‘FOLLOW WASTE’

A Journey of the Organic Waste from the Citizen until the Biogas

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Content

Introduction

"*Our waste are not only our problem, but become entangled with the lives of nonhuman creatures and the future of the planet we share*" (Reno, 2015, p. 557)

Waste has always been a part of the human life, although, in connection with the overpopulation and increased consumption, a growth of produced waste can be observed. It is a challenge for all in the world due to the created pollution, CO2 emissions, and impact to climate change. These challenges set the question concerning the future of resources and population in general. (European Commission, 2010)

The issue is on the academic, as well as the political agenda, where European Union (EU) takes an active stance. Denmark is not only an independent country, but also as a member of EU who faces these challenges too and is in the process of implementing new waste management plans for the municipalities, which directly also impacts the citizens of Denmark.

There is a need for sustainable waste management and at this moment EU sees the resolution in recycling. In this case, Denmark focuses on decreasing the use of landfilled and incinerated waste and increase recyclable solutions. Biogas production from organic waste is one of the solutions for recycling and is considered as a green solution for energy production. It becomes especially tempting as Denmark has set a goal to be fossil energy free until 2050. (European Commission, 2010; The Danish Government, 2013) To recycle the organic waste into biogas is already introduced in some municipalities of Denmark, where the citizens who carry out the sorting in the households, are taking an active part.

We, as techno-anthropologist, see this topic and the implementation of the waste management as complex, which involves different actors in different layers. For example, a citizen who turns the commodities into the waste; waste per se; a supermarket where commodities are bought; the men who collect waste; municipalities, ministries or organizations who are making decisions; or landfills. On top of that, we can observe different technologies (such as biogas plants) and their constant development and reshaping, which impacts all the other actors in the field and vice versa.

Therefore, we believe that techno-anthropological as an inter-disciplinary approach, could benefit the field and provide with a new perspective to the ongoing. Børsen

referring to Klein (Klein, 2010, p.17 in Børsen, 2013, p.38) writes that inter-disciplinarity "*refers to problem-solving activities that involve interactively, and to some extend integrate, at least two different disciplinary perspectives to the problem at hand*". We believe that the combination of elements of technological perspective, humanities, and social science can bring up some discussions and reflections regarding the complexity in the field. And besides just providing an insight and bringing up the discussion, we similar as Law look to that "*if we recognise this and work it right, we can interfere and make a difference"*, i.e., by entering the field and opening up specific complexities we are interfering with the field and we ask ourselves can we impact it in a more sustainable way. (Law, 2004)

To be able to introduce our problem statement and research questions, we beforehand introduce the specific case description.

Case Description

The EU has set the goal of every EU country shall have a municipal waste recycling percentage of 50 by 2020, and the Directive is focusing on moving the EU towards a recycling society where the waste is viewed as a resource. (European Commission, 2010, p 4) On Sjælland the waste management is decided by the municipality and the companies ARC, Vestforbrænding, or Kara/Noveren depending of which company the municipality is a co-owner of. Copenhagen municipality is a co-owner of ARC with 4 other municipalities, whereas Vestforbrænding is owned by 19 municipalities and Kara/Noveren of 9 municipalities, and further Vestforbrænding together with Kara/Noveren, and the company Solum are co-owners of the biogas company BioVækst. (Kara/Noveren, unknown) (Vestforbrænding, unknown) (Appendix, Solum)
Additionally, the Ministry of Environment and Food of Denmark have had various statements about waste where in 2013 the strategy was to recycle more than incinerate and now in 2015 they have the strategy to prevent waste. However, the repeating focus of the waste management is to establish Denmark without waste. This enhances how fast the strategy changes due to the change of politicians which affect how the waste is being processed is impacting the companies, municipalities, and citizens or individuals

as they refer differently to the inhabitants. (The Danish Government, 2013) (The Danish Government, 2015)

However, the waste management entails multiple fractions like metal, glass, and plastic, though, the focus will only be regarding the organic waste (cooked and uncooked food; bones from meat; egg shells and nutshells; cut flowers and flower bulbs; tissue paper, coffee grounds and tea bags; fruit windfalls) as it is one of the recent added fractions to the waste management in order to reach the requested recycling percentage from EU. For now, it is not enough to reach the 50% of recycling when recycling plastic, metal, glass, construction materials, cloth, and the other more than 30 fractions Vestforbrænding recycle and 40 fractions Kara/Noveren recycle from their recycling centres and their incineration of domestic waste processed into electricity and district heating. (Appendix, recycling centre Kara/Noveren) (Vestforbrænding, unknown) (Rødovre Kommune, unknown)

The process of managing the organic waste is to sort it into another container carried out by the citizen in their private home and collected by garbage men hired by municipality and will then either be used for incineration at Kara/Noveren or Vestforbrænding or processed into biogas and fertilizer at BioVækst (further on we will refer to Solum). The outcome of what the organic waste will be used for has not been finally determined due to political disagreement among the municipalities and also collaborative disagreement between Solum, Kara/Noveren, and Vestforbrænding. (Appendix, Vestforbrænding Camilla Bjerg Pedersen)

Problem statement

In regards to previously mentioned in this thesis, we want to research:

What are the practices regarding the recycling of the Municipal Organic Waste in a part of Sjælland? How the recycling practice could be improved in a more sustainable way?

In order to answer these questions we divide our problem statement in several research questions:

RQ1: What are the main technologies involved in the recycling of Municipal Organic Waste in a part of Sjælland?

RQ2: How the actors/stakeholders of our field are perceiving these different technologies?

RQ3: How the practices around these technologies are enacted?

RQ4: How the recycling practice could be more sustainable?

Methodology

To some extent the inspiration of our field was Appadurai and his idea about social life of things – things have values added by persons and these values can change throughout time; things do have social life and they live it through social relations. Today something is a commodity and tomorrow a gift, for example, a trash. In order to understand the social life of a specific thing, the focus should be on the movement and trajectories. (Appadurai, 1986) Therefore, we approached our fieldwork as a journey – a journey of a waste (or more specifically, the municipal organic waste). We called it - '*follow the waste'* – from the citizen until the biogas.

We use ethnography as our method according to Sunderland and Denny to whom it consists of several different methods and their choice depends on questions and situations. However, participant observation stays the main focus as the best possibility to see actual behaviours. Further, the authors mention that in order to be able to talk about an anthropological research opening up assumptions and taken-for-granted knowledge there should be some kind of participation involved – here also referring to interviews. (Sunderland&Denny, 2007, pp. 50-52)

We chose practice theory as our theoretical approach of analysis. This choice highly impacts the fieldwork and the choice of methods. We were aware that the practice involves *sayings and doings* and practices can be *complex*, therefore the fieldwork had to look to the whole ecosystem (field) of the practice and engage with the informants as much as it was possible. (Will further be elaborated on in the chapter - Theoretical approach) Here we find it relevant to bring up the discussion about *praxiography* – the methodology of practice driven by research. Bueger writes that *praxio*graphy and *ethno*graphy may seem similar, they even have similar concerns (e.g., selection of data). However, he distinguishes 'praxis' (practice) from 'ethno' (culture) and that some challenges are more typical to praxiograhy, e.g., how to write about practices and unravel the tacit knowledge. (2014, pp 383- 385) Further, Bueger mentions that it is up to every researcher of how he/she will design the research, as praxiography "*is not a singular strategy*" and different strategies should be blended. (2014, p.385) But observations (participant) are important to obtain the tacit knowledge which is seldom verbalized, as well as to see the actual movements of materials and carriers in the specific situations. The researcher has to "*observe, watch, listen, and record*", and be able to make interpretations. (Bueger, 2014, pp. 378-379)

We look to our attempt making this fieldwork and analysis as *praxiography* as such. Similar as Buerger writes '*doing praxiography requires 'learning by doing', that is, actually writing one*". (2014, p.386)

Methods

Notwithstanding that the observations are so important; our main method was **in-depth semi-structured interviews** with all the informants. Semi-structured interviews are scheduled and usually cover specific topics, meanwhile stay open ended. This type of interview is the best choice if the informant is accessible only one time and the time for the interview is limited. For all the citizens, we had made the same type of leading questions to be able later on to compare them; for the official representatives the questions were adapted to their responsibilities. ((See Appendix, Frame of interviews) it entails the frame of interview and description of how questions were made.) The interviews were scheduled beforehand and all the informants were informed about our topic. Regarding the institutions, the main topics of the interview were sent to e-mails beforehand as it was requested by them. (Bernard, 2006, pp.210-212) We asked if the interviews could be recorded and if the informant wanted to stay anonymous. For the informant who expressed such will, the name is changed. Also permission to take photos and make maps was asked. During and after all the interviews we took notes. We faced here an interesting phenomenon – as we all are with different background, the field notes and observations differentiate a lot which at the end was beneficial.

Starting our fieldwork, we understood that we will not gain any access in making a participant observation at citizens' homes, so we decided to focus on the interviews at their home and ask them to show us where they place their waste. We took an inspiration from Isaksson and Ellegård (2014) where they planned interview with the informants at their home and watch them interacting with their heating systems. If the interview could not happen at the home, we asked them to send us photos and write explanations. (This happened only in one case out of eight.) All together, we had produced 8 interviews with citizens each of them for 1 hour or more; and 6 representatives of the different institutions each of them for 40 min or more.

Here we have to take a critical stance. Bernard points out that interviews are a way to find out what people "*think they do*" and the accuracy of the answers can be questioned.

Observations are the only way to understand what they actually do. Besides participatory observations, Bernard also distinguishes if persons are aware that they have been observed or they do not. (2006, pp., 245, 431) Here we have to take into account that we did **observations of informants** only during the interviews and all the informants were aware that we were doing research. Also our analysis of data showed that informants are giving contradictory information. For instance, one of informants states to throws out waste every 2-3 days, but later when we asked a question how much he consumes and if he could consume less, the informant changed his answer and stated that perhaps he exaggerated with those 2-3 days and in reality it could be 3-5 days. It could happen that informants are expressing their thoughts about actions and their memory could be "fragile" regarding their own behaviours. (Bernard, 2006, p.247)

We also faced the situation arriving at the couple's house and the kitchen surfaces were empty only with some coffee boxes above the shelves. There were no kitchen tools or any private items. We kept on wondering if the informants really live like that or they are trying to give the best impression. We tried to overcome these by paying attention to the answers and ask deeper questions or return to the question later with a different angle. One of us was always a leading interviewer and the two others could ask extra questions, thus, helping to escape missed points during the interviews.

To better understand the language of the field and see how *doings* by citizens are done, we all tried to write diaries of our own interaction with waste, i.e., do **self-observations**. We did not succeed to do it daily, but some of the information was beneficial and it also allowed us to become more aware about the field. Here we also have to take into account that the practices of the citizens are something that we as citizens are also performing every day, so we believe that through diaries we could better understand the doings and be more aware about possible contradictories in the interviews. All diaries were included in data analysis.

One of us also engaged in the discussion on Facebook when she posted information that we were searching for informants for interviews. We also looked deeper into some Facebook groups, but this part of the fieldwork is left out. As well as we investigated websites and the waste plans of the municipalities, but also this data are not included into the analysis due to time limitation.

After the interviews we asked the informants to make **drawings**. The citizens were asked to draw two drawings – perception of the lifecycle of biogas production; and

involved actors in the recycling process. It must be enhanced that sometimes the citizens misunderstood the question and pointed out more to the actors in biogas production. For the official representatives, we only asked them to draw the lifecycle. Some of the representatives refused, and others already gave written documents. According to the one of the authors' previous research experience, we believed that drawings could reveal more data about the perception and the placement of the technology.

We also had a **tour** at the biogas plant, a tour at the university's lab where the experiments with biogas are made and **a meeting** with a professor who specializes in biogas production; a tour at two incineration towers, in a recycling centre, and how the waste is treated in apartment houses (house administration). Further, we attended **an event** regarding food waste (Energy Mondays – Food Waste Solutions and Practices organized by Energy Crossroads Denmark), and interviewed an ethnologist, (Antropologerne) who had conducted research about the food waste in the Danish households.

The field description

It was chosen to focus on the municipalities that are co-owners of Vestforbræding as they were informed about the expansion of Solum and the guarantee about processing the organic waste into biogas in May 2015. (BioVækst, 2015) Further, the citizens were chosen based on which municipality they live in and the municipalities were contacted too by phone or mail regarding their managing of waste, recycling, and services provided for the citizens.

We started out in the fieldwork by contacting the company Solum (February 2016) and were planning to write thesis about the biogas production from organic waste and how organic waste is treated at households and what are the approach of the municipalities towards this topic. After visiting BioVækst (March 2016), the biogas plant placed in Holbæk, which is owned by Solum, Kara/Noveren and Vestforbrænding (the last two are public companies owned by municipalities), we lost the contact with Solum (we contacted them several times by mail and phone), who was supposed to provides us with the contact information to municipalities. (Here we should point out that during our fieldwork we found out that Kara/Noveren and Vestforbrænding are planning to

step out of BioVækst). We started to contact the municipalities (we chose the ones where the citizens are from) and Kara/Noveren and Vestforbrænding by ourselves in Danish either by mail or phone (March 2016-May 2016). To see a wider perspective and also practices of all the possible main actors, we contacted also a house administration of one of the citizens (it is a house administration that one of the thesis authors is renting an apartment at) (April 2016).

The ethnologist was contacted by e-mail provided by the main organizer of the research. The report of the research (*Miljøstyrelsen, 2016, Madspild: Forstudie af forbrugeradfærd med henblik på nudging*) was found through digital media where the report was published. (April 2016) The visit to the university laboratory (the profile of the person and the transcription of the visit see appendixes) was organized by ourselves, but we were introduced to a student by Hinrich Uellendahl, a professor at Aalborg University in Copenhagen, who specializes in biogas production. The meeting with the professor took place before visiting the biogas plant; the visit to the laboratory was after the biogas plant. (March 2016)

During this period, we also started to contact the citizens. (March 2016-April 2016) It was chosen to focus on the municipalities that are co-owners of Vestforbrænding as they were informed about the expansion of Solum and the guarantee of processing the organic waste into biogas in May 2015. (BioVækst, 2015) Further, the citizens were chosen based on which municipality they live in and the municipalities were contacted too regarding their managing of waste, recycling, and services provided for the users. Here we have to take a critical stance regarding our own actions, that in the beginning of the fieldwork we did not understand the links between all the organizations very well. Later when the fieldwork was already near the finishing point, we were informed by one of the informants that there is a possibility to see on the website municipalities providing organic waste for BioVækst. The criteria of how we chose the informants made us exclude the municipalities represented by Kara/Noveren and we ended up only with one citizen who has a possibility to sort.

Our informants

- 9 citizens (one couple was interviewed together) from 4 municipalities – Ballerup (3 citizens), Ishøj (3 citizens), Rødovre, (2 citizens) and Glostrup (1

citizen). The profiles of each of the citizen and photos, as well as maps can be found in the appendix. It is described how each of the informants was contacted. The level of the sorting for each informant was different – some of them show high performance, while others had low sorting performance. Even if the informant tells us that he/she does not sort, each one of them were performing at least some kind of sorting.

- House administration is of one of the citizens (Ballerup municipality). The informant has worked for the house administration as a janitor for 35 years. The profile of the interviewee is in the appendix – House Administration. The photos of this visit are added to the citizen (see the appendix, Zahid).

- 2 municipalities – Ballerup and Rødovre. We also tried to contact the municipalities Ishøj and Glostrup, but during our phone calls we were transferred to Vestforbrænding.
    - Ballerup municipality – has not implemented the new waste plan yet. They will start in 2017. The representative is the only employee who manages the waste for Ballerup municipality. The rest of the services are provided by Vestforbrænding. However, they are planning to hire a new communication employee for the waste management. (See the appendix, Ballerup)
    - Rødovre municipality – is in the process of the implementation of sorting organic waste. One of the citizens from this municipality had the possibility to sort organic waste, while the other one did not have it yet. The representative is one of the two employees who work with waste management. Originally, we had arranged the meeting with the other representative but due to private obstacles, he asked his colleague to replace him.

- Solum (see the Appendix, Solum)

Solum is responsible about the technological implementation of the biogas plant, while the two other public partners are providing waste, its collection and incineration of residues. Solum, besides this biogas plant, also has a compost plant and other fractions in Roskilde where they are placed next to Kara/Noveren.

We had a presentation with the chief technology officer, Morten Brøgger Kristensen, and afterwards a tour around the plant. Originally, we had to meet the CEO of the company but some days before the meeting, we were contacted by the chief technology officer and he informed us that he would have the meeting with us.

- Kara/Noveren

  Kara/Noveren is a public, non-profit organization owned by 9 municipalities[1]. They have 14 recycling centres and two incineration towers. The visit was divided in two parts.

  - The recycling plant. The busiest one of their recycling centres is placed in Roskilde. The centre hosts around 6000-7000 customers per week. We interviewed a manager who is responsible about 7 centres of 14.
  - The Energy tower (incineration). We started our visit there with an interview with the tour guide, who later hold a powerpoint presentation about the company and then guided us around their newest Energy tower they have.
- Vestforbrænding is a public, non-profit organization owned by 19 municipalities.[2] They have several recycling plants, the oldest furnace and services for the municipalities. The visit here was also divided in two parts.
  - An interview with a leader of consultancies, who explained about how the work is organized at the company and showed their new materials. (See the profile in the appendix, Vestforbrænding, Camilla Bjerg Pedersen)
  - The tour around energy tower/Furnace (incineration). We were guided through the plant and shown the educative facilities they have. (See the profile in the appendix, Vestforbrænding, tour).

After fieldwork - Analysis process

In the middle of May 2016, we finished our fieldwork. All the interviews and visits were transcribed; those interviews which were held in Danish were translated into English.

[1] Greve, Holbæk, Kalundborg, Køge, Lejre, Odsherred, Roskilde, Solrød and Stevns municipality.
[2] Albertslund, Ballerup, Brøndby, Egedal, Frederikssund, Furesø, Gentofte, Gladsaxe, Glostrup, Gribskov, Halsnæs, Herlev, Hillerød, Høje-Taastrup, Ishøj, Københavns kommune, Lyngby-Taarbæk, Rødovre, and Vallensbæk.

The transcribes, our own diaries, and field notes were added to NVIVO (the software for qualitative data analysis) to better help us organize data.

We made our code list by dividing codes in several big families with different nodes (i.e., subcodes). The code families and some subcodes were theory driven (as for example, the code families – material, competence, meaning, community) while all the subcodes (as for example, container, prestige, digital media) were data driven. In other words, we made a frame of coding based on the theory, meanwhile allowing our data to 'talk' in the coding process. Here have to be reminded that also our leading questions were organized around three elements of the practice.

Altogether, we had 165 subcodes with about 15 main codes where 10 of them are creating code families with subcodes: actors (have subcodes); agency (has subcodes); material (has subcodes); challenges (have subcodes); climate change; competence (has subcodes); consumption/awareness (has subcodes); definition of technology (has subcodes); dirt; improvements (have subcodes); language analysis (has subcodes); meaning (has subcodes); public/private; smell; pay attention.

Each of the 165 codes were extracted with related quotes from the software, read through, made summaries, and then from summaries created story. We decided to create the stories around the codes.

Reflections

To continue with the analysis process, we can add that during our writing process we reflected about our choice of approach. This software does not show if the quote is coherent with other codes, so we were repeating ourselves a lot and thus creating extra workload for ourselves.

Also writing stories about each of the element instead of focusing on the practice per se and then framing out more specific problems, perhaps would create a better over-view for us and other readers. As well as the question of whether or not if it was the right choice to focus on the practices around the technologies emerged. The experience showed us that it is challenging to write down the practices and its elements on the paper. They are usually so complex and elements are interchangeable that seem difficult to cut it into the little pieces for the purpose of the analysis. The questions should we chose practice theory at all and perhaps better would allow the organic waste and

actors lead us in the journey and choose, for instance, Actor Network Theory as a tool to for analysis.

During our fieldwork and analysis process, we all the time faced with the challenge that we do not have participant observations. In the process of working on the analysis, several times we returned to this question – we believe that it would allow us to better see temporospatial trajectories of the practice; as well as better noticeable links instead of only elements; and see in the life how practices are performed in different situations. We also would avoid of discussions in such extension of how accurate the information of the citizens is.

Additionally, there had also been some inaccuracy from our side during the interviews – 1) sometimes we use the words *trash, garbage, waste* interchangeably. This sometimes created difficulties to analyse and compare data; 2) we did not follow the same instructions with drawings; 3) our field notes and diaries could be more elaborated with more descriptions of observations.

Above all, we should take into accounts that neither of us, nor any of the informants have English as their mother tongue. That created some challenges in our field –because it created some challenges to understand if the informant use the specific word and expression because they want to or they just lack English vocabulary. For instance the words waste/trash/garbage were used interchangeably. Further, the transcriptions of House Administration, Ballerup, and Rødovre municipalities were translated from Danish into English where some meanings of the words could be lost in the translating process.

Theoretical perspective

This chapter focuses on the theoretical approach and concepts we apply for our data analysis. We start by introducing our standpoint towards the technology and then framing main theoretical concepts and practice theory we used.

What is technology from techno-anthropological perspective in this project

Here we want to introduce our theoretical standpoint towards the technology.

According to Williams and Edge (1996) there are 3 theoretical approaches of how relations between society and technology can be seen:

- Technical determinism,
- Social constructivism,
- Social shaping of technology.

The Social Shaping of Technology (SST) approach is developed as a critique to the technological determinism, which is looking to the technology as being taken *"for granted"* (as appears in author's work) and developing independently from the society. The technology, due to itself and during its development, is having an impact on all the social aspects. The central point of SST is the idea that technology has multiple possible paths of development and is opened for intervention. Choices are being made during the technological development which can lead to different technological outcomes and affect the character of the technology and the social implications. (Williams and Edge, 1996, p. 868) Scientists from SST were interested in 3 directions of how society influences the technological development: the direction of development, the form and content of technology, and the outcome of it for different social groups. The Social Constructivism approach has a similar opinion regarding the technological development, affirming that there are multiple options of how technology can be constructed. But they are more interested in identifying why a specific trajectory was taken instead of another one. (Williams and Edge, 1996, p.869)

To sum up on that matter, technology and society are two entities which cannot be analyzed separately. They can be mutually shaped. Regarding this topic MacKenzie and Wajcman (MacKenzie and Wajcman, 1985 in Williams and Edge, 1996, p. 875) proposed not to look at technology just as a physical artefact, but rather to treat the technologies as inclusive phenomenas. Therefore, we - like them - have chosen to look to technology

that it is not just the equipment itself, but also the process that is leading to the creation of technology, as well as the knowledge (know-how) and skills that are necessary for the process of developing the technology (Dosi, 1982 in Williams and Edge, 1996, p.875; Sahal, 1981 in Williams and Edge, p.875).

Like Williams and Edge, we have chosen to look to society and technology as shaping each other. This understanding accompanies us throughout the thesis and is the applied lens through which we chose to view our field. In similar way, the technology is also looked at with practice theory, i.e., that social practices and technology are interweaved. Christensen (2013, pp. 385-387) emphasizes that technologies are artefacts in practices; technologies always should be looked to as integrated in practices instead as merely artefacts. It is important to look to whole ecosystem and dynamics of practice as the technological development and innovation shape practices and vice versa (Shove et al., 2007,pp. 134-135; Shove et al., 2012, p. 12). So, if there are any changes in technologies, it will mirror in practices, as through them the technologies are embedded. As Watson mentions the practices and socio-technical systems (technologies, regulations, norms, markets, and infrastructures) are "*mutually constitutive*", i.e. socio-technical systems become embedded in routines through practices; and performances are shaped by these systems. (Watson, 2013, pp. 117)
As technology is seen as an artefact in practice and as a combination of three layers, we find our field consisting of three main technologies in how municipal organic waste is treated: biogas production (which was the initial technology), the incineration (what we discovered by following what happens with municipal organic waste from households where citizens do not sort it) and above all - recycling process and solutions (the technology we faced through entering at the citizens' households).
Taking into account that technologies are integrated in the practices, we also believe that the understanding of how our informants perceive technologies in the field could benefit to our desire of understanding how the practice could be shaped in a more sustainable way.

Practice theory

The central framework we used is Elizabeth Shove's classification and definition of practices, which is elaborated below. Shove and Spurling (2013) state that there are no

one strict practice theory and that practice can be defined differently. In defining her understanding of the practice theory, Shove is largely inspired by Reckwitz and Schatzki whom we are looking for inspiration from too.

General notion of practice

Reckwitz brings German lexicon to make the differentiation of practice as the central focus pointing to practice theory (*Praktiken*) and practice as noun (*Praxis*). *Praxis* represents the outright of all human actions, while "Praktiken" is what Reckwitz calls "the routinized type of behaviour *which consists of several elements, interconnected to one another (...)*" (Reckwitz, 2002, p.249) A further elaboration of the elements will follow in the following subchapter. Also Shove, Pantzar and Watson (2012, p.82) believe that practice is more as '*provisional, but relatively consistent, relatively enduring integration of elements*'.

Additionally, Schatzki (1996) is identifying several notions of what practice is. First, he is defining practice as a organized *nexus of doing and sayings* which are temporally unfolded and spatially dispersed such as cooking, voting, or industrial practices. These nexus have elements that can be traced and linkaged that can be examined. In this conjuncture, practice becomes one's ability to do something by repeatedly working and carrying it out, which is what Schatzki is referring to as "doing" and represents the "*act of performing and carrying out"* itself. This approach is showing that the links between doings and sayings can be observed only while being performed. Warde names them as *practice as entity* and *practice as performance* and points out that *"Practices are thus coordinated entities, but also require performance for their existence. A performance presupposes a practice."* (Schatzki, 1996, p. 89-90; Warde 2005, p. 134) On top of that, as performances are singular, it is crucial to be able to view that they are allied with the specific entity. (Warde, 2013, p.20)

We can see that the multiple aspects of the social life give a wide area for practices to be unfolded, giving enough space for diversification of practices. Here is relevant to mention another categorization by Schatzki as 'integrative' and 'dispersed' practices. However, as Shove et al. (2012, p.82) mention that they do not use this differentiation in their approach; we have choose not to look any deeper into this distinction. Similar to Shove et al. (2012, p.81- 87) we search if practices are linked together thus creating

bundles - '*a loose-knit patterns based on the co-location and co-existence of practices*', or ***complexes*** - *'stickier and more integrated combinations, some so dense that they constitute new entities in their own right'*.

Elements of practice

Shove, Pantzar, and Watson are unifying different elements in three big groups*: Materials, Competence,* and *Meaning*.

As already mentioned, practices are highly related with the socio-technical world view and artefacts play an important role in shaping the practices. According to Shove et al., (2012, p.23) the material constructs have not been in focus of practice theory until Schatzki and Reckwitz. Reckwitz explains practice as a way in which the body is acting, moving, manipulating, and performing an activity which makes *Body* as one of the main elements.

Routinized behaviour can be seen as a type of activity that is constantly performed by the individual, and for this activity to become a performance, the body is not an agent as such, but more as the necessary compound that permits the performance of the practice. Besides the body, the Thing (the object as such) is also necessary in order to establish the practice (Reckwitz, 2002, p. 251-253). Thereby, Shove et al. state that the first element of a practice is the things, objects, infrastructures, hardware and the body itself- i.e. the *Materials*. (Shove et al, 2012: 23)

However, the practice is not just based on the bodily activities; there are mental activities and emotions implicated into constitution of a certain practice. By mental activities, Reckwitz means a set of knowledge about how to perform certain activities, understandings and motivational forces of the practice. Both the body and mind are not perceived as instruments or possessions of the individual, but more as an element being a part of the social practices. (Reckwitz 2002, p. 252)

The second element for Shove et al., *Competence*, is the '*multiple forms of understanding and practical knowledgeability together*' (Shove et al., 2012, p. 23). The authors refer to Giddens (1984 in Shove et al., 2012, p. 23) who emphasizes that the importance of the "practical consciousness" representing the skilfulness or shared understandings of how a performance should be enacted. Warde is distinguishing between 2 types of knowledge: knowledge as ability to evaluate a performance and knowledge as skill to

perform. According to Warde, it is important to make this distinction in some situations (Warde, 2005 in Shove et al., 2012, p. 23). Additionally, Reckwitz states that *knowledge* is placed outside of the individual in the social world constituting in the social interactions (Reckwitz, 2002, p.253-254).

The third element, *Meaning*, is an unification of the mental activities, emotions, and motivation, which Shove et al. unite in one. These compounds could seem to bring Meaning very close to the definition Schatzki refers to as teleoaffective structure circulating in 'timespace' (to take into account the history, future of projects, etc.). (Shove et al., 2012, 24) Schatzki states that practices are being organized by rules, understandings, and a mix between teleology and affectivity, i.e., "teleoaffective structure." The teleoaffective structure is an ensemble of possible orders and is constituted by beliefs, actions, emotions, and moods and further "*it also holds of its ends, purposes, projects, and tasks. What it is for a person to pursue ends and purposes is for the sought states of affairs to be objects of her intentions, desires, hopes, and wants.*" (Schatzki 1996, p. 101) However, Shove et al. point out that they opposite to Schatzki perceive *Meaning* as an element and '*not something that stands outside or that figures as motivating or driving force*'. (Shove et al., 2012, 24)

Meanings and competences can be mediated; however, as Shove et al. mention – it does not mean that the mediated elements through media will stick. Meanings and competences travel through abstraction and re-contextualization, bringing back to local context. It is crucial that a carrier can pack and unpack, i.e., de-codify information and re-link it back to his local context. (Shove et al., 2012, pp. 55-57)

As *Language* and *Discourse* which according to Reckwitz is a routinized way in which objects have been given meanings, during our research, we paid attention to the language and choice of words of the informants (Reckwitz, 2002, p. 254).

Warde emphasizes that practices are influenced by *understandings*, *objectives* and *procedures.* These 3 compounds are the ones that assure the possibility to reproduce the practice through the formal and informal codifications. (Warde, 2005, p.140) Warde (2013, p.23) refers to codification as "*a matter of specifying the objectives or purposes in view in a domain of activity, and the ways to go about attaining such goals*". As nowadays mainly these are different documents with rules, procedures, and standards, he ties it to the formalization of the practices. Formalizations are necessary to improve or facilitate

the performance and one of the most common tools is the instruction materials, rule books, or teach yourself materials (Warde, 2013, pp.23-24)

Creating and breaking practices

Having the elements outside in the field is not enough for constituting a practice, there is a need for the links between these elements to be made; besides the links have to be at the same time. Therefore Shove, Pantzar and Watson identify two other possibilities:

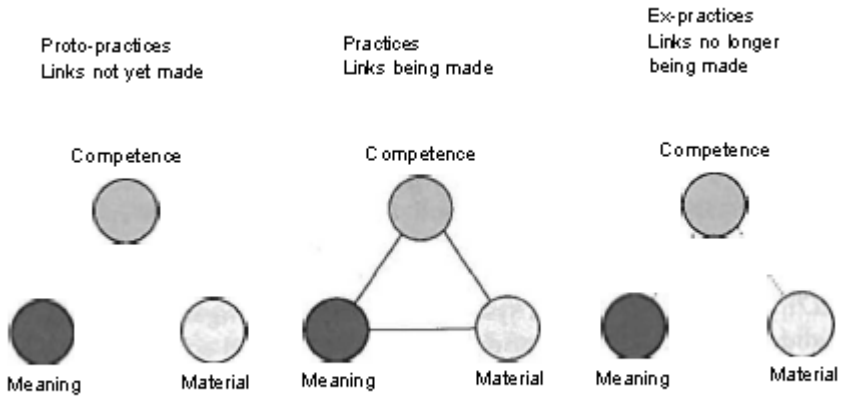


Figure 2.1 Proto-practices, practices and ex-practices

(Shove et al., 2012, p.25)

Proto-practices - the elements are out there but the links are not yet made; or ex-practice, when the practice was made, but due to influence of various circumstances the links are broken and no longer connecting the elements i.e. the practice is not enacted. (Shove et al., 2012, p.24)

If there are no links, the competences may still be carried out and the meanings still being present. The competences can be stored, can persist in the memory without being active and in the future it can become an important part of the new competence in a new practice; and the knowledge can diversify and constitute a basis for new competences. This also indicates that the materials and competences are developing and migrating between practices that co-exist in the field. (Shove et al, 2012, pp. 24; 26-33) On top of that, as Warde mentions practices are carrying out the possibility to transform, creating dynamic, and adaptable constructs, the agent can learn, borrow, and

apply some procedures from one practice to another which are being enacted in parallel. (Warde, 2005, p. 141)

A similar linkage to elements is working also with practices. Previously mentioned, the practices are also linked, i.e., being co-dependent, among themselves, and can create complexes or bundles. However, it should be taken into account that these complexes can be black boxed, i.e., authors give an example of the driving practice which in most of the people perception is one practice, though, in reality consists of lot of different practices. (Shove et al., 2012, p.82-83)

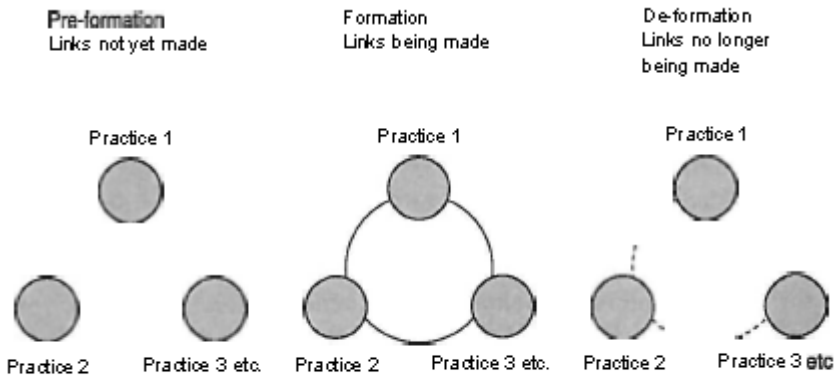


Figure 5.1 The pre-formation, formation and de-formation of connections between practices

(Shove et al., 2012, p.83)

According to Shove and Spurling (2013, pp.7-8) there is a possibility also for competitive relationships between practices. However, it does not mean that one practice takes over the other. Meanings change as well as attitudes towards practices and they emphasize the necessity to take into account infrastructures surrounding these practices and changing relations between them. For example, the policy promotions for a specific practice are "*themselves an emergent product of ongoing relations and dynamic process within and between these co-existing systems*". (Shove & Spurling 2013, pp.7-8) Additionally, Schatzki (Schatzki et al., 2001, p. 11-12) mentions the importance of also looking to the phenomena such as science, power, language, knowledge, meanings, etc., that is referred to as a *"field of practices".* The practices should be examined in the fields where they are being acted.

According to Shove et al. to enact practice it is necessary that a carrier have relevant financial and material resources, physical ability, expertise and time. How much one

practice can take time compared with others becoming of important aspect, as it has become hard to reorganize and manage time in daily life. (Shove et al., 2012, pp.65-66) Additionally, Shove, Pantzar, and Watson (2012, pp. 86-87) point out that sometimes in a case of co-dependence of practices, temporal relationship of sequence and synchronization could be important – that is if specific sequence of how practices are linked can be demanded in order to ensure that complex practice is established.

Critical approach of practice theory

Previously mentioned, there are not only one practice theory, each of the authors apply it differently. One of the most sparkling discussions within the practice theory is related to the individualism. The consumption studies, here also recycling practices if looked wider, mostly are investigated from behavioural study perspective, which place the responsibility on the individual, meanwhile, practice theory *de-centres individual from analysis*. (Shove & Spurling, 2013, p3; Hargreaves, 2011, p.79) Practice theory offers a wider angle and

"*rather than seeing change in the resource intensity of daily life as an outcome of individual choice, or of seemingly external social and economic forces, it makes sense to ask about how social practices evolve, and what this means for the use of energy, water and other natural resources*" (Shove & Spurling, 2013, p 3)

While according to Hargreaves, (2011, p.84) Shove believes that "*terms practice and behaviour are incompatible*", we similar as Hargreaves have decided to perceive it broader regarding this topic. Here we believe it is important to mention that also Sayer points out that behaviour is embedded and shaped by practice, but he questions what place have individual's reasons and values then, and states that *"it will be strange to deny that they have any influence on what we do [...]"*. (Sayer, 2013, p. 167) Additionally, Kurtz et al. (2015) are supplementing on this matter and stating that practice theory can "borrow" some ideas from social psychology studies which will permit a deeper understanding of the social meaning of a practice. (Kurtz et al, 2015, p. 124) They present the unsustainable human consumption through habitual behaviour and through social practice. (Kurtz et al., 2015) We believe that due to our topic it is necessary to focus on both, therefore, we look into how psychological studies and which notions from there can be used to benefit practice theory's approach to the individual.

Other theoretical concepts

Reward and punishment

The motivation represents one of the processes through which behaviour can be changed to a more pro-environmental and the motivational factors are divided into two categories: extrinsic and intrinsic. The extrinsic motivation refers to the external factors such as material rewards, while intrinsic motivation refers to inner feeling to do so. *Rewards* can constitute an important strategy to implement a desirable behaviour, but while referring to sustainability, not every behaviour can be supported by external rewards. (Kurtz et al, 2015, p.120) There can be that the intrinsic motivation can bring changes as well. According to Warde, there are 2 situations that must be avoided in relation in building an intrinsic motivation. Firstly, the case of providing tasks that are below the agent's competences, which will lead to a decrease of the motivation to participate in the activity and the agent will not perceive this as a possibility to develop himself/herself. Secondly, if the task is too difficult, the anxiety will occur and the agent will feel overwhelmed and the psychological effects will emerge as a decreased self-esteem and self-confidence, which will lead to a denial of performing the activity. (Warde, 2005, p.143)

Shame, prestige, and community

The European Environment Agency (EEA) report (2013, pp.24-27; 42) focuses on various ways of how the social studies can change human behaviour and practices into being more energy efficient and sustainable. Besides pointing out the importance of social norms as well as the necessity including the understanding of behaviours and practices, it emphasises the importance of the community. Based on their calculations, engaging in the community-based initiatives can increase the energy saving with 5-20%. The percentage is depending on if the other tools like feedback, measuring, etc. are applied.

Additionally, Shove and Spurling (2013, p.7) refer to Hitching's article in their book where they state that "*social networks are crucial for how strategies and practices of comfort circulate and change*". Meanwhile the 'community', i.e., social networks can bring to both - higher or lower consumption.

On top of that, Alpizar and Gsottbauer (2015) identify that *shame, pride* and *community* as intrinsic motivational factors, which are playing an important role in establishing a more pro-environmental behaviour. Based on experiment in Costa-Rica, they conclude that the initiatives based on reputational effect can highly benefit for changing a specific behaviour. The punishment (the negative information about the individual's behaviour) and the pride (public acknowledgment of individual's contribution) in a community can significantly impact decision making regarding a specific behaviour. (Alpizar and Gsottbauer, 2015, p.373) However, it must be enhanced that the motivational area is very specific from case to case, and it is difficult to predict the person's reaction while applying one or another strategy. (Kurtz et al, 2015, p.120)

Self-awareness and self-control

The psychological studies are analysing the interaction with the environment - here also the waste - as being a part of the behaviour. We believe that the sorting practice represents a routinized behaviour. In the psychological studies, routinized activities are creating a specific type of behaviour referred to as habitual behaviour (persistent behaviour). A persistent (habitual) behaviour is automatic and reoccur as a response to a specific context where the behaviour is taking place multiple times before. Thereby, when a person will be situated in a specific context, the habitual behaviour will unfold automatically and with a minimal cognitive effort. (Kurtz et al, 2015, p. 114)

In relation to sorting, it is important to identify if behaviour is habitual or not. In the case of having a habitual behaviour, the person is performing automatically and has almost no control. Here we find it relevant to bring in the concepts *Awareness* and *self-control* that are another important point when changing a person's behaviour. Due to the fact that sorting most likely happens in the same environment, possibly in the kitchen, this behaviour can become unconscious and less controlled. (Kurtz et al., 2015, p. 120)

Consumption and sustainable practices

We perceive the self-control and self-awareness in relation with another topic, the consumption due to the discussions regarding overconsumption of resources (Shove & Spurling, 2013).

Several authors who represent practice theory (e.g., Hargreaves 2011; Shove & Spurling, 2013, Warde, 2005) look to consumption as a complex practice and is incorporated in most of the practices. Shove and Spurling (2011), as well as Hargreaves (2011) reflect on the possibility of changing consumption, impacting future practices in more sustainable way, and thereby also reducing the risk of climate change like greenhouse emissions. Additionally, as the demand for resources is exceeding the accessible ones, it is necessary to have more sustainable consumption practices. Further, Shove and Spurling (2013, p.1) point out that consumption can refer in buying objects, but also using electricity, eating, heating, showering, etc. we see that waste production is clearly related with society's consumption practices.

It is important to enhance the question regarding embeddedness of people's resource, demanding lifestyle, and expectation of 'normal' lifestyle which for example can be utilization of cars or the living space square metres, and ask what should be done to change these actions. The understanding of what counts as normal social practice should be reshaped. (Shove & Spurling, 2013, pp. 1-2)

Before framing out the other concepts we use, we find it necessary to define what sustainability is in this case. Sustainability is a rather broad concept and can be viewed differently. One perception could be the reduction of the consumption of resources in regards to future generations; however, even if different authors in academia agree that the goal is to reach sustainability, there is no single way of how to reach sustainable goals and more sustainable societies. (Shove & Spurling 2013, p2) In this thesis, we have chosen to perceive sustainability similar as to how Shove and Spurling perceive it that life quality for future generations shall not be decreased due to the current generation's lifestyle.

Agency

The description of the elements is to leave the impression that individuals are just carriers of a practice instead of being actively involved in the practice. The role of carriers provides little space for agency, and mostly place individuals as a passive and without dynamic, normative or evaluative relation to the practice. In this case, the posture of being a "spectateur" (as appears in Sayer) who allows a third person to be considered accountable of how the practice is constructed and developed. (Sayer in Shove and Spurling, 2013, pp. 170) We found that the carrier's perception, regarding

their own agency, interesting in terms of who is responsible and how much agency they perceive to have when establishing recycling practice which will be further looked into in the analysis.

Disposal of waste and dirt

Regarding the academic approach to waste, we have to mention that the discard studies, which is stated by them is "*an emerging interdisciplinary sub-field that takes waste and wasting, broadly defined, as its topic of study. We use the "discard studies" instead of "waste studies" to ensure that the categories of what is systematically left out, devalued, left behind, and externalized are left open*". (Discard Studies, unknown) Here we take a critical standpoint with ourselves in discovering that these studies are included rather late as to bringing in a more explicit way of dealing with our research. , However, we have taken the idea that waste is being 'left out' as inspiration for our thesis. To reach this standpoint Mary Douglas and Joshua Reno are applied in order to perceive the waste further.

According to Reno, Douglas with her definition of 'dirt' shaped largely the way how anthropologists research the field of waste. She understands dirt "*as something that challenges and reaffirms a given cultural system*". (Reno, 2015, p. 558) Further, Douglas writes that "*dirt is essentially disorder*" and it "*exists in the eye of the beholder*". Here taking into account that the actor does not see the elimination of dirt as a negative action but as a positive - it is the ordering of the environment around her/him according to her/his perception. (Douglas, 2015, p. 1-2)

However, Reno has a critical approach to waste which we agree upon, and that this structural-symbolic approach has some gaps in the waste researches. Additionally, the focus should apply to the afterlife of waste - what happens after disposal and what the impacts to socio-technical world are. Reno uses the words 'humans and nonhumans'; however, we have chosen to look wider from the socio-technical world perspective where different actors are included instead of only human-nonhuman. (Reno, 2015, p.558)

Reno emphasizes that waste has to be observed in the context - waste in not something general but instead something particular; questions as "what", "why", "when", and "how is it disposed" should be researched. (Reno, 2015, p.559)

Analysis

To answer our research questions we split up analysis in several parts:

- We look closer to the main material - waste and organic waste - and analyse what waste means for the informants and what the associations are to it.

- We outline the different actors involved in the field as they shape the practice and to see the complexity of the recycling practice. Here we also look closer to the citizens' perception of involved actors in the recycling practice based on their drawings.

- Further, we frame out the complexity of the recycling practice where different technologies are involved. We focus on the technologies in the field by explaining the technological methods we observed in our fieldwork, what happens around the technologies, what are the advantages, disadvantages, and possible challenges. As well as, we draw out how informants perceive each of the 3 main technologies mentioned above. Under each of the technologies we also look closer to the elements of practices that relate to the specific technology.

- After the description of the practices and their elements, we conclude our analysis by outlining how sustainability, climate change, and environment are perceived. As we aim to change the recycling practice into a more sustainable way, we find it relevant to frame out the perception of these terms.

The meaning of waste and association to it

What does it mean *waste*, *garbage*, and *organic waste*

As we state in the theory, we look to the language and discourse as routinized way in how meanings have been given. In order to understand our informants' perception of the waste which could give an insight also of why they do as they do, we asked them what does it mean *garbage* for them and their associations with this word - here also the associations with *waste, and organic waste*. Before moving further, we find it relevant to point out that we asked sometimes only about garbage, and other times for both garbage and waste. We did not separate as different questions, but allowed them to talk more freely. However, our own choice of words could have impacted the informants' answers.

For the majority of the citizens, *garbage/waste* means something to *throw out* or something that has been used and it is not possible to use anymore. Additionally, it can also be a by-product and/or a complication to understand where it should be placed.

The majority of associations with *garbage/waste* are either food, specific food products, or the placement of where they are getting rid of it (i.e., bags or wagons). Also plastic was mentioned. One of the citizens associates the waste with anything with a long disintegration time, while two other mention recycling of different fractions. One of these citizens even use the word *dagrenovation* but in connection with other fractions like plastic, cans, metal, etc.

Organic waste is associated with food waste and residues of food. It was mainly the food items that were expired, food residues, (e.g., egg shells, peels) or food that is not attractive anymore. However, one citizen emphasized not plastic, but only food; while others mentioned food products and separately pizza tray. It shows that in the citizen's mind they separate food from its packaging. We will discuss this topic of food product and food packaging later on in the analysis.

One of the citizens emphasizes that organic waste is not a garbage. The pizza tray is the only product that does not correspond to the description of the organic food according to the municipalities' perspective. Otherwise, we believe that if we only follow the associations, the citizens should not face any problems in understanding and sorting the organic waste (see the case description for definition). Their perception could even be expanded with for example the tea bags and coffee filters.

Regarding the representatives of the companies and municipalities waste means something related to the work, i.e., they right away bring up the discussion about their work issues. For example, Ballerup municipality talks about the citizens and companies and how over time it has changed their perception from "*something to get rid of*" to "*something to reuse*". While at Vestforbrænding, they talk about the sustainability and how the services should be made easier for the citizens. Kara/Noveren is one of the first ones who pointed out that there are two words - a "*bad*" one (garbage) and a "*nice*" one (waste). Waste can be used, while garbage is something to throw out and cannot be used anymore. Also Ballerup municipality tries to call *ordinary residual waste* instead of *refuse collections* (*dagrenovation*). (Appendix, Ballerup municipality; Appendix, Vestforbrænding, Camilla Bjerg Pedersen; Appendix, Kara/Noveren)

If we apply the municipalities' and companies' approach to garbage and waste, we can observe that the majority of the citizens still have similar associations of what the municipalities would rather call garbage than waste. However, there can be noticeable patterns in the understanding of the appearance of the waste. Those citizens who have

this understanding are sorting in an average or at a higher level and mostly are more or less interested in this topic.

The other associations regrading waste - dirt and smell

Referring back to the theory above, if waste is perceived as *dirt*, it can become something related with *disorder* that can be *ordered*, i.e., expelled from the society. We assumed that waste will be associated with something untouchable and the citizens will feel a necessity to wash hands, therefore we asked questions regarding how the citizens interact with *waste/garbage* (in this section further on - waste).

We did observe some interesting patterns - not all citizens are washing hands after being in touch with waste, which is highly related to what they will do right after. Here we have to take into account that the disposal of the waste usually happens in connection with other actions carried out, i.e., going to shop, school, or work. (The topic will be elaborated on later in the analysis) Washing the hands also depends on if the handler of the container is dirty or sticky. In this case, the citizen will only use one finger and wash hands later. One of the informants expressed that she likes cleanness, and thereby her container and bin usually is clean. There were two citizens who paid extra attention to washing their hands; however, one relates it with work where it has become a routine; whereas the other one does it due to microbe organism and the knowledge of how they get into a human body. However, she calls it "*deformation*". Both answers can point out to the social norms/understandings regarding washing hands as they both felt a necessity to explain why they have this habit. We believe that washing hands and perceiving the waste as dirty can be related only in some situations and it is not a common practice.

Besides washing hands, the interviews brought up some other perceptions of dirt and waste. The understanding of disorder depends on each person. For example, one of the citizen points to her boyfriend who returned home and did not pay attention to the waste lying in the backyard because of animals. The boyfriend only perceives the waste as '*that's a little trash*'. (Appendix, Ida and Martin) The majority of the citizens also prefer that their surrounding is clean.

During one of the interviews, the informant pointed out that waste should not be at people's houses. He considers it as it should be somewhere outside.

"*Of course the system of sorting might be smart, but it's not right to have our waste in the house.*" (Appendix, Christian)

Taking into account, that the informant is living in a small studio apartment where the stove and sink are placed rather close by his bed. In our opinion it is debatable of how close a contact people want to have with waste. Similar aspect, i.e., about the distance to waste, it can be observed regarding distance to the landfills, energy towers, and a biogas plant. All the plants we visited were located outside of a living area in a rather open area of fields and no residential houses were nearby.

The smell was mentioned as being one of the reasons of their location which was mentioned during the interviews with Solum, and the recycling centre. On top of that, regulations had been set in Roskilde regarding when Solum can mix the compost, i.e., it should be done according to wind direction. During the visit at Solum, it was mentioned that there had been situations where compost plants had been closed due to the odour. We find it interesting to point out that Solum informs us that they have not received any complaints regarding the organic waste in Holbæk, while the manager of the recycling centre in Roskilde - represented by Kara/Noveren - points out that the smell and complaints in Roskilde comes from Solum but they never have admit it. However, when we left the recycling centre to visit the Energy Tower of Kara/Noveren, the smell seemed to increase too. It seems the smell is something no one wants to be related with. The smell of the waste was also mentioned by the citizens and pointed out as a reason of breaking a habit in throwing out the waste on their way or filling up a trash bag as much they can. The citizen who had the possibility of sorting the organic waste also pointed out the smell as being a reason of not recycling it.

Further, we associate the smell with a similarity of something that is dirty - as something that does not fit in a *nice* environment and should be ordered, i.e. get rid of. Here we look for inspiration from Classen, Howes, and Synnot (1994) who state that smell can be a biological, psychological, and cultural phenomena. For instance, the smell can be an indication to the 'class' and carry values. We could observe that the smell from the waste is something the citizens want to avoid and get rid of. That made us question if the smell - besides the biological reasons - also carries some cultural meaning and therefore could be a reason of dispose the waste. If so, the understanding of how the smell could be reduced might help the citizens to engage more with the waste. (Elaborated later in the analysis of recycling practice)

Actors in the field

During our fieldwork, we observed that there are different actors involved in different levels concerning the recycling practice. Some of them are directly performing the practice (as for example, the citizens and different companies providing recycling), while some are just creating background field (as for example, EU or the Ministry of Environment and Food). To approach the involved actors, we tried to set codes during the coding process to see how the actors of each category are linked to each other. We could observe that citizens are indicating the garbage man or someone who collects will sort the waste and also time by time the municipality could appear - meanwhile there are no direct links to Kara/Noveren or Vestforbrænding. Similar as the descriptions of the drawings (see the perception of each technology), the municipality is the farthest association that can be pointed out by the citizens by calling it precisely. Family, friends, and significant others are the other group which appears for the citizens. There is a third group of actors who are more detached - supermarkets where the end-products could arrive; NGO's, G20, the Ministry of Environment and Food - who are related to the communication and creating awareness.

The municipalities and the incineration companies cover most of the actors that have been mentioned in the codes, however, only the close related actors to the citizens (e.g., significant others) do not appear in the municipality's context. The incineration plants and municipalities have different companies or countries they collaborate with in selling the different fractions to; politicians, the ministries, media, outsource companies for specific tasks (e.g., advertising), house administrations and house owners are also linked with them.

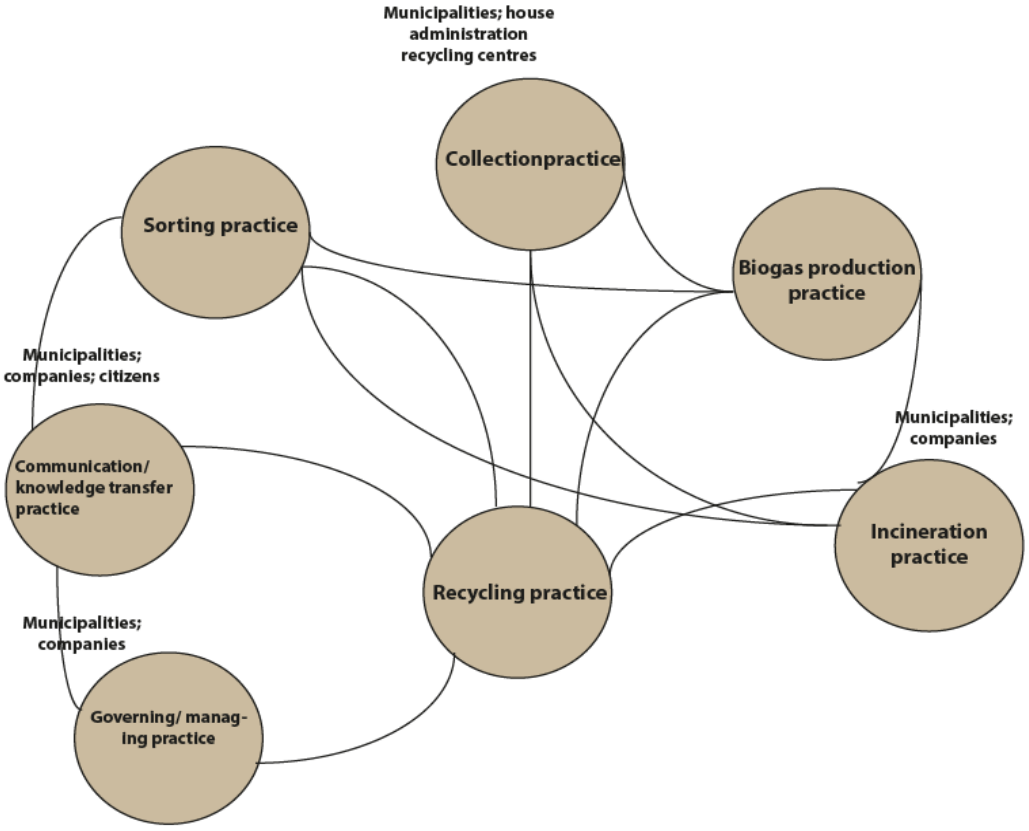
When we look closer to the actors drawn by the citizens, we could observe that only persons with a high sorting performance are including media and some other organizations, which could bring awareness and disseminate information.

The rest of the citizens included someone who would collect the waste - like the garbage man or the municipality. One of the citizens did not know what happen after the contact with garbage man. Additionally, three of the citizens also included supermarket or some factory before drawing themselves. As techno-anthropologists, we find it interesting

that one person actually mentioned machines as an actor involved in the process of sorting, while all the other persons mainly focused only on the human beings.

The recycling practice and its complexity

When we entered in the field, we could see that the practices regarding biogas production, incineration, and recycling are complex, and co-dependent elements which are overlapping each other in different practices, and on top of that, the same element can both be a material and a competence at the same time. For instance, we observed that the recycling practice is composed and co-dependent with other practices carried out by different actors in different contexts, where for instance the recycling practice is not the same for the citizens as for the municipality.



Recycling practice regarding organic waste

Here we want to mention as the recycling practice is complex and we could observe that citizens have vague understanding of the whole recycling process (see below in perception of recycling process) and involved actors, the recycling practice will be narrowed down to the sorting practice when we will approach it from the citizen's perspective.

Additionally, it should be pointed out that initially we made our analysis based on the practices around the 3 technologies - biogas production, the incineration, and the recycling practice. However, we faced a challenge to understand what exactly the biogas and the incineration practices entail and if we can from our data describe them. For example, the biogas plant is a technology which by itself already includes several practices and based on only one visit it would be difficult to analyse these practices.

In general, we approached our analysis of practices by describing the elements of the practice and the mentioned challenges, meanwhile the recycling practice was pointing towards the biogas production and incineration. As the improvement of biogas production or incineration technology as such were not our main goal, we chose to focus more on describing the elements of these practices based on informants understanding of the incineration and biogas production. In other words, the elements of the biogas production and the elements of incineration are purely driven by the data - we set the according code of the information and practices are related to the biogas production or incineration and further created story around these codes. Meanwhile, we are aware that if we would focus more on the technology processes, these two practices would be better elaborated. However, we believe that the description of these two elements still can give an insight of improving the recycling practice.

Biogas production

Technology Method

The process of reproducing the organic waste into biogas has been researched at the company Aikan A/S/Solum, located in Holbæk, who has patented the Aikan technology in the name of BioVækst.

The Aikan technology has 3 processes; hydrolysis, methane production, and composting. (Aikan A/S, unknown) The process will take place for about 5 weeks; one week in hydrolysis, and 3-4 weeks for methane production and composting. (Appendix, Hinrich W. Uellendahl)

Picture 1 shows the process at Solum

Before the Hydrolysis can start, the organic waste has been separated from other waste objects like metal, glass, plastic, and taken out of the plastic bag by compressing the waste through the processor. See picture 1.

The pre-treatment is also breaking down the waste so the organic waste is coming out in the middle of the processor and the rest of the waste comes out in the end of the processor. Morten Brøgger Kristensen describes with hand gestures how the processor is designed with small holes inside and is squeezing out the food and makes sure that glass and plastic are not being squeezed as well in order to prevent crushing it into too small pieces, which will destroy the composting process.

The squeezed out waste goes to incineration afterwards which either is to Vestforbrænding or Kara/Noveren. (Appendix, Solum) Hydrolysis is the process where the organic waste is being stored in the processing modules under aerobic conditions and is being spread out in the storage and sprayed with water. See picture 2.

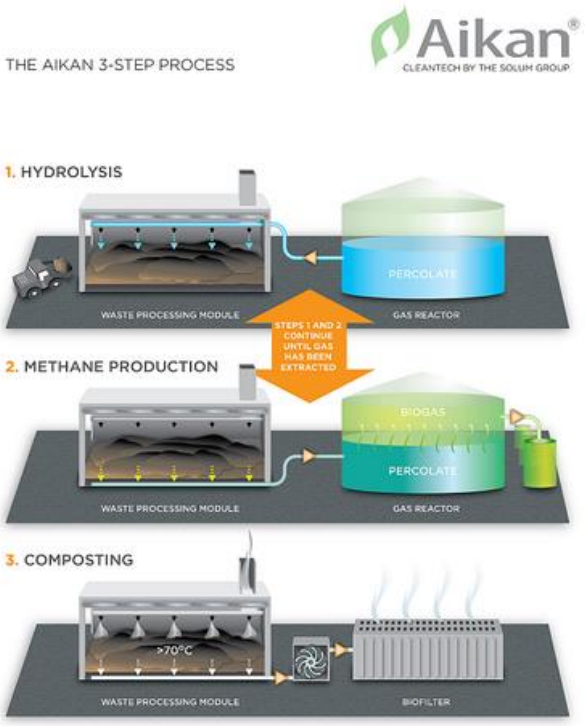
Picture 2 - the compost in the waste processing module at Solum

It is important to notice that the water sprayed to the organic waste has been stored in the reactor tanks and is being pumped into the processing modules, which is illustrated in the picture 3. (Aikan, (webpage), unknown)

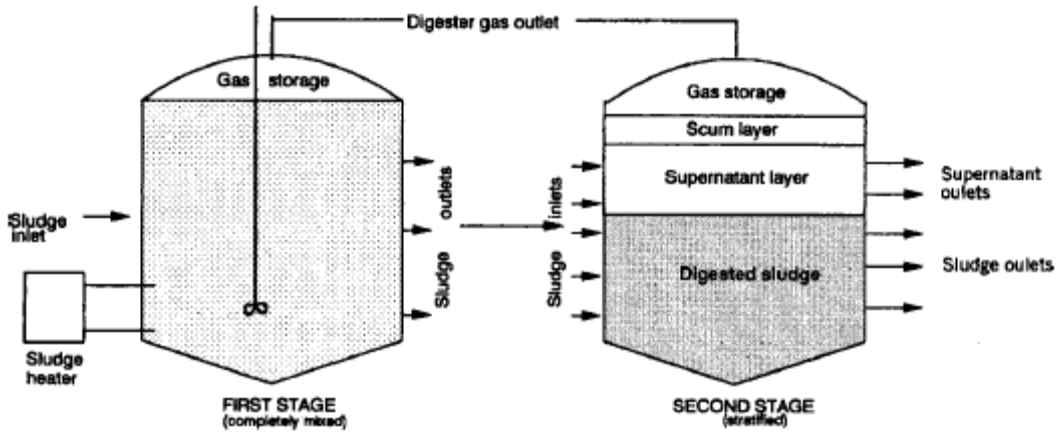
The water contains bacteria that will end up in the bottom of the processing module which is installed with a separation system that separated the wet and dry fractions (Aikan, unknown - hydrolysis - webpage) (Aikan presentation, 2016, slide 7) This process takes about 1 week where the water is being pumped back and forth between

the tank reactor and processing module. (Appendix, Hinrich Uellendahl - meeting) The water is not suitable for consumption, as it contains various microorganisms, mostly bacteria, which will break down the complexity of the organic molecules like protein, cellulose, lignin and lipids in the anaerobic conditions in the reactor tank into soluble monomers molecules like amino acids, glucose, fatty acid and glycerol. (Bitton, 2005, p 350)

The second process, the methane production, is taking place in the reactor tank which is where the anaerobic digestion is taking place. Inside of the reactor tank several layers are forming where in



Picture 3 ± illustration of the Aikan technology (Aikan, unknown (webpage)



Picture 4 ± drawing of the inside of the reactor tank and shows the layers (Bitton, 2005, p: 348)

the bottom the sludge consisting of waste and water are floating and stratifying layers as shown in picture 4. (Bitton, 2005, p. 348-349)

As illustrated in picture 4 – the layers in the reactor tank is showing how the microorganisms are acting in the anaerobic condition. The reaction taking place in the reactor tank is:

$$\text{Organic matter} \rightarrow CH_4 + CO_2 + H_2 + NH_3 + H_2S$$

The reaction results into the CH_4 which is the methane. During the tour of Solum Morten Brøgger Kristensen elaborated that Solum is not producing methane and electricity which is being sold. Further, he mentions that the methane is about to be implemented as fuel for the garbage trucks the municipalities have invested in. However, Solum also has a plan b to sell the biogas to Naturgas. (Appendix, Solum)

The final process, composting, is taking place in the waste processing module where a forced ventilation will start in order to initiate an effective composting process. At this point the compost has a temperature of 70°C. (Aikan, unknown (webpage))

Picture 5± photo of the rough compost at Solum

Further, the composting is being stored outside like in the picture 5 and will be sorted by a drum sieve with holes with a size of 10-15 millimetres. The drum sieve separates the compost into 2 types of compost. One is the fine compost used as fertilizer by the farmers. The other is considered as rough compost where pieces of plastic and other unneeded waste are still a part of the compost. The rough compost is being reused as structure on the floor of the process module after it has been through an air classifier to remove the last pieces of plastic.

For the process of screening the compost into either the fine or rough compost, the compost has to be dry and is stored outside for 1-3 months depending on how often the farmers are collecting the fertilizer from Solum. (Appendix, Solum) (Appendix, mail from Morten Brøgger Kristensen)

Solum is continuously working on improving the technology and expansion of the plant and have for now implemented a new pump system. On top of that, the chemical process is also being improved continually where they measure the pH level and the potential of the methane and further redesign the plant and methods of processing the organic waste into methane.

The perception of the technology

In order to answer our research questions we look closer to the perception of the technology by the informants.

The perception of the production of biogas is viewed quite interesting by Vestforbrænding:

- *"Are you paying for the organic food waste?*

  We pay, but the municipalities decided that we should have some money here for that. But right now it's the same price as burning it." (Appendix, Vestforbrænding, Camilla Bjerg Pedersen)

As Vestforbrænding believes that their incineration is just as good as biogas production in terms of the expenses and outcome of the processes, it will assumable end up sorting the organic waste and not have a greater purpose if it just ends up in the incineration. By perceiving the incineration and biogas product from the perspective of financially and end product as quite similar outcomes, it might create issues in the future in persuading the citizens to sort if there is no final difference of it either being burned or processed into methane.

The citizen's understanding of biogas and its production is limitedly showed from the interviews which are debatable of whether or not an advantage or disadvantage in terms of implementing the practice of sorting the organic waste as they are not aware of the purpose and what will happen to the waste after the garbage men have collected it.

- *"Where have you heard about biogas?"*

  "At the gas station, with the green sign that's biogas. It's gas made by organic things. Separate things and from recycling, that's the far ahead I can tell, but I haven't looked much into it." (Appendix, Ida and Martin)

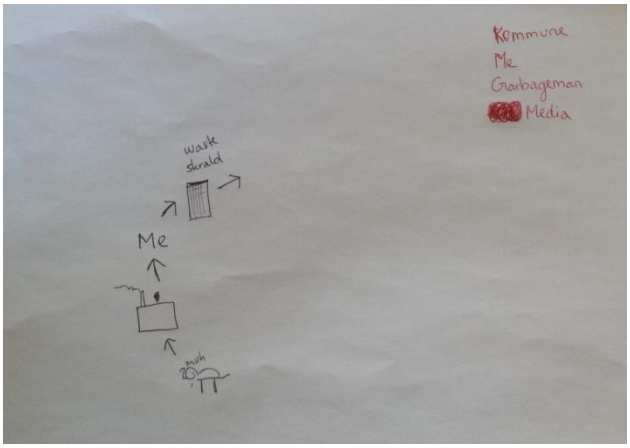
  "*I've heard, but I cannot remember seriously. Bio it's biologically, maybe from waste*." (Appendix, Kacper)

  "*I've heard about that but not an interest for me.*" (Appendix, Søren)

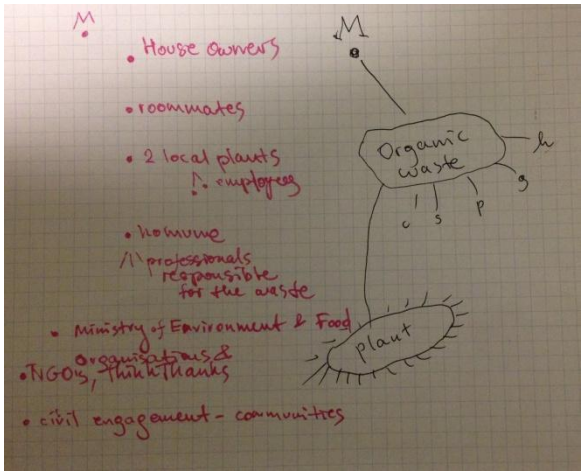
  "I've heard about it but don't have knowledge about. I know that it's made by the waste of animals." (Appendix, Zahid)

Additionally, the informants were requested to make a drawing of how they perceive the biogas production. The drawings were made in the end of the interviews and it shall be mentioned that during the interview they had been lightly informed about how the

biogas is being produced and its purpose. The information was provided due to questions and the context of the interview and there is awareness about that situation.
It must be enhanced that none of the interviewed citizens understood the production of biogas, and that the drawings of the technology were very simple, and the citizens used various words to describe their technological understanding as the biogas would be "*squeeze it out*", "*do something*", "*burn it*", and "*goes into the bottle*". (Appendix, Ida and Martin) (Appendix, Zahid) (Appendix, Christian)
An interesting aspect was that 2 of the citizens, who neither have a strong meaning nor a high level of performance in sorting the waste, did not include the technology in their drawings and have an unclosed circle and short description of what happens to the waste. The 2 citizens had mainly focused on the waste and themselves. See picture 6 and 7.



Picture 6 ±/LOOLDQ¶V GUDZLQJ



Picture 7 ±0LUMD¶V GUDZLQJ

On the other hand, there is a citizen who has the option of sorting the organic waste and has more detailed drawings of how to process the organic waste into biogas, but he does not perform the sorting. Also another one who had more elaborated drawings, though, unfortunately has a weak performance regarding sorting the waste in general, and they both believe that the waste will be sorted after the garbage men have collect it and be turned into the biogas.

- "*But if they bring you a container for organic waste, what is going to happen?*

I can use that one, the commune gave me some container, commune take it to some plan where they can separate which is going to biogas and then they give it to biogas where they make it." (Appendix, Zahid)

Therefore we can see that awareness about the technology not always provide good sorting skills.

The field around the biogas production practice

The field around the biogas production is rather complex, which creates the constant changes of the practice. The technology is still developing, i.e., the practice is all the time being re-shaped. We visited the biogas plant that provides energy for the plant itself and the administration building, but it is not distributed further yet. They are constantly working on how to improve the plant (make roofs or implement new doors), biogas production (increase quantity), and the infrastructure around it. In addition to the EU demands, according to the interviews the government is funding the biogas production, i.e., there is a will to produce the biogas even if it is not profitable. On top of that, there is a new waste plan for the municipalities.

Elements related to the biogas production practice

Material

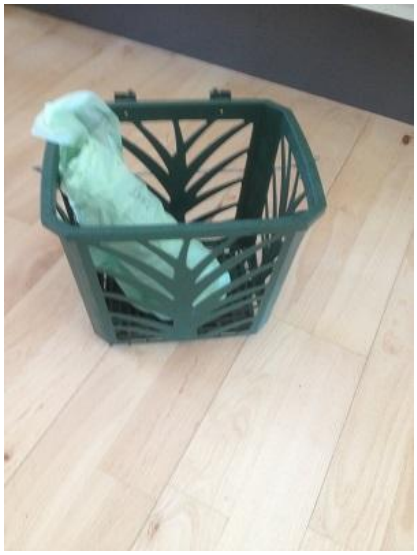
The organic waste represents one of the materials in this specific practice. It becomes as one of the main material for the biogas plants, as it is its main resource. The citizens are an important part of this practice as they are interacting directly with this material. Some of the citizens have the perception of not producing much organic waste, and as one of them pointed out that he does not consider sorting this type of waste reasonable.

The next step was to figure out where the informant would supposable throw out the organic waste. The trash bins and bags are an important part of the practice, because in a specific case, the bag considered as a material can improve a competence and give a reason to sort - further on through the analysis, the trash bins are the ones placed indoor while the container is placed outside. Additionally, the companies and municipalities are trying to transmit the message to the citizens about the importance of

separating the organic waste from the other fraction specifically plastic by providing them with a special plastic bag and trash bin. The municipalities and Solum mentioned:

"'*cause it's easier to understand for them [citizens], that you cannot put plastic into bio-degradable bags*" (Appendix, Solum)

The implementation of the degradable bags was seen as an improvement in the process of the biogas production due to the fact that the plant will easier deal with the impurity and the decrease of the amount of plastic in the fertilizer. The design of trash bins is another material the municipalities and Vestforbrænding are focusing on. Vestforbrænding has two different sized trash bins only for organic waste, and Rødovre has already giving their citizens a bin for organic waste.



Picture 9 - the bin in Rødovre (green)

Picture 8 - the bin and Vestforbrænding (brown)

However, even if the material is designed to help establishing the practice, citizens might see this material as being inappropriate. The citizen living in Rødovre stated that the bin was too big in contrast to the amount of organic waste he believes to produce. Though, he has not used the bin or measured his organic waste amount. He assumed that it would take too long time to fill it up, and it would start to smell.

The biogas plant itself is considered as a material as they are the ones that are providing the technology and location for this process. The end product of the biogas production is considered as another material which we will look into. The majority of the citizens are perceiving the end product of the biogas production as being the biogas which can be used in producing electricity, heat, or used for cars. However, as written above, the end

product is not reaching the citizens, which might result in the material will be interpreted as missing.

As presented in the technological description, besides the biogas there is another end product which is fertilizer and it is given away for free. Here we believe that the end product could be used as a reason of establishing a practice. The benefit from the processed organic waste into biogas will help citizens to understand that the outcome of their practice will return to them in one way or another in terms of the heat, electricity, cars running on methane and contributing to an improved environmental condition, etc.

Competence

Solum mentioned that the presence of the non-organic waste (impurities) in the organic waste is not a big problem; however, they notice irregularities and points out that the sorting performed by the citizens has room for improvements. At Solum, they have a machine that screens out the impurities, but even so, there is a risk of small items like a fondue fork could end up in the fertilizer and further end up on the farms. The impurity consisting of plastic and other unneeded waste items are sent to the incineration, however:

"*Of course, it benefits also for the incinerator, because it makes heat. But it costs."* (Appendix, Solum)

The municipalities and Vestforbrænding are aware of this lack of competence. They mention that with "*a help from outside*" that they are organizing meetings where they discuss the process, technicalities, and what needs improvements for the citizens. Both biogas plant and incineration plants organize tours for people informing them about the technical processes in order to help them improving the competence. In this sense, there are also educative materials made in collaboration between Vestforbrænding, the municipalities, and other companies possessing the knowledge and skills in designing advertisements. The expectation is that knowledge given through these materials will constitute a basis of developing the skills to sort. However, during our meeting with Rødovre municipality, we were presented with a picture designed with an educative purpose showing an eaten apple as a light bulb. This can just as easily serve as a meaning for establishing the practice. These kinds of examples and stories are often mentioned by Vestforbrænding and the municipalities as being a key to combat the

negative previous experience the citizens might have. The "bad stories" that they were referring to were the actual cases in Aarhus and Helsingør that we introduced earlier. These bad stories are affecting the competence. The citizens might decide not to sort even though they may still have the competences. Some citizens might have a relaxed attitude about how thoroughly they have to sort because "*since it gets incinerated with the regular trash anyway*" (from Facebook interaction with citizens), and there will be a need of a strong link between the competence and meaning for them to re-start this practice.

Meaning

The citizens can have multiple reasons of starting to perform a practice or not to do it at all. As example, there are various attitudes towards the biogas production which might affect the strength of this element. The majority of our informants were directly asked about their opinion on producing biogas from organic waste and they were positive and saying that it is a good decision. The possibility of producing the electricity from organic waste was an exciting idea where one informant saw the biogas as another energy source besides wind power and solar panels.

Further, we questioned the informants if the end product returns to them might improve the meaning. Some of our informants did not need something in return for sorting properly even if they mentioned that *"it would be nice if they will pay my bills"*. (Appendix, Lillian)

Another citizen mentioned regarding this matter:

"I think if they will make a big advertisement that "if you do your trash like this you will get more energy for your house" they may think "oh, that looks cheaper, I can save money!" But I think people need the idea of getting something back, else people throw trash like trash." (Appendix, Ida)

However, the house administration, the recycling centre, and few of the citizens are concerned about the tax money supporting this implementation. They are sceptical while talking about biogas, since they do not see any visible benefit of it, and the implementation of a new sorting system could cost more than the final outcome of it.

"If it is just a way to waste money, then I do not see point of it. It is always the matter of is it profitable or it is just waste of our tax money." (Appendix, the manager of the Recycling Centre)

On the other hand, the other end product, the fertilizer, could be a foundation for debating the meaning of the biogas production. For example, we were informed from several informants that this fertilizer could create the problems for milking cows. ARLA is trying to lobby the regulations which would forbid the use of this fertilizer.

Rødovre municipality mention that there are groups of a specific political attitude who wants to save money and refuse to look broader to the waste management. To overcome this obstacle, Rødovre municipality is trying to go beyond the economical implication and look into sustainability and concerns about the global environmental condition as being a reason to implement the practice.

Advantages and disadvantages of technology

One disadvantage with producing the methane is how fragile or delicate the chemical process can become if in the reactor tank there is a too high or just high enough amount of H_2 [hydrogen], the acetate formation will be reduced and the final chemical product will be converted to propionic acid, butyric acid, and ethanol instead of the needed chemical product, methane. (Bitton, 2005, p 350)

Additionally, as more and more waste is being produced, the process of biogas production is made shorter and the technology must be improved to reach full potential of producing biogas; pH level should be monitored better; there are still water that could be saved during the process if the technology is developed; screening process lets some small impurities go through, for example, a metal fondue fork we found.

On the other hand, an advantage of the biogas production is the process of producing compost as a manure product that is rich on phosphor which is needed in the ground and for now it is a cheaper fertilizer for the farmers as it is free for them to take it at Solum. (Appendix, Solum)

Producing biogas from waste is also perceived as more sustainable than incineration or composting. This production type of biogas can decrease biogas production from livestocks, gives energy (what compost does not); and provides a rich fertilizer which

incineration does not provide. Besides, as it will be noticeable later before the incineration produces toxic residue. (The Danish Government, 2013)

Other challenges and improvements

During our fieldwork several challenges regarding producing the biogas appeared which could impact the practice and its future.

One of the most challenging aspects is that the biogas production is more expensive than incinerating the organic waste together with the rest of the waste. This aspect includes several points: a) the price for the waste going to the biogas plant is higher; b) the technology is still developing which will result into an increased investment over time; c) the new infrastructure is necessary to make if the biogas should be distributed through gas pipes to national gas company; d) the technology should be upgraded in order to be able to sell and distribute the biogas; e) the impurities should be screened better to increase the value while at the incineration all the waste is not being screened. Additionally, as mentioned, the plant does not sell the biogas and fertilizer is given away for free. Although, the financial costs of using the specific degradable corn bags is an extra cost for the municipalities and is more related to the sorting practice in the households, this practice impacts the biogas production and the distribution of the bags is only due to the fact of sorting the organic waste.

From a practical perspective, the challenge could be the smell in the area of the biogas plant. The area inside of the plant is also muddy, but it does not impact anyone who is located outside of the plant, while smell can impact the surrounding.

Another aspect regarding the technology and Solum is the negotiation of the collaboration between Solum, Vestforbrænding and Kara/Noveren, which will not continue due to the fact that they have not reach an agreement in terms of making a new contract. (Appendix, Vestforbrænding, Camilla Bjerg Pedersen) Thereby, there is an uncertainty if the organic waste provided by these companies will be processed into biogas in Denmark at all.

It has been decided that Vestforbrænding will stop the collaboration with BioVækst (Solum) 1th January 2017 and it is expected that Kara/Noveren will do the same. The negotiation ended up without a result in March 2016, and Vestforbrænding has chosen

that the treatment and processing of the organic waste will be offered for sale for other companies for an interim period of time of 3 years. The expectation of the technology is to continue with a similar technology as the one BioVækst has because Vestforbrænding believes it is considered safe in contrast to other treatments of the organic waste. Though, it is unclear if within the 3 years-time another technology will be chosen that is as safe as the technology designed by Solum.
Additionally, as the municipalities have chosen to recycle the organic waste, it will be brought to Vestforbrænding and they will have the responsibility in handling the organic waste no matter what plant will be chosen. (Appendix, mail from Camilla Bjerg Pedersen)
On top of that, it seems as Solum is in one way or the other also depending on the incineration provided by Vestforbrænding or Kara/Noveren as Solum only use the food waste. The impurities are being incinerated at Vestforbrænding or Kara/Noveren. (Appendix, Solum)

To conclude, we want to point out that the incineration was established in Denmark in the beginning of 20th century, while the biogas production is a rather recent technology. The technology of the incineration is developed and the practice to incinerate the waste is well established.

"But right now it's the same price as burning it. In Denmark we have such good incineration plants that to make it to bio or to put it here and make energy is almost the same." (Appendix, Vestforbrænding)

At the current moment, the biogas production works as it has financial and regulative support from the government which entail its development, but to establish a stable practice will demand more time. For now, we consider that there are missing some elements, for example, in materials (e.g., right size bags at homes of citizens, not-accessible end product for the citizens) and meaning (e.g., not profitable enough); and the technology is still developing, which highly impacts the meaning as an element. We believe that there is a possibility that the elements exist, although, the links have not been connected, but our data do not show it.

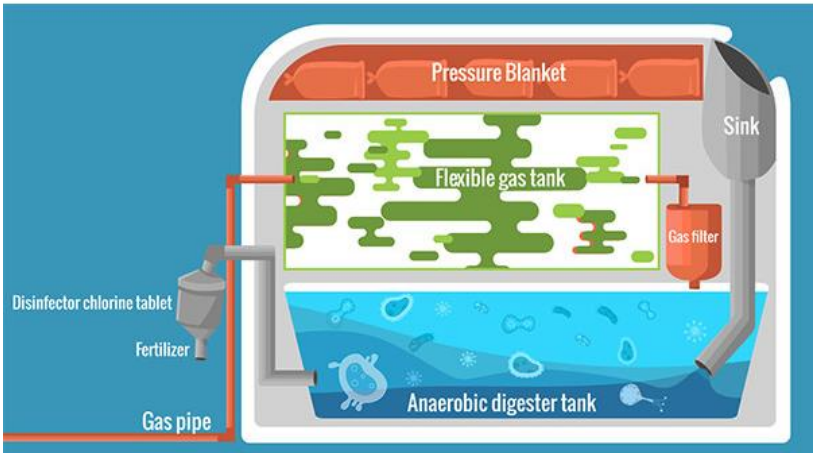
Alternative technology for the biogas production

Picture 10 - Illustration of the HomeBiogas (Indiegogo, 2016)

Regarding the biogas production there are alternatives on the market, where one of them is called HomeBiogas that reprocesses the organic waste and animal manure into gas for the stove and fertilizer – see picture 10.

The HomeBiogas can process dairy, meat, food scraps, and litter from animals. It is described as being easy for 2 persons to build, though, needs a licensed gas technician to attach the HomeBiogas to the stove, and shall be placed outside of the house and close to the kitchen. (Indiegogo, 2016)

It is designed quite similar as the process at Solum where the organic waste is in the bottom and creates the anaerobic digester tank and just above the flexible gas tank is placed with pressure blankets in the top. The fertilizer comes out in the same end of the HomeBiogas as the gas to the stove. See picture 11. (Indiegogo, 2016) The amount of gas produced is estimated as from 1 litre of organic waste 200 litres of gas is produced which is gas for one hour.



Picture 11 - illustration of the HomeBiogas functionality (Indiegogo, 2016)

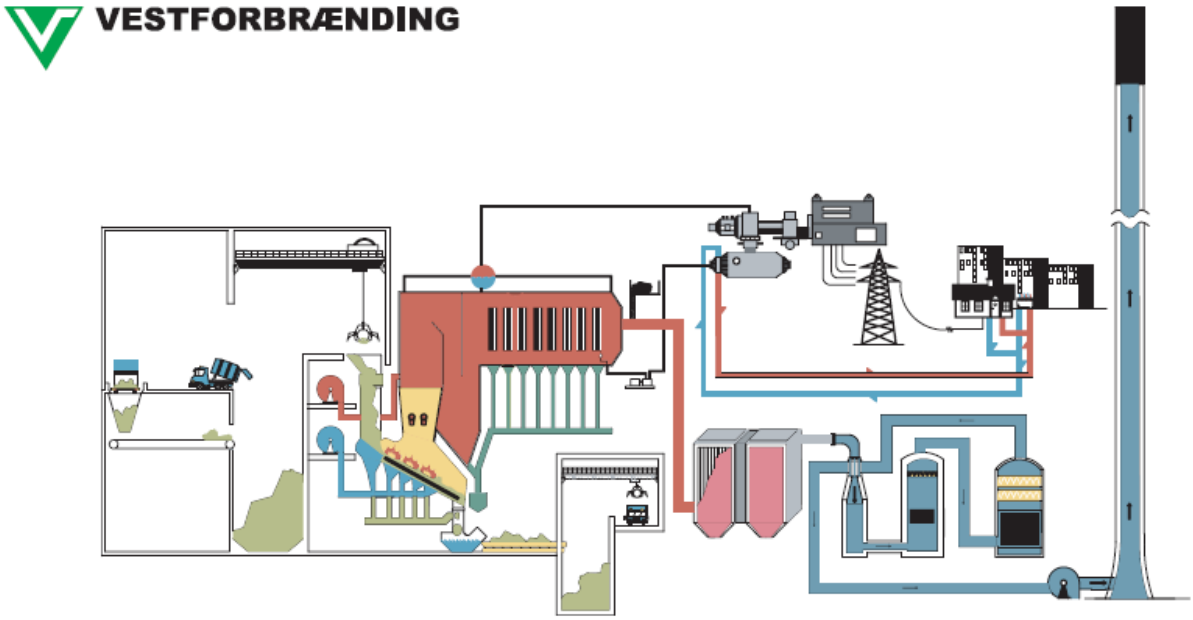
One disadvantage might be the amount of water the HomeBiogas needs which is 650 litres always in the bottom of the anaerobic digester tank and for every litre of organic waste added it needs 1 litre of water too. Further, the HomeBiogas also needs animal manure mainly from a cow, but can be replaced with biogas bacteria to start the process. (Indiegogo, 2016)

The HomeBiogas is mainly designed for private households and to implement this it demands that the stove is running on gas and not electricity. If this HomeBiogas was implemented on Sjælland the outcome of it would be that the work of Solum and municipality would be decreased. However, this alternative is mainly designed for houses and thereby the apartments would still need the service of municipality and Solum, though, to calculate the recycling percentage of organic waste and reaching the EU requirements would be a challenge.

Incineration

Technology Method

At Vestforbrænding, they incinerate the waste which has not been sorted into organic waste and thereby is a mixture of waste. However, the incineration process taking place in the furnace is in the need of some wetness from the waste that typically will come from the organic waste. On top of that, the furnace needs about 20 litres of water for every ton of waste it incinerate. (Appendix, Vestforbrænding, Mads Kring) (Grønt Regnskab, 2014, p. 10) The following figure is illustrating where the various processes are taking place - Figure 12. (Vestforbrænding, 2014)



Picture 12 ± picture of Vestforbrænding from the side illustrating the furnace (Vestforbrænding, unknown)

The garbage trucks bring in the unsorted waste and off load it into the input holes at Vestforbrænding. The unsorted waste will be plugged into the furnace by 3

automatically cranes and burned. (Vestforbrænding, unknown, plate 001) Vestforbrænding has 2 furnaces which can burn 37 tonnes of waste per hour each. (Appendix, Vestforbrænding, Mads Kring) The furnace has an optimal temperature of 1050°C and has to be kept higher than 850°C to reduce the risk of dioxin. The waste is burned and moved through the furnace on several grates designed with water- and air-cooled grate blocks – see picture 13.

Picture 13 – picture taking during the tour of Vestforbrænding of the grant blocks

The waste is being burned for about 4 to 6 hour.

During the process of the furnace, the waste also produces burnt waste, called slag, which is going through the grant blocks and down into a slag silo. The slag is being loaded onto a truck which transports it to a special plant to mature. The slag makes up about 20% of the amount of the waste in the furnace and contains a number of pollution components. During the maturing process, the pollution components will bind to the slag and will be used for road construction as replacement of sand and gravel when constructing roads. See picture 14 (Vestforbrænding, unknown, plate 005) (Appendix, Vestforbrænding, Mads Kring)

Picture 14 – picture taken at the lab at Vestforbrænding that illustrates the ise of slag for road constructions

The furnace is designed with water pipes placed along the ceiling and walls of the furnace to transmit the thermal energy to the water pipes, which heats up the water and changes it to steam. (Vestforbrænding, unknown, plate 002) When the furnace burns the waste, there is another system attached to the furnace, called the boiler which is located on figure 2 as the red block. The boiler is designed as a system to extract the energy from the flue gas to produce the steam at the temperature of 380°C and cool down the flue gas from 1050°C to 170°C. During the process in the boiler, there are 2 kinds of ashes; boiler ash and flue ash. Boiler ash is a part of the flue gas and settles on the pipes in the system and is being removed by “pneumatic hammers” so it will be collected in the ash silo. (Vestforbrænding, unknown, plate 003) The rest of the flue gas is continuing to a filter where the fly ash and dioxide are being removed and the

flue gas will be cleaned. The fly ash is being removed as it contains heavy metals. (Vestforbrænding, unknown, plate 003) Under the boiler, there is another system which collects the boiler ash and transports it through the pipes to the fly ash silo – in figure 2 it is the green vertical pipes drawn under the red boiler. In the silo the ash will be mixed with the slurry from the wastewater and stored as dangerous waste as it has a high concentration of heavy metals like lead. There is produced
about 26 kg of flue gas per ton of waste, which has an amount of lead of 15 g per kg. (Vestforbrænding, unknown, plate 004)

The heated steam from the boiler is being used for the turbine to transfer the kinetic energy to the generator. The generator provides with the electricity for the electricity network by the transformer.

The steam from the boiler still has the temperature of 380°C and at a pressure of 53 Pa, the steam is being sent further to the district heating production where the rest of the energy is being utilized before the condensed steam is moved further on to feed water tank. (Vestforbrænding, unknown, plate 006) The steam from the turbine will be condensed to water again in the condensers in order for the remaining energy to be utilized for the production of the district heating system. The district heating is being transmitted into Vestforbrænding's own district heating system providing heat for citizens of Ballerup and Herlev. If there is a surplus of district heating it will be sold to other district heat distributing companies like VEKS and CTR. (Vestforbrænding, unknown, plate 007)

In Roskilde Kara/Noveren has a waste-to-energy plant which has 2 processes. The first implemented process, called Line 5, has a capacity of 20 tonnes per hour and is combining heat and power to treat the waste. The second process is the Energy tower which has a capacity of 25 tonnes per hours. See picture 15 and 16 (Kara/Noveren, 2016, p. 11) Line 5 and the Energy tower treat 350.000

Figure 15 - picture of Energy tower at Kara/Noveren, illustrating the entire furnace

tonnes of waste annually. The Line 5 and energy tower are producing district heating and electricity which are also designed with the similar processes as at Vestforbrænding with;

- Grate blocks to move the burned waste
- A boiler where the water is transformed into steam
- A flue gas cleaning part
- A turbine to produce electricity and district heating. (Kara/Noveren, unknown [webpage])

Picture 16 - inside of the Kara/Noveren's furnace

The process with cleaning the flue gas is explained by the illustration at the energy tower as taking place in the big scrubber tower where the flue gas is decreasing in temperature to 60° with the use of water in a quench. The flue gas is moved further to the first scrubber tower to separate the chlorine with the use of water from the flue gas, and in the second scrubber tower to separate sulphur from the flue gas with the utilization of limestone. To achieve the optimised amount of energy resource, a condensation of the flue gas is installed and with the help of cold district heating water gaining the last amount of energy from the flue gas. The ultimo scrubbing stage of the process is to remove the fine dust of the flue gas. Throughout this process, the flue gas is being sucked through by a vacuum fan which is installed close by the chimney. See picture 17.

Picture 17 – picture taken of the description of how the flue gas is being cleaned at Kara/Noveren

The perception of the technology

As we did not ask the citizens directly about incineration as a technology, it is difficult to frame out their perception. However, it is clear that none of the citizens mention incineration unless it has been brought up by ourselves. However, some of the citizens mention that "*burning*" is related to the waste cycle.

The field around the incineration practice

The technology is developed then also the practice of incineration is more stable. Of course, there are some technological improvements, but those are more related to building new plants, expansion, and optimizing old ones. Recently, the newest change in the field is the new top-down approach entailing that waste should be recycled rather than incinerated, which we believe will create shifts, however, not in the nearest future. As previously written, the plants are owned by municipalities which impact their work from the political perspective. Additionally, the politicians also impact the technology and financial costs by implementing new regulations, for instance in 1970's when Vestforbrænding were building the tower they did not clean the smoke to decrease the amount of acid, due to the fact that the politicians considered it too expensive. Later in the 1990's, the perception of the environment and pollution changed, and the politicians demanded that the tower had an implemented cleansing system which is the same system already accessible in the 1970's. The practice is also overlapping with electricity and energy distributing process in general - i.e., how and who sells the first; where energy is distributed, etc. We did not go deeper in this topic, but there seems to be a complex economical system involved regarding who is buying from whom and which way; who owns which company, etc.

When looking to Vestforbrænding, the incineration practice is closely overlapping with providing the service to municipalities and citizens, and the recycling process in general. Also the biogas production is partly overlapping with incineration - as we have already mentioned, impurities in the biogas production is incinerated.

The elements related to the incineration practice

Material

As mentioned in description of the technology, all the domestic waste goes to incineration. The practice of incineration is based on this material. The waste that reaches the incineration plant is anonymous since it is placed in one enormous input hole where it is continuously mixed and moved further into the furnace. Additionally, the organic waste was mentioned by one of the incineration plants as being "*good to burn*" but only together with other fractions. The reasons behind this statement are presented below, so we are analysing the organic waste as another type of material for incineration. Currently, the citizens who are not sorting the organic waste, are placing it together with domestic waste which goes to be incinerated afterwards.

The second material we discovered in this practice is the trash bin and containers. The trash bins and the bag are often perceived by citizens as one object. All the informants have placed the trash bins under the sink, though, except from one who was not using a typical bin with staples where the plastic bag should be placed (see the photos of the informants in appendixes). The interesting fact we discovered was that the majority of the informants are using the shopping bags instead of special garbage bags - this will be further on elaborated in the recycling practice. However, in the incineration practice, the type of bag is not important. The containers, collecting the thrown away waste from the citizens, are different as well. Three informants mentioned the refuse chutes while others have the common container for domestic waste outside the house.

The domestic waste reaches the plant in different ways: either transported by municipalities who hire private companies from households, or from recycling centres. Here, materials such as trucks, containers, and recycling centre are overlapping with the practice of recycling, which we will elaborate on later.

The incineration plants are the next material that we examined since they ensure the technological support for maintaining the practice as such. The core of the plant is the furnace where the waste is being burned, and this material is directly affected by how well the sorting practice is performed.

Next step was to look at the end product. The outcome of the incineration is power, district heating, and electricity. The end product from incineration is better known by the municipalities and companies, however, the citizens are not aware about this

technology. The context in which the slagge and heavy metal were mentioned by companies allowed us to treat them as end products.

Competence

Both companies - Kara/Noveren and Vestforbrænding - use digital media like website and Facebook to post various information regarding their work.

"It's more like what is going on, why did it smelled today, sometimes they have open house." (Appendix, Kara/Noveren) We believe that in this way of communicating could cover an important age segment of the citizens due to the fact that the young generation prefer this type of media instead of the formal one also mentioned by one of the citizens.

Both companies have facilities for pupils and citizens to learn about waste and a guided tour of the plant. However, the facilities were targeting not just to transmit a certain knowledge regarding incineration as such but also to help improving the sorting practice. Thus, we are developing this topic in the recycling practice. It is of importance to underline here that the improvement of the practice may help maintaining the furnace.

Meaning

Both of the visited incineration plants are treating and perceiving the waste as a resource in the terms of a meaningful material to obtain district heating and energy. However, this approach to the waste is not overlapping with how the citizens are perceiving waste, which we presented before. Vestforbrænding position is to show the citizens that while burning the waste, it does not disappear, it is just becoming less, and slagge is the right example of it. The awareness about this fact should give an insight of the environmental condition and sustainability, as well as taking the control of the consumption practices.

Technological advantages and disadvantages

It is debatable of whether or not the slagge is an advantage or disadvantage as it is being reused to replace sand and gravel when constructing roads which is an advantage as slagge is a stronger material. However, the production of slagge is a big process and

assumable as slagge consists of pollution components it is important the mature process must be performed correctly to prevent the risk of damaging the ground under the roads. Besides, there are fly ashes which are residues and toxic; and together with slagge is one of the end products the plants are paying to get rid of. The slagge is sold to a company owned by Kara/Noveren and Vestforbrænding.

To sort the waste into organic waste and the unsorted waste seems of having various benefits for Vestforbrænding and Kara/Noveren regarding the process of burning the waste. At Vestforbrænding, they need the wet waste for the incineration process because otherwise they may have to add more water in order to burn the waste which assumable will increase the cost.
On the other hand, at Kara/Noveren it was described as the organic waste as not being useful for the incineration as it does not burn well.

"*We think it is at Kara/Noveren because when we put food in this one it doesn't burn that good. So, from our perspective it's best if you make biogas and then you can make electricity and heating from that if you want.* (…) *We can burn it but it doesn't make any sense. And the government wants to use more and recycle more.*" (Appendix, Kara/Noveren, Michelle Diana Hansen)

One of the disadvantages of the incineration process is concerning the sorting process where if there is metal in the waste, the metal will melt due to the heat and block the grates' functionality in blowing up air and water. Mads Kring described that 1.5 year ago they had to close down the furnace to clean the grate blocks by manpower which took about 3 weeks of work and cost about 500.000 DKK for each day. (Appendix, Vestforbrænding, Mads Kring) At both Vestforbrænding and in Roskilde they have had a fire in the input holes, where at Vestforbrænding the gasses had developed and were ignited, and in Roskilde a gas bottle exploded.
Thereby, the maintenance of the incineration is expensive where ¾ of the budget is used for cleaning and maintenance of the furnace. On top of that, to restart the process after being closed is expensive too and time consuming with a starting process of about 60 hours. In these situations, the incineration plants are collaborating with each other to manage the waste.

However, if the new waste plan is fully executed, the costs of maintaining the input holes and furnace might decrease due to that the waste will be sorted correctly and damages like fire and melted metal will not occur that frequently.

Additionally, during the tour of Vestforbrænding Mads Kring explained how the technology of the incineration is working and how useful the energy from the organic waste is from the incineration and not from the biogas production:

> "*You know one of the reason why you do not want to burn the food waste is because it is wet, but actually the incineration plant is build to burn waste which is wet, so if the burning value gets too high if there is not that much water in the waste it will destroy the incineration process so we have to have some water, some wet waste for this kind of incineration plant. It is necessary – it is how it is build, but you need to heat up the water so it will go into steam before you can use the energy in the food waste, but there is still some energy left in an apple or trashed bread or something like that, but we have to get the water into steam before you can use that energy. But actually the energy you use to heat the water into steam we can take it back and how to facilitate to take the water back. This facility which is a condense facility which condense on the smoke, so all the steam and the smoke will condense and will go into water again and then the energy will go back again to the district heating system, so when it goes from steam to water it will go back into the system, so we will take energy that we use make the water from food into steam back again, and that is one of the reasons that it is a nulsum [zero sum] to burn waste over making it into gas and on a biogas facility"* (Appendix, Vestforbrænding, Mads Kring)

Mads Kring explains how the process of burning is a zero sum and thereby cheaper than processing the organic waste into gas as he may say in between the lines that it is too expensive to even have the biogas production as it is not a zero sum production like the one Vestforbrænding has.

Other challenges and improvements

Some of the challenges we found during our fieldwork were related with financial costs. Further, we could see some practical challenges - if the organic waste from the municipality will reduce, the plant must increase the water consumption for the furnace in order to incinerate the domestic waste, i.e. reducing the organic waste will result in a

decrease of wet waste that is needed for the furnace and they will have to buy the wet waste. Meanwhile as mentioned, both plants have different opinions regarding this topic.

Vestforbrænding and Kara/Noveren are constantly working 24 hours, and always 2-3 employees monitoring the processes.

Besides, it is not a common practice, but it can happen that a truck can fell into the input hole while disposing waste. And finally, seagulls are flying inside the waste room and die - anyhow it is not impacting the work of the incinerator, but makes us question the impact on nature - is nature perceived as an equal actor in this practice.

To conclude, we want to state that we could not observe any missing elements or links at this moment. Perhaps, as already written, the waste plan and new top-down approach regarding the recycling could in the future change the perception of waste and impact the practice.

Recycling

Technology Method

As stated before, we look to the process of recycling as a technology. For the recycling process to take place, there are several technical processes required to reproduce the different waste, e.g., biogas production can be one of them. The infrastructure of roads, truck system as well as waste management at each house also is involved in the process. It also demands a cross-border cooperation as a part of the waste is being sent out to other countries. Further, the process of sorting the waste, which already takes place in the kitchen of the citizens or near their trash bin or container at their home, is necessary.

Besides, the process of recycling is consisting of various actors – as administration of the municipalities, haulage constructors, Vestforbrænding, Kara/Noveren, house administrators, the recycling centres, the citizens/end users, and the companies to whom the various waste are being sold to from Vestforbrænding and Kara/Noveren.

To illustrate the process of recycling, we use the perception of recycling at Vestforbrænding as illustrated in the picture below, showing how paper, metal, bulky

waste, glass bottles, and garden waste are being reused into new functionalities or just reproduced again into the same functionality.

Picture 18 ± picture taking of a post at Vestforbrænding illustrating how they perceive the recycling of waste.

However, we have to admit that we faced difficulties now and then to distinguish recycling as process, i.e., technology and recycling as a practice. To ease the process of the analysis, when we talk about the perception of technology among informants, we look to the recycling process as technology; while during the analysis of recycling practice, we see technological solutions, as for example, biogas production as technology.

The perception of the technology

The previous sorting trials seem to play a greater role in the understanding of sorting the organic waste both in the minds of the house administrations, municipalities, the citizens, and Vestforbrænding.

"Food waste? Some places it is used as biogas and that has not been the greatest success in Helsingør among others. They closed it eventually because they had a massive deficit and they did not want to finance it – a big biogas plant was established. I believe it is about 5 years ago." (Appendix, house administration)

Here is referred to the situation in Helsingør and Aarhus where they were sorting the organic waste but the municipalities did not succeeded with the biogas production, and the organic waste was just incinerated with the unsorted waste. The 2 incidents have been mentioned both by house administration, citizens, recycling manager, municipalities, and Vestforbrænding, so in terms of re-implementing the practice of sorting the organic waste might be more challengeable and demand something new from Vestforbrænding, Solum and municipalities in succeeding with the implementation and the new system of sorting. (Appendix, house administration) (Appendix, Vestforbrænding, Camilla Bjerg Pedersen) (Appendix, Kara/Noveren, recycling manager)(Appendix, Rødovre municipality) (Appendix, Ballerup municipality)
Additionally, to reach the 50% of recycling, sorting and recycling the organic waste might stay as a part of the waste management to even reach the 50%.

*"We have the food separation from the beginning because we could see ... the potential of collecting the waste – of course we have had some trials where we have collected food waste to view how big an amount it was out of the gathered amount. Which we could see for us to reach the 50% then we have to add food as a part of it, so that is way it was a part of it from the beginning." (*Appendix, Rødovre municipality)

The drawings of biogas production could tell us also more about the perception of recycling. It is interesting that the citizens with weaker sorting skills expect the sorting of the waste to be handled by the municipality and not by them. This can assumable be questioning how they perceive the service from the municipality and the technical process with the waste they imagine is taking place. If the citizens are not being informed about to sorting and recycle, they may expect that somebody else will take care of it for them. Those citizens had a closed circle of how they perceive the waste being processed and this might also show that they are aware of the technology, though, do not fully understand it.

"*You want to hear my drawing? I got a little crazy here! But I throw my tomato can here and that's food in here, and then is being driven to the dumb yard, and then is separated, and burned and clashed to pieces and then it's boiled together, and squeezed out in this and put in the stations, that fills out the cars but also houses and factories. And we have windmills and all the steam from the windmill is biogas in the air.*" (Appendix, Ida and Martin)

The drawings made by Ballerup, Rødovre and Kara/Noveren focus more on the recycling process where the biogas is only one of outcomes. The drawings show a more centralized placement of the technology in the process of viewing the waste and focus on what happens to the various waste objects like glass, metal, plastic, and organic waste. Though, as they are working with the waste and are managing it, their level of knowledge of waste is of course higher than the citizens. The interesting aspect of the municipalities and Kara/Noveren's drawings and the citizen's drawings are that the citizen's drawings are in some way overlapping into the municipality's drawing with the garbage men, trucks, and incineration/biogas (i.e., some end-product), though, the common understanding is not similar of how the waste is being treated and how the placement of the technology is different.

Assumable, this shows how the perception of waste is viewed from the municipalities, Kara/Noveren, and the citizens differently and of various importance. For the municipality it is the house, the garbage trucks, the technology, and the end-products of recycling the various wastes that are of importance, however, the citizens mainly focus on themselves, the waste, and garbage men collecting the waste.

The field around the recycling practice

As already mentioned, the recycling practice is complex and co-depends on different elements. Each of the actors are enacting with it differently according to their responsibilities. Here we want to enhance it one more time that the citizen's approach to the recycling practice is enacted more as a sorting practice while the municipalities and other institutions are more relating it with providing a sorting practice and ensuring the process of recycling.

Further, the field of the practice is complex and involves different actors. As previously mentioned, the EU, government and municipalities are strongly impacting and changing the practice through strategies, regulations, and laws. For example, *Teknisk Forvaltning* presents the waste directive to the politicians and then the politicians decided what should be sorted according to EU guidelines.

Waste is a sensitive topic in the year of elections of political party, so the practice is shaped also due to politics and the understanding of how waste should be treated. The existing infrastructure and architecture, also involving the technological solutions, are shaping the practice and practice is shaping the technological development. As for example, we refer to the already constructed roads.

Other findings/concepts related to the recycling practice

Before moving to the descriptions of elements involved in the practice, we want to introduce some findings that are impacting the whole practice, though, we could not place them under the specific element. We looked into how the citizens are positioning themselves as agents in the recycling practice (regarding their agency towards climate change and sustainability look below) as we believe it can give a better overview of the involved citizens and how they engage in the practice and could engage with it in the future.

It is difficult to place the persons in a strict position - is he/she an active agent or passive. The person's ***agency*** is a highly context based. According to the codes, we can see that only one of the interviewed citizens, house administration, and the recycling centre appear as an active agent (the last two were coded from the individual perspective); as only passive agent - one of the citizens who has a possibility to sort organic food but he does not do it; and the rest of the citizens appear as both - passive and active. (See Appendix, the Diagram of Agencies) The active positioning agency can be expressed by showing the practice to others; searching for the information, where the containers are, and what happens with waste afterwards; carrying out sorting practice and showing extra activities e.g., purchasing the bins.

The passive agency can be positioned in expecting that others will help to sort e.g., the other significant or flatmate should do it or is doing it; the municipality should provide

the recycling possibility close to home in order not to break routinized behaviour; believing that they cannot impact the process and should just "*rely*" on that the recycling is later provided.

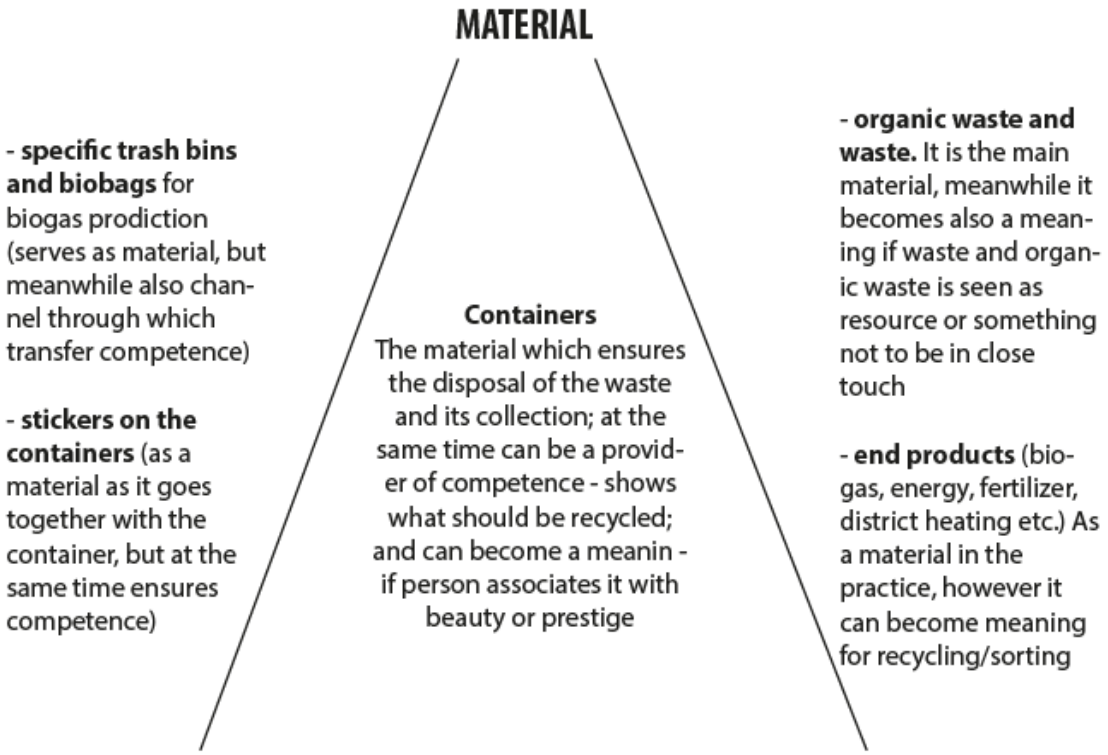
On top of that, we also noticed some patterns regarding the division between *private* and *public* which in our opinion can impact the performance of the practice. It seems as there is an unwritten border regarding public space and private space. The home and the kitchen are considered as private spaces where access is not easy - here the buckets, stickers, or educative materials are the way the municipalities are trying to enter into the private homes of the citizens. Rødovre municipality even uses the word "*control*", i.e., to control how the citizens get rid of food waste by providing them with a specific bin and bags. Also House Administration tries to control their inhabitants '*throwing out*' practices by giving them specific bags so they would be able to close them before disposing them in a garbage chute.

One of the non-Dane informants also emphasized - "*my friends are Danes, and you know Danes do not want go that further just to impose or to (…)"*, especially if the persons do not have personal contact. This indicates that there are barriers which cannot be crossed, especially if it is relating with persons should be sorting. There is not only a division by public companies and citizens' houses, but also among citizens who separate *work* and *home* which could happen that they do not bring the competence of the work practice to home, as "*home is different*".

The elements related to the recycling practice

In a drawing below, we try to draw out the recycling practice and its elements. Some of the elements are in the middle as they are overlapping – for example, containers can appear as all three elements, i.e., material, competence, and meaning.

To carry out srting practice therefore also recycling - **trashbins and trash bags**/ shopping bags, as well as **garbage chute** (here also containers which overlaps with other elements). **The kitchen** and the interior desing can be as a material too. To be able to carry out recycling practice, collection of waste is necessary where **trucks** are materia. **Citizens** are performers of the sorting practice but in the wider perspective of recycling practice, they become as a material too.
The plants (biogas; incineration) as such.



Regarding the citizens, the competence is related with the skills to be able sort waste and place it correctly; while the house administration should carry out the service and collect it; municipalities and the companies have to be able to perform wider spectrum of skills - providing citizen service; communication; transfering knowledge and teaching; ensuring management of recycling (e.g., agreements with collectors and truck companies).
The municipalities and the companies have **meetings** regarding recycling and its implementation. (Meetins among themselves and with house administrations/ and citizens). **Digital media, and tours with educative facilities** can be way to transfer also knowledge and show how. **Family, significant others, work - or someone who shows how**. The citizens can 'transform' the competence by themselves too.

Meaning can be created or impacted by **previous experience** which creates associations. Additionally the **information that circulates around** by good and bad stories, which leads to **attitude** regarding techlogy (e.g., biogas production) or recycling process in general. Besides **physical and mental effort** can impact the meaning - the recycling should be easy. **Financial benefits or fees;** and will to fit in the **community** (here also shame). Intrinisic motivation, as for example, feeling responsible in front him/herself also can create a meaning.

Social understandings regarding private/public, as well as **the social understanding what is a 'norm' to sort and engage in the practice. Recycling as taking care about the environment and future generation.; or sustainable living.** Here also perception of what is **a 'norm' consume and dispose waste. Time as social and individual value**.

MATERIALS

According to our data, we have observed 9 materials in this practice, which are interconnected with each other.

Waste is the material operated in the recycling practice. Earlier we discussed how citizens, the municipalities, and the companies are perceiving waste. The citizens are operating with both types of waste, organic, and non-organic. Also, the waste is mentally separated by its value. As example, the informants are not giving the same value for the packaging of the food in contrast to the food item itself. Moreover, in one case the packaging can bring such a negative impact that one of our informant said;

"For example, I bought some package of pitta. Because I am very nostalgic and emotional of the food I have in Greece. I am vegan, I cannot eat it, but I bought it to share it with some of my friends. I bought it of certain emotional drive from Liddle. It is Greek and I want to share it. I bought 5, 6. As the drive was emotional, I did not pay attention. Then!!! The package was almost impossible disintegration process, because it says that parts of this package will never be dissolved because they use some kind of PVC, which is very hard material. Then for me it was like - Oh my gosh, I bought a garbage! Suddenly the emotional value disappears when I understand that. That pitta does not have almost any value for me because the package is." (Appendix, Mirja)

Sometimes, the citizens are uncertain about what type of fraction specific object belongs to. Especially if they have difficulties identifying soft and hard plastic, which type of package should then go as a cardboard or domestic waste.

Most of the citizens have experiences with organic waste in relation with composting and using it for gardening. One of our informants is sorting her organic waste and brings it to a farm. The treatment of the non-organic waste will be elaborated further as a part of the competence.

The sorting practice is performed mostly in the kitchen. So the interior design is highly impacting the citizen's practice. Shove et al. (2012, p. 68-69) mention how important the design of an object is in order to encourage citizens to engage with a specific practice and continuously performing it. The right design can recruit new citizens to involve them in the practice.

Some of the informants believe that their kitchen does not provide them with the possibilities of developing a proper sorting practice, while others just made the space to continue with the already established practice. Since the perception of the space of the kitchen varies from one person to another, we concluded that having a strong meaning could lead to improvements and shaping the material so it will carry the sorting practice.

For example, in order to carry out the practice, one of our informants was planning to go and purchase **trash bins** from IKEA after the interview the same day. She already had two bins and she needed another system for the kitchen that would allow her to start sorting. While in other cases, citizens can be creative and adapt other objects to serve as a trash bin if they are missing one, e.g. cardboard box for storing paper waste.

However, some citizens perceive their kitchens as not having enough space for starting to sort, and are confused about how many trash bins and which type they should buy. One of the informants said that he interacted with a family who have 5 trash bins and that was "*too much*" for that family. Additionally, it should be mentioned that some fractions are occupying more space than others due to the consumption. For instance, plastic or glass bottles could require a more spacious trash bin than others. Another interesting aspect was that the interviewed citizens had a common characteristic about recycling which was that they had all made an individual system to recycle glass and paper, which was quite low budget performed with for instance a bucket or a plastic bag under the sink for the glass and placing the papers in a pile close by the exit door of the apartment. We could assume it was an established practice for them to recycle the paper and glass.

The general requirement regarding the trash bins was that it is supposed to help citizens perform the recycling practice; meanwhile it is also supposed to be easy accessible and to fit into the interior design. As mentioned before, according to Rødovre municipality it is difficult to access into people's kitchen since this is a private space. In Albertslund, there is a special service that the citizens can contact and invite into their homes and help them to organize the indoor space for this purpose.

The possible bins for sorting the waste

A short visit at IKEA in Gentofte has been carried out to see which designed options the citizens have to sort the waste in the kitchen. IKEA has designed a variety of black plastic buckets with a handle to carry the bucket easy out to empty them. They has designed in a squared shape with round corners, so they are easy to clean and fit into a drawer under the sink which they also show in their showroom at IKEA. To illustrate the functionality of the buckets, IKEA has placed cardboard pieces with photos showing for instance organic waste, newspapers, metal, and packaging to illustrate what waste type fits into which bucket.

Further, the citizen can combine the number of buckets and sizes to their need and if needed they can buy lids to the bucket, though, they are not included in the price of a bucket.

The prices of the buckets vary from 49 DKK to 452 DKK where the highest priced buckets also include lids and a frame for the buckets in the drawer or in the cupboard to handle the buckets easier. (IKEA, 2015)

The solution from IKEA seems functional, however, it has several demands such as a specific sized plastic bag which can only be purchased at IKEA, and that the buckets y are mainly designed to fit into a drawer. Additionally, the price range is debatable of

being too pricy in contrast to the fact that it is just buckets designed in a specific shape. During the visit at IKEA an employee explained that all the IKEA sales items are being giving a price before even being produced and designed in order to prevent a too high price of a product due to its production and design expenses. Thereby, IKEA has decided beforehand the price of the buckets which is interesting that IKEA believes the Danish population will use an average of 49 DKK to 452 DKK or more for buckets to control their waste. Additionally, there have not been carried out a survey, interviews or data giving from IKEA about how many of the buckets they have sold or the citizen's satisfaction when using the buckets in the practice of sorting the waste. Though, the Municipality of Frederiksberg gave the citizens a couple of the buckets from IKEA when they had their pilot project with about 250 households of sorting the waste, and based on their evaluation it seems as the citizens were pleased with the buckets due to size and risk of smell from the organic waste.

The Municipality of Frederiksberg gave the households the buckets for free as a gift of participating in the project, and thereby their satisfaction may be different of the buckets in contrast to the citizens who must pay with their own money for the buckets. The expenses and financial benefits as a meaning will be discussed below.

Bags, as we presented earlier, are also referred to as trash bins. The main concern regarding the trash bags was that they are too small, cannot hold enough waste, and break easily. That is why almost all of our informants said that they are preferring shopping bags, since *"the problem is that we got so many shopping bags that we have to use them in some way"* (Appendix, Ida and Martin), and they are more comfortable to carry out. The biodegradable bags are not used by any of the informants and it does not serve as criteria when bags are purchased. The citizen who had the biodegradable bags did not use them because he sees it as a waste to throw out a bag that is not full. So, in this context, the biodegradable bag, any other trash bags, and including shopping bags have a higher value than the waste in the bag has.

The municipalities and companies mentioned the importance of the **containers** in the recycling practice. They have meetings to decide the appearance of the containers and placement. The house administration is trying to provide their inhabitants with a small version of recycling plant, being ready to help the inhabitants when getting rid of bigger items or dangerous waste like chemicals.

Regarding the special containers, Rødovre municipality and Vestforbrænding mentioned that they are interested in providing their citizens with a special red box where they can dispose batteries and chemicals; and they will bring the box to the citizen's house attached to the new containers. Besides the municipalities and Vestforbrænding are designing the containers in order to help citizens developing their competence, meanwhile it will not affect the working conditions of the garbage men.

Picture 19 ± photo of red box for batteries and chemicals (hazardous) shown at Vestforbrænding during meeting with Camilla Bjerg Pedersen.

Picture 20 ± photo of the 2 chamber bin for private households ± photo taken at Vestforbrænding.

Each municipality have their own opinion about what type of container they want to provide their citizens with and how the collection shall be managed. However, Vestforbrænding is proposing a standard system with a container that:

"It can open in 2 ways. When the garbage truck is coming he uses this way and the citizen uses the other way. And it's because the garbage men is going to pick it up this way to take it to the truck. And the citizens have it the other way and it opens right here." (Appendix, Vestforbrænding, Camilla Bjerg Pedersen)

This new type of container has a chip that will permit the collection of data (e.g., when the containers are collected; where it is placed), that could be interesting for the municipalities. We could conclude in this paragraph that with such a complex practice as recycling, changing one material (container with the two chambers) will affect the entire system and bring changes into other elements of practice. The idea will be developed further describing the garbage truck as materials.

The containers are not just a material in recycling practice, but constitute as an important element also in sorting practice since citizens are directly interacting with it. We observed in the field that people are either using the shopping carts to help reach the containers if they are placed too far away or as in Rødovre where they were used as replacement of the missing containers. However, Rødovre municipality thinks that citizens have all the necessary containers for sorting; and some citizens first noticed that the number of containers increased recently. Not just the presence but also the placement and condition of the containers are very important for the citizens. Even if the majority of our informants are satisfied with the placement, they mentioned that sometimes they are disguised by smell and dirt, and avoid touching the containers when opening the cover. In some cases, the containers are missing there for specific fractions and thereby people are mixing the fractions together; this can happen also in situations when the container is overfilled. The poor illumination, bad placement, and containers that are not accessible for various reasons are often mentioned as being a barrier to perform a practice. According to most of the informants, people like it to be easy.

Stickers were mentioned as well by the citizens as being an important part of the materials to help them achieving a better sorting. Vestforbrænding decided to change the old type of stickers which previously were glued on to the container to imprinted

stickers instead. In this sense, the containers are contributing with the knowledge that will help developing a competence of sorting.

Picture 21 ± the new type of stickers on the container for private households.

Another type of container was the **garbage chute**. Just one of our informants has the garbage chute which is accessible from the staircase, while the other three mentioned that they interacted with it years ago. From the house administration's perspective the garbage chute is requiring a proper maintenance, since some fractions of organic or domestic waste could start to smell. Also, in the case of throwing waste into the garbage chute there is the risk of waste getting stuck. Another concern was regarding the working environment of the garbage men. The house administration mentioned that in the past the waste from the garbage chute was collected in big containers placed in the basement. This placement was inappropriate for the garbage men since they had to make an extra effort to lift the container up. These are the reasons of why this type of container system was closed in one of the other houses we visited.

Haulages were mentioned as the material assuring the circulation of the waste in the recycling practice. The municipalities and the companies were emphasizing how to change the containers and the system of collecting the waste with the type of trucks. As one of our informants said:

"They cannot empty the same bin, you cannot empty a 4 chamber bin in 2 chamber car. So when the areas are big enough this is not a problem. They need at least one car to collect the waste, so this is not a problem". (Appendix, Vestforbrænding, Camilla Bjerg Pedersen)

We were told that it could happen that some small parts of waste from one chamber could accidentally fall into the other one. That is why the fractions are "*sensible*" to each other are also placed in separate containers, as for example, a container has paper in one chamber and plastic in another one. Vestforbrænding and Ballerup municipality said that it is not economically profitable to use the new garbage trucks for small areas, and therefore they unified four municipalities that are having common borders into one system of collection. Here we could observe how containers are changing other materials.

Citizens are carriers of the sorting practice, which directly impacts the recycling practice in general, thus, they also become a material of recycling practice. The municipalities and the companies think that citizens' practice of sorting should be improved and they are trying to provide them with all the necessary elements. They have been given containers, and in some cases the citizens will be provided with the old system with only one chamber if it is noticeable that they cannot adapt to the new system with 2 chambers in one container. The recycling centres also look to the citizens as carriers of sorting practice since they are the ones who are coming and disposing the waste by themselves. The workers of the recycling centres are ready to help and fix the mistakes which often happen. Thereby, the workers are impacted by how well the sorting practice is performed by the citizens. As the manager of the recycling centre stated,

"we have 40 different fractions of waste. It is the challenge for regular people that maybe come here for couple times a year to overlook all these different fractions. The main part of our job is to help them do it correctly. And fortunately most of them really want to do it correctly. There is always that little amount that just does not care. But most of them want to do it properly." (Appendix, Recycling centre)

The End Product of recycling practice is different. We were told from the municipalities and the companies that different fractions are treated differently and

have another "life" after being recycled. Kara/Noveren mentioned that government is supporting more the "re-use" instead of "recycle". Ballerup municipality mentioned for examples end products that are produced of recycling plastic such as pipes, the traffic object with the orange colour and black block in the bottom placed in the street, fences, or sewage pipes. Using recycled plastic is already a step forward. Vestforbrænding and the municipality are thinking that using this type of plastic for containers as a great idea and a good story to be told to citizens. In this case when the right story is told, we also believe, that the end product of recycling process can improve the sorting practice.

COMPETENCE

To help improve their own competence of the recycling practice, the municipalities and Vestforbrænding schedule meetings to discuss and share the experience. The meetings are planned with different topics and the municipalities can participate in the ones they find interesting as for example, the one about different chamber containers. Vestforbrænding is providing support for the municipalities and have consultancies that can assist in various situations such as how to implement a new system in existing road infrastructure.

What competences the citizens have. The municipalities and the companies believe that recycling practice can be improved by improving the citizens' competence of sorting. So, we asked our informants if they were sorting the waste. But what is a competence and how could we observe the competence in sorting practice?

Since practice requires performance in order to be enacted, we decided to emphasize the informants' competence by the level of performance showed while enacting the sorting practice. Even as some of them responded *"I do not sort"*, during the interview we discovered that they actually are separating some fractions from another. Some people are going into very meticulous sorting which shows good practical skills and knowledge about where each fraction is supposed to go. Most of the citizens mentioned that batteries shall be stored separately from other types of waste and disposed in a special container due to the impact on the environment. Also, electronic devices are mentioned by them as being separated and placed in a special place. While referring to the sorting competence, the majority of citizens are showing good skills in separating glass. They are pretty much aware that glass requires special treatment and should not

go along with other fractions. Even one of the informants who almost did not sort and just placed everything in domestic waste, glass was separated. However, the fraction that is creating doubts is the cardboard. The citizens are confused about placing the cardboard as cardboard or together with the domestic waste. Only the citizens who have work related experience/competences were able to make a differentiation of it. That may be why there are many mistakes when sorting this fraction. Further, the cardboard that was in contact with food is considered as being domestic waste and goes to incineration, while clean cardboard is going to be stored to be recycled which can take up to a month stated before.

Also metal is known as being a fraction that is supposed to be sorted. Some citizens who are using metal cans are washing the remains of food due to the concern of smell. Vestforbrænding wants to make the practice as easy as possible, and does not require the citizens to clean the cans, just to empty them.

The house administration is providing the inhabitants with a special place for fractions such as pottery, china, and bulky waste. They are also providing the inhabitants with information about where the containers are placed and what is supposed to be placed where. Most of the buildings we visited were having the option of where to place the bulky waste. However, none of the informants indicated that they knew where to throw china or pottery during the interviews.

The plastic represents a real challenge for the citizens' competence. Due to the fact that sorting plastic into soft and hard is complicated, Vestforbrænding decided that it is enough if citizens are sorting plastic in general and the company will separate soft and hard by themselves. However, Solum mentioned that they are finding plastic in the received organic waste which shows that citizen's competence in sorting this fraction can be improved.

How the citizens gain their competence. There can be several ways of how our citizens gained the competence in sorting practice. Having a positive, previous experience and growing up in a family who sort were one of the ways of how the competence was established. For instance, some informants grew up in families that were sorting and for them sorting is a habit that they are "*I just do it, don't see any effort*". (Appendix, Kacper) One informant underlined on this matter that he have not seen his parents sorting so for him it was difficult to start doing it.

Most of the citizens are sorting accordingly to which containers they have. There were two informants with strong performance who were going to recycling centres to dispose their waste. One of them had to bike for 15 minutes and the other one had it nearby her home.

We should mention here that the presence of the competence and material does not necessarily indicate that the practice will be established. As for example, one of our informants shows good practical skills and competence in sorting different fractions at job, while at home he is almost not doing it *"before that we were putting all in one place, but we got a letter from Copenhagen Commune that we must separate (…) But home is different. At job we follow all the procedure."*(Appendix, Zahid)

The municipalities and companies are trying to improve the citizens' competence in sorting by offering, what we refer to as, educative materials. The citizens are mentioning that they are lacking in knowledge about how the waste is processed and why it is supposed to be separated. Even if the knowledge about the process would not necessarily create a competence (one of our informants was working previously at a recycling plant in England but showed low sorting practice), the municipalities are keen in transmitting the knowledge to the citizens. The knowledge is transmitted through brochures, mails, meetings with citizens, and pamphlets. The municipalities are trying to reach the citizens in various ways and provide them with their informational support. Another way of providing the citizens with information could be the digital media which could be one of the first sources for the citizens. All the municipalities have their websites with a webpage dedicated to waste. Ballerup municipality thinks that the webpage is supposed to be more personalized with the good stories from Ballerup. However, at this moment - besides their webpage - all the other initiatives are only as '*to do tasks*' on their waste plan. The citizens mentioned the internet as a source where they search or would search for the information regarding the waste.

However, most of our informants said that in general they have not received any information about the waste from the municipality. One informant said that she was not able to get in contact with the municipality. The information from municipalities is not always reaching the citizens and even so, some citizens are not interested in reading it,

"*I did get one paper from Rødovre commune, and it was very pretty actually, soft cover, colourful. And it was clearly that they wanted me to read it but, couldn't be bothered to read about garbage I think I threw it out."* (Appendix, Soren)

Another type of educative material is the list "Ja, Tak" and "Nej, Tak" which are often placed in the disposal area and are guiding citizens in their sorting practice. Sometimes these signs are giving a detailed explanation that can further create a basis for improving the competence. On some of the product's packaging, such as electronics, there are indications of how to throw out this type of waste. One of the informants mentioned that this is how he got the knowledge regarding separation of these items.

Another strategy applied to improve the competence of sorting is "show-how". For this purpose, Vestforbrænding has a room similar to a playground, where small kids can play and interact with different kind of waste and learn how to sort correctly. Also, both Kara/Noveren and Vestforbrænding are open for tours for the schools and citizens. We saw during our interview at Vestforbrænding a group of pupils (probably 8th class) that were on a guided tour. Ballerup municipality mentioned as well that children are easier to be taught. One of our informants, a mother of a three-years-old daughter, is expecting that the kindergarten and further on the school will provide her daughter with the necessary knowledge and competence to sort. Regarding this topic, Kara/Noveren mentioned that there have been changes in the educational program and focus more on topics such as sustainability and environmental condition. Besides public institutions like schools, co-habitants are also an important factor that can help to transfer the competence by showing how. Some informants mentioned that the people with whom they are sharing a house with helped and determined them to develop the competence. Two informants were referring to work as being the place where they got the competence of sorting. Later the informants can by themselves spread the practice to their friends.

MEANING

The municipalities, Vestforbrænding, and Kara/Noveren, plus the house administration and the recycling centre see recycling practice as beneficial. Even if the new waste plan is challenging some aspects of how this practice is performed, the overall attitude to recycling was positive. Since these actors posses more knowledge about the process,

they have a clearer understanding about how recycling practice is affecting daily life and what are the benefits of it. Thus, they are emphasizing that recycling practice depends on how well people sort at home. While at the recycling centre the fractions placed wrongly can be fixed by the workers, whereas the home is inaccessible for corrections. If there is a strong top-down approach in the implementation of the new waste plan, the municipalities and companies are expecting that citizens will start to sort better. They expect it should be done voluntarily. The citizens by themselves also consider that it should be a voluntary act. During the interviews it was mentioned that the companies together with municipalities are creating different strategies of how to give a "meaning" to citizens with the sorting practice.

Some of the informants were motivated enough to sort even if some materials were missing; while others having the competence and materials were not sorting. Discovering this situation, we tried to look into which factors could impact the meaning to sort and constitute a basis of future practice.

People have different **attitude towards recycling**. Some of them are thinking that recycling brings benefits since you can use some of the waste in producing something new out of it. The people are using statements as *"recycling is great"*, *"recycling is smart"* and are able to see the connection between recycling and their sorting practice. The informant with a strong sorting practice has a high awareness regarding the impact of sorting properly due to the waste in the environment. She mentioned that she started to enquire about establishing her sorting practice while facing the consequences of people's indifferent attitude on the nature:

"Those beautiful places, mainly nature, just starting slowly decay because of this garbage everywhere [...] And now, when I think how many whales are found stranded in the beaches and their stomachs are full with plastic. If you see the movie, I think it is called Albatross or West Atlantic Albatross, these all colonies are just collapsing because there is all this plastic". (Appendix, Mirja).

She is mentioning that sorting the waste properly can be something to be proud of and she is happy to help others improve their practice and speak about sorting with neighbours.

However, not all informants, who were sorting, had the same positive attitude towards recycling. One informant expressed that recycling is a good thing to do, though, did not

see the connection with his sorting practice and did almost not sort at home even though the house administration was providing him with all the necessary materials: *"Recycle...I have not think about that, just throw it, that is it!"* (Appendix, Zahid)

Negative attitude is equally important on the motivation to sort. For one informant recycling was creating "*a huge mess*". Another informant said that she is planning to be more actively involved in the sorting practice, but she is concerned about economical situation as to implement a new sorting system and if the benefit from recycling will cover the expenses of implementing these changes. Additionally, she sees recycling as being a way to improve the environmental condition, and repeatedly mentioned that *"if costs us more to do it I don't see why should we".* (Appendix, Mathilde) We also met people that were not performing sorting enough due to a neutral attitude towards recycling. *"No, not really. Especially for me, I cannot see what benefit can be"* (Appendix, Christian).

The information regarding the recycling process

The brand of being a sustainable country and the story behind it does not necessarily fit with the reality. One informant said that before coming to Denmark she had a

"pinkish picture, because we knew that those Scandinavian countries are green, sustainable. I really expected that I will see it on higher level or more perfection in the ways, processes, management[...] But I was kind of disappointed." (Appendix, Mirja)

Vestforbrænding and Ballerup municipality also mentioned the importance of "*good stories*" and "*bad stories*". During our interaction with the field, we heard from some informants the stories that waste is all going to be burned and fractions are collected and placed all together. These kind of stories are circulating due to two cases that actually took place and through interaction with other people that have a bad experience with waste (garbage men spreading the information that all is getting burned; citizens that saw that different fractions are collected in one chamber haulage at once). Therefore, informants who provide services are interested in telling more good stories about what can be made from waste. We believe that this approach towards the recycling is very positive and can have an impact on creating a meaning for the sorting practice.

Changing the practice of sorting can constitute **physical or mental effort** for the citizens. The municipalities and the house administration are trying to diminish the effort of sorting by providing the containers in the most accessible way. Meanwhile, the citizens are still facing the situation when containers are placed in the yard and they have to go through the basement to throw the garbage. One informant mentioned that she actually was sorting waste in different bags, and when she accessed the containers they were not accessible or missing one. The sorting means that people will carry multiple bags at once which make the placement of containers and the distance to them having a highly important. In this situation, if the competence will still be present and the materials will be placed accessible again, people can still have a weaker meaning which can lead to interrupted performing of the practice.

The containers and trash bins can as well enforce the meaning. People can engage in the sorting if they have "beautiful", "beneficial" containers. One informant imagined how it could look like with new container from municipality by saying *"actually I could picture it right there. I can see it, it's black with letters, it's pretty."*(Appendix, Ida)

Also **time** can challenge the meaning of the sorting practice. The perception of time is individual and cultural, and most of the persons are seeing time as a resource. In this situation, the time spent sorting is perceived by some citizens as being wasted, others mentioned that they will have to use more time to sort correctly until they will get habituated with it. Only informants that already have a strong competence do not see any effort in sorting the waste. Besides, similar to Shove et al., mentioned above, have to take into account that enacting practices is time consuming and daily life consists of continuous enacting of different practices, thus some practices will not be carried out. In this case it is important that waste has priority in citizens' mind.

We observed that persons value their time and do not on purpose go out to throw the waste, but are combining this activity with something else. Therefore, there can be situations where persons will place their waste in the most convenient containers. That was the reason of why in some buildings the containers were made accessible just for the inhabitants of those specific buildings and were given a key.

Besides intrinsic motivation, **financial benefits** were also mentioned in connection with recycling. Some persons need something in return for their effort of sorting. As we

mentioned before, some waste has a special value. Also non-organic waste carries value as well, if persons are seeing material benefit in it, e.g. plastic bottle *pant* (i.e, deposit). One informant was referring to his plastic bottles *pant* as being *"my treasurie"* and returns them at the shop *"once in awhile, at the end of the month when the credit card is low."*(Appendix, Søren) All informants are sorting their plastic bottles with *pant* to bring it back to the stores for the same purpose. Whereas for one informant it takes him 15 minutes by bus carrying his big bag with *pant*, and finds this easy since he will *"get my money back"* (Appendix, Christian).

On the other side, the expenses perceived with implementing the sorting practice can also be challenging. Most of informants are not specifically mentioning expenses related with buying the trash bins, but it is more related to the fact that at this moment they are not in the process of implementing new fractions at their places. The citizen, who was in the process of implementing to sort, was expressing some concerns about how much it will cost to buy different trash bins and mentioned that

"I am a little bit sad it costs money to do it but if it's beneficial […] It's Commune who came and push it "you have to do it". And when you push people with "you have to do it" some people will get rebellion and don't do it and make it not good for anyone else. If they [municipality] have paid and say, we know we made all this on you, we pay whatever takes for you to do it. Because if I chose it myself I don't have any problems to do it, but I didn't choose it." (Appendix, Mathilde)

Besides the aspect of control that we mention above, the municipalities are also trying to give the biodegradable bags for free as they are aware that expenses could be a reason not to sort.

Although not all citizens engage with their neighbourhood, we could observe that for some persons **community** could be a meaning to sort. Here it has to be taken into account that each of the citizen can understand community differently – for one it can be neighbours from the same house, while for others it can relate to everyone who lives in the municipality. Three of the citizens did not engage anyhow with neighbours and surrounding, and one of them admit that he does not care what happens in the municipality, however, he emphasizes that he likes the environment nearby his home. While some of the citizens are using the word "*we*" while talking about the municipality

or housing area. An interesting aspect is that also social media (Facebook groups) can be a tool of how to create community and engage more with recycling and environmental topics. However, only in two cases we could observe that the topic of recycling can create connections among persons - one regarding the voluntary based recycling centre; the other the neighbours watching each other sorting or helping other friends to sort.

Shame was expressed by one citizen if she would sort wrongly. Although, another informant does not speak directly about the shame and community, but he states '*I could just toss it out in one big one and throw it out from the window hopping no one will see that…but…you know what I mean*'. (Appendix, Søren)

So the common understanding in the community, regarding appropriated way of handling the waste and a wish to belong to this community, can create a meaning to sort. Vestforbrænding gave an example about fliers on the container if the citizen has sorted badly, the garbage men warn him with a flier with different colours and next time will not take the container. As the neighbourhood can see these colours, it is indicating to them that the citizen does not know how to sort. Vestforbrænding are planning to implement the system that if they see that a citizen cannot adapt to the new sorting system, they will provide him/her with an old container again. In this case, we can ask, if the fear of losing those new containers would help to improve the performance, and receive the old container would also show that the citizen does not know how to sort. However, we should take into account of how crucial it is if a community believes that sorting is important; and a citizen should feel the need of belonging to this community.

In Vestforbrænding's opinion the fee system will not work on Sjælland due to the political situation. However, one of the citizens told that the entire house will be fined with an increase of the rent if the sorting is done incorrectly. The situation actually makes persons argue with each other and follow each other's waste handling. So the community can serve as a learning network and fee can be added as an extra emphasis that neighbours should try to teach each other. However, if we base our conclusions from the stories of the informant, it creates also negative emotions and tension among neighbours. **Fine** in general as a method of punishment is perceived by the companies as not the best way to determine a practice establishment. Vestforbrænding affirmed

that people are sensible to fines as well as political system, thus, fine is not the best strategy to be chosen.

The house meetings can be another way in how to engage more in the practice and create community, especially as the administration usually ensures the services include waste management. As all persons share the same house type, yard, etc., they will have a reason of creating their community. Almost all the citizens who live in the apartment or terraced houses do not participate in the meetings - they do not have access unless they are voted in; they do not have time for it; or they have not searched for more information about it. They usually receive some information afterwards but not all are reading it. The waste has been a topic at those meetings mentioned by 2 citizens - one about previous dump-yard; other about new implementation of sorting system and what could be resolutions that persons would better carry out the action of placing garbage in the containers.

Concluding the chapters of elements, as we mentioned already above, we remind that the elements can change over the time. Thereby meaning can also change and we can observe it in the case of the double perception of the waste as the municipality of Ballerup pointed it out. Regarding waste as a nice word and garbage as a bad word, we can observe that in order to change the practice there is an attempt to shake off old meanings by the municipalities and companies to give place for new ones thus creating new meaning.

We can also observe that there are some changes in citizens' understanding. The majority of the citizens are sorting more fractions than they did previously and they have an understanding that some items can be recycled even if they have no clear idea how it happens. It means that all items are not thrown out equally.

Consumption

The waste production is directly related to consumption, so we asked our informants about it and how they follow it. Most of the citizens follow their consumption at least in some parts of their lives and try to reduce it if they can. The electricity consumption is mostly mentioned, however, here we have to take into account that it was one of the questions brought up in the interviews to see if the citizens have already practical skills of measuring consumption. Money and bills are related with electricity; and, for most of

the citizens, money is a purpose in following any kind of consumption. Though, here should be taken into account if the citizen is paying for bills separately or it is included in their rent.

Also grocery shopping is related with consumption, and as mentioned before, food is associated with money too. The citizens try to freeze their food, leave it as leftovers, or not to buy too much if they are not sure they will eat it; and they do not like that they have spontaneous grocery shopping habits (following their desires instead of eating what they have at home)

"Yeah, it's a little too often! It's impulse buy. Like I said, I'm gonna buy for pasta tonight, but then there's pizzeria and the smell it's nice, I think I'll have a pizza tonight!" (Appendix, Søren)

The waste can be a tool for some persons in following their consumption. The citizens could name the most common items they throw out (milk packages, food packaging, food plastic, egg shells, and peels), but most of them could not tell precise amount of waste they produce. Mainly they indicated how often they empty their trash bin or how full their container is (refers to private houses).

During our meeting with the ethnologist, who produced a research about food waste, she informed us that finances and life changes can make persons reconsider their consumption habits. (Appendix, the ethnologist) Ballerup municipality also mentioned that during the financial crisis they observed a reduction of waste; and families with low income have less waste in general. However, Kara/Noveren disagreed and pointed out that they believe that the amount of waste during the financial crisis actually increased.

To better understand consumption habits, we tried to look at citizen's self-awareness and self-control. Here we could see that for the majority of the citizens, immediate consequence or local impacts create more links to awareness, for example, spontaneous shopping and food waste that both are associated with money. Values in general (here more money and time, but can be also environment) can be a way for the citizens to become more aware of their habits - there should be some point of reference (and in the best case immediate and local) to make citizens more aware about their habits. The point of reference can also be any tool - footprint calculator, apps, bills, and also diaries for ourselves; however, the tools should be related with the items citizens value, i.e., it

should be important for the citizen. These values or items they believe are important can also make people show a higher self-control (as for example, freeze food, do not buy extra things, turn off all the electrical devices, do not use 'stand by' regime; using candles instead of electricity). Meanwhile, rush, stress, and convenience can be a reason of why self-control is lower even if the persons are aware.

Which activities can be made sustainable? - I can start to measure how long time I am taking bath, turn off all power in my apartment in the night. I can do all this things. What stops you to do that? - Convenience. (Appendix, Christian)

Other points that can create persons to become more aware are the life changes such as starting adult life and moving away from the parents' house. One of the informants pointed out that for instance containers in the yard make him informed about the current regulations and what is demanded from him. According to the Ballerup municipality, media has increased awareness about waste, so besides value also repeatedly information from the sources to citizens to watch and hear can create more awareness.

An interesting aspect is that citizens can be aware about their bad habits, but they do not want to break their routine. They expect that the new sorting system will be implemented in a way that they would not have to change anything in their established practice i.e., how and where the container will be placed.

Challenges and improvements

As different actors are involved, the communication among themselves should be improved. According to Hinrich Uellendahl, who during the meeting expressed that when he wrote his research he observed that municipalities did not communicate among themselves and did not know what the others were doing. According to our information, municipalities are not visiting each other, though, if they are co-owners of Vestforbrænding, they have common meetings and a digital network to help each other. But the question about the collaboration out of this circle stays open. Perhaps the Ministry of Environment and Food as a responsible institution regarding this topic, could oversee the information flow and collaboration, however, we do not have such information.

Also the different understandings of how the goal should be reached can become a challenge - for example, Ballerup municipality wants to have more personal communication with citizens (i.e., directly oriented to their citizens); while Vestforbrænding wants to have more standardized approach. Here we can refer to the website of the municipality (http://www.ballerup-affald.dk/), which at this moment is under the control of Vestforbrænding. As we mentioned, it is the only digital tool for the municipality, so the only possibility to reach their digital citizens (here we meant, citizens who mostly use digital media) with Ballerup's good stories which are not represented there yet; besides some of the information was not understandable even for the representative of Ballerup; and links to the videos 'what happens with waste after' did not work, although, these videos could be one ways in creating meaning for the citizens. Here also should be mentioned the other kind of cooperation among municipalities and Vestforbrænding - depending on each of the municipality, they can provide also economical calculations and strategies regarding process of recycling.

During our interviews one of the municipalities mentioned that the improperly sorted plastic is expensive in terms of being recycled. Here we can refer to that the general poorly sorted fractions costs more as they have to be resorted instead of just incinerate. The costs, and how profitable the recycling in general are, is one of the main topics - besides the citizens, the employees involved in this process reflect on the financial profit of it.

"*It is a political decision, it can be said, and it does cost something to sort. It costs to drive trucks out to people, it costs to collect it in because now it will be multiple trucks driving around gathering now from 3 containers instead of only one.*" (Appendix, Vestforbrænding)

Thereby, the entire process of implementing new fractions and recycling system is expensive. The costs can be a reason of postponing the implementation - for example, Ballerup municipality cannot start earlier than 2017 due to the existing contract with haulage contractors. The contract is usually planned to last for several years, which means that any change will challenge the current contract.

One of the citizens pointed out that the employees at the recycling plants should be more educated and careful or as she mentions "*tidy*" in regarding of placing the items.

According to her experience, she has seen that several items were misplaced. The visited recycling centre considers that the centre works well and there should not be any improvements at this moment - unless new fractions are added due to technological development. However, he mentions that they do have problems with damaged fractions due to the citizens' misplacement and they have to deal with it. Therefore, we are not sure if the observed misuse is due to the actions of the citizens or employees.

On top of that, the regulations also demand where the containers shall be placed (20m from road), meanwhile it can create challenges for the citizens who are not able to move the containers or for the citizens who are on vacations - when the containers have not been removed from the pavement, the thieves can take it as a sign that the citizens are not home.

The technology should go hand-in-hand with starting with establishing the practice (i.e., the technology should be there ready to function), otherwise its lack of functionality can create inappropriate performance from collectors side (disposing all in one dump-yard or incinerating all), which later can lead to citizens refusing to carry out the practice.

The different municipalities are recycling different fractions which they have chosen by themselves. As adapting to the new practices takes time, we see here a challenge, if citizens are moving from one municipality to another, they will need time to adapt to the new type of sorting system again. Of course, they will have practical skills, though, new knowledge will have to be acquired.

The knowledge of placing your waste is one of the problems the citizens face regularly; their decisions are directly further impacting house administrations, municipalities, and recycling providers who have to ensure that the re-sorting is done. For instance, the citizens are trying to throw out too big items into the garbage chute like carpets or Christmas trees; placing dead animals in the containers; bringing food to the recycling centres.

Additionally, the plastic packaging is one of the most challenging fractions for citizens - what exactly can be placed as hard plastic and what cannot. If the system is provided as Vestforbrænding offers, it can avoid problems like these for the citizens. However, the technological problem is still open for debate/improvement.

"*I know Teknologisk Institute are trying to pull out the softness of the plastic to use the rest of the plastic. There are many tests also about fragment about remodeling a bucket and if there is another kind of plastic in it then what will the fragment then become – can you still use it for this? Or packaging for food have extremely high demands where you cannot use reusable plastic for which is the reason of why some places they sort soft and hard plastic which often is also where you can get the best money for it because the quality of the material is better.*" (Appendix, Ballerup)

We also believe that the barriers between public-private can create some challenges in how the municipalities or the companies can enter into the households' of citizens and improve their performance directly.

Shove et al. (2012, p. 54-55) mention that the practice can be related also with the specific group of persons. Meanwhile if more persons get involved in the practice, the social significance changes. We can also observe it regarding the sorting practice. At this moment, vegans, for example, are associated as a group who performs practice in a higher level, because they 'care'. More persons are comparing their past with sorting more fractions, however, there still is a distinction among those who sort too much and rest of those who are sorting. There exists a social understanding of what is a *'normal'* sorting practice. The citizen who has strong sorting practices expresses that she and her housemates are going "*too far*" and that they are *"crazy"*. Also other informants refer to persons with strong sorting practices describing them with words as *"crazy"* or "*maniacally"*, i.e., someone who does not correspond to '*normality*'. We consider that perhaps some challenges could appear if the persons with the strong sorting practices are faced with being labelled as out of the *'normality'*. Firstly, it could repulse some persons to engage more in the practice; secondly, it points out that too much recycling and showing activity is not considered as good practice.

"I am not the one who separates the things maniacally, and then go to the nearest waste disposal area recycling facility because I have no idea where that is strictly. I can't be bothered to go there every time I need to recycle stuff. So just using things I have available." (Appendix, Søren)

To conclude, we can see that the sorting practice is established but due to the new materials and changes in the field, the practice is changing and demands the citizens to acquire new competences and creating new meanings. There can be observed problems with the performance.

The recycling practice is also established, however, due to the complexity it requires not only the existence of the elements and creation of the links, but also a decent level of performance of other practices that are directly related with recycling. As Shove et al., state that sometimes the sequence of how the co-dependent practices are carried out is important, we could observe that sorting practice is a significant in order to provide recycling practice and other practices. Partly this is an answer also why we focus so much on sorting practice when we talk about recycling, and why the problem statement states 'recycling' practice while mostly all of our analysis (later also suggestions) are concerned with sorting. Also our visits to different stakeholders always brought us back to the sorting practice at homes – as it is the starting practice, it is crucial that it is performed well. Hereby by trying to make sorting practice more sustainable, we benefit also by making recycling practice more sustainable.

The changes in the recycling practice are mostly due to the field surrounding it, which creates new meanings for carriers. We consider that the field and the new meanings create links between the elements which are impacting the creation of new materials and competences.

We could also observe that the practice has been changed over time – for example, the interaction with waste becomes more and more anonymous and detached – there are machines and cars which help to sort and the waste is transported away. Technologies have changed the shape and enactment of practice (here perhaps history of technology could allow us to see how practice has been changed).

Sustainability and climate change

Here we try to frame out how the citizens and some other informants perceive climate change and sustainability and where they position themselves during the interview. For some informants the sustainability or environment showed up also as a meaning of the recycling practice, however, we include these ideas under this subchapter. We asked specifically how the informant perceives sustainability, sustainable living, and climate

change; as well as some of the questions were focused on the environment. For us, an interesting discovery was that most of the citizens did not know the word in English. The Danish speaking citizens were introduced with the word '*bæredygtighed*'. Even then some of them were not familiar with the word. We were expecting that the word would be '*trendy'* and everyone would have some kind of opinion. Additionally, the ethnologist mentioned that the organic and biological food were not so popular in her field study as she expected. (Appendix, The ethnologist)

Regarding the citizens' own positioning in the field, they are aware of not throwing garbage in the streets and also pointing to others, which is one possibility of how persons think they are showing an active position related to the environment. Also buying the organic food; "*removing*" everything that can harm even if the citizen likes it - here refers to spray deodorant and its impact to ozone; not using car; participating in joint work at the apartment house's yard (planting, etc.); slow living; being a vegan; can be a way to express an active agency.
Reversely, the passive agency is transferring the responsibility to big companies or 1% of population who has money, or all population together instead of him/herself; not interested in the topic in general and does not care about environment. One of the citizens considers that instead of focusing on how to stop it, people should focus on how to survive global warming. None of the citizens are paying attention to whether or not the trash bags are biodegradable when they buy them.
The climate change is associated with "*no snow*" and "*rains a lot*"; temperature increase; increase of water level; climate change in some other place (Pakistan, China, Maldives, etc.); Kyoto protocol and G8 meetings. It can also be associated with a footprint that people leave on this planet; and one of the citizens consider it as a natural cause that world has "*speed up little bit*" with industrialism. The CO2 emissions are for the majority of the citizens related with big companies and fabrics or cars. On the other hand, Rødovre municipality and house administration talked about climate changes in connection with rainwater management.

Sustainability as a term has different meanings and depends on each informant. As one of the informants mentioned, it is a *complex* term that still develops. It can be associated with something as "*strong enough to hold something else*"; being able to work again and again; organic food; planting own food and having a farm; recycling and waste

management; less toxic production of food or any other item. Additionally, the sustainable living can be implemented by not using car but biking or walking; buying organic food; re-using things; more awareness about consumption; setting up windmill in the yard, and use less electricity. Ballerup municipality associated it more with Green city, where the informant approachs the topic from social, social housing, and environmental aspect. Both municipalities relate it also to waste management. House administration refers to rainwater management, new renovations they are planning to implement, as well as talks about Ballerup as a green area.

The environment also can be approached differently - from one side the citizens talked about the pollution perspective, from another about local surroundings. We sometimes purposely asked the question about local environment to see if they have more close relationship to their surrounding as the environment in general can be too broad. The citizens like to have nice surrounding around them - clean air, parks, and other places that are green. However, not many of them are actively engaging in keeping it clean; besides not throwing out their waste in the streets - they carry it around in the pocket; or even point to strangers who throw waste in the streets.

Not all citizens understand the link between recycling and sustainable living or in which way they can impact climate change. Some of them are pointing it out, but it could happen only when we later asked directly this question. The sorting should also be voluntarily based and should instead be inspired to do it rather than forced to do it. Meanwhile, for the representatives of the institutions the recycling is directly related to sustainability and environment.

The future generation appears seldom in their concerns, where only some of them mention it. Here it relates if the informants have children or have an active position regarding the environment (work can also be a reason for the informants to be more aware).

"I like it, and I like to think that's an Earth for my daughter and my daughter's daughter, so it will be nice to conserve it like it is." (Appendix, Ida and Martin)

We link it again to the direct impacts - here and now; the future generation is somehow considered as further away which is also viewed in connection with the climate change and noticeable impacts of the weather in Denmark.

As citizens have difficulties in tying concepts to their daily actions and they need some point of reference, we could conclude that perhaps these concepts as meaning have not been de-codified (re-linked) back to local perspective and citizens have not acquired this ability yet.

Conclusion

There is an understandable division between the words 'garbage' and 'waste'/resource from the institutional side, but the citizens still mostly associate it with something to 'throw out' or not usable anymore. Those citizens who have this understanding of waste as a resource are sorting in average or at a higher level and are rather interested in the topic.

The organic waste is associated with food waste and residues of food, so the citizens can point out the organic waste and from this perspective should not face any problems in understanding and sorting the organic waste. Their perception could even be expanded with for example the tea bags and coffee filters.

Waste is not so much associated with dirtiness, unless the containers are dirty, but rather the smell is something the informants want to avoid or get rid of. There are some borders regarding what persons do not want to cross in connection with waste, but those are usually individually shaped. However, the smell can be a reason to break the habit of disposing the waste on the way to somewhere.

The food, shopping bags, trash bags, and *pant* (deposit) have added value and persons do not want to throw them out just like that. Waste as such has no value and the citizens also do not want to spend time or money (something they value) on it unless they have meaning to do it.

In some extent, all the citizens are following their consumption or express a will to do it. However, majority of the citizens do not think that they are consuming too much. They also do not consider that they producing a lot of organic waste or too much waste in general. In general, the values are perceived as time, money, food, and environment which can be a way for the citizens to become more aware of their habits - there should be local and immediate point of reference to make citizens more aware about their habits.

The majority of the citizens did not know the word *'sustainability'* in English. Even when the word was introduced in Danish ('*bæredygtighed*') there still were citizens who did not know it. Sustainability as a term has different meanings and depends on each informant. Additionally, sustainable living can be associated with bike riding, not using the car, organic food, farming, re-using things, reduce consumption, etc. The future generation appears seldom in their concerns. Not all citizens understand the link

between recycling and sustainable living or in which way they can impact climate change. The sorting should also be voluntarily based and should instead be inspired to do it rather than forced to do it.

Climate change is associated with the climate change here in Denmark as to rain or to further places. There can be observed that the citizens still have detached attitude towards this topic and at this moment the majority of them consider that it does not impact them directly. Regarding the CO2 emissions are for the majority of the citizens related with big companies and fabrics or cars. The citizens can take both an active and passive positioning towards the environment and climate change. Not throwing garbage in the streets and also pointing to others is one of the most common answers of how persons show care about the environment.

The biogas production technology is perceived as a more sustainable solution by the government, although, the technology is still in the process of constantly development. The end product is not accessible for the citizens, which can impact their meaning to engage in sorting the organic waste. The future of the current biogas plant is not clear due to the political situation and the disagreement regarding the expansion with co-partners.

The incineration practice is well established and the biggest challenges at this moment are the impropriate sorting and political pressure.

The citizens have detached understanding about the technology of biogas production and recycling process. They mostly only recognize the actors with whom they are involved directly in the process - e.g., a garbage men and the municipality.

The recycling process and the new waste implementation plan have a top-down approach, and the practice is highly being shaped by the government and EU. The new technological solutions are also impacting the practice.

Further, there is the social perception of what is normal sorting, which can be perceived as sorting what is accessible near to the house. Persons who recycle more and express an extra activity can be labelled as going “too far”.

The knowledge of where to dispose each of the fractions creates problems and demand mental effort. The waste has no attached value, and the informants do not want to spend time on it. Therefore, persons frequently bring out their waste on their way to

somewhere else. The necessity for the easiness is also related with the fact that the waste does not have value for the citizens.

To improve the sorting skills, the municipalities and the companies try to improve the practice through educative materials, biodegradable bags, specific trash bins, containers, or stickers. However, citizens do not always use them. The educative materials can be disposed or due to the perception that the material is not appropriate for use (for example, bags and bins for persons living alone).
The community can shape the practice and give a reason to sort or improve the sorting practice. Additionally, previous experiences with waste are impacting the sorting practices skills. According to the experiences, the performance can increase or decrease.

There are circulating both “Good” and “Bad” stories about recycling. The municipalities and companies want to reach the citizen by telling them the “good” stories. However, the digital media, media, and educative materials are the ways of how the municipalities and companies are trying to tell the stories. The municipality and the representative companies can have different opinions of how they could provide the stories to the citizens.

Suggestions

To conclude on our fieldwork, we propose here suggestions regarding our problem statement: how can recycling be more sustainable?

- *Bring the technology and infrastructure around to the 'front yard'.*

We observed that the perception of the technology is detached and most of the citizens do not know exactly what happens in the process of the recycling or biogas production when it leaves their direct viewpoint. As the technology is shaping a recycling practice, we believe that a better understanding of it can empower the citizens and the practice could obtain more meaning for them.

Here the important aspect is also to give meaning for the end product. As we stated in the analysis, the end product can have a high impact on citizens meaning. Due to this, we suggest that municipalities and companies are supposed to give a clear message regarding what the outcome is of the recycling practice, biogas production, and incineration practice. However, as presented in the analysis, we faced situations where informants are sceptical regarding how economically reasonable the implementation of the new waste system is and if the outcome of it is worth the investments. The circulation of these doubts and bad stories are weakening the meaning for sorting practice and we suggest about this matter that companies and municipalities should concentrate not just in giving the knowledge about how the sorting practice should be performed, but also in constructing a meaning for the citizens.

- *Transforming the idea of sustainability into a "reason" for citizens.*

Sustainability is a concern the government is aware of - this being the reason why the new waste plan is implemented. However, we could observe that the citizens do not have a direct link to how their actions impact the environment. Further, their perception of sustainable living is not wide enough to incorporate it into their daily activities. According to our own observations, we believe that sustainability is a buzzword and is used more and more often, but even so, our informants were challenged defining what 'sustainability' means and as we presented earlier, their explanation was blurred. We believe that the idea about the sustainability should be brought closer to the citizens and thereby creating the meaning of sustainability would become a reason to establish the sorting practice.

Persons need to have more knowledge about their direct impacts of their daily life practices. Here we also include more understanding of how exactly on the individual level the CO2 is created and what the possibilities are in terms of improving it. This deeper understanding can create both competence and meaning for more sustainable practices. Perhaps by looking to the other practices where citizens have sustainability as meaning and see how the meaning can be transferred to the other practice and what could be the possible solutions to help de-codify (pack and then unpack) the element in the specific context.

- *Presenting waste as a resource.*

There is a gap in how waste is perceived which on one side are the companies and municipalities and on the other side the citizens. The companies and the municipalities refer to waste as a resource, and for the citizens waste is something that lost its value in the process of utilizing it. No matter how the municipalities and the companies are working on this topic, we believe that the still existing gap is one of the reasons why citizens are challenged to perform the sorting practice. We think that there is a need of a shift in how waste is perceived. As we have seen from our interviews, citizens are giving a higher value to the items (fractions) for which they are getting money back or when another kind of value is attached. The added value would allow an increase in the priority of sorting among other practices.

- *Popularizing recycling practice.*

Vestforbrænding and Ballerup municipality are mentioning the *"good stories*" that can constitute a foundation in creating the meaning for the citizens. We were given examples about what these good stories could be, but so far we did not observe these stories circulating among our informants.

We believe that to reach a wider audience applying media and digital media can be a good strategy. As one of our informant said *"people rely on 6 o'clock news"* so telling a good story about how the sorting impacts the recycling and how it can return to the citizens can be a good solution.

The opposite flow of communication should also function, i.e., the citizen should be able to find the stories by him/herself if he/she wants so. Thus making the accessible and updated digital media even more important.

- *Improving communication.*

The information flow is another problem that requires some improvements. The municipalities and companies are aware that citizens will *"not bother too much"* and some of them will not read the information from the municipalities even if that will be persuasive. In this sense, we are returning to the problem of "how to reach the citizen".

It seems as there is a continuously, vicious circle – in order to read the information from the municipality, the citizen needs the meaning and the meaning can be created only if the information reaches the citizen. The information should also reach the citizen without his direct choice to open/read the information and spend his free time on it.

- *Different users - different approaches.*

Each of the interviewed citizens mentioned various problems faced in connection with the sorting practice, as well as different ways of how he/she would like to receive the information and further the reason influencing his/her practice. . As we mentioned earlier, one informant considered that it will take too much time for him to fulfil the biodegradable bag and throwing it out only half full is considered as a waste as well. Additionally, the municipalities are mentioning that standardizing a system is not always the best strategy since then the entire infrastructure will be different. Thereby, Ballerup's intention in managing their webpage on their own and personalizing it might be a good solution in terms of not forgetting the citizens with various needs, backgrounds, and competences.

Reflections

Before entering into the field, we already discussed about the theoretical approach of our thesis and chose that we will look to the field through the practice theory perspective and search for practices. Under these circumstances, we shaped our interviews in a way that will permit us to obtain as much data as possible about the practices and elements of the practice, also from other information which could supplement the practice theory. This strategy helped us to stay focused during the fieldwork and to not go too broad in such a big field. However, we understand that there are other options of how our thesis could be constructed. We could discuss and be more critical to the chosen theory as such. Is it enough having just three elements to discuss appropriately; what happens in such a complex field with so many actors. Perhaps Actor Network Theory could help us to see the picture better or we could allow the field speaking for itself without a frame of the practice theory. By letting the field speak, the political, economic, and academic world might have become greater aspects of the project and letting their understanding of recycling and global warming affect the field more.

As stated before, we used Shove et al. as basis for our theory, however, we are not discussing and analysing how the links are created between the elements. We decided to go into a detailed analysis of what are the elements of the different practices and our suggestions are mostly related to how these elements can be improved in order to make them more accessible for the citizens. We partly do more what Shove et al. as basic scheme where the linkage is not explained so much; which is rather central - the elements constantly should be linked together. Our approach, especially reading conclusions and suggestions, could mislead the reader and give the impression that we assume that the presence of elements are per se leading to an establishment of a practice and there are no changes in between the elements.

In this case, if we do not focus on linkages and temporospatial trajectories, as well as not paying deep enough attention to the field and movements of practices, we can bring up the question - is this an analysis that uses practice theory approach or just analysing perception or problems in the field?

The discussion about who is the carrier of a practice and how we should approach still remains open. We were debating if we should include the carriers as material (as a

body, which Reckwitz separates from the agent) or should we analyse it separately from the elements of the practice as being the agent.

Also, we feel that we did not take everything from the practice theory, and there are still some parts that we are not reflecting on, such as practice as entity and practice as performance. Looking at recycling practices from this angle would have given us a deeper insight regarding how the practices are interacting and about the field of the practice. We tried to look to the field of the practice, but due to lack of time we did not go deep into analysis regarding this matter.

Additionally, we could also ask, what is the meaning of the recycling practice to the house administration, the recycling centre, or the municipality? We just looked to the top-down approach and political decisions but never asked deeper. Even if we have data – we do not bring it up to the analysis from this perspective.

Another point that made us reflect on the elements is that we categorised them in groups. As we used the classification from Shove and others, we supplemented each of the elements with elements found from other sources, mostly Reckwitz. In the beginning of our fieldwork, we were determined that we will use just what Shove are mentioning as being materials, competence and meanings, but data showed that there are many aspects of how you can see a material, and due to the complexity of the field, we decided that these categories will be supplemented. Shove by herself is referring to Reckwitz and mentioning that she classified the elements of a practice by unifying the elements defined by Reckwitz and Schatzki, thus, we did not see a problem in bringing some new elements from these authors.

An analysis of power relations would also help to see the influence that the field of the practice has on the practice and its carriers. However, we restrained our description of the actors to the ones that were directly mentioned by our informants.

We have to point out that there exist multiple ways of sorting and recycling. Each municipality has its own way of recycling; also citizens sort differently; and sorting in the recycling centre differs. We partly similar as Shove et al. mention have blended all these different 'doings' together. We can tell that we struggled regarding sorting and recycling practice as black boxed by ourselves and perhaps never succeeded in really open these practices.

Here we should bring up also the question regarding technologies – what is recycling technology? At the technology part we refer to recycling technology as a process and

later as a practice almost as similar. While we believe they can seem the same in a daily life depending on the stance and lens we look to recycling; meanwhile according to practice theory approach we take, it cannot be the same, – as technology as such shapes practice and are embedded in practice, but it is not practice per se.

In the beginning of the project, we were clear that our topic would somehow be related to sustainability. Searching for how to approach this topic, we found out that there are at least two ways of how sustainability could be approached from the social science perspective: sustainable practices and sustainable behaviour. Due to this, we were discussing whether we should take one approach or another. However, we understand that each of the paths could lead us to different findings and impact the choice of our fieldwork and methods.

We could have approached our citizens only from an individualistic perspective and we even looked into the behavioural studies and searched how the psychological studies could help to improve sustainable behaviour (on this matter we found many references to Theory of Planned Behaviour and Reasoned Action Approach), but we decided in the end that following this path will restrain our research to the individual area and will give us a poorer vision about the field in general. Instead we combined both – chose to look to practice theory but taking into account also behaviours as we saw that these are part of the practices.

We also have excluded to touch upon any kind of discussion regarding ethics. Are there marginalized groups or actors, for example, non-Danish speaking persons or nature, and what are the implications concerning current practices? We believe that the discussion regarding the implications of the technology could benefit the project, but due to time we left this discussion out.

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