, and develop networks in order to allow its replica in different neighborhoods of Greater Copenhagen.

- Ultimately, bringing results of successful practices at national level to push the transformation of political instruments for motivating the reuse and repair of furniture products.

Private sector, including corporations, social and policy NGOs:

- Always, the private sector, (businesses and NGOs) should contemplate the public authorities in the initiatives in order to be allowed the access to waste and use it as source for innovative ideas.

- Create collaborations between small organizations, such as SC, who are already applying circular economy initiatives and manufacturers and producers, such as IKEA, who are seeking to improve the business strategies for the CE in order to share knowledge and best practices.

- In order to accelerate the transition, IKEA Denmark should increase its staff members of the Sustainability department and find opportunities throughout collaborations at local level

- Cooperate with NGOs that work for better policies (DØR) in order to pave the ground for coming initiatives. Eventually, better legislative framework will allow initiatives to be more independent of the public authorities in terms of circular practices.

- Manufacturers and producers should engage at local level, for example with the Guldminen KBH project, seeking for opportunities which could contribute to improve their business strategies and understand the problems of waste management that their products generate.

The benefits from Public Private Parnerships:

- IKEA should engage with new local projects facilitated by the municipalities, such as the new recycling station for the CE in Sydhavn and co-work to identify potential business possibilities. It would also help them to use the feedback from the users of the recycling station to apply product design improvements to prevent its end-of-life.

- Rethinking the concept of waste and creating middle steps to prevent reusable products to be downcycled

- A new cooperation between municipalities and a new or existing actor, could prevent great amounts of furniture, left at the *storskrald*, from being incinerated and would generate new local jobs.

General conclusions:

The previous measures would contribute to enhance the circular model of Copenhagen in relation to furniture. The consequences would be a reduction of waste generation, saving in the local budget for waste management and, in addition, it would favour the creation of new jobs which could help people move out from social risk situations.

6.2 Recommendations

The current scenario offers different possibilities for future research that could contribute to reduce the environmental impact from social practices and initiatives in the furniture sector. It could be interesting to know in detail the answers for the following questions:

"What are the reasons why consumers throw away their furniture in the Danish context?";

"What are the most common disposal methods for cheap furniture?";

"What are the reasons why people bring the furniture to the recycling stations? (Change of life, problems with the integrity of the product, willingness to change for new...?)";

"What is the level of consciousness around the disposing of furniture that could still be reused?";

And, *"What are the products most brought to these facilities?"*.

In addition, the focus of the future research should include:

- Quantification of reusable furniture out of the total of products taken to the recycling station.

- Quantification of reusable furniture out of the total of furniture left at the *storskrald*.

- Quantification of the economic and environmental value created out of the initiatives that rescue furniture from the recycling stations or, potentially from the *storskrald*.

Last, further research could focus on the networks of actors who can potentially play a role in the initiatives for the Circular Economy.

"How could new collaborations arise between existing actors in order to prevent the generation of furniture waste? What roles could play the recycling stations to be seen as actors for the reuse and not only for recycling?"

Appendix A

MOOC Content

1. What is the Circular Economy?

1.1 What is the Circular Economy?

1.2 Principles of the Circular Economy

1.3 Why do we need a Circular Economy?

1.4 Assignment 1: The Butterfly Diagram
Assignments (5 Points) ✎

1.5 Quiz 1: Principles of the Circular Economy
Quizzes (5 Points) ✎

1.6 In-Depth: the roots of the Circular Economy

2. Business Value in a Circular Economy

2.1 Introduction

2.2 Closing Loops

2.3 Value Creation in a Circular Economy

2.4 Case: Philips Healthcare

2.5 Business Models for a Circular Economy

2.6 Assignment 2: The Case of Riversimple
Assignments (5 Points) ✎

2.7 Quiz 2: Closing Loops
Quizzes (5 Points) ✎

2.8 A Narrative for the Circular Economy (Part A)

2.9 In-depth: The Darker Side of Access

Figure A.1: MOOC Content Module 1 and 2

3. Longer Lasting Products

3.1 Introduction

3.2 Product life extension

3.3 Case: Fairphone

3.4 Designing longer lasting products

3.5 Assignment 3: Repair Criteria
Assignments (5 Points) ✎

3.6 Assignment 4: The Repair Café
Repair Cafe Assignment (10 Points) ✎

3.7 Quiz 3: Longer Lasting Products
Quizzes (5 Points) ✎

3.8 In-depth: Planned Obsolescence

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4. Remanufacturing

4.1 Introduction

4.2 Business value of remanufacturing

4.3 Design for remanufacturing

4.4 Challenges for remanufacturing

4.5 Assignment 5: RapidReman case
Assignments (5 Points) ✎

4.6 Quiz 4: Remanufacturing
Quizzes (5 Points) ✎

4.7 A Narrative for the circular economy (Part B)

4.8 In-depth: Growth within

FIGURE A.2: MOOC Content Module 3 and 4

5. Waste = Food

5.1 Introduction

5.2 Recycling

5.3 Case: Circular Textiles

5.4 Nature Inspired Design

5.5 Assignment 6: Nature Inspired Design
Assignments (5 Points) ✎

5.6 Quiz 5: Waste equals Food
Quizzes (5 Points) ✎

5.7 In-depth: Fashion Consumers

6. Thinking in Systems

6.1 Introduction

6.2 A Global Perspective

6.3 A Circular Economy of Metals

6.4 The Urban Mine

6.5 How Long Will it Take?

6.6 Quiz 6: Thinking in Systems
Quizzes (5 Points) ✎

6.7 A Narrative For the Circular Economy (Part C)
A Narrative For The Circular Economy (10 Points) ✎

6.8 In-depth: Critical Materials

7. Full Circle

7.1 Introduction

7.2 Final Exam
Final Exam ✎

7.3 Share Your Thoughts

7.4 Final thoughts

How was your course experience?

FIGURE A.3: MOOC Content Module 5, 6 and 7

Appendix B

Interview Details

This Appendix informs about the details of each of the interviews. First of, a section starts with the name of the organization chosen. Each section is constituted with a three lines table. The first line contains the name of the spokesperson interviewed as well as its job position. The second line of the table includes the specific date and venue where each of the interviews took place. Lastly, a description of the job position or main tasks of the interviewee are explained.

The order of actors is arranged by the date of which the interview took place.

B.1 Det Økologiske Råd (The Danish EcoCouncil)

Malene Møhl, Advisor on chemicals
Date: 20th April 2017 Venue: Det Økologiske Råd Office Address: Kompagnistræde 22, 3rd floor, 1208 Copenhagen K
Job description: Policy officer working for the improvement of the Danish and European regulations and laws by suggesting more ambitious targets and ensuring its implementation at national and Scandinavian level. Her expertise is on microplastics, endocrine disrupters, EU chemical legilations and Circular Economy.

TABLE B.1: Det Økologiske Råd's Interview Details

B.2   Guldminen KBH

Peter Munthe-Kaas, Post PhD in the Center for Design, Innovation and Sustainable Transitions (C-DIST) at Aalborg University (AAU) (Copenhagen)
Date of interview: 24th April 2017. Venue: Aalborg University (Copenhagen Campus) Address: A. C. Meyers Vænge 15, 2450 Copenhagen SV
Job description: Peter is a researcher who has been deeply working in the process of Guldminen. He, from an action research angle, has been part of the design and development of Guldminen KBH. Peter was part of starting it up together with the project leader from the municipality of Copenhagen and, since June 2016, he has been leading the project.

TABLE B.2: Guldminen KBH's Interview Details

B.3   Folkekirkens Nødhjælp

Meta Palle, Sydhavn's Second Hand Shop Store Manager
Date of interview: 24th April 2017. Venue: Sydhavn's Folkekirkens Nødhjælp Second Hand Store Address: Borgbjergsvej 32, 2450 Copenhagen SV
Job description: Managing the group of volunteers that collaborate at the Sydhavns' Second Hand Shop. Coordinating the pick ups and collection of reused goods.

TABLE B.3: Folkekirkens Nødhjælp's (1) Interview Details

B.4   Folkekirkens Nødhjælp

Torben Engelbrecht-Vindnæs, Regional Manager of Genbrug
Date of interview: 1st May 2017. Venue: Folkekirkens Nødhjælp Head Office Address: Nørregade 15, 1165 Copenhagen K
Job description: Working to create collaborations between the NGO and external institutions or organizations. Ensuring the logistics for the reuse of products and the second hand shops. Closing agreements and partnerships with agents sucha as public sector, donors, etc.

TABLE B.4: Folkekirkens Nødhjælp's (2) Interview Details

B.5   IKEA Denmark

Jonas Engberg, Sustainability Manager
Date of interview: 2nd May 2017 Venue: IKEA Taastrup Offices Address: Mårkærvej 15, 2630 Taastrup
Job description: Manager of projects, within the Sustainability Department, to implement innovative and sustainable solution across all sector. Driver of Circular Economy and Sustainable development of IKEA Taastrup. Seek for collaborations and participate in debates to demonstrate the interest and actions of IKEA to move towards the Circular Economy.

TABLE B.5: IKEA's Interview Details

B.6   Amager Resource Center (ARC)

Linda Rebien, Development Consultant
Date of interview: 2nd May 2017. Venue: Amager Ressourcecenter Address: Kraftværksvej 31 2300 Copenhagen S
Job description: Employed as development consultant with analysis, planning and development tasks. In cooperation with ARC's municipalities, other waste companies and authorities, new recycling activities are being developed and implemented. The focus is on developing ARC'c recycling stations, including following the market for waste treatment and ensuring the best possible quality and price in subsequent processing.

TABLE B.6: ARC's Interview Details

B.7   Municipality of Frederiksberg

Mia Makne, Waste Consultant
Date of interview: 4 May 2017. Venue: Frederiksberg Rådhus Address: Frederiksberg Rådhus Smallegade 1, 2000 Frederiksberg
Job description: Securing the implementation of the *Waste and Resource Plan 2014-2018* including leading some specifis projects in order to improve the recycling rates. Updating every two years the 'Regulativer for affald', 'Waste Regulations' in Danish, (legal documents that commits citizens and companies to recycle). The third important part of her job is to support the recycling of the institutions of Frederiksberg Kommune (schools, daycare, the town hall, job centres, etc.).

TABLE B.7: Municipality of Frederiksberg's Interview Details

B.8 SydhavnsCompagniet

Spokesperson: Camilla Toft Sørensen, Innovation and Creativity Manager
Date of interview: 5th May 2017.   Venue: SydhavnsCompagniet   Address: Borgbjergsvej 26, 2450 Copenhagen SV
Job description: Working with upcycling, reusing, recycling and redesign regarding development and coordination of SydhavnsCompagniets secondhand shop and redesign workshop. She coordinates the volunteers and other people in their employment project.

TABLE B.8: SydhavnsCompagniet's Interview Details

Appendix C

Interviews

C.1 Det Økologiske Råd (The Danish EcoCouncil)

Malene Møhl,

- What's the role of The Danish Ecocouncil?

For three years we've had different roles and projects in the prepare for reuse and reuse. Our role is as project leader to organizing networks. We mainly work to promoting Repair Cafes so we have hands on project where people can go and get their things repaired. Repair Cafes in Copenhagen, and across Denmark, are collaborations between the Kommunes and different other organizations. We bring all these people together and say what can your part be and what is your role within the *Reparations netværker* (repair network in Danish) and we try to establish the projects.

- Repair Campaign within Legislative Framework

The new project we are working on has a Nordic scale, so we are working with Finland, Norway and Sweden, to learn from each other. We were the idea-makers of this project and we invited collaborators (other Nordic environmental NGOs) on board to work on the promotion of repair.

It is a campaign with a focus on legislation on the right to repair. What are the obstacles? In law, why are we not repairing more? Why can so many things be used for such a short period of time and be thrown away? "So when you buy an item you need to be able to get manuals or instructions, but also spare parts. So if you own a product you have to be able to replace pieces and do yourself simple repairs."

We believe that if you buy something and you don't have access to repair it then you don't own it. And also work on the different levels of design obsolescence, which can be

addressed in different levels. For example using parts of which are a bit worn out but all the rest works perfectly. So our focus will be on legislation so it will make it illegal to create design obsolescence products.

The Repair Campaign addresses the promotion of repair and longevity of products. And for it to work, it should be done at EU level.

Sales Tax, the 25% of value of anything you buy goes for taxes. And, in Sweden for example they are testing to have lower sales tax for any kind of repair so it becomes cheaper. Because the problem now is that the price of new and getting something repaired is almost the same. *"We are working with legislation so that it can be more cost-efficient for the consumer to repair their products, and consequently, it would create new jobs and small businesses as well. And it will also keep the product in the loop. That's what we think it has to be part of the Circular Economy."*

- How does the Reuse and Prepare-for-reuse in Denmark?

There have recently been some analysis about how many repairs have been done in Denmark on different product categories and it's just going down. And the amount of outlets, where citizens can go and get their products fixed, is also decreasing.

In the *Reparations netværker* (www.reparationsguiden.dk), which is a web page where you can look up where you can get fixed products which are broken. Furniture as well. So people can look where there are the outlets where they can get a chair fixed, for example. So that it is easier for people to access the repair of things.

We also supported the development of the project called *Stor Skrald DK* (it means bulk rubbish in Danish) (www.storskrald.dk) for when you have bulk waste, heavy waste. In some countries they call it curbside. Here in Denmark with Storskrald, people can post in the website the items they want to give away and others can contact them and collect the products for free. Our role was to support it by making the web page and designing it so that it could be mobile friendly.

"There are already a lot of platforms and, in the Danish community, we are used to bargaining. Meaning that we might look up on internet first and try to find a used item of what we need."

- Besides legislative work, is there any project right now specific on furniture in which The Danish Ecocouncil is currently involved?

Initially we had hoped to work more with furniture, recycle and repair, but that has not happened. But other NGOs and the Municipality in the waste collection department have.

- When it comes to the Reuse and Prepare for Reuse in Copenhagen, there are several organizations and institutions playing different roles in the network. Experts on the Circular Economy, Ellen MacArthur Foundation, etc. say that it is part of the transition to create partnerships between the public sector and the producers. How do you think this could work in the case of furniture?

There is a great role to be played in this cross-sectoral partnerships. Because, one of the obstacles that we see, in terms of reusing and repairing, is that shops that sell are not allowed to take their old products for disassembly themselves. So, when it becomes waste, it needs to be handled as waste under the waste directives and you need to be a waste handling facility rather than an outlet shop.

This law makes sense for hazardous waste, because it needs to be exposed off in certain ways so that the hazardous components are kept away from the recycling.

So if you can work together with waste facilities or waste handling businesses you can have that part covered. So they can be your outlet and re-source you the "raw" materials and products that will no longer be under the Waste directive.

- Keeping the value of Products and Components...

As environmental organization we would like to see that companies that sell new products would take those products back and make those old products into new ones. And at the moment it's very difficult because we use products for a very short period of time and then the materials and components that create that product become waste. One it is dumbed they need to disassemble it and reuse its parts and usually these materials do not become part of what they had once been. So we would like to see that materials can become again part of products of the new type.

We have it with our deposit system of drink bottles in Denmark. It is very efficient because we're currently retaining 90% of the bottles that are sold and they recreate new bottles out of old bottles. But, what happens in the recycling facilities of household waste, is that, all kind of plastics are put together and recycled in a big blog and the outcome is lower quality materials. And this is not Circular Economy. Good products should be recycled at the same level.

For example we work a lot with flame retardants, and we are very concerned about the push of chemicals out of the circular economy. These components are a big problem for furniture as well. If you have flame retardants in computers you can have it back with the "producer pays principle?" But, if you have flame retardants in a mattress and you want to recycle that into a circular economy model then you remove all the fluffy part

and you use it to fill in jackets or other products that are not supposed to contain flame retardants, that's a problem. So, who's responsible to for that? It is not a raw material anymore. It has no home. It is not waste, and it is not a raw material - it is something in between. So at the moment, there is no way to handle or label it. What is it? And, what can it be used for?

- How do you see, from The Danish Ecocouncil perspective, the possibilities of Public Private Partnerships in the framework of furniture reuse in Copenhagen?

It could be great if, either from business strategy plans or through legislation, make it easier for mattresses companies to take back their mattresses o because then we know it will remain in the mattresses' business and it won't become children's jackets that contain flame retardants and exposing consumers.

If we could create collaborations between specific producers and companies and waste managers... that could be an opportunity to keep the materials within the same sector. But for this to happen we need to look at the legislative obstacle of producers being able to collect *'their waste'*. Why a law as such does exist? is it because handling waste can be hazardous? So it does not pollute the work environment nor natural environment. . . But then there need to be done some criteria if you are your own company that have your own return policy you should then follow your own criteria.

C.2   C-DIST at Aalborg University

Peter Munthe-Kaas, Post PhD at Aalborg University. Working for Fuldminen KBHin collaboration with The Municipality of Copenhagen.

Who are the actors that initiate new recycling center in Sydhavn?

ARC, the public company that is co-owned by five municipalities, and the Technical administration of The Municipality of Copenhagen.

What is the aim of Guldminen KBH project?

The Guldminen KBH is a strategic design experiment in the Municipality of Copenhagen meant to explore new ways of doing CE in Copenhagen. To inform a new recycling center that will be built, by the end of 2018, in Sydhavn. This new recycling center is meant to be a flagship and 10 % of the waste that will go to this new recycling center is supposed to be directly reuse. We started the project in September 2015 and it will end when then new recycling center in Sydhavn opens.

City of Copenhagen and Circular Economy of furniture

Guldminen is actually the first project that is specifically focused on the Circular Economy. There have not previously specific initiatives on project about Circular Economy and specifically on furniture. This is a core problem because they don't know what to do with all the furniture that comes in because there's no space where to leave it. And you can't get it out again.

Was it an experiment that came with the new plan?

The new recycling center of Sydhavn is part of the Resource and Waste Management Plan of Copenhagen (p.19)*. Guldminen was an initiative made because Katrine and I wanted to figure out what content should be included in the recycling plant and how it should work. We had a lot of unsolved questions like, what do you do with the waste? how to clean it? what fraction will there be? who is going to buy it? what companies will there be around the project? So the whole idea of Guldminen was create a prototype that could explore all these questions before the recycling center was built.

These 12 project that are part of the Guldminen prototype are designed to be scaled up?

These project have gotten a contract with the Municipality of Copenhagen to test out different of ways of working with waste. They are companies or associations.

One of the projects is called *SydhavnsCompagniet*, it deals with furniture. What do we know about this project?

This is the only project part of the Guldminen that specifically works with furniture. The is one shop in Sydhavn and they are opening a new one.

What are the main problems that furniture present when in comes to the reuse/prepare for reuse?

Furniture is a bit difficult to work with because it takes so much space, and no one has really space for that. Also because it's bulky and hard to move around. There's a big flow of furniture going in/out everyday, so there's a big potential in doing something about it.

The other problem is that it deteriorates and gets spoilt very easily. As soon as it has been rain on the furniture it kind of breaks or ruins. So it really need to be stored under a shelter and these are usually not the conditions at the recycling stations. Furniture is often left outside on a corner without a shelter, in a too small space.

Another problem is that, a lot of the things that are thrown away need some sort of repair (often there's a leg that's broken). But as it's difficult to access to the repair because it requires space and a little bit of work, and then, the whole item is thrown away.

Also, there are not platforms for showing it [the repaired item] to people. So, how do you get your customers to know that you have this furniture if you don't have a physical shop? And, if you have a shop, you will need a lot of space to show repaired furniture. And it costs a lot of money it is not easy to create this.

On the other hand, I've noticed that there are Facebook pages where people give things away for free. And, there's a lot of furniture advertised and it actually moves pretty fast because people want furniture. So, it seems to be a missing link somewhere that could connect people that need furniture with the people that need to get rid of furniture. The problem is that, most of the time, when people want to throw away furniture they want to do it "now". So this link should be someone that could store it for some days until someone wants it.

The EMAF mention that public private collaborations will be key when it comes to Circular Economy. How could they (the manufacturers of the furniture sector) play a role in the -after consumer's use- in order to move towards the Circular Economy?

I could see a private actor that creates a new relationship with the recycling stations. Because, right now, a lot of private actors they have contracts with the recycling stations for materials (for example, a big actor buying all the wood and making it into sort of dust, then glue it, and using it to create wooden boards at a lower quality (downcycling). So you could have a private actor buying the furniture of the recycling station and taking it of the recycling stations and then resell it somewhere.

What are the challenges or problems that this new actor could face?

There are problems regarding laws that actually, when something has been left at a recycling station it can't be taken out again because it's classified as waste. So you cannot directly use it for people. You first need to re-do something (turn it into something else) and then it can be reused. This is a problem for the Circular Economy in itself as soon as products go into the containers. That can be changed, of course, but that needs to happen if anyone needs to sell the furniture that is thrown out at the recycling stations. So by now it is impossible.

The other option, to avoid this, is to take it before the products are put inside the containers. So you could have an extension of the recycling station where people could

leave their furniture for a specific company (the one that would prepare it for the reuse). That would be a hard intervention. But I think that it is unlikely that this would happen.

So, the more likely alternative network would be to create a business that takes the old furniture directly from people's hands for a reasonable low price. So they would go to the location where someone needs to get rid of their furniture and pick it up and sell it afterwards. This would be the business I'd make if I'd have to work with Circular Economy of furniture because, as soon as the furniture gets near the recycling stations it gets very complicated.

What is it better (in terms of Circular Economy) to bring it to the recycling station or leave it at the *'storskrald'* (bulwaste)?

It's the same. Because once the furniture is left at the *'storskrald'* building that is also brought to the incinerator plant. Furniture that enter in the recycling station is not reused. It's also brought to the incineration plants. That's why someone needs to create a link and actively get out there, and pick up the furniture, store it and then sell it. But I have no idea if that would be a sustainable business plan... How much can you make on selling old furniture?

And, what would be the role of the other actors once this new actor would come into the new actor world?

The interesting place to look at would be the people who work with waste and resources in The Municipality. And, collaborate with them on making this project to happen. Because they also have ...if you scaled it up. If you imagine a big company starting up and creating this project with furniture... for example every month there are waste magazines sent to everyone that lives in Copenhagen by The Municipality, and it could be possible to advertise there. This is a new way of getting rid of furniture. So this could be a new relationship.

Generally, I think that, collaborating with the Waste department and The Municipality would be quite essential to make it happen. And I have hard time to see a cooperation between the recycling stations because they are banned by law not a lot can be done.

Regarding the new recycling station here, there will be a multiple house with a visitor's center, lectures, workshops and there's also supposed to be furniture. For example we've talked about creating a permanent exhibition there where you put furniture that comes into the recycling station and then sell it directly from that place. In there, everything is used and reusable and for sell at the same time.

Does the law allow this?

Technically if the products have not entered into the recycling station the yes. Because you sort the stuff in the way in then there is the gate to get in. So before getting in, you can take them because it has not been waste yet - it is technically a donation or something similar. There's a storage place where products that are reusable should be placed and then they could be sold. But then, again, I also imagine that it would be full of furniture very fast.

But old and high quality furniture, can last longer...

If it's actually old yes. But most of the furniture stuff that go through the recycling stations is like IKEA, who create furniture that breaks easily.

Regarding IKEA... what do you think this business model could do in order to accelerate their transition towards the Circular Economy? The fundamental problem is over consumption, which is a general problem of our society. We need ot learn to not buy stuff that we don't need, swap more instead of always buying new... But we still don't have the institutional framework to do this. There should be something where if you need a new sofa, you leave your old one before buying the new one.

From the point of IKEA, their interest is to sell as much as possible. And with this principle is very difficult to come up with sustainable solutions. But, they could, for example, making their products repairable is one way to become more sustainable. But their whole model is build upon designing with bad quality wood, and designing things that break easily...

This is not where I would look into in order to find a solution for the problem

C.3   Folkekirkens Nødhjælp

C.3.1   Meta Palle

How does the Genbrug store work? Earlier, people could bring furniture and, at the same time, they could also take furniture with them if they wanted. But now, they can only bring the furniture and leave it there.

Who can bring/take furniture? And, in order to take furniture from our shops they need to have a special arrangement from the recycling stations. Sometimes, very expensive furniture is available. Up to 5,000Dkk. But you need to have an special authorization to be able to take this furniture from a recycling station.

Who gives this authorization? Frederiksberg Kommune [to be continued later]

How much furniture do you get? (or how often?) Folkekirkens Nødhjælp, Projekt Hjemløs and Diakonissestiftelsen we have agreements. Last week, for Easter, we had a big donation, and came for four times with things that we pick up and allocate in here. This means, that sometime we have too many things, that require space. For example, this chair here (there was an old chair in the room where the interview took place). It could be very valuable but we don't know yet. So, we need to call a specialist that can look at it.

Who comes here to buy furniture?

All kind of people come here to buy furniture. We have local customers and also people from all over the place. And you have to have a feeling for old furniture too. People who live Sydhavn buys in here. There are so many young people from Aalborg University that live here... They come here, at our shop, to buy home furnishing instead to go to IKEA. They also buy porcelain and other things... They buy everything because it's better quality and conditions than IKEA. Their furniture is ....

There also come people from everywhere because they know this is a good place where to shop. And it's around the corner and if they need something they just come here. People from the neighbourhood they come to our shop and bring things with them so that we can sell them. This Folkekirkens Nødhjælp shop in Sydhavn, is the best Folkekirkens Nødhjælp shop in the whole Denmark.

There are many retirees living in Sydhavn, and they don't have a lot of money. Now, we have been here in this location for two years and there are many of these customers that come and say "thank you" because you are here and we can get "new" furniture.

What is the source of the furniture you sell? Does it also come from the Genbrugstation?

Yes, it can be from the recycling stations from the Copenhagen or Frederiksberg Kommune, there is a coordination where they work together for this purpose. We get so many furniture items and so many things from private people. The last week, for example, we were told that, an old lady, before she died, she had said to her lawyer that we (Folkekirkens Nødhjælp) will be the ones inheriting everything from her - clothes, furniture... There have been three people this year that have assigned us to receive their heritage. Folkekirkens Nødhjælp is a huge organization. So, the furniture is given to the main organization and they decide to which shop is the best place (shop) to take care of each item. Maybe because that one is the best shop for reused items.

What would happen with organizations such as Folkekirkens Nødhjælp if a new actor, like a new business, would appear in this existing network of organizations and institutions that deal with used furniture?

Well, some of the recycling stations around the country they have their own shop where they can make money. So, maybe they don't give much away as they could sell it themselves. Maybe. Not much in Copenhagen but this happens more in Jutland. But, the Municipality of Copenhagen likes to support organizations that work for homeless and poor people, in Denmark and also in other parts of the world. So it's not about making money but supporting them. Also because reusing and recycling is something sustainable that Copenhagen includes in their plans and that's a very good idea.

The design of furniture now is not the same as before. They should design it in modular ways it so it could be used in other ones with some connections. Some people think that in the production of everything, from the very beginning, you should think "if it does not work anymore, how can we construct it so it can easier be used again". It is easier said than done. But it's good to think this way.

Some business are built upon the idea that the more breakable the better so they can sell new products again.

Even these kind of businesses... even if they want to sell more new products, they could make them so that when they break it is easy to take them apart and easier to separate all the parts. Also, it should be easy to find if some of the parts still can be functional, and if it does, who can use it? So even if they are trying to sell more new things all the time, they could still try to design modular items during the production system so it could be easier to reuse things.

C.3.2 Torben Engelbrecht-Vindnæs

Where does all the second furniture that Folkekirkens Nødhjælp sell come from?

There are four different channels through which we can get furniture:

Most of the furniture is donated by ordinary people. Either they bring it to the shop or they ask us to come and pick it up. For example, it can happen that someone in a family has died and the family they choose the most valuable stuff and the rest they leave it to us. Then, we go and pick up whatever we need or we would like. Basically we pick up what we are sure that we're gonna sell.

Another way to get furniture is with a cooperation with Kobenhavns and Frederiksberg Kommune. I the region of Copenhagen, we have an agreement with the Genbrugspladser (recycling stations). More specifically, we work with them at the Bispeengen recycling station. We have an annual contract with them (every year is renewed if we do our job properly). There are other organizations who also have this agreement so there weekly turns to pick up the furniture.

There another channel. These donors are retailers who have some brand new goods (it can be furniture, shoes, clothes, etc.). They don't want to bother by organizing a clearance sales so they call and ask us if we would like to pick up their goods. For example, once they called and ask "Do you want to pick up 300 pairs of brand new shoes plus all the fixtures and furniture from the shop?". Then, we go and pick it up.

From May until mid-October Frederiksberg Kommune organizes a Flea Market every Saturday. We have an agreement with them for some weekends. In the afternoon, when the Loppedmarket finishes, there are always some leftovers from people who don't want bother taking their stuff back home. They leave them in a container and we are there to choose what we want that can be reused.

What are the main problems that you find when you go and pick up furniture and when you receive furniture to be resold?

There are some goods we don't take. We have made an arrangement so we can limit our efforts to take the furniture that we are able to resell. We don't take old broken televisions, partly broken bicycles, electrical household goods... because you are obliged, after repairing them, to give a guarantee, and we can't do that. Also we don't pick mattresses from beds or similar... Because we cannot resell that.

Is there any features on the furniture that you consider unsellable?

We mainly look at furniture that we can resell which means that normally it will be office furniture. We're very restrictive when it comes to picking up the office furniture because they have shelf systems that people don't buy. Most of them are made of cheap board, and they are too broken when we're supposed to take them and, therefore we don't take them. First of all, because we cannot sell them. There are no customers who would buy it. So, to summarise, I'd say that we take around the 75% of the furniture we are offered.

Folkekirkens Nødhjælp helps a big quantity of people. If manufacturers were about to create a sub-business that would create new jobs based on the repairing of stuff in order to prevent huge amounts of furniture from entering into the incinerators, do you think this could give jobs to people in need from

Folkekirkens Nødhjælp? They could receive an education of how to repair and have a job and increase their life-quality.

Yes, I think that could be a possibility. We do some repairs as well, and we also do upcycling of furniture. But that depends on each shop, basically on who is in charge of it or if we have creative and handcraft people among the volunteers... They upcycle a lot of furniture and sell it of a larger profit margin. So, we don't have any central organization that can deal with upcycling.

We are focused on keeping our organization very slim because our main job is to create funding for poor people in this world. So we don't have a large organization of people being paid with a monthly salary. We are dependent on volunteers. In the whole Denmark we have 125 shops and around 3500-3600 volunteers helping in our second hand shops. We were the first to start having second hand shops in 1972, but today we are not the largest. By far not the largest. We are the oldest but we are very keen on not spending too much money on new infrastructure because it takes focus and money away from our main target. So we are very conservative when it comes to investments.

You mentioned that sometimes you cannot pick up the furniture because it's not re-sellable. What would you suggest to the manufacturers when it comes to produce furniture so that after 10 years it can still be valuable for the second hand market?

One big help would of course be if all furniture were knocked down furniture, which can be disassembled. Because then, you can get spare parts. But it's only IKEA and few others who knock down furniture (flat packed furniture). Very good quality furniture is handcrafted and in those cases is very difficult to get spare parts, so if it breaks it's very difficult to get one unless we have a very skilled carpenter in our shops, and that's something we don't always have.

IKEA they sell spare parts for furniture but not all models...

IKEA has a limited arranged of spare parts but they should have more. When it comes to IKEA furniture. Most of the furniture is not re-sellable because when you purchase it for the first time the price is so low. So when it's been used for 3 or 4 years is more or less broken that if we have to sell that in our second hand shops, the quality would be so low that we cannot sell it. If you pay 50 Dkk in IKEA we can maybe sell it for 10 or 20 Dkk.Because their furniture is not made to last, it's made to be thrown away. For example, a shelving system that has been assembled and reassembled again by a young couple that move 2 or 3 times we cannot sell that because it's worn-out. And that's a problem. If they made higher quality products then they would last longer but the business would be different as well. The quality is actually very low in much of their

furniture, they optimize every single little screws, joint.... And we've seen that over the years, some traditional screws and joints have decreased in quality. In my personal opinion, 20 years ago IKEA products lasted longer than today.

C.4   IKEA

Jonas Engberg

Val ByDel is very interesting because it holds everything I think municipalities should be working with. Because there are jobs and interaction with people, and hopefully also a lot of recycling.

This interview has been specially designed for the IKEA actor because, one of the aims of this research is to provide possible paths so that IKEA can become an active actor, among the existing ones who are already part of the reuse infrastructure of furniture in Copenhagen. The interview is divided into three different areas that tackle the three approaches framed in the theory chapter. The interview starts with an understanding of the design of products and how improvements in product design can bring the company closer to the CE. Then, the interview focuses on the business strategies that could pave the road for IKEA to become a frontrunner among their competitors in terms of circularity and closing the loop. The last part of the interview addresses the relations between existing actors and how the network could develop so that IKEA could play a relevant role in the city of Copenhagen and be a change agent of furniture waste reduction.

Product Design

We have come up with a set of design criteria for circularity that all of our products will need to be developed upon. We have 11 design criterias that are related to sustainability. And, some of them have to do with circularity already. But, then, we've defined, in addition, some circularity design criteria like separability, mono-material products, modularity (to build something that can be turned into something else). And, all these things have been developed over the last couple of years, perhaps three. But, it is going to take some time before we see these big shifts. We might see new products that are being developed on the basis of these criteria. But we could also say that we have already a lot of products that, maybe they are not designed for the circular economy but they work very well from the circularity perspective.

Like what products?

Bookshelves. Not the white ones but the solid wood which is a very flexible system. Is made from solid wood and it"s very easy to put together and take apart as it does not have screws. Joints are basically these metal pins and you can move them around. You can change it and pack it away... put it up again. Basically it can last your lifetime. And, you can repair it so if it gets scratch you can sand it down, put oil, paint it...

But this is solid wood

Yes. It's not MDF or particle board...And that makes the difference. But for example our kitchens have also some sort of circularity aspects because it's possible to change the fonts without having to change the entire kitchen. You can change the wide wood because these are standard measures... It's also possible to change our sofa covers. Most of our sofas come with washable covers so you can take the off, wash them and put them back on. You can replace them if you want to because they are completely worn away so you don't need to replace the entire sofa. So, there are already in our range products that work in the circularity perspective. But we are not part of the journey necessarily. We sell the products and then they can last sort of 20 years and change hands many times and be repaired, restored or changed. And, we're not part of this.

20 years long life, is that for the products that are made of good quality?

I would not say any of our products are of bad quality but I totally get that there are products that are more suitable for disassembly and reassembly. And we understand that. This is part of our circularity criteria as well. The Sustainability Scorecard was released in 2011 in IKEA Sweden (in the product development and product design department). In addition, we've now released the Circularity Criteria. These 11 design criteria of the Sustainability Scorecard are an internal working tool so, even though we might talk about the criteria, we don't talk about how they have influenced the product design.

So, in theory products are circular but they are not applied into product design?

Yes, it is applied but maybe it's not told popularly or shared. Because our products change constantly, even the ones that have been in the range for very long time. It seems like they are similar but there are small changes all the time, if it's relevant to do so (how they are packaged, how they are put together...). There is one product example that we use many times to explain the sustainability product design criteria and that's a lamp. It used to consist of 19 different parts, and now it's only 7 different parts, it is a lot easier to put together and to separate in different materials and we've reduced the costs. It is not necessarily for a long life time but for an easy separability of components.

Improvements need to happen...

Yes, and we need products that exemplify that. So we are able to say that we are not only talking about it but we are also making things happen. It might not be as quickly as we could wish, but changes are happening. There are many different things... We need to look at our range with 9500 products and not look at it as one range. There are many products. Some can last for a whole life time. Iva bookshelf... There are many products, such as the lack table – the small square really cheap one. It's 29 dkk- you could argue that this product is probably not designed for circularity. Because most of it probably end up as waste. And, I think, that in a country like Denmark where we've had IKEA for a long time and IKEA also came (and we are quite honest about that) from a quality level which was probably not very high. The iconic IKEA product white book shelves, Billi book case and stuff like that, 20 years ago they weren't very well designed. They did not cost very much, but they did not last long neither. And changes have been made. And, we are turning our entire range into a lot more durable design for circularity. More sustainable range. But this is happening gradually. It's not a big shift (radical). We also need to realise that even though a lot of it end up as waste because people can't be bothered disassembling it, it's a lot ... we're moving a big packs wardrobe and can't be bothered taking it all apart, packing it down, transporting it, putting it up again... Let's just leave it and we buy a new one. That's an attitude that is not necessarily 21:55 reassembling because of the quality of the products but more because of the price of the products. "Let's get rid of the whole thing so we don't need to screw all screws out, take it all apart and move it, let's just go and buy new stuff".

But, isn't it the price low, because the quality is not that high?

Not necessarily. There might be some correlation between price and quality... But our prices can be low because we order big quantities so we can keep production and transport costs very low and have a very efficient supply chain setup, which is the best... You can argue that... The lack table, is that high quality? Probably not if you compare it to solid wood lack table design by famous designers. It's a different quality but it's difficult to discuss product quality if you don't put it in a context. Is the lack table good quality? A lack table can last for ever if you take care of it. If you move a lot, stand on it But if you have it in a corner with a plant on top of it, it's gonna last for ever.

... (audios)

C.5 Amager Resource Center (ARC)

Linda Rebien

Before starting the interview, Linda Rebien shortly explained about ARC and the different projects in which ARC and the recycling stations are currently working with. A little introduction of ARC... Amager Resource Center (ARC) is a Public Business owned by five municipalities - five municipalities -Dragor, Frederiksberg, Hvidovre, Copenhagen and Tarnby - in charge of managing the local waste or resources. We supply around 260.000 households and 700.000 inhabitants. There is also Vestforbrændings who are owned by 19 municipalities and they have the biggest incineration plant in Denmark. They also have recycling stations. We have to collaborate with the municipalities because they own us. So whatever we would like to do, they need to agree upon. And we're running the recycling stations of the area as well. Sydhavn's new recycling station is a collaboration between ARC and the Municipality of Copenhagen.

The ARC Recycling Stations... We are currently managing 10 Genbrugplads or Genbrugstation (recycling stations) and 5 naergenbrugstation (small recycling stations placed in local areas of Copenhagen. There are not all the waste streams fractions). There is one recycling station in each neighborhood. The only exception is the recycling station located in Christiania because they don't pay taxes it has special requirements.

Reuse and Prepare for Reuse at the recycling stations... - Byttecenter is where you can come and give stuff and others can come and take it home. It is direct reuse for free. It is usually open during the whole week or almost every week day. We have two byttecenters, one at Vermlandsgade and the other at Kulbanevej. - Byttemarked is the same concept as byttecenter but it only opens one day of the week. It can be every Sunday or every Saturday. So during all weekdays stuff can be brought to the recycling station but only one day of the weekend it's opened to the public so they can come and share/take what they want. Anyone who wants can come and pick up stuff. - Frederiksberg Ordningen (Bispeengen) it's a shared recycling station with both municipalities, Frederiksberg and Copenhagen because it is placed in the border between both areas. At this recycling station we have a cooperation of direct reuse with of stuff, including furniture, with three organizations - Folkekirkens Nødhjælp, Projekt Hjemløs and Diakonissestiftelsen - that pick them up and sell them afterwards. Before, there were 5 organizations but as it requires a lot of time because they need to come at least twice or three times a week to empty the rooms and it's voluntary job so it takes time. On the other hand, they can collect very valuable things so they will earn a lot. The contract of these organizations is with us (ARC), Frederiksberg Kommune and Copenhagen Kommune. - Loppedmarked (Hvidovre) specific organizations collect for free and sell it and earn the money.

What is the fate of furniture left at the storskrald spaces of the waste rooms shared by the different buildings in Copenhagen? It will be shredded down into

pieces. The iron will be melted and recycled as metal but the products that can be incinerated will be incinerated it won't be reused at all. It's a big job for the municipalities... to figure out what type of solution they should provide in long term. What are the main problems that recycling stations find with furniture? Most people will probably don't bring it to the places where furniture can be recycled and will put it in the containers for incineration or if it's wood, they might leave it to the wood container. Instead if they would leave it in the "byt center", we could then reuse it. Is there any employee from the recycling station indicating where should the products that are still in good conditions be placed? There are workers in the recycling stations during all the opening hours. But they are very busy so they cannot be in contact with everyone, even though they try to. We also have a lack of area, there is such a little space in the recycling stations for direct reuse. So, if we had a bigger space we would be able to collect more furniture for the direct reuse. The two main issues is that we're not able to be in contact with everyone who come and therefore they leave the furniture in the wrong places. And then, we also lack space. If we had more space it would be possible for us to collect much more for direct reuse.

So, could one of the solutions be that one of the employees is all the time in the entrance of the recycling stations guiding the users in order to sort the reusable items and place them in the reusing corner? We have thought a lot about this. Of course, it's an issue because it is costly to maintain a salary of a person standing there. But, the idea for the new recycling station in Sydhavn is that there should be an entrance where every person is in contact with the employee and they are asked to deliver the valuable stuff can be reused. But it is costly to have this extra employee. Normally there will only be two employees working at a time. And, it is also very important to be present at all the other fractions. We have 32 different fractions at the recycling stations and they need to guide the people to sort it correctly.

It might be costly but it could be a good idea to have them so more furniture is reused... A long term investment. We are still having the debate. And I think when we'll start the Sydhavns Recycling station and we have a good experience with this service, we should implemented in all the other recycling stations. I hope that would be a solution.

Once materials are sorted out, are they incinerated or recycled? Most of it will be recycled. 89% of what we collect (in weight) is recycled.

Do people need to pay in order to leave their waste in the recycling stations? Particulars they pay through taxes. So they don't have to pay when they come to the recycling station. But, the private sector they need to pay upfront. Either they pay for a year or every time they visit the recycling station.

What role do you think, from the perspective of Amager Resource Center, that the furniture producers could play? How could they collaborate in the new constellation of actors? How could they contribute to take responsibility of the waste they generate? It's a difficult question because there is not Extended Producer Responsibility (EPR) for furnitures. There is EPR applied for WEEE but producers are not interested into producing long life products or products that can be repaired. They would think about their profit of selling more things, so if the lifespan is very short then people will buy and throw away... It's a devil circle. But, as customer you can do something. You can buy products that have longer lives. So you can buy wood that is not from rainforests, for example. And with this way you can influence the producers. The producers might not be interested in the way we are developing the recycling stations because the more we can reuse the less they might sell of new stuff. So there's a little conflict there. Normally, producers are interested on selling stuff. But, now, some producers they are branding themselves more environmental friendly by saying that some of their products have longer lifespans. So products, might cost a little bit more, but if you're the customer you might be willing to pay a bit more for a better product. But not everyone think this way. Some just want the cheapest products even though it will only last half of the time...

What type of furniture is the most brought to the recycling station? Materials or brands? We don't have statistics on that but according to what we receive there's a lot of wood, plastic and composite coming from furniture. For example, this table made of wood (the board) and metal (the support) would be asked to be left at the wood container and then the wood would be recyclable and the metal would be removed with a magnet and recycled as well. Concerning wood, we are now doing some analysis about recyclability. And it shows that as long as it is not painted then is safe to recycle.

From the recycling stations point of view, would you have any recommendation to the producers regarding the way they design their products? It would be very nice if it would be easier to separate parts and materials (disassembly). First off, because for the customer it would be possible to replace some broken parts instead of throwing the whole product away. And also it would be good, to separate the different materials (wood, plastic, metals...) then it would be easier for the customer to reuse, and then recycle for us. Because composed products are difficult to recycle.

Observations... Society has developed in a way that we use for few time things and then we throw them away, including. We can see the development with the generation of waste. When there is economic growth we get much more waste at the recycling stations. On the other hand, when he had the economic crises we saw it in the amounts of waste (decreasing) immediately.

Because, when there are good economic times, people would, for example, replace their kitchen. And it's not because something is wrong as it might function perfectly but they might not like the colour or the exact model so they will replace a totally functional kitchen room for a new one, which is not necessary. And this only happens if you have the economic resources for it so that's why when there's economic growth we receive more waste. Waste generation is a sign of economic growth.

C.6   Municipality of Frederiksberg

Mia Makne

What are the main problems with furniture design that prevent furniture last longer and be reused? I think that part of the problem is not necessarily how it is designed but more that people get tired of it and they want to have something new. Perhaps there might be some problems with the design when people move... Sometimes IKEA furniture, that you are looking at, is difficult to take it apart and put it back together... This fact oftens makes it not work anymore. But, I don't think it's the main problem. I think it's more that people want something new and, a very good way of solving it, that I hope we'll get in the future is that we could have more furniture on leasing or renting basis. So that you have something for a while because that would also make it more worth while making companies produce more long term and good quality stuff. So, that would be, in my world, the ideal way for the future.

But, as it is now, I don't think that [referring to the product design] is so much the problem... There is something on the way we collect it when it becomes waste and people leave it at the storskrald then, most of the times is just put into waste trucks and it's smashed into little pieces and compressed. This, therefore, is impossible to reuse directly and also quite difficult to sort the parts out with another truck that can grab it and sort it into different piles. It makes it difficult when it has been compressed. This is another problem and it is something we are looking at. We'd like very much to begin to collect in a different way. For example there could be something like one truck is sent to first look at what can be reused and collect it. And afterwards, send the other one that will collect without intentions of reusing. There is a lot of waste generation there that does not have to be wasted because things are fine. So it's not necessarily because of the design of the furniture it's simply because people are tired of it.

Is Frederiksberg Kommune looking upon different long term solutions? Yes. They will happen in a while in the future but we're definitely looking at other ways to solve this issue. For example, it could also be great if we could have the organizations,

such as Folkekirkens Nodhjaelp, to make the first "trip" of waste collection from the storskrald. But that is difficult because in Frederiksberg 96% of people are living in apartment buildings and many of the yards, where the waste and the storskrald are placed, are closed. And, of course we can't give the keys of this area to all kind of organizations and private people.

So if it was on the streets it would be easier? Perhaps we could solve it. But, there could be other illegal problems with it. I am not sure. Now what we have to look at is that we have to collect the waste and then give it to somebody or sell it ourselves... something in order to have it reused.

Could the private sector play a role in the collection? If it has become waste then it's regulated by the waste regulations. And they cannot take it. Because people have thrown it out basically and that means it becomes property of the municipality so that's why a company can't just drop by and take stuff back. But of course, a private person can donate and make her own arrangement to come and pick up when it has not thrown out yet. Because that's something different. Private people are actually not allowed to take anything from the storskrald. But we like to promote and encourage buildings to create an area with shelves dedicated to swap Bytte yarne or bytte skabe

Are there also some places where citizens can leave furniture and books for the exchange? Neargenbrug stationer are the ones that have a place where you can swap things like this. The ones that you can walk in, they all have this as far as I'm aware. And some of the bigger ones also have different types of initiatives in order to encourage reuse. Some of them have a shop that's open once in awhile.

The way we get around this thing about "whose property is it?" and the laws about waste is to say that it is not waste yet. If people come in and donate something which is still in good conditions, then is not waste. So that's how we deal with this.

In the one we have in Frederiksberg people can donate things all the time and we have currently 3 organizations that collect them. But it's basically open for whoever wants to pick up furniture.

Public Private Partnerships (PPP) should appear within the Circular Economy in order to work in an optimal way. So, could you see partnerships between Municipalities and the private sector? I think think the ideal solution would be a shift of business model towards the leasing and renting because everyone can then be satisfied. Otherwise users can just call and say "This lamp is not exactly what I wanted, could I rent another one for the next month?" This would be the best way.

Do you think the leasing could be a problem in the change of people's mindset by the fact that they don't own and instead they have to pay a monthly fee? Could this be a challenge? Maybe but I think that our thinking is going in that direction. Also for example with music and films, we don't own the CD or the DVD anymore. We kind of rent it from the internet. That's why I think the mindset is also shifting in various areas. So, why not with furniture? And, I think that many people would think that it can be fun because they can be more creative with their homes and change it in spring and autumn... seasonal changes. But, of course there will always be people who will prefer to own it. Perhaps it will never completely only leasing or renting but it could be a larger part of the market (than now).

Problems of take back systems? Take back systems for the producers are difficult to happen because there needs to be an incentive for the consumer. There's a company that want to take back their own products, Nespresso with their capsules, but as far as I am aware it does not function for them. And, also I am thinking that if you have to bring back everything to all the producers there, it will be very very difficult. It will be difficult for each individual to have to deliver back to various different places. Also, if you buy something in a foreign country then it's even more difficult... so I don't know how take back could work.

C.7   SydhavnsCompagniet

Camilla Toft Sørensen

Sydhavns Compagniet We made a collaboration with a Design School. They made the visual identity for us. In this project they made examples of upcycling. They created a catalog of upcycling ideas (including furniture). They created this model of furniture from wood found inside the containers of the recycling station. And, they created the design guidelines so it can be re-produced and assemble it. The wood was taken from the wood-containers of Bispeengen Gengrustation, within the Guldminen project.

Sydhavns Compagniet sources of furniture Our main focus is to collect things and furniture, for both purposes direct reuse or prepare for reuse. So we take stuff that don't need to be fixed or upcycled so we can sell them directly as they are. Some things we will redesign or upcycle. Or, we also collect wood from the wood container and construct something completely new. Sydhavns Compagniet Syghavns Compagniet in Sydhavns is both a café, where you can buy all the interior furniture from. But we also are a second hand shop which will open before the café (in about one month). We have big furniture like tables and chairs and also small like coffee tables.

What's the difference between this second hand shop and Folkekirke Nødhjælp?
We are also an NGO. We are a local NGO or Social Economic Enterprise. All our pro-
fits will be reinvested in out work with socially vulnerable people in Sydhavn. We have
volunteers and also users from a community center (at the next street) where people
can come and eat breakfast for 5Dkk. They can also get counseling if they need help.
And they can get a cheap lunch. They can go and socialize, create a network, etc. We
are also in unemployment projects so people who have been sick or out of work for long
time and they are under the social services they will be coming to us guided by the
municipality or the job center. Then, they will come to work here and try to help them
also. Trying to get them an internship or employment. They often have a lot of problems
such as alcohol abuse or any other thing so by coming here maybe they get the right
push and have a reason why to get up in the morning. Regarding the furniture that you
are collecting and then selling at the second hand shop or at the café. What percentage,
more or less, does it come from the inside of the containers and what percentage does
come from donation in the recycling stations or others? I would say, 50% of things we
sell are from inside the containers. The other 50 comes from donations to the Guldminen
or others.

Due to a problem with the recorder, during the interview, there is no more audio available
and, therefore the transcribing has not been possible.

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