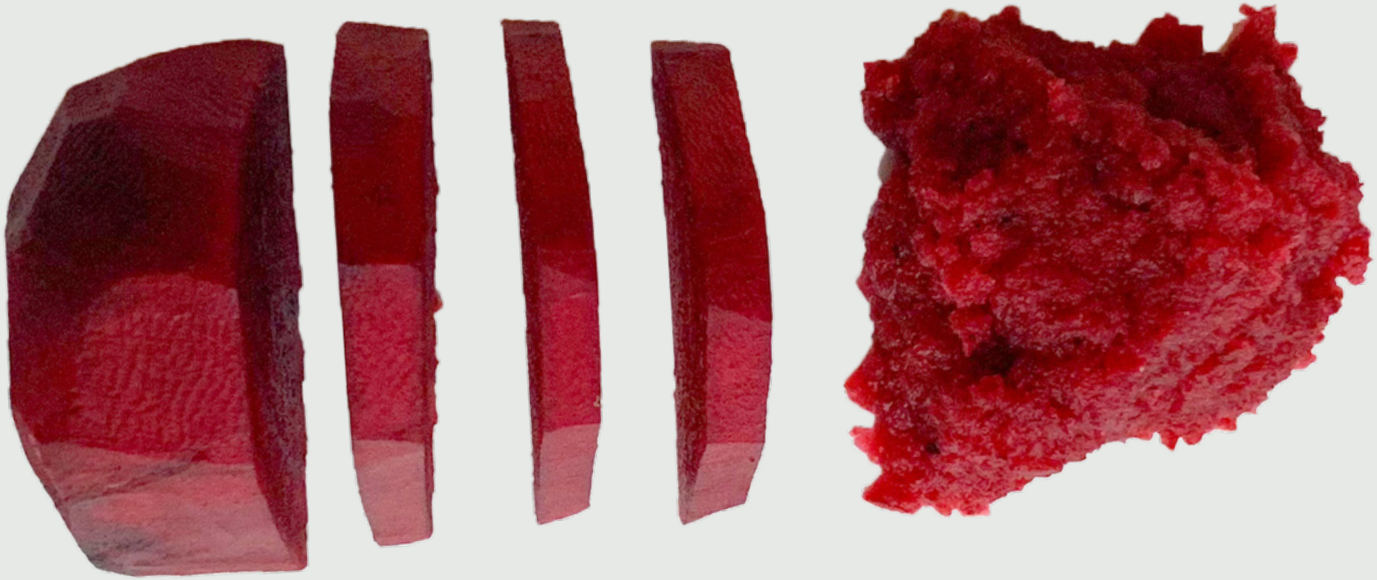

Pulp Action

- Supporting Use of Edible Biomasses

Title page

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Abstract

The world is facing a catastrophic loss of biodiversity, climate change, resource scarcity and depletion of land. There are many ways to act on this urgent agenda. One is to focus on the food system that currently causes 25 % of the world's greenhouse gas emissions and is challenging biodiversity due to land clearing for growing crops. Furthermore, only 20% of all food produced is eaten and that excludes residue biomass from food production.

The challenge of using biomass as food requires a shift of the status quo in the industries and in the food culture. But how do we utilize the edible residual biomass that today is not considered food?

In this project, we investigate activities related to the concept of bioeconomy and residue biomass from food systems. These findings serve as a foundation in our design process towards creating a concept that aims at supporting participants in bioeconomy projects to become aware of the broader systemic aspects when applying residual biomass from food systems in more sustainable ways.

To approach this task, we unfold the controversies within bioeconomy through a systemic sustainability aspect. Bioeconomy is not sustainable by default and is interpreted in many different ways. We elaborate on how the current perspective of bioeconomy has a focus on designing for status-quo and through our thesis, we wish to challenge that perspective by proposing how it should have an earthly sustainable focus instead. We argue that in order for bioeconomy to e include more sustainable aspects, one needs to apply residue biomass in the food system instead of using it as feed and gas production.

In order for us to exemplify a more sustainable approach to bioeconomy, we introduce a case around pulp from Juice production, a collaboration where Frankly Juice delivers pulp to Plantepølsen. We used the whole multi-level perspective to identify dynamics in the system around this residue biomass. Through staging and knotwork activities we identify how different rationales and interests play out on various levels. These insights help us to shape our design specification and assist us in strategically choosing who, what and how to involve actors in our design process.

With brainstorming methods, various design tools and a participatory approach with multiple iterations we developed a concept that, with our insights, can support the application of residual biomass from food systems to be used more sustainably. We designed for and with the bioeconomy development project Det Store Spisekammer. Our suggested concept Bioeconomic Food Challenge.A framework and guiding tools including elements such as a web platform, interactive film and analogue tools for a future educational challenge aimed at university students. The concept is a prototype, not to be implemented directly in a project, but it is intended to be developed further in the Det Store Spisekammer project and other similar initiatives.

Key words: bioeconomy, design tools, film, Pulp, food systems, staging, socio-technical action, sustainable transition

Table of Content

Preface

This design project is a completion of our master studies in Sustainable Design at Aalborg University, Center for Design Innovation and Sustainable Transition.

Several persons have contributed with practical, academic and inspirational support to this master thesis. We would therefore, like to thank our supervisor Inge Røpke for her time and valuable inputs and support throughout the project. Furthermore we would like to thank Micheal Søgaard for sharing his engaging insights.

We would like to thank Plantepølsen and Frankly Juice for letting us join their journey and Gate 21 and the rest of the partners in Det Store Spisekammer project for engaging us in their work.

Finally we would like to thank Peter Mørch Nielsen and Siri Astrup for help and fruitful inputs and support during the project.

Pulp Action | Anders Devantier & Liva Bjerg Linnet

Chapter 1
Introduction

1.1 Introduction

Biodiversity loss, climate change, resource scarcity, depletion of land are some of the biggest challenges our world face today. International collaborations, researchers, students and many more are fighting for our future planet to sustain. Fortunately, there are many ways to act on this urgent agenda – one way is to direct focus on the food production. Worldwide it causes 25 % of the world's greenhouse gas emissions (IPBES, 2019). The meat sector is contributing to 75 % of that (IPBES, 2019). In Denmark, 60,4% of the land is used for agriculture and 80% of that is used producing feed, while only 10% is used for food production. The rest is used for producing bio-oil, flowers etc.(Holmstrup, G., et al, 2018). On the contrary, a plant-based diet requires only 10% of land use (Eshel, G. et al. 2016) which gives "room" for more biodiverse land areas and put less pressure on heavy industrialised land areas as we would need less land to grow our food.

On top of this is 20% of the food that is produced in Europe is not eaten (Eu-Fusions, 2016). Much of the food is lost during harvest, transport, processing, in the supermarkets and in private homes. 20% might sound like much but only the edible waste was included in the reported amounts. That means if food is considered not eatable it is not in a part of these 20 %. Residual biomasses from the food industry is by many considered not eatable. The food industry, therefore, has a large potential of a dramatic transition towards more sustainable production and consumption (IPCC, 2018). The challenge of using this potential requires a shift in the status quo in the industries and in the food culture. But how do we utilize the edible residual biomass that today is not considered food?

From Pulp to Sausages

A company that currently try to utilise edible residue biomass is Plantepølsen (plant sausage). Since 2018, Plantepølsen has applied residue biomasses in form of juice pulp. It is a unique cooperation between the Danish juice producer, Frankly Juice, and the vegan hot-dog restaurant, Plantepølsen. Frankly Juice is cold-pressing organic fruit and vegetables to juice and in that process, only half of the biomass becomes liquid juice and the other half becomes a dry, fibre- and vitamin-rich biomass called pulp. Pulp has countless food application possibilities, great nutritious value and is still not considered as food in the food regime. Each month Frankly Juice end up with 18-22 ton pulp a residue biomass from their food production system, but only 50 kilos is used as food ingredient by Plantepølsen. So how can it be that not all the pulp is applied as food? And how can we support more collaborations like this?

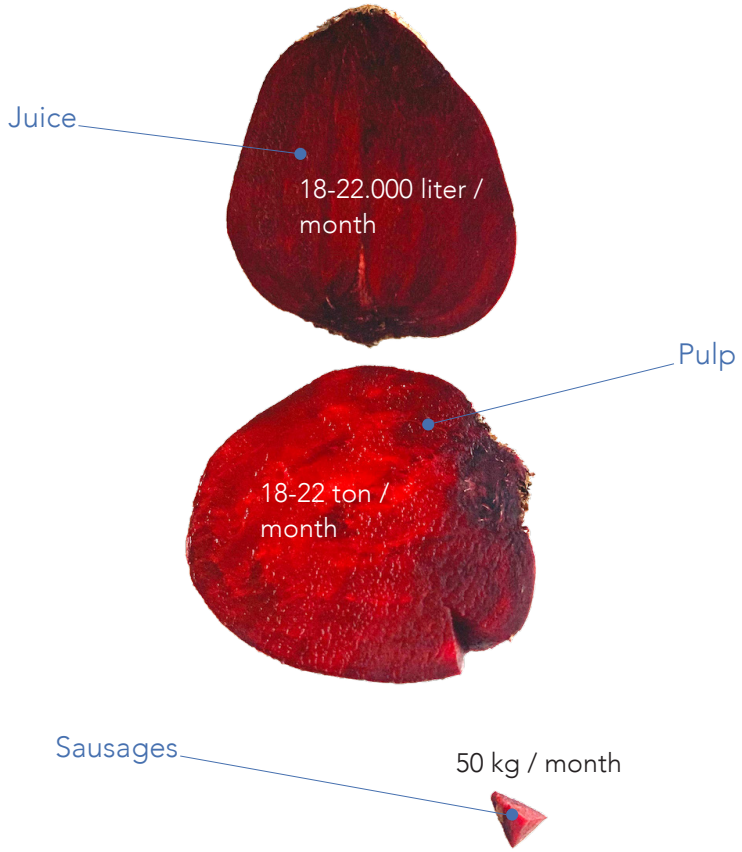

Figure 1 - Distribution of biomasses from juice production

Is Bioeconomy the Solution for Change?
One concept that might end up being the next big innovation development is the concept Bioeconomy. It aims to replace fossil-based resources by utilising renewable biomasses and their residue streams in development projects. The focus is hereby to use the biomass at the highest value. In the last couple of years, bioeconomy has become a popular strategy for policymakers in an attempt to address the great challenges our world faces today (Purkus, A. et al., 2018). Therefore we see that the concept holds huge potential to direct attention in development projects towards the enormous amounts of unexplored and unexploited biomass residue streams from food systems. Bioeconomy has the goal of using the full potential of biomass and create the solutions for tomorrow to replace the use of fossils. But are the most sustainable solutions chosen by default? And how do you apply bioeconomy as a focal point in a development project?

Development Projects Paving the Way
One project in Denmark that takes up bioeconomy is Det Store Spisekammer (Translation: The Large Pantry). Det Store Spisekammer is a pilot project on bioeconomy and is a collaboration between Gate 21, Lejre, Odsherred and Guldborgsund municipality. The project seeks to explore how to design and run development processes around food with the use of the municipalities' respected residue biomasses. The project partners are very open to explore the different possibilities within bioeconomy, and at the same time acknowledge the importance of addressing sustainability, but knowledge is limited on how such bioeconomy development process should be designed.

No Stable Plug-and-play Solution
Det Store Spisekammer is an example of an increased attention on bioeconomy that has potential to support development projects concerning biomasses in a more sustainable direction. But the concept of bioeconomy is not a stable plug-and-play solution and the sustainability aspects of bioeconomy are far from given, which has also been acknowledged by many researchers (Meyer, 2017; Priefer, C., et al. 2017; Birch, K., et al. 2013; Bryden, J., et al. 2017). Bioeconomy can be seen as a strategy or vision representing a certain intention of change. Rather than being seen as one solution, it is an unstable guideline that is, and can be, influenced by many factors such as rationales, interests, knowledge, practices, technology, climate, biodiversity societal landscape and so on. So how do we become aware of the factors that influence bioeconomy development projects?

From Technological Fix To New Collaborations
Within bioeconomy, there is a lot of focus on the development of biotechnologies and extraction of proteins to use in/as feed. Unfortunately, in this connection, technology is seen as the solution to all the problems. This directs the attention away from how we, as humans, are able to change the way we produce and how we consume. Thus in order for ensuring a sustainable application of the biomasses, it is important to approach development work, with bioeconomy wisely. We need to work actively in order to ensure that sustainability plays an active role in the intended changes and the enactment of them. It challenges the status quo and provokes a focus on social change instead of technological development. In order to have bioeconomy as a guideline in development projects, it needs to reflect a desire to make people act differently and move in an intended direction. In our case in a more sustainable way. But how do we translate the bioeconomy intentions into operationalizable actions?

The challenging work in such development projects hereby firstly becomes about changing people's perspectives on e.g. what biomass is worth, and open up the imagination to unexplored utility forms for this biomass. It requires new knowledge, collaborations and practices to change the existing patterns among actors.

Innovation projects with bioeconomy becomes difficult because there are new collaborations and many actors involved with many interpretations of where to go. Many companies and researchers are already in the field of bioeconomic development, but there is a challenge in pushing the projects and design solutions away from designing technological fixes to unsustainable status-quo regimes. So how can more actors such as students and municipalities become involved in the game of collaborative sustainable change?

Film for Change
Design tools is an interesting approach to apply in innovation projects and can be an effective way to create awareness, involvement and collaborations in bioeconomy development projects. We have chosen to work with different visual tools and we seek to complement this by applying film as an active design tool and mindset in our design process. Equipment in terms of tools, visualisations and objects are crucial for supporting development processes. Firstly the work of getting to know the actors' rationales and knowledge positions, the commonalities and differences among them can be facilitated by introducing tools. Secondly, tools can serve the purpose of supporting new dependencies and interconnections to evolve among these actors. Thirdly the process of developing supporting tools can in itself enable the possibility for people to change perspectives. Hereby we want to contribute to creating bioeconomy innovation from a sustainable design perspective with film.

Shift In Perspective
Bioeconomy seems to have an overarching focus on technological development which results in an implicit focus a product solution.

We argue that in order for bioeconomy development projects to contribute to a move in the needed sustainable direction, we have to improve the focus on social and collaborative aspects as well. We want to influence bioeconomy development projects from making technological solutions to creating socio-technical systems and tools that enhance sustainable applications of residue biomass in the food industry.

Therefore our main focus of our study is to investigate:

How can we design a concept that supports bioeconomic development projects to apply residual biomasses from food-systems in more sustainable ways?

Through the study we also wish to dive into these Sub-questions:
- What are the current controversies with bioeconomy in Denmark?
- What factors influence a bioeconomy development project and who should be involved?
- What entails residual biomass from a food system?
- Can film as an active design tool contribute to creating awareness and collaboration through our participatory design approach?

1.2 Strategy

Systemic Thinking And Action
As sustainable designers, we work to influence and support the projects we engage in to consider the larger complex systems. We aim to uncover sustainable and unsustainable aspects connected to the area of development e.g. around an application of a residue biomass from a food system. In this project, we apply a socio-technical action research approach. Action research usually works on behalf of oppressed societal groups, but we twist this by drawing on Actor-network-theory. Hereby we see actors as human and non-human that interact and influence each other in constantly changing networks. With this perspective, we see the earth as an equally important actor that can be said to be oppressed. Therefore we work on behalf of the oppressed earth. We do this by applying a systemic understanding of sustainability that includes all the earthly systems: ecosystems, societal systems, technological systems, climatic systems etc. But this is not an easy thing to grasp, therefore we look to the Whole Multi-Level Perspective (Geels, F. W., 2018). We see potentials in using this as a way to see some of these otherwise hidden aspects, but we also need more specific knowledge at a practical level, to be able to influence and support through our design. Therefore we seek to combine the broader socio-technical systemic awareness with a context and activity based participatory approach. We apply a staging and navigation methodology and through this, we want to investigate how we can support sustainability aspects in development projects.

Based on these different choices of theory and methods, we have chosen to structure our report the following way:

What is at Stake
We present our take on sustainability from a systemic perspective. We look at controversies w the field of bioeconomy to uncover and understand rationales in the field. So we know the context we work in and what to be aware of.

Tools to See it with and Equipment to Act on it
In our design process, we use mixed methods from ethnographic research, participatory design, action research (in a socio-tech perspective), transition theory and activity theory/navigation & staging (humans interactions around tools and artefacts) to analyse and prioritise our actions of involving actors. We use film and visual tools as part of our design process to see if this can help to support awareness.

Two cases to Learn from
We investigate a case (case 1) on residue biomass from a food system: Frankly's Juice - pulp and Plantepølsen. We use the findings from this case to support a bioeconomic development project: Det Store Spisekammer (case 2)

What do the Tools show us
- With the MLP we see the dynamics around pulp; we see that we have to pay attention to which and how the dynamics can influence the use of residue biomass. We have to consider this in our design specification to involve and consider the multiple activities around the residue biomass.
- With the knotwork, we identify five topics reflecting interests and challenges found in the empirical data around development projects with using pulp as food.
- Through examples of our backstage and frontstage work, we see how invisible activities can affect collaborations and we see that film can work to support awareness and involvement - and possibly enhance collaborations in design processes

A Concept to support
We develop a participatory design concept based on the findings

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Chapter 2
Bioeconomy in a Systemic Sustainability Perspective

This chapter serves the purpose of providing a foundation for how sustainability in bioeconomic development projects can be seen. In the first section, we present our thoughts on sustainability with a focus on including a systemic sustainability perspective. We use this as a foundation to investigate how we can support bioeconomic development projects to apply biomasses from food systems in a more sustainable way. This work as a basis for the second section where we look into what the concept bioeconomy consist of and some of the controversies and rationales are at stake. In the last section we present a new approach to bioeconomy.

2 .1 Systemic Sustainability

Sustainability is not a stable concept and it has many faces. Therefore we wish to present and clarify our understanding of what sustainability is in order to set the stage of how we think when working with ways to apply residue biomass from food systems in a more sustainable way. For clarification reasons, we will refer to this understanding as systemic sustainability henceforth in the later chapters. To clarify how we see sustainability we draw on inspirations and interpretations of existing knowledge in the field and practical experiences.

Firstly, we argue for a sustainability perspective that avoids splitting the term into people, profit, planet, the famous 3 P's, which is most popularly used model. This understanding often risks undermining the fundamental environmental dimension, where companies exploit the term to greenwash their products or services (Kuhlman, T., et al., 2010). Meaning a company brand themselves as sustainable, even if they only focus on one of the 3 P's, e.g. people. The company might call themselves socially sustainable which takes focus away from what is not sustainable about the company in terms of the environmental perspective. Even though the company is said to be more socially sustainable, the company might do harm to the planet in terms of production, circulation of materials etc. We, therefore, take distance for dividing sustainability into focusing on single p's.

Interconnection Through Time and Space
Rather with a socio-technical perspective, inspired by among others Latour (2005), Callon (1986), we see the world as constantly unstable networks in which actors consider human and non-humans, henceforth referred to as actors, are connected in various shifting relations. With this perspective, we see the earth as a system wherein actors are constantly influenced and influence each other in a massive fluctuating network through time and space. Thereby we see sustainability as a movement that has to be worked on constantly and not as a final goal that can be reached.

One Earthly Ecosystem
We advocate for a systemic approach to sustainability where our underlining priority is to support ecological environmental aspects. By this, we advocate to include us, humans, as part of and together with nature in one common ecosystem. There is a tendency to see humans or culture as separate and isolated from nature. This can be seen as when humans try to control and direct the nature with e.g. geoengineering systems, that seeks to control the weather systems. It is done by using technologies instead of working together with the nature by e.g. plant more trees or stop the use of fossils. We argue for a shift in the dichotomous nature vs. culture perspective since we are indeed a part of one and the same ecosystem. That ecosystem being within our earth. Ecosystem is a great way to explain the interconnectedness of living and non-living actors in a complete system, but it is often used to refer to a bounded specific area. To oppose this, we find inspiration in Latour's notion to the Earthly [le Terrestre] (Latour, B., 2018) as a new political orientation. Which we see as the need to look at the earth as one interconnected system that should not be divided into local unities isolated by boundaries. Meaning that we must consider the earthly as being a part of the development not distanced from it. Hereby we see the earthly become an important actor as well as other actors in our design process.

Common Equality
It becomes crucial to include aspects of responsibility and equity in our systemic sustainability understanding. When ex. Denmark is

grabbing vast areas of soy producing land in South America, just to be able to feed the 1.896.000 ton pigs produced in 2017 in Denmark (DST, 2019), we cannot isolate impacts to be within the Danish national boundaries. To accompany our systemic sustainability perspective, we see the earthly aspect implies that we should see society within earth. With society within earth we propose an ecological world view where nature is not something distinct from us humans and the so called civilised world and the all the societal systems operating here. Instead, we include all the earth's spheres: biosphere, lithosphere, atmosphere, hydrosphere seen in an Earth system perspective. The Planetary Boundaries figure 2 provide us with a clear indication of the large pressure the earthly systems are undergoing, which make us aware of the limits that are already exceeded in e.g. the biosphere integrity. Therefore when working with development projects, we have to assess the projects and processes for their contribution to the earthly ecosystems and environment seen in a systemic sustainability perspective, shown in figure 3. We there by see that: "Sustainability transitions is not just a technological issue… It's also a social, economic and governance challenge requiring fundamentally different systems, structures and practices to be conceived and implemented in all these areas combined." (Gaziulusoy, I., 2019).

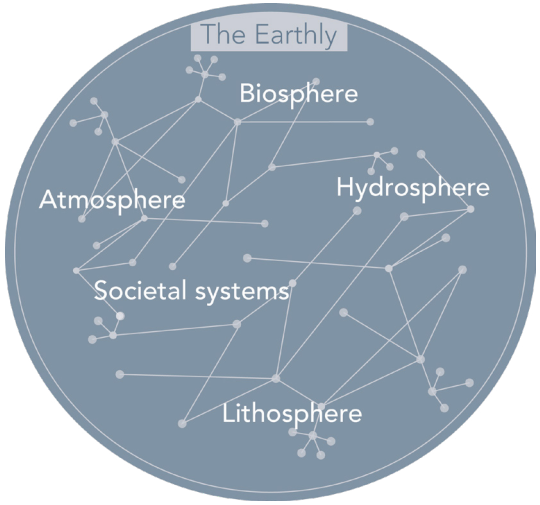


Figure 3 - Earthly Systemic Sustainability - own illustration

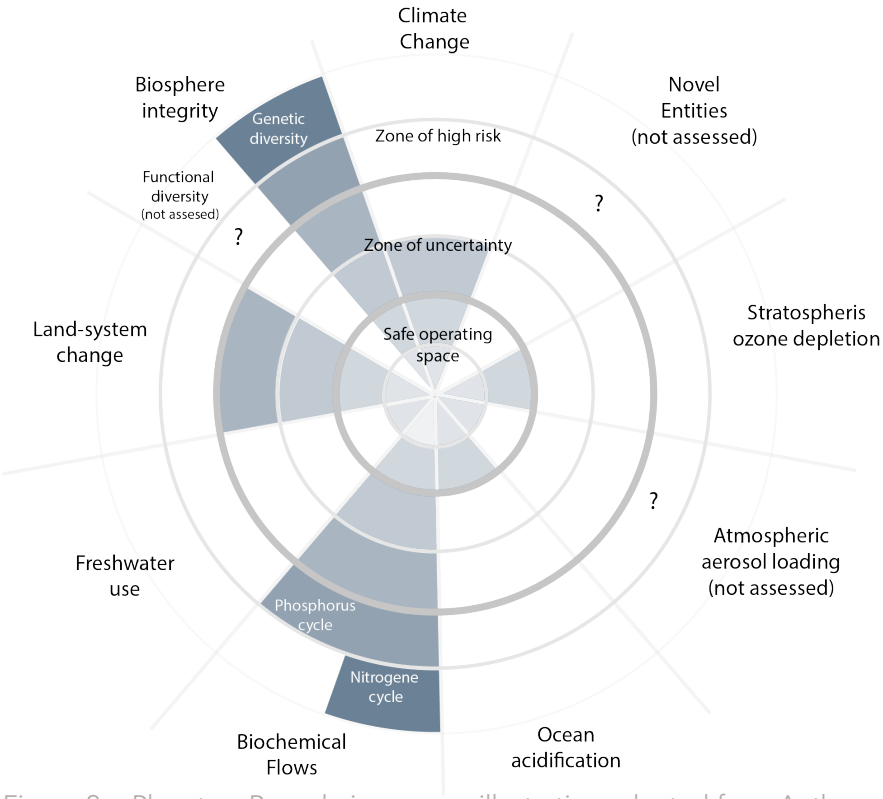


Figure 2 - Planetary Boundaries - own illustration adapted from Anthropocene (2018)

Complex Simplicity

From our belief systems are interconnected, but this complex approach is challenged by a need to make simple statements in order to make people aware of the problems. An example of this is the work by among others the IPCC, Intergovernmental Panel on Climate Change, created in 1988 in the wake of the Brundtland report Our Common Future published the year before (IPCC, 2019). The focus presented by this panel on Climate change from a meteorologist perspective. This has also been the most common public

interpretation and tendency in the sustainability discourse, to focus on climate change, simplified to energy and CO2. Which is indeed very critical. By focusing on solving solely climate change seen as CO2 goals, we risk reducing the considerations of the systemic sustainability aspects. To set an example, it is not sufficient to grow first generation conventional crops for bioenergy to reduce fossils, without realising the harmful effects this might have in terms of ex. biodiversity loss. The recent publication from IPBES, The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019), brings forward urgencies from a perspective on biodiversity and ecosystems. These aspects tap into a more systemic sustainability understanding. And hereby new challenges also arrive of ex. how to measure it quantitatively into political goals. But also challenges on how to translate it qualitatively in order to make it work in a development project with many different actors. Hereby the IPBES report adds important knowledge which is conflicting with many of the approaches applied in current bioeconomy projects. Some of these conflicts will be elaborated in the following chapter.

Act Now, Keep Learning and Adjust

In our understanding of systemic sustainability lies an element of openness. We are of that convincement that we all are obliged to work from the knowledge position in which we currently are. Meaning that we should act on what we know today based on the research existing at this moment in time. This means that what we do today might be insufficient in a couple of years - but we have to act now - as addressed by IPCC, IPBES, the glaciers, the school kids, the depleted land - to the best of our abilities. And stop waiting for more technology to be produced, but rather create a development framework and an approach that holds room for constant flexibility to morph into the new knowledge we discover as we go along acting.

With this project, we aim at influencing and supporting bioeconomic development projects to move towards more long-term earthly ecosystemic respects for future generations being humans and non-humans.

As a limitation to this project, we do not dive into the many quantitative tools for how to measure environmental impact specific to bioeconomic solutions. Though this can be relevant when comparing different use cases of biomass to discuss which might be more sustainable or has the least negative impact on the earth.
Approaches such as Human Appropriation of Net Primary Production (HANPP), Ecological Footprint, Energy Returned On Energy Invested (EROI) or Life Cycle Assessment (LCA). They can work as arguments for why one bioeconomic project might be better than another bioeconomic project. They can be useful approaches to frame a discussion on what ways to proceed. We, therefore, see these quantitative tools as useful to include in bioeconomic projects, but in order to make it work in development processes with many different actors from divergent backgrounds, it needs to be translated qualitatively to be able to include more actors in the process (Linnet, L. B., 2019). In this study, our focus is therefore on influencing the actors involved in bioeconomic development projects to evolve a more systemic sustainable perspective, with an aim of supporting the development of projects that might not support the current regime.

The perspectives presented here make the foundation of our systemic sustainable understanding and this foundation will, therefore, be reflected in how we as designers navigate and analyse but also how this foundation is weighing in the creation of concepts and tools.

Systemic Sustainable Considerations

So what does it imply to work with a systemic sustainable practice?

As designers with a sustainability backbone, we ask ourselves and the context a lot of critical questions. We do this constantly throughout a development process. As the process moves along and new knowledge and insights arise the contextual frame changes and you might have to reconsider what you thought was cleared. Here follows a list of useful questions and reflections, that we used throughout the process, which has supported us with to a more systemic understanding (considered a non-exhaustive list):

- What happens after *it* has been used to what it was intended to be used for?
- What does *it* do for future generations (seen as both humans and non-humans)?
- No toxins and harmful substances whatsoever should go into the equation!
- How do my actions and choices influence other factors/systems?
- Does *this* contribute to fair and equal distribution of resources in time and space? Ex. no land grappling for own profit
- How does *it* look in a society within an earthly and long-term perspective?
- Climate, environment, ecosystems, biodiversity etc. should not be looked at separately without considering the others equally important.
- Economy is not an aim, but simply a mean - the economy has to work within the earthly boundaries where there is a limit to growth.
- What is the 'mainstream' journey of a product/service and what are all the invisible side/crossing flows? - what influence does our suggested change have on this?
- Do we really need to develop a new technology or can we just utilise what already exists out there - in a smarter way - perhaps through new collaborations?

2.2 Bioeconomy & the Controversies

The Context

The bioeconomy is, in general terms, a way to replace fossil-based resources by utilising renewable biomasses and their residue streams in development projects. Bioeconomy is then about doing something with the biomass. Biomasses understood as everything from mussels and seaweed to wood, plants and animal manure. Each type of biomass has a different set of properties that makes it useful for different purposes. The type of biomass applied, therefore, determine the best possible utilisation. Bioeconomy development projects, therefore, becomes about how to make that utilisation, product or solution, valuable to apply. But how is it valued?

Bioeconomy has been increasingly and vastly used as a concept and a strategic approach to direct development work internationally as well as regionally since OECD published The Bioeconomy to 2030 - Designing a policy agenda in 2009 (OECD, 2009). Following this was among others the European Commission with their first bioeconomy strategy launched in 2012 (European Commission, 2012). And nationally was the Danish National Bioeconomy Panel, launched in 2013 (Miljøstyrelsen, 2019). And today the publications, strategies and projects on bioeconomy keep rising all over the globe. Bioeconomy is referred to under different names including biobased economy, bio-economy and circular bioeconomy, for clarification reasons we will in this study refer to it simply as bioeconomy. Looking through the various current publications and initiatives from global organisations Food and Agriculture Organization of the UN (FAO), to International Sustainable Bioeconomy Working Group (ISBWG), the European Bioeconomy Stakeholders Panel etc.; to national and local entities on bioeconomy (Det nationale bioøkonomipanel, Gate 21 - Det Store Spisekammer, Bioøkonomisk Vækstforum Guldborgsund, etc.). It seems to fathom a broad range of political agendas counting among others growth, employment, technological progress and environmental protection and sustainability (Purkus, A. et al., 2018). Bioeconomy can be seen as a way to diminish unsustainable depletion of scarce and harmful resources through a better

use of the bio-based resources we have available. But there is no common definition of the concept, which according to Priefer et al.'s comprehensive discourse study, is also reflected in the different definitions used in all the strategies. And since bioeconomy is worked with and understood very different, great controversies arise between the ways projects work towards sustainability (Priefer, C. et al., 2017)

Valuation Framing

To uncover the controversies in relation to juice pulp, we look at the bioeconomy development initiatives as expressions of certain intentions for driving change through e.g. strategies and agendas. Said in other words: the way bioeconomy is worked with and articulated can be seen as a representation of different actors' certain interests, knowledge positions, concerns, political beliefs, social standing and other contextual conditions. This representation can be said to reflect the set of values and rationales behind a certain actor's choices through the bioeconomy initiative. With inspiration from (Gehman, R. et al., 2010), we look at this as valuation framing. This means that the rationales behind the choices made in the bioeconomy projects are reflected in the valuation framings. Bioeconomy development projects are often a collaboration between many actors with a wide set of interdisciplinarity in the projects. The actors working with the bioeconomy initiatives in praxis interpret the valuation framings to fit their intentions for driving change. That happens to conflict with other actors' intentions of change. The concept of bioeconomy is thereby shaped and used strategically by many public institutions, organisations, researchers, practitioners etc. And the many valuation framings in the field of bioeconomy hereby lead to continuous negotiation and controversies between these actors.

To understand some of the controversies in the valuation framings that govern in the field of bioeconomy, we will in the following highlight selected examples. This will be limited to focus on discourses related to the utilisation of edible residue biomasses from food systems and thereby include discourses directly linked to bioeconomy, but also include discourses we find relevant for the context. Therefore, it will not paint a complete image, but rather outline areas that might be of influence when doing developing projects with residue biomass from food systems.

Selected Controversies

We have selected controversies identified through the following actors. Public institutions such as IPCC, IPBES, EU, the Danish National Bioeconomy Panel (DNBP), Klimapanelet; Organisations such as Gate 21, The Danish Agriculture & Food Council; Researchers and other institutions with a diverse background spanning from agriculture, biologists, engineers and business developers including among others The EAT-Lancet Commision, Lene Lange (also board member in DNBP). They are actors of importance to investigate valuation framings and rationale of the choices made in bioeconomic projects in relation to residue biomasses from food systems.

Controversy 1 - Utilising what Full Potential?

This controversy is concerned with the utilisation of the *full* potential of residue biomass. What often happens when talking about the full potential in bioeconomy is it often ends up only being about the economic potentials and undermining the sustainable aspects of the bioeconomy solution.

One attempt to display the valuation framing in the bioeconomy is through the pyramid illustrated in figure 4 (Lange, L., et al., 2016), often referred to as the biomass - or bioeconomy value pyramid. The pyramid, represent a broad understanding of how different utilisation possibilities of biomass should be valued and thus prioritised in development projects with an economic rationale. The economic rationales reflected in the value pyramid (figure 4) are thereby closely related with a phrase often used in discourses to describe the concept bioeconomy: "It is about utilising the full potential of renewable bio-based resources" (Lange, L., 2018). The pyramid represents different output types of bioeconomy projects and how they can be prioritised in order to gain the highest economic value of the least amount of biomass. The higher in the pyramid the better the biomass is utilized, and the more value the output has in an economic understanding.

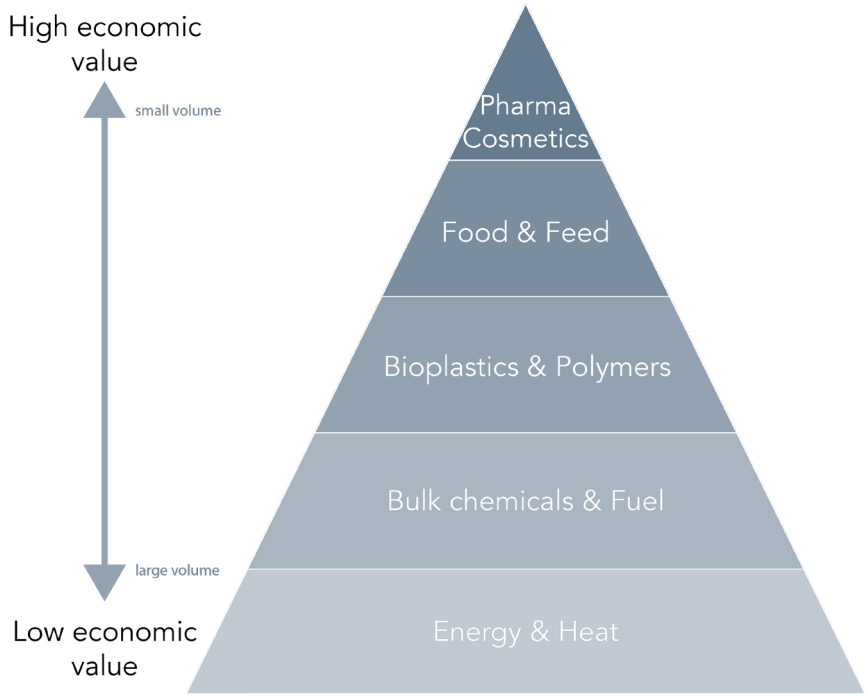


Figure 4 - Bioeconomic Value Pyramid - own illustration adapted from (Lange, L., et al., 2016)

The full potential for economic growth and employment
Another perspective that advances from an economic rationale, is that bioeconomy strategies often are seen to have a huge impact and transformation potential due to the focus on local job creation, local production of goods etc. Bioøkonomisk Vækstcenter Guldborgsund (Bioguldborgsund.dk, 2019). The discourse of these strategies is often how they are able to create economic growth that supports status quo economic growths way more than it considers sustainable development.

Controversy 2 - Technological Development
Bioeconomy is closely connected to discourses on technological development. We see a strong focus on technological development in projects driven by a biotech perspective.
One example is the set-up for the applications to the EU funds Bio-based Industries Joint Undertaking (BBI-JU). The set-up draws on technology development tools borrowed from NASA's tools when developing space-rockets. The models are used to describe the technology readiness in a level from 1-9. This indeed takes the focus away from surrounding socio-technical aspects as the focus is on the development stage of technological solutions e.g. protein extrusion or biogas plants.

Related hereto is again "Using the full potential" as presented in controversy 1 is also closely linked to a biotechnological perspective of developing solutions to "..using energy content, structural building blocks and nutritional value.." (Lange, L., et al. 2016:7)

In opposition to uncritical technological development and continuous application of new technologies is among Adam Greenfield: "The moment you pick up a technology you contribute to increase a demand for more resources needed" (Greenfield, A., 2019). Greenfield hereby questions the very idea of developing new technologies to make e.g. bioeconomy more efficient, which can be said to relate to the idea of utilising the full potential through new biotechnologies. He raises an important concern stating that we do not really understand the technologies we advocate for. We see this as a crucial perspective in relation to the considerations on how to make the bioeconomy development projects more sustainable. Since as soon as you start to think the new technology you intend to develop into a broader and earthly systemic context, you have to consider e.g. all the potential waste-heat generated by the technology.

Controversy 3 - The need for proteins
This controversy circulates around the heavy weighing focus on proteins in bioeconomic strategies and development projects. One dominating perspective is the discourse concerned with the future provision of proteins which is the main focal point for the Danish national agenda, that can be seen in DNBP – Proteins for the future (DNBP, 2018). In this report, the focus lies on developing new ways to extract proteins for feed. This perspective is supported by The Danish Agriculture & Food

Council, the national agriculture interest organisation. In their recently published report (Landbrug og Fødevarer, 2018), they advocate for the same development. The rationale is that with the future growing population we will need a corresponding amount of food. Based on dietary it is projected that we will need twice as much animal-protein as we have today. Therefore, the focus for bioeconomy development projects has to focus on new ways to produce proteins for feed. The valuation framing is hereby stating that using proteins for feed is a great way to ensure future nutrition and food.

The demand is meat and we have to follow the market is the consensus among many of the practitioners, who are affected by status-quo: what the market wants and what creates revenue (JA event, 2019). Another contradicting perspective, that is gaining more interest is the focus on plant-based protein products. This perspective proposes that there is a rising market potential for plant-based proteins and it is no longer a niche market which is supported large companies produces plant protein products. (Plant-Based-Protein event, 2019). In opposition to the meat-need rationale is also the recent EAT-Lancet Commission report, Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, stating that we should cut down 50% on the consumption of among others red meat in order to "Transformation to healthy diets by 2050.." and achieve sustainable food systems (Willett, W. et al., 2019:448). This is recommended both in regards to health and nutritional reasons but also in regards to climate and environmental aspects. Additionally hereto is the perspective that we in Scandinavia consume more than 150-200% of the needed proteins (Plant-Based-Protein event, 2019). But actually, the residue biomasses from food systems contains other important qualities than protein. E.g. are fibres highly overlooked in the discourse. Fibres play an active role in regards to sustainability in the bioeconomy since the increasing production of among others fibres "...has occurred at the cost of many other contributions of nature to quality of life…" (IPBES, 2019:2). Therefore, the discourse should include the importance of utilising the existing residue biomass also with attention to the fibres it might contain

In our perspective, we need to look at the potentials of plant-based proteins and to apply residue biomass to food instead of feed. We need to shift the focus and change the discourse away from a need for meat to a need for earthly respects for the land we use.

Controversy 4 - Wasted Land

A perspective linked to the controversy on proteins is how the overarching focus on feedstock has a negative impact on the biodiversity, depletion of land and equity due to the intensive monocultures required to grow the huge amounts of plant proteins to feed the animals. A method that threatened biodiversity through monoculture land-use and degradation of the soil is growing renewable biomass resources for the purpose of producing energy. Biomass that has been produced for a specific bioeconomic purpose, e.g. pile to create energy, will put even further stress on the land. And relating to controversy 2 about technologies we should question whether we actually need so much electricity? This discourse is related to the use of land perspectives on ways to use less land on vegetables. Growing crops specifically for energy purposes gives an indication of the wickedness of the situation when at the same time around 20% of all food produced in the world is wasted (Eu-Fusions, 2016). Therefore biomasses in a land use perspective is extremely important to pay attention to in development projects. An aspect to be aware of before applying biomass to a new utilisation is to consider the existing system it is a part of. Some of the wasted biomasses are already used inside the agricultural sector though there are still a lot of residue biomasses from the food sector, that currently could be used in more proper ways. A lot of the biomass is not even used in the agricultural sector but is simply wasted or used as biogas. This seems to be the case with the fairly large amounts of juice pulp.

2.3 A new Approach to Bioeconomy - Changing the Perspectives and Actions

We suggest a new and undermined rational that considers the earthly aspects and includes e.g. previously mentioned perspectives from IPCC, Planetary Boundaries and IPBES combined. This involves working with solutions that support the future need for making projects that are not harming biodiversity but rather seeks to contribute to it. And avoid supporting projects that apply a weak mitigating approach of adjustment of status quo, as for example by trying to make the meat production more sustainable instead of focusing on to the urgency for radical changes in the food culture by excluding or cutting down on the meat production. As a final remark, we urge the bioeconomic development projects to include aspects of social and earthly equality in relation to the exploitation of land and resources. The social aspect comes to play when considering producing energy (biogas) over food. Looking at Denmark isolated, food is not a problem but 11% of every human beings are starving (IPBES, 2019) and the earth's population is growing, so in our eyes, bringing solidarity to the bioeconomic rationals are crucial.

Based on the new rationales, we readjust the previously presented bioeconomy triangle (figure 4), as an attempt to suggest alternative valuation framings to include a more sustainable and solidary approach, figure 5 The Sustainable Bioeconomy Pyramid. Here we placed feed and cosmetics at a lower priority level, and placed food as the second highest priority. This is done to guide prioritisation in development projects in a direction towards using the residual biomasses from food systems as ingredients in food.

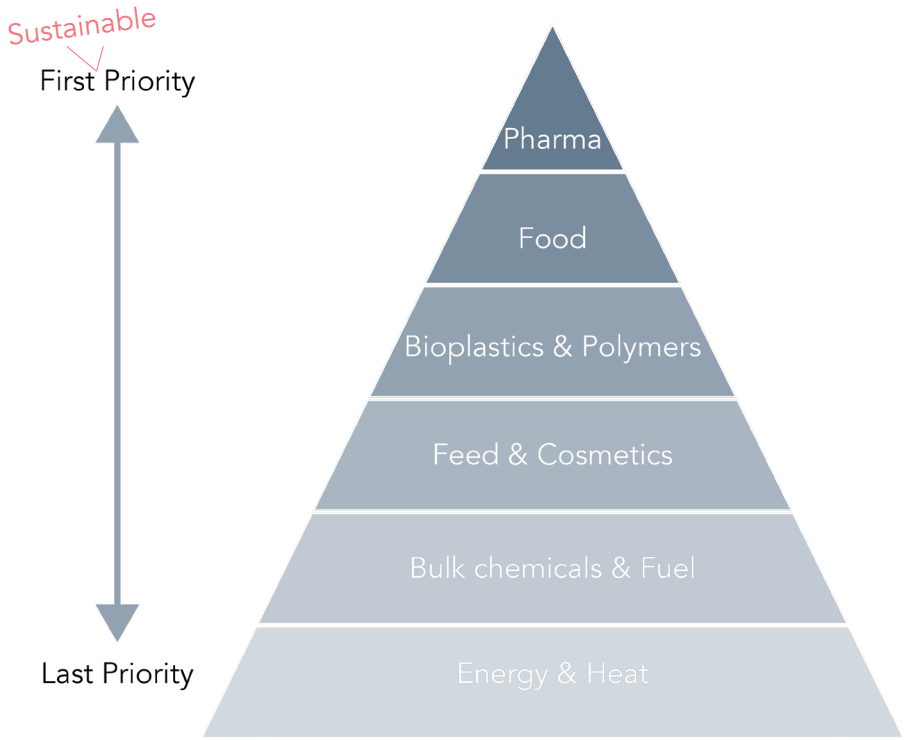


Figure 5 - The Sustainable Bioeconomy Pyramid - own illustration

We take a strong distance from 1st generation biomass, which is mentioned as a rationale for creating sustainable energy. We see that other far more suitable alternatives exist such as wind, solar and water power. These alternatives should be used instead of 1st generation biomass. Before considering ways to produce more, we advocate focussing on what is already there and what biomassses we need to explore how to use more wisely.

We see that a great challenge in bioeconomy is the many diverging rationales and discourses which influence how the problematics are scoped and thereby how they are dealt with in practice. We argue to include a holistic perspective - which means more than merely accepting status-quo and assume that consumption patterns will proceed as they are today - we argue that the bioeconomy projects have an obligation to dare to challenge the existing rationales and pave the way to alternative futures that considers systemic sustainability aspects.

By doing so you all of a sudden look different at the solutions needed. We have all the technology needed available; this is not the challenge. Those arguing that we still need new technological advancement in order to fix the climate crisis simply just do not dare to make the required radical shift towards taking responsibility for changing their actions. Therefore, what we need the most is to have decision makers, municipalities, students, farmers, food producers, grassroots, start changing their ways by acting differently than the status quo. Hereby we argue that bioeconomy development projects need to shift focus from overarching technological development towards including ways to create new collaborative synergies, deeply connected to and conditioned by a respect of the earthly ecosystems. Through this value frame, we can develop novel ways to make use of the full earthly potential, of not only the biomasses that are already there but also the technology that already exists in a humble and considerate manner. It is important to say that we do not undermine the value of all new technological solutions. We see technological development as important to provide clean energy, mobility etc. to reducing the negative impacts from the humans on earth and it can make a great difference in term of sustainable transition. But there is a need for a more critical and holistic perspective that not only fix one part of the system.

Sub conclusion

With our systemic sustainability perspective, we unfolded controversies within the field of bioeconomy and sustainability by investigating selected valuation framings related to the utilisation of residue biomasses from food systems. We identify conflicting discourses such as animal versus plant proteins, energy crops and biodiversity loss, technological development or changing habits, market fixation etc. With these insights, we are in a better position to challenge the discourses and rationales that support status-quo. Bioeconomy can be a great concept to outdate the use of fossils - but the technology, feed and energy focus needs to be challenged in order to support a systemic and earthly perspective. That could push the bioeconomic focus in a more sustainable direction.

Working in the field of sustainability and bioeconomy it has become clear that firstly, we need to be able to see what is at stake understood in a socio-technical and systemic sustainability perspective. Secondly, we have to identify what elements and interest that are challenging the sustainability aspects in bioeconomy development projects with residue biomass from food systems. And we need to find ways to transfer, communicate and share this knowledge and perspective in order to support awareness building among participating actors in the project. In order to do so, we need tools and design approaches to support actors to take up a more systemic sustainable perspective when developing bioeconomy projects with residue biomasses from food systems.

Chapter 3
Methods & Theoretical Concepts - Designers Toolbox

In this chapter, we present how we as sustainable designers approach the design process and what tools we have in our toolbox. We will do this by introducing the main theoretical and methodological approaches we draw on and how we use them. This works as our foundation for our work with investigating and developing a design process and concept which can influence and support bioeconomy projects to move in a more systemic sustainable direction in the food sector.

We advocate for a necessity to apply the abstract context of earthly sustainability into the design process. This provides a wonderful complexity that inevitably requires collaborations between more and diverse professions over time (Björgvinsson, E. et al., 2012). That implies inviting new eyes and competencies into the process which require balancing and considering correlating activities in terms of now, past and the future. To do that the designer needs a backpack of diverse world views and methods to navigate them. Therefore, it becomes important to approach, describe, analyse and work with our activities from more than just one theoretical point of view.

This chapter begins with two sections that describe our process and role as sustainable designers, followed by three sections that present the tools used in this study.

3.1 The Design Process

The Object of Design
Our main focus has been to design a process as well as designing objects to support this process. Hereby we see our design work with developing the project, involving actors, creating relations, initiating activities etc. as a part of the design itself. In our design methodology, we find inspiration in mixing a variety of explorative, iterative, creative, cross-disciplinary, participatory, contextual, analytical, and activistic approaches.

Design Process - Structure in Chaos
We as sustainable designers face the difficult task of carrying out research work and at the same time performing design work in praxis where we see ourselves performing many roles dependent on diverging contextuality of the design process (Bilfeldt A., et al., 2018). Thereby our wonders have travelled along the lines of ex. Buchanan's (1992) notion of how we grasp the wicked field of doing design and development work. Accompanied by the challenge to "balance the tension of performing research work with many diverging viewpoints and the need for generalised findings", (Linnet L. B., 2019). We therefore in this report apply a classic structure to explain our work, though this should only be seen as a mean to represent a somewhat structured version of a design process that is by nature messy and wicked.

In figure 6 on the next page we have with inspiration from Gaziulusoy I. (2019) illustrated our process roughly. In chapter 6 we will elaborate more on the figure in relation to our specific actions in the design process. As shown in the figure we have throughout our process practised stakeholder activities and desktop research activities in diverging intensities. These include among others email correspondences, literature research, phone calls, film recordings, unplanned tests, informal talks, events, etc. this will be elaborated in the data foundation in chapter 4.1. Between the stakeholder - and research activities are highlighted examples of some of our most important activities and how they relate in time. The timeline should not be considered equivalent to the actual time spent on the activity.

For our ideation phase presented in chapter 6, we draw on the inspiration and previous experiences of operationalising and adjusting methods from Cross N., (2008). The methods presented by Cross focuses on product development and ways to define e.g. elements such as functions, looks, weight etc. But we have found these methods to be quite useful also in a design process that does not solely focus on product development. We have expanded the view to include more qualitative and interpretive elements in order to make it fit our design process better. Especially we have found it fruitful to

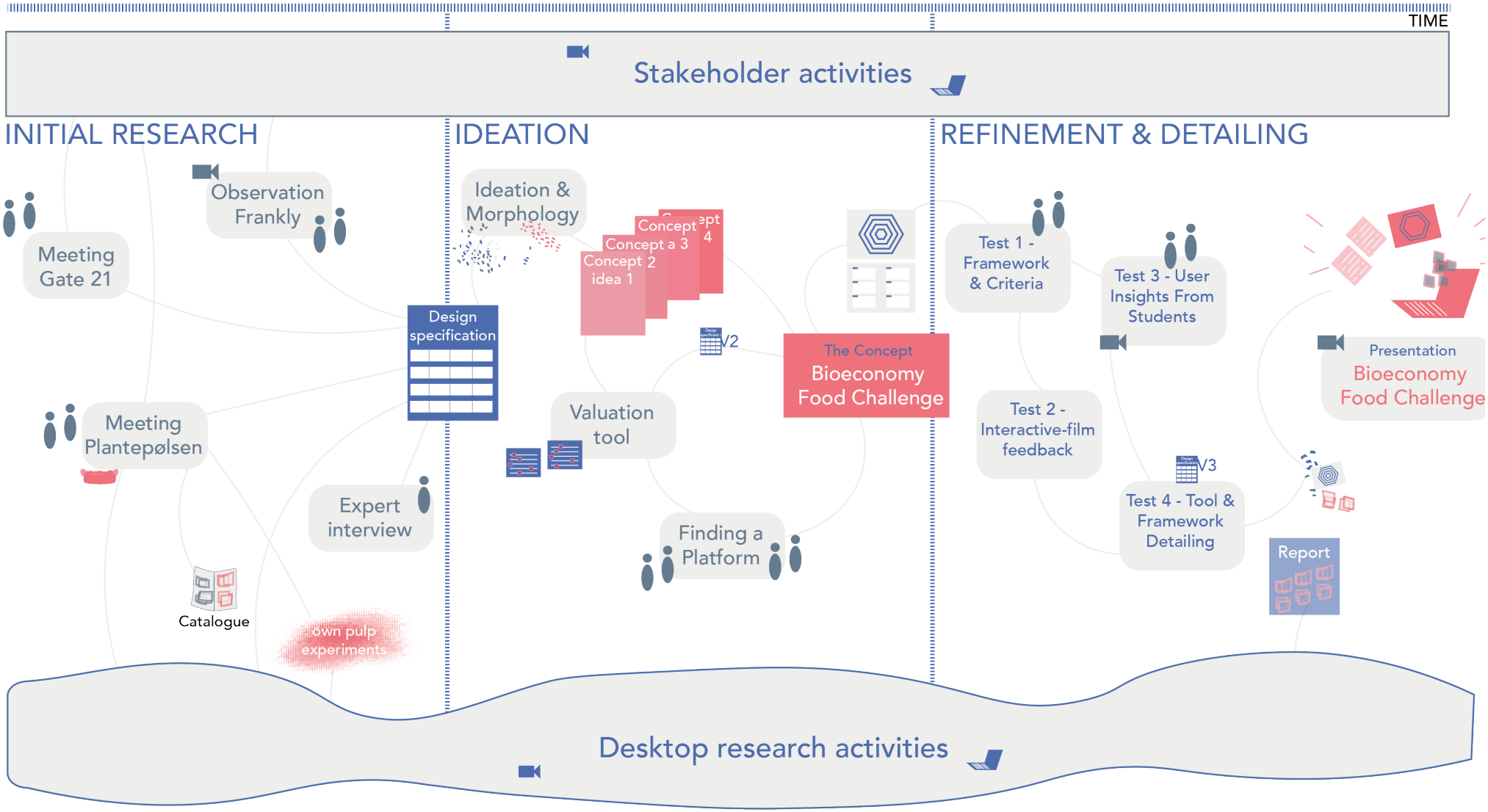


Figure 6 - Our design process - created with inspiration from Gaziulusoy I., (2019:13)

use the design specification, as a way for us to collect and sum up our research and empirical findings. In an analytical perspective, the design specification as a tool has served to facilitate negotiations between actors in the project. The specification led us to combine our understandings into a common idea of the design field we are navigating in. Since this common idea of the field of design has a tendency to be very momentarily, we have in this project, used design specification recurrent in an agile way as a tool to structure our development process. Yet making it flexible enough to change according to new findings as the process moves along.

Based on our first design specification we use classic methods of brainstorming and ideation. We structure the ideas in a morphology chart. Elements of the chart and how we use it is described in chapter 6.3. The morphology chart is normally applied for the development of products, but it still serves as a framework to concretise concepts that include other activities than a single product solution. To evaluate our concepts we developed a tool, which is based on experience with supporting tools for evaluation processes from one of the designers work at Danish Design Center. These tools will be elaborated in chapter 6.

3.2 The Role of the Sustainable Designer - Action & Collaboration

- Action Research in Participatory Design Socio-Technical Activism

We see our most important task as sustainable designers to challenge status-quo. To do that we apply a new interpretation of conducting action research. Action research is a democratic inquiry that aims to create practical solutions in collaboration with the participants. It originates from a wish to empower oppressed groups in a society. In our study, we work with a socio-technical perception of the world and we argue that our work is action research in the terms that we work on behalf of the earth, that can be said to be under pressure and oppressed. In action research, you often collaborate directly with activist groups or NGO's, but instead, we have sought to make our actions count through collaborations with companies and organisations, that we found likely to become potential allies to create solutions that work against the oppression of the earth.

In order to enhance the possibilities of influencing the bioeconomic project as thoroughly as possible in a sustainable direction, we have applied an approach drawing on action research. As part of our sustainable design backbone, we find it crucial to work actively on changing status-quo rather than merely study it. We pay attention to create a design process that enables actors to participate and shape development. It is closely linked to participatory design eg. Björgvinsson, who propose the theoretical concept of political design "…that challenges and articulates power relations and evokes new questions and themes…" (Björgvinsson, E. et al., 2012:129). We wish to influence bioeconomy projects by incorporating central sustainable aspects, as presented in chapter 2 in development processes through our own design process. One way of doing so is by paying attention to "...the importance of negotiating (sometimes conflicting) values, as these cannot be identified by a priori assumptions but rather are subject to negations and emerge in collaboration with diverse stakeholders…". (Brodersen S. et al., 2018:1). We have in relation hereto approached the field with an exploratory and open mindset and applied a variety of ethnographic methods and included a broad group of stakeholders and equipment.

In order to know how to carry it out in practice, we need to figure out who and what to engage, how to do so and when. Here we draw inspiration on the notion of designers as creators of infrastructure activities, that enable and establish spaces for important negotiations to take place. The infrastructure unfolds a mental image of all the cables, sewage and hidden systems that support society to continuously develop. This can be said to relate to Storni's agenda on shifting focus to designing systems instead of objects. Hereby including a systems thinking as a part of the design process as well as designing a system as end product "...the participatory design process turns into an open-ended process of infrastructuring [...] where participants with a divisive matter of concern can confront one another and continue to explore design-after design." (Stor-

ni C., 2015:169). Our attention is hereby directed to visualise our activities as being part of a broader system, that includes future and parallel activities that we are not directly involved in but yet perhaps capable of putting our mark on. This is important as we, as sustainable designers believe that we can contribute positively towards sustainability in and around projects. We follow the thoughts from Brodersen S. et al., (2018) presenting the designer as navigator between matter of concern, which is seen as people interests or knowledge positions. But we argue that besides being navigators, our agendas and matter of concerns as designers have to be a very present aspect of the design process as well. We are hereby aware of our role as designers to change and manipulate the frame creation and contexts, in which the participants can interact, through the work we perform (Dorst K., 2018).

3.3 Tools to Navigate and Stage

With this project, we wish to contribute to a larger mobilisation where the process comes to include more actors with often divergent or intertwined interests and world views. Here it becomes fruitful to apply tools to navigate and stage in order to grasp the activities we initiate and perform throughout the project.
The tools to navigate and stage we present will help us see what knowledge positions and interests are at stake in the field in order for us to improve our design work and process to consider more aspects. This has proven valuable in especially three aspects; firstly we use it as a method to create internal common ground, secondly, we use it externally to identify and establish strategic framing of our work-about in the field, thirdly we use it to enhance transparency and communicate the importance of navigating and staging.

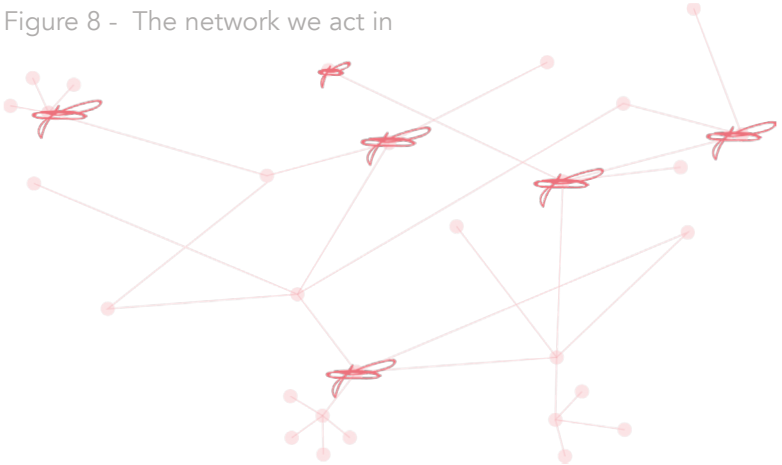
In the following, we unfold three different perspectives to navigate and stage. We find inspiration in participatory and infrastructuring design as an enabler for us to see key aspects from different viewpoints. This will be done through the three dimensions: Knotwork, Backstage & Frontstage and Vertical & Horizontal. The three perspectives are worked within as one interconnected, reflective, analytical and practical participatory process of deciding which activities to stage, where to stage them, how they should be staged and why.

Knotwork - Attention on Actors, Interests and Relations

As a way to investigate how we can support bioeconomic projects, we use the concept of Knotwork and Network. With this perspective, we get to know actors in and around the network and their interests and relations. At the same time, we use this perspective as a way to take strategic decisions in our design process. With the knotwork dimension, we see the field by zooming in on the knots, that represent the different activities we initiate during the project, illustrated in figure 7. With the network dimension we are zooming out on the network we are a part of, that represent the broader system that we are operating in, illustrated in figure 8.

Figure 7 - The Knotwork we tie with our activities

Figure 8 - The network we act in



Knotwork is a metaphor for tying knots. It is a way for us to keep an open mindset that focuses less structuring and more on exploring through our design process. We use this metaphor to describe intertwined relations in the network we navigate in and how we make progress by tying knots. Drawing on a relational network approach leads us to notice alliances between the actors considered human and non-human as a part of our design process. With this perspective, we get to see that the object of design and research work is as much a matter of designing networks as designing a specific object.

Networks are constantly fluctuating and changing with the result of them becoming quickly overwhelming in scope and abstract to work with. This is why the concept of knotworks by Bødker S., et al. (2017) is helpful because it provides us with a focus on the actions that are taking place in the knotwork. We see strengths in parallelly considering our own work as doing knotwork while analysing it as a network by looking at them as "...fluid, yet momentarily stable, constellations that emerge among participants with different backgrounds, perspectives, and agendas as they come together in matters of common concern." (Bødker S., et al., 2017:251). Hereby we get to look at the actors we engage as not necessarily having to have identical objectives and agendas in order for them to relate in a knotwork constellation.
Our focus of design will not solely be on tying knots by creating or supporting spaces or constellations where matters of common concern can flourish, rather we combine the approach with the infrastructuring work of enabling different and dependent matters of concern to be enacted and unfolded (Storni C., 2015).

Backstage & Frontstage
- Attention on the Invisible Process

With this perspective, we get to focus on the backstage as well as the frontstage, that make us become aware of all the invisible work that shape and influence our choices and work-about. We find great inspiration in thoughts from Bødker S., et al. (2017) and Star S. L., et al. (1989) with their notion to the concepts of backstaging and

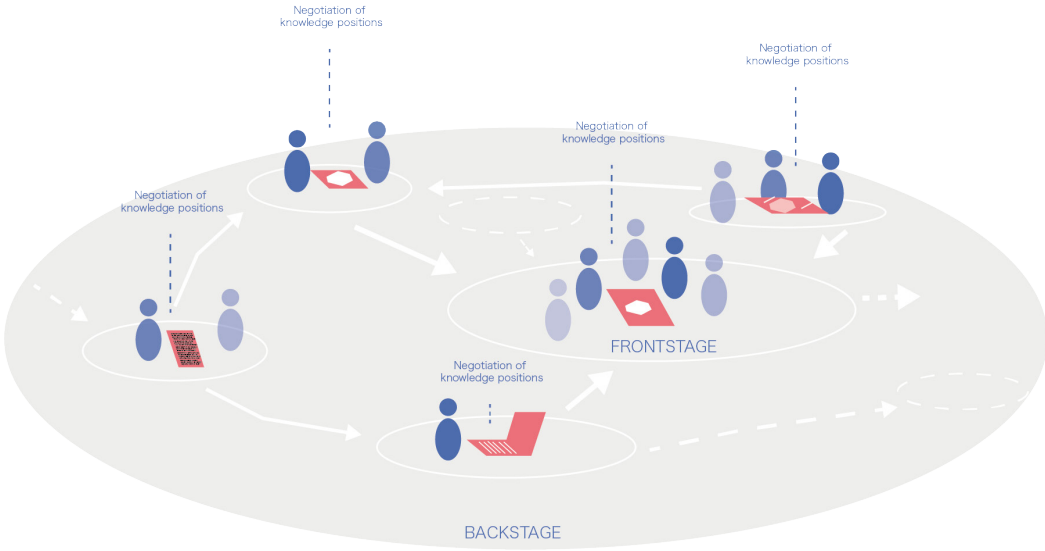


Figure 9 - Objects in frontstaging and backstaging activities of negotiating positions - adapted from Linnet, L. B. (2019)

frontstaging. Through this perspective, we get a spatial and tangible platform to look at the activities we perform and stage, on either a pretty and representable frontstage or on a messy and confusing backstage, illustrated in figure 9 above.

Staging as a concept is used by many researchers within the field of participatory design and infrastructuring (Storni C., 2015, Brodersen S., et al., 2018, Clausen C., et al., 2015). It can be used as an attempt to visualise the invisible layers and dynamics taking place during participatory processes and activities. It illustrates e.g. a play that is performed on the stage but also includes a perspective on the activities that take place behind the scenes to make the performance possible.

We identify the frontstage as the pretty scene of actions taking place at our workshops, official meetings, prototyping, and likewise activities where actors "... come together to work on the object of design..." (Bødker S., et al., 2017:248). These are the activities that often are the ones highlighted when a design is presented. The backstage is identified as the messy, invisible and less pretty work we perform throughout the design process. All the work that lies behind the frontstage activities, such as preparations, research, negotiations, coordination, alignment of actors, stakeholder orchestration, political and influential activities - as well as the development of objects and tools to equip the activities. These are activities "that fundamentally shapes the set-up and outcomes of the entire process." (Bødker S., et al., 2017:250) This metaphor provides us with a framework to noticing diverse and dependent knowledge positions and interests from the involved actors at the front- and backstage and this way of describing the field enables the discussion of activities behind what might seem to be obvious and fixed. Our work experiences as designers have shown that backstage activities in many projects can be more important knowledge to communicate than the results of the one final frontstage activity.

The attention on backstage and frontstage has served the purpose of creating a common ground for us as a design team, to work strategically with our pathways towards influencing bioeconomy development projects to include sustainability considerations and approaches. In line with the pragmatic thoughts by Carlile P., (2002), which will be elaborated in chapter 3.4, the backstage and frontstage approach can be said to serve as a boundary object. The backstage and frontstage tool has hereby served to improve our internal collaboration by establishing a common syntax, means for us to communicate and transfer our knowledge and adding interdependencies and new ways for us to work. Even though our education is the same, our thought-worlds/knowledge positions are not alike. By knowledge position we mean a mixture of political, societal, experiences, interests, rationales, contextual relations etc. This is important to be transparent about in order to create novel common understandings in a design team in order to improve movement in the same direction. The internal process is as much a negotiation of knowledge positions, as the external. And we find it crucial to embrace this actively in the design process in order to enhance collaboration and create new common knowledge.

Verticalities & Hierarchies - Attention on Distribution

With this perspective, we see the importance of including actors vertically as well as horizontally throughout our design process. This supports us with an open mindset that makes us look in directions and for actors and relations that might not be obvious. It is important for us to be able to describe how activities and knowledge can be seen as happening simultaneously at different layers. Each layer can be seen as vertically stabled and affecting each other. An example could be how politics are actions happening in one layer, that are affecting a specific bioeconomic project and vice versa.

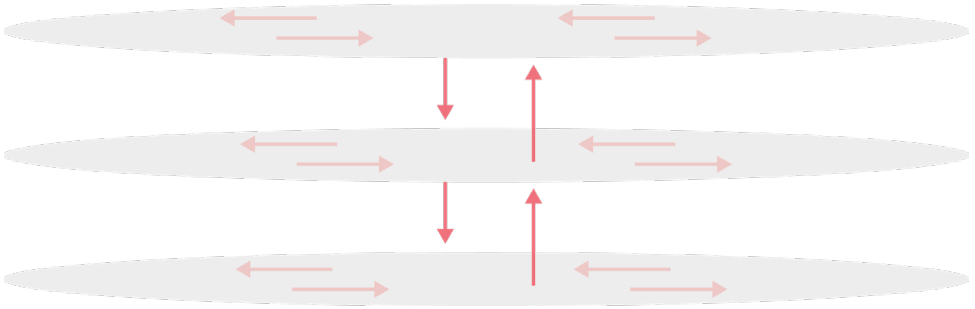


Figure 10 - Vertical and horizontal distribution of activities

We apply a perspective on vertical activities in order to include, engage and influence actors on more levels and arenas. Hereby we aim at dispersing our activities and agency not only horizontally but also through the layers of the formal political and organisational hierarchy as Bødker S., et al. (2017:266) propose. Hereby we get to include many participants and several perspectives in our knotwork around the juice pulp. By doing so we intend to enhance the possi-

bilities that our design of activities and tools can be shaped by and take place on more levels. (Bratteteig et al. 2001:63). This makes us see that "... some of these [activities] are in certain ways meta-activities that sustain the actual infrastructuring, and enrol actors in ways that make them allies of the greater project." (Bødker S., et al., 2017:266).

3.4 Tools to Visualise and Learn

To enhance our possibilities of influencing the bioeconomy development projects, we apply a pallet of methods and tools to visualise and transfer knowledge. We do this in order to support the learning and negotiation processes that take place in development projects. Hereby we become equipped to support and perform staging activities that can make people consider a context that can not immediately be sensed. We find inspiration in the importance of using visual objects, with a specific focus on film, as a powerful tool to translate, transform and learn about complex matters in development processes.

Objects to Open up the Imagination

Objects play an important role in supporting and shaping design and development processes. With inspiration from Carlile P., (2002) and his pragmatic approach, we pay attention to knowledge boundaries and how objects, referred to as Boundary objects can work to display, share and develop new knowledge among actors. We are aware of the many related concepts such as intermediary objects and interessement devices (Akrich M., et al., 2002; Clausen C., et al., 2015), but in this study, we will apply the term boundary object. With this perspective, we see actors' differences and dependencies and possibly how new interdependencies can evolve. We hereby find inspiration in Carlile's idea of three characteristics on successful boundary objects. They work to:

- establish a shared language and - hereby they work across syntactic boundaries.
- facilitate communication and transformation of knowledge, that enables learning about differences and dependencies and - hereby they work across semantic boundaries (Carlile P., 2002:444).
- support a process where entire new knowledge evolves among the actors, which then create new interdependencies at the semantic boundary - hereby they work across pragmatic boundaries (Carlile P., 2002:445).

With this perspective, we see an advantage in combining the three aspects as a way to explore how objects can work. We find the learning aspects as crucial to include as part of practising design and development work, where many actors with different knowledge positions and backgrounds come together to work on a bioeconomy project. We apply this awareness of knowledge differences and dependencies to our staging perspective. And we hereby see the objects, placed at the stages, serving a role to shape the possibilities for negotiation or exchange of knowledge positions within the field of bioeconomy development projects. Important to keep in mind is that interactions around these objects at the stages enables certain actions and negotiations to take place while leaving less room for other negotiations to be enacted (Linnet L., 2019).

Visual support

We apply a variety of methods such as sketches, mappings and other visual elements as part of our research and design work. These are used with different purposes at different stages. In line with the pragmatic approach, we use these to represent, display, transfer and transform knowledge positions in the project. With inspiration from Clarke we see that "Situational maps and analyses [...] enable us to better grasp the complexities of social life even if ultimately we "cannot pin them down." (Clarke A. E., 2003:572). We find it extremely important when putting awareness on and involving people in the complexities in the field of sustainability. As part of our par-

ticipatory design approach, we use interactive objects to support the development of new knowledge and eventually perhaps create interdependencies between actors. This can be done through e.g. "... exploratory design games that may address the issues of developing shared design representation on a conceptual level involving both user and several groups of designers." (Brandt, E., et al. 2008:1). We are aware of additionally great theoretical concepts such as scenarios, world building, gamification and blended learning. It can help show our proposed ways of dealing with the found controversies, challenges or missing links. Though as a limitation for this study we will not dive into these theoretical perspectives here. Instead, we will look into the potentials of applying film as a boundary object with more purposes.

Film as a Mindset and Method in Design Processes

With staging and navigation activities as an active part of our design approach, we accompany this with methods inspired by visual ethnography. Both of us having a background in film production, we see fruitful potentials in combining the staging approach with film production as an active method to enhance and support the activities we carry out. In this study, we do not distinguish between the term video and film and will henceforth use the term film.

Applying film as a mindset and method in our design process, we try to "bridge the gap between using video as an exploratory and subjective fieldwork tool and the practice of ethnographic documentary video making" (Pink, S., 2007:171). We seek to explore how film media can contribute in three ways.

- Firstly, to use the recorded material as a part of our ethnographic material
- Secondly, to use film as a tool to share knowledge across disciplines, in the sense of a boundary object to stage activities, and as a tool to display and translate knowledge to someone about a specific idea (in chap 5, 6, 7).
- Thirdly, to activate it as a design tool to influence innovation and development projects by functioning as a boundary object between different actors.

Mindset

As it is the case with doing design work, doing film work is also about staging. It is about planning, framing and constructing scenes were specific, more or less directed, activities take place often with the use of props. Hereby our film approach contributes and interrelates with our design approach. We do not see e.g. documentary films as films that present a factual true story and fiction films as the opposite, a fictional story. Rather we see both of them representing insights from one version of the story. Just like our design work are representing our version of e.g. the challenges with residue biomasses and sustainability. Therefore, the film we produce in our design processes should not be seen as objective recordings, but more as in line with subjective text (Pink, S., 2007:172). This means that it is "never impartial and usually engage with human experience and individual concerns" (Pink, S., 2007:172). Documentary film processes tend to focus on finding the good story. Likewise, our process has been influenced by hind lying considerations of finding e.g. the complex and possibly conflicting aspects that need to be considered in a systemic sustainability perspective. There are numerous approaches to do this but classically a scale can go from flye-on-the-wall to completely orchestrated. We have applied a mixture of these by both following the flow of actions, but also directing the scenes by ex. asking actors to perform a movement or state a sentence once again.

Method

With this mindset, we have throughout the process used film recording as a tool with more agencies combined. Firstly, we use it to document our process and empirical research. Secondly, we use it to gain access to perhaps otherwise tacit knowledge. Thirdly we use it to communicate and carry our agenda forward.

Documentation
To use film as a creative tool to document and explore, in our ethnographic research process, it provides us with a powerful microscope in the design process. By using film as an active approach, we apply a new mindset, that is focused on catching the contexts we are exploring with more senses. And at the same time, we get to harvest more nuanced data of that context.

Tacit knowledge
With the material captured by the camera lens and microphone, we are enabled to increase the detail and data that can be obtained and retrospectively analysed through and by multiple frameworks and actors (Derry, S. J. et al. 2010). It enables us to get data on more than what is being said by e.g. the respondent in an interview or the practitioner in an observation study. Instead, we get access to collect, more tacit or invisible knowledge, such as interactional detail of the participants compared to sound recording or notes. The film material can be coded, divided into different themes and then analyzed.

Communication
Film is a powerful tool to translate, transform and learn about complex matters in development processes. By incorporating film as a method in this project we wish to contribute to the practice experiences of exploring the possible interlinks between film research and film presentation. And hereby unfold the great potential for developing forms of film representations (Pink, S., 2007). Film can make examples of the collected data more explicit compared to e.g. written text in articles. And hereby possibly enhance awareness as it may enable the viewer to identify with the people or subjects represented at a more personal or empathetic level (Pink, S., 2007). It can also make the viewer re-analyse the collected data in another way as the viewer can reflect on e.g. not only how a design process is described but also how it looks (Pink, S., 2007).

It is important to be aware of the drawbacks of using film as a tool in research. Not all people feel comfortable being on camera, it can create a distance between researcher and person, the selection of framing leaves some things out and other drawbacks should be considered.

3.5 Tools to Grasp Sustainable Transition

To operationalise our systemic sustainability perspective, presented in chapter 2.1, we find inspiration in the work by researchers in the field of sustainable transition theory. In a project like this, we find it crucial to pay attention to how to deal with work carried out on a short term basis anchored to long-term complex systemic. Therefore we find it fruitful to incorporate a transition inspired perspective in our work. Our navigation and staging tools lack a description of performing activities in connection to systems changes. With ideas from transition theory, we are able to apply elements on a more systematic transformational level to accompany our practical staging work where our focus is on activities we perform. We acknowledge the perspectives on how to implement transition strategies such as e.g. Transition Management (Loorbach, D., 2010), which suggest a conceptual framework that from a managerial bottom-up perspective focus on creating many small scale interventions that eventually might push the transition. These are inspiring concepts, but we see a possibility for a limited focus on the emergence of small scale niche interventions that challenge the existing regime (Geels, F. W., 2018) one could think that transition only happens due to the heavy influence of niches. Therefore we see potential in focusing more on how to become aware of the larger intertwined mechanisms that influence how residue biomass can be applied. To include an awareness of these mechanisms and dynamics as part of our staging, we especially see potentials in the concept Whole Multi-Level Perspective by Geels F. W., (2018), henceforth referred to as MLP. We use this perspective as a framework for our investigation in chapter 5.1, to look at the dynamics and change processes of the regimes around pulp as residue biomass.

The concept of MLP is usually applied to describe how supply systems, such as mobility, change over time, and foster transitions to take place. It helps to describe how social and technological initiatives often referred to as experiments or niche innovations has the ability to put pressure on regimes and how landscape activities can influence the two others. With MLP we see that transitions in society happen through interaction between three levels and through action in each individual level. The first one is the niche-innovation level. On this level, the focus is on experiments and novel solutions. The experiments and solutions are niches, which means they do no not currently fit into the existing regime. The niches are constantly affecting the regime as they "grow bigger" when more social groups and power (eg. financial) is supporting the niche. The second is the regime-level. On this level, we get to see the existing and dominating socio-technical structure in society. The regime is not to be seen as stable, but under constantly influence by the niche-innovation- and landscape-level. In our case, we use this level to describe how residue biomass is used in different regimes. The third is called the landscape-level. Here attention is on the exogenous activities that can not be influenced by the two other levels in the short run (Geels F. W., 2011). The landscape level can put the regimes under pressure which can change it. This can be exemplified by climate-changes or decreasing biodiversity that can change activities in the existing, not-sustainable regimes. Additionally to the vertical levels are parallel regimes and multiple landscape trends that affect the three levels (Geels F. W., 2018). The parallel regimes are regimes that indirectly influence the MLP system. The multiple landscape trends imply descriptions of the landscape level from multiple sides to "include the possibility of trajectories that are not well aligned or go in the wrong direction" (Geels F. W., 2018). The landscape level can have multiple trends due to different interpretations of the landscape elements.

In our application of the MLP, we twist the perspective from focusing on a supply system to focus on a resource, a residue biomass. Hereby the MLP serves the purpose of providing us with insights on how the resource, juice pulp, find its way into different supply systems with multiple regimes and what dynamics are at play. In this way, we become equipped to include issues and possibilities of sustainable transitions and how multiple systems can work with residue biomass. We thereby attempt to address "A fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values." (IPBES, 2019:5). This perspective enables us to investigate the regimes and on the same hand "... address to persistent environmental challenges, like climate change."(Geels F. W., 2018) and other earthly conditions like increasing biodiversity loss. As mentioned in chapter 2 we apply a socio-technical system approach to consider challenges and solutions to sustainability issues holistically by including aspects such as technical, cultural, political, business etc., when addressing and analysing environmental problems and designing for changing these. These aspects are affected by social groups with agencies (Geels F. W., 2018) which mean they are acting in the regime and constantly changing it.

In our design process, we use the Tools to Grasp Sustainable Transition in two ways. Firstly we use it as a way to present how we see and understand the regimes we are navigating in and how residue biomass from the food regime fits in a transition perspective. Secondly, as a tool for us to discuss and understand the sustainable transition in our case by describing the actors and actions in our field in a MLP. This enables the ability to discuss how niche activities and landscape factors are challenging the regimes.

Sub conclusion

With the perspectives and tools presented in this chapter, we advocate for a socio-technical mindset that enhances valuation framing with the inclusion of a systems perspective. With our work of influencing bioeconomy projects, we can use staging activities to visualise and equip valuation framings that support sustainable considerations. In the following chapters, we will apply the above-mentioned tools and frameworks on our empirical data.

Photo Action | Anders Devantier & Liva Bjerg Linnet

Chapter 4
The Two Cases

Firstly we present the data foundation for our research and where and how we use it. This will be followed by reflections on the quality and potential drawbacks. The second part of the chapter introduces pulp as residue biomass followed by a description of the two cases.

The first case is an example of residual biomass from a food system. It presents the case actors Frankly Juice, the juice - and pulp - producer, and Plantepølsen, a niche company that use the pulp in their sausages. We use knowledge from case 1 as a reference example to transfer knowledge to case 2.

The second case presents the bioeconomy development project Det Store Spisekammer, that we engage in.

Data foundation

The empirical data foundation for this study is based on research conducted during the period from February 2019 to May 2019.

We will draw on research and design work conducted prior to the presentation of the final concept to our partners in case 2 which is on June 18, after the finalisation of this report. The data in this report consist of our findings and reflections from the development and design process performed prior to the last finalizing design work that will take place between the hand-in and the presentation on June 18.

During the project, we have conducted 12 interviews and 3 observation studies we have participated in 8 official meetings, 7 events, held 3 workshops and recorded 11 hours of film footage. In addition hereto are vast desktop research on official publication, strategies, project description documents and scientific literature reviews etc.. Besides this are a number of e-mail correspondences, coordinating phone calls and other invisible activities. Further details on this can be found in the Appendix 4.1.

Case 1
Juice Pulp

4.1 Case 1 - Juice Pulp
- A Residual Biomass From the Food System

Following the somewhat circular journey of the pulp biomass from juice production, this chapter presents Case 1 with the main actors Frankly Juice, Plantepølsen and Daka Refood. We will in the following refer to the pulp biomass from juice production, simply as pulp. We have in this project focused on two actors are central to the pulp:

Franky Juice (FJ) - a juice production company with the residue biomass juice pulp
The company and production facility is currently located just outside Copenhagen in Brøndby. FJ is a medium sized business with 10-20 employees. Their business model is mainly to sell juice at business-to-business.

Plantepøslen (PP) - a purchaser of juice pulp
Plantepølsen, which means plant sausage, is a vegan hotdog restaurant/takeaway located in Nørrebro, Copenhagen. PP started their business in January 2018 after being enrolled in an innovation start-up programme. PP is unique in terms of having vegan hotdogs as the main product in their business and has since the summer of 2018 experimented with using pulp in their sausages.

Another actor who is a part of the current pulp system is DAKA Refood is a biorefinery or biogas plant, in Hedensted, Jutland. Their business is to provide a service model with logistics and handling systems where they collect waste biomasses from business and private households and recycle it at their plant to produce bioenergy and gas.

What is Pulp and Juice?

There are various methods for making juice. All of them includes extraction of liquid and sugars from fruit and vegetables. In this case, the extraction is made with an industrial slow juicer that is cold pressing the fruits and vegetables. When slow pressing the juice, more of the vitamins are contained in the juice compared to other juicing methods. As the fruit and vegetables mainly contain water, sugar and fibres, approximately half of the biomass that is pressed becomes liquid, juice, and the other half becomes pulp. The juice contains most of the water from the fruit and vegetables and the pulp is, therefore, a relatively dry mass with lots of fibres, sugars and pectin (Lübeck, M. 2019; Lange, L. 2019). The various available methods of juice extraction make the pulp have different nutritional values, which also depends on the type of fruit or vegetables it comes from. The specific nutritional values of Frankly's raw pulp has not yet been scientifically researched which might be due that the raw pulp is not seen as a food source. But possibly also due to the pulp, except for pulp from non-organic citrus fruits, are great as human food and has a shelf life of 7-14 days when stored in a cool place in an air-closed container (FJ interview, 2019).

Pulp, and juice, are produced in many factories all over the world and also in Denmark. Quantities of pulp span from 400 ton a month (anonymous juice producer, 2019) to a couple of ton a month depending on the size of the production.

Frankly Juice's Pulp Journey

In figure 11 it is shown how the pulp currently travels in the system. The journey starts when the vegetables and fruit is being harvested. Årstiderne is the supplier of organic and primarily seasonal fruit and vegetables grown as local as possible. Årstiderne is placed in Humlebæk in the northern part of Sealand. From here the fruit and vegetables are distributed to the FJ. Here the fruit and vegetables are processed in their cold press production facility into approximately 50% juice and 50% pulp. The different types and the amount of juice depend on the orders they have received.

The juice is bottled in their own pressing facilities. The juice is sold mainly to other businesses for about 40 DKK per half a litre which is in the very high end of juice prices in Denmark.

The monthly amount of pulp is varying from 18-22 tonnes and all of that, except for 50 kilos is stored in a big container outside FJ's production. All the pulp in the container is currently going to biogas plants to create energy (gas) that can replace energy from fossils such as oil. Currently, FJ is not profiting on the pulp, instead, they pay Daka Refood to provide a service where they deliver containers and handle transportation of the pulp. The container is replaced with an empty container once a month and the full container is transported to the biorefinery.

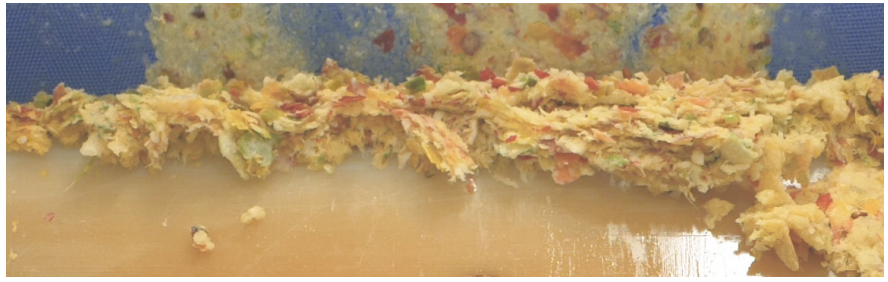
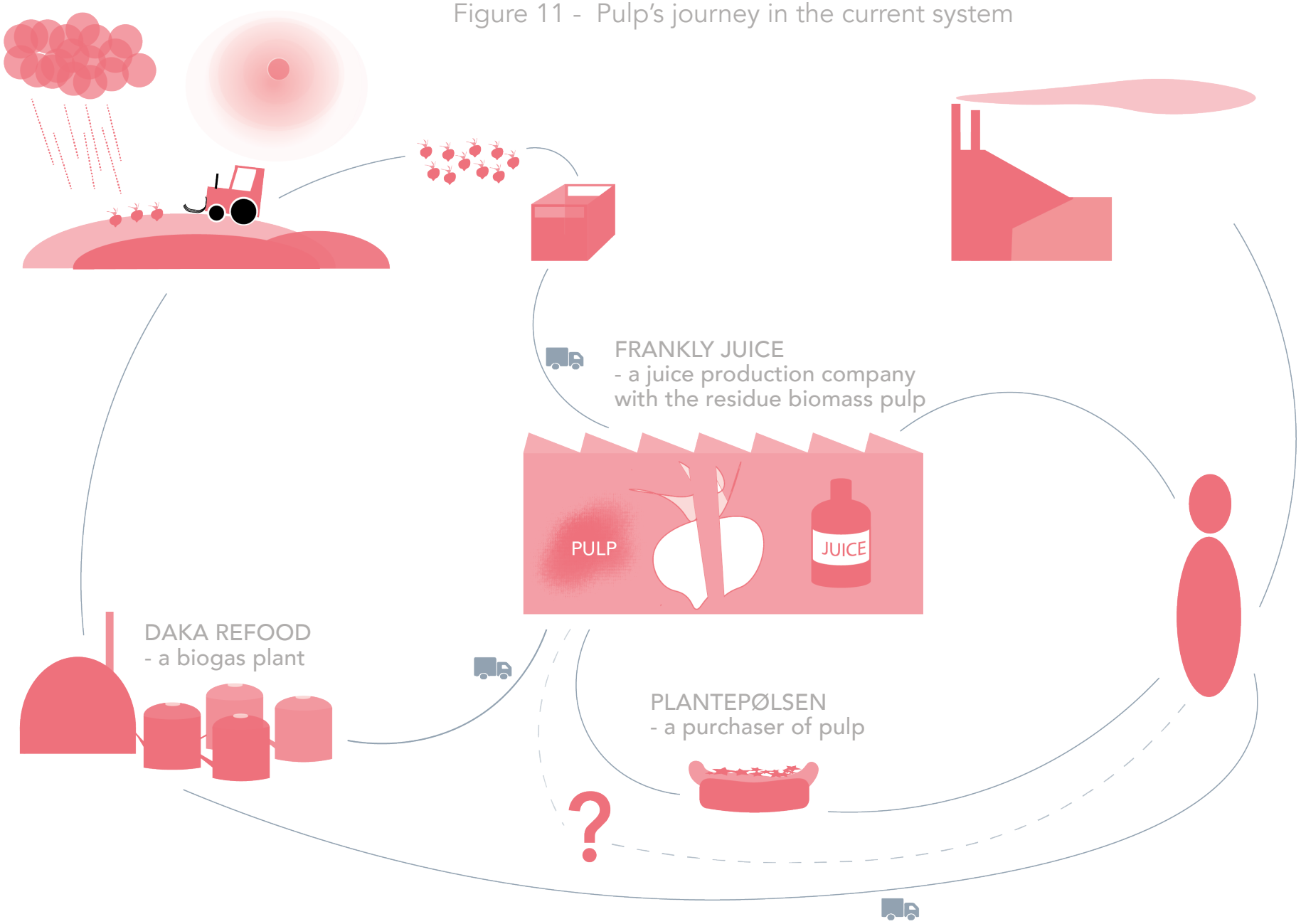


Figure 11 - Pulp's journey in the current system



When the pulp arrives it is mixed with other biomasses for example manure from livestock and processed to gas. Through the anaerobic processes in a biogas plant, you get biogas, methane CH4 and carbon dioxide CO2 and fertilizers. Biomasses from non-animal food systems including pulp from vegetables and fruits are in general not a sufficient resource for gas production. Especially in the case of pulp, where the fibre fraction is significantly higher (Ridjan I. S., 2019). As mentioned, different biomasses are therefore mixed in the biogas process, meaning that biomasses from ex. pig slurry from conventional farms. In Denmark, around 75% is mixed with organic vegetables and fruits (Energistyrelsen, 2019).

When the biomasses are no longer emitting gasses in the refinery it is used as fertiliser in the agriculture industry. Here the leftovers from the processed mixture of pulp and other biomasses become very beneficial to use as a fertilizer due to the high amounts of phosphorus and organic nitrogen left in the biomass. As a back side, conventional pig slurry has high amounts of copper and zinc due to medical treatment (Jensen et al., 2018). After the processing, the copper and zinc stays in the leftover biomass and is thereby also distributed out on the land as part of the fertilizer mass. And since it is allowed to use fertilizer from biogas plants in conventional as well as organic agriculture, the results are a decrease in copper and zinc concentration in the soil and the water environment. Which over time has a harmful influence on the organisms living there (Voigt S., 2015).

The residual 50 kilos of pulp has a different journey. Currently, PP comes to collect 50 kilos of pulp from FJ, without charge, as a part of a trial period but. The pulp is transported to the kitchen at Nørrebro where it is mixed with other ingredients into sausages, which are sold to customers in their food shop.

Commercial experiments with pulp

FJ has initiated test collaborations with more companies that have tried to experiment with using the pulp a food ingredient in food production. These are: Plantepølsen, Emmerys Bakery (bread, cake and jam), Organic Boho (vegan dishes), Meyers (bread and vegetarian dishes) and Årstiderne (paddies, vegetarian meal boxes) to challenge the use of pulp as a food ingredient. FJ have a wish to minimise the food waste from their juice production and they are interested in finding alternative ways and recipients that will apply the pulp as food.

In this project, our investigation focus is on the collaboration between FJ and PP. We see this as an interesting example of a project that seeks to apply a residue biomass from a food system in a possibly more sustainable way by utilising it as food.

The collaborations between FJ, Daka and PP is not articulated as a bioeconomy project as FJ and PP are not aware of the concept and the actions around it.

Case 2
Det Store
Spisekammer

4.2 Case 2 - Det store Spisekammer - a Bioeconomic Development Project

Det Store Spisekammer (DSS) is a part of a two-year developmentfunded by Region Sjælland. It started in January 2018 and runs until the end of 2020. in this report we will only look at this part and not refer to two the other parts of the project. The DSS a bioeconomic development pilot project with an overall aim to work with the possibilities to refine residue biomasses "... into high value products rather than they are wasted or being disposed as feed." (Regionsjaelland.dk, 2019, own translation). The project partners wish to generate knowledge and experiences on how to create bioeconomy development projects with a focus on food, that "develop high-value-products from residue biomass by the food industry in our municipalities. This will be done by creating products that can be used in every kitchen and create scalable business models that can be implemented in food societies" (translated from confidential strategy paper).

DSS is coordinated by Gate 21 and is a collaboration between more actors. The project partners are municipalities: Odeherrede, Lejre and Guldborgsund; knowledge institutions: RUC and DTU and a variety of companies in the food production industry.
The DSS project is divided into three project areas:

- The first area is on Lolland with a focus on the use of rapeseed cake, the leftover after the oil is pressed from the rapeseed.

- The second area is in Odsherred municipality. The industry in Odsherred municipality are large scale producers of among others root vegetables such as carrots and beetroots. The challenge here is that many of the e.g. root vegetables are currently not able to be sold on the market as food because the market demands that the products are a certain size and not bent. This results in a challenge of finding out how to use the great quantities of residue root vegetables.

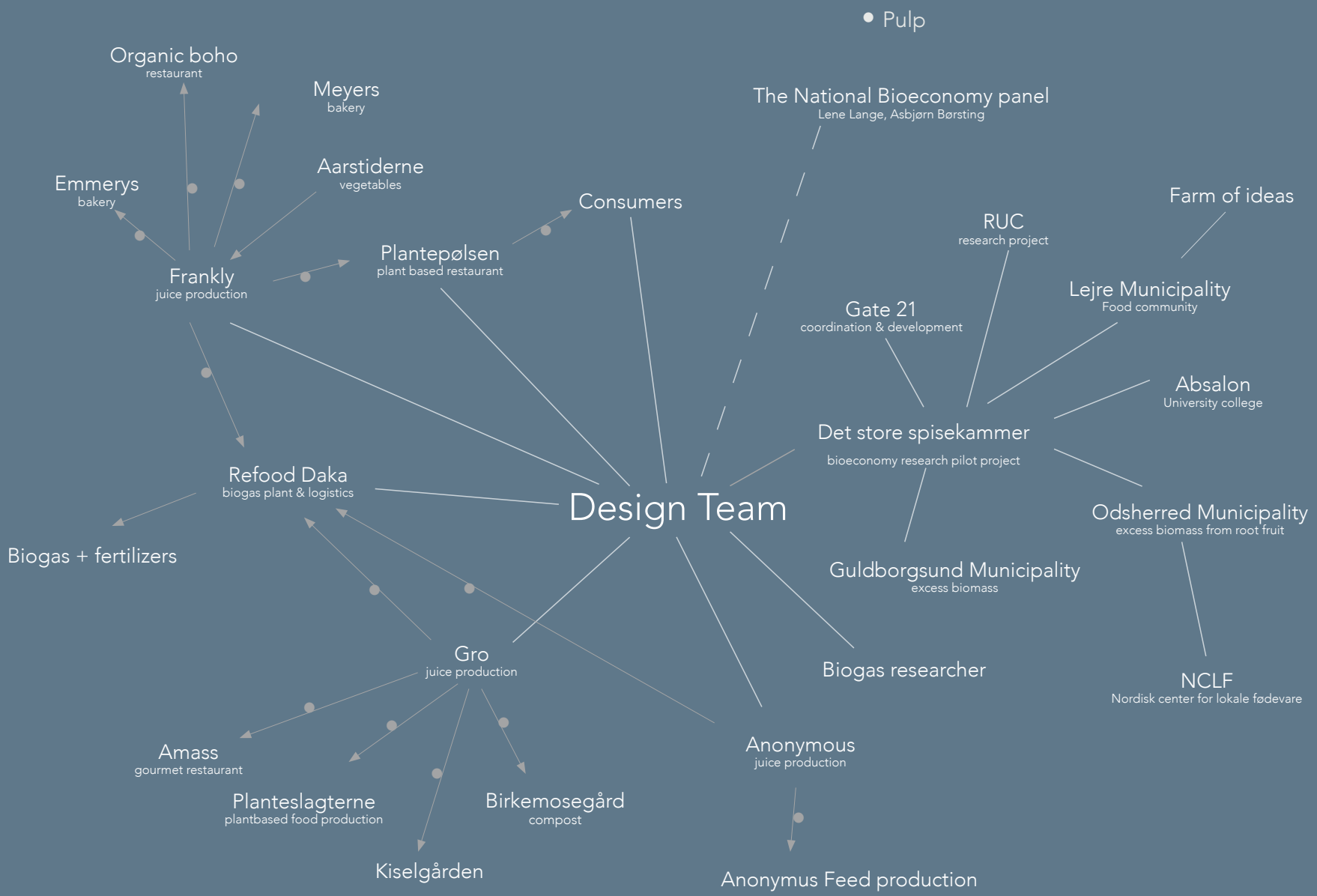
- The third area is in Lejre municipality with the aim of creating food communities and synergies between the different restaurants, small organic farmers and the citizens. Through among others better utilisation of residue biomasses in the area.

Organisation
The three areas consist of a representative from each municipality and one or more people from local businesses or organisations such as Nordisk Center For Lokale Fødevarer (NCLF) and communities such as Herslev. Through the project development process synergies and knowledge between the areas are shared through workshops, meetings and masterclasses. This is a particular way of working with projects that is very common for Gate 21. Gate 21 has experience from many previous projects within circular economy, energy, big data etc. but DSS is the first bioeconomy project for Gate 21. Gate 21 is, therefore, not experts in bioeconomy development projects yet, but they are open to explore the possibilities and find sustainability aspects important, but their knowledge is very limited on how such development processes should be

4.3 Our Network

We have been in contact with many actors throughout the project and in figure 12 is a visualisation of the actors in our network related to the two cases.

Figure 12 - Our network with actors from both case 1 and case 2



Chapter 5
Design Specification Development

- How Different Elements and Rationales Challenge and Affect the Development Project using Pulp

In this chapter, we draw on the bioeconomy perspectives and controversy considerations explained in chapter 2 and use theory and methods described in chapter 3 to apply on the case of pulp described in the previous chapter. Through these investigations, we become aware of different factors that might influence other future bioeconomy development projects.

In the first section, we unfold the larger dynamics and change processes in a systemic transition perspective with the use of MLP. We do this to become aware of how change processes can be supported with arguments around sustainability and to make it interesting for the actors in the system to be involved in. The analysis will finally describe how we see a desired transition of systems around residue biomass and what interests we have to include in the design process to create a concept that supports that transition.

In the second section, we draw on our exploratory participatory research and our staged activities to investigate the near and specific picture of the interests and challenges central to actors related to pulp. We do this to become aware of contextual factors that we must consider and include in our design in order to support participating actors in future bioeconomy projects.

In the last section, we unfold examples of strategic decisions and objects as part of our process design. We show how to see our knotwork activities as played on more levels in order for us to reflectively work with them. And we bring visual objects to stage through concrete activities with a purpose of supporting collaboration, involvement and awareness. With these insights, we see who and what we should approach and how to do so as part of the design concept.

These findings will work as a guideline for our design process and activities in the following chapters, towards designing a concept that can support bioeconomy development projects to apply residue biomass from food systems in more sustainable ways.

5.1 The Larger Perspective - Dynamics and Systemic Change with MLP as Design Tool

In this section, we will use the Tools to Grasp Systemic Transition presented in chapter 3.5. We apply the MLP, as an analytical framework and design tool, to become aware of the larger picture of the regimes and the elements that influence each other in relation to the residue biomass, pulp. We use the MLP as an inspirational input to our focus or design and development process in chapter 6. In bioeconomy, the focus is on a commodity, a biomass, which in this case is juice pulp from Frankly Juice (FJ). We, therefore, focus on regimes that are using pulp and pressure from landscape- and niche-activity that are affecting in which regime the biomass is used. To apply the MLP as an analytical framework we use the MLP inspired figure to understand what regimes that surround the juice pulp. This chapter will thereby elaborate how pulp finds its way into different supply systems where different regimes rule. Thereby we become aware of potential issues and possibilities for supporting sustainable transitions through pulp.

Pulp in a Systemic Transition Perspective
Drawing on the insights from chapter 2 on the controversies in relation to residue biomasses and bioeconomy, we see many diverging discourses. These are circulating on topics such as economic growth, technological development, the need for proteins, biodiversity, bioenergy etc. We apply the MLP framework as a way to grasp these many positions in a sustainable systemic perspective and relate them to case 1 - Juice Pulp. Hereby we are able to look at the field as systemic dynamics that push or draw change in different directions. Said in other words we see that the multiple landscapes such as biodiversity loss and climate change have an influence on how pulp, seen as a residue biomass from a food regime provided by Frankly Juice, is applied into other systems like the bioenergy regime at e.g. Daka Refood. And we see how niche innovations and experiments such as Plantepølsen with time might be able to mobilise larger movements that can pressure the food regime to use the pulp.

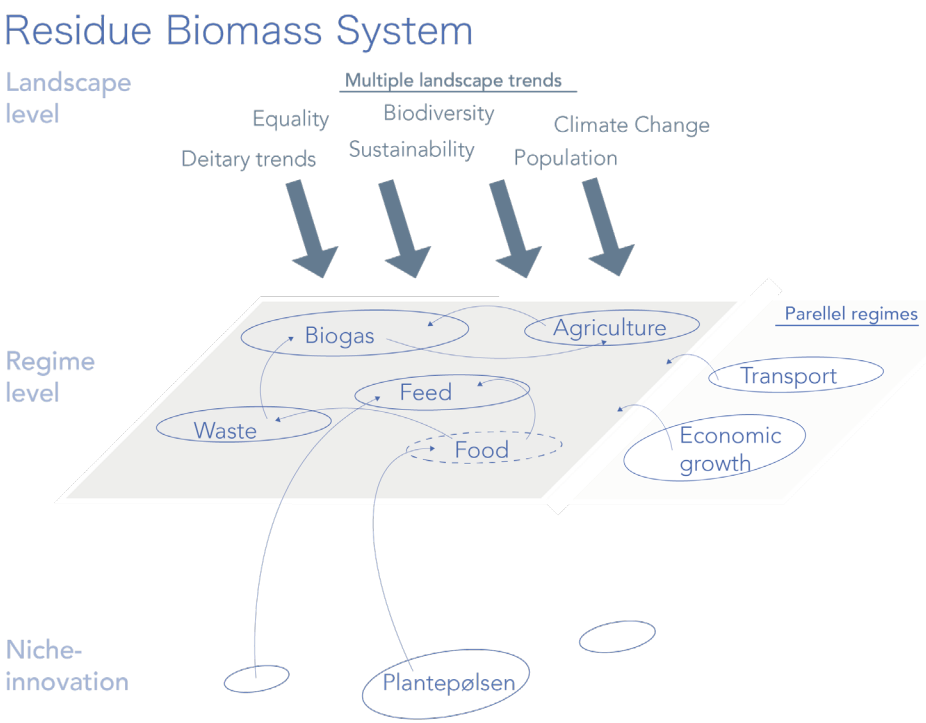


Figure 13 - The MLP related to pulp - own illustration created with inspiration from (Geels, 2018)

On the figure 13 above, are the regimes in the MLP; feed-production, agriculture, biogas production, waste and lastly food. They are seen as a part of the status-quo system in regards to the use of pulp. In the figure, we see that the regime is not only seen as being challenged by niches like Plantepølsen but also landscapes and landscape trends. This, in our case, means that we include landscape factors such as future growing population, bioeconomy politics, limited resources, loss of biodiversity etc. Food has a dotted line in the model to illustrate that the food regime where pulp is seen as food, is not yet established. The reason for this is that pulp is only applied at very small scale experiments, presented in chapter 4, that currently do not have the capacity of using the 18-22 tonnes of available biomass from FJ each month.

The Biogas Regime - Awareness of Energy and Economy

Starting where pulp finds its way into the biogas regime. Here energy and economy seem to influence how pulp might find its way in the food regime instead of the energy regime.
Currently, 99,5% of the pulp from Frankly Juice (FJ) goes to a biogas plant near Kolding. This is about 225 km from the FJ factory where the juice, and pulp, is produced. The biomass is used to produce gas and the leftover is used as fertilizer on land fields. The transport regime can, in this case, be seen as a parallel regime, which will be described later in this chapter. The gas generated from juice pulp, based on vegetables and fruit, alone is very limited (Ridjan I. S., 2019). Since the biogas plant is in Jutland, it is unlikely that the energy that is produced from the biomass in the plant is more or even equal to the fossil energy that is used to transport the pulp. And this is without the energy used in the processing of the biomass on the plant that needs to be taken into consideration.

In the economic dynamics of using residue biomass for energy, there are several factors playing out. Firstly, the Danish Ministry of Energy is substituting biogas production (Energistyrelsen, 2019). This economic incitement can be seen to foster a potent draw of the pulp into the biogas system. Controversially, the biogas plant that receives the pulp Daka Refood can produce between 6,62 Nm3 CH4 (Normal Cubic Meter Biogas) and 8,43 Nm3 CH4 per ton pulp depending on the fruit/vegetable ratio in the specific biomass (Skøttrup B. C., 2019). One Nm3 CH4 is worth about 2,25 DKK this means that they can sell gas for approximately 268,- to 417,- DKK on 18-22 tonnes of residue biomass from FJ every month (Skøttrup B. C. 2019). Which is not a high economic output.

In contrast, when pulp is used as food in a niche level e.g. in plant sausages from Plantepølsen(PP) the biomass has a significantly higher economic value. The biomass in the plant sausage is mixed with 50% other ingredients and sold for 10 DKK per sausage. If we look at the economic case of using 18-22 tonnes of pulp in sausages, PP could have ingredients to make 50% filling for 360.000 to 440.000 sausages that can be sold 3.6 to 4.4 million. In this contrast, pulp suddenly accounts for 50% of 3,6-4.4 million DKK when sold as food

instead of 100% of 268 to 417 DKK when sold as gas. This indicates a potential economic benefit of applying pulp into the food regime. This economic factor can together with the energy aspect, mentioned earlier, be seen as dynamics that can be used to push pulp as residue biomass in the food regime instead of the energy regime. Pulp is currently seen as a waste product that has no economic value for FJ. It is instead tied to the dominating biogas regime where it is nothing but an expense for FJ. By using pulp in niche innovations with food such as PP and the other experiments mentioned in the case described in the previous chapter, FJ hope that they can be able to earn money, at least enough to cover the work hours related to handling the pulp.

The Feed Regime - Awareness of Landscape Pressures

Pressure from national bioeconomy strategies, international and socio-economy might have a negative influence on the use of pulp in the food regime. This is a pressure that we should be aware of when supporting bioeconomic projects. In related cases with other producers of juice pulp (e.g. Gro and an anonymous Juice producer), some of the pulp is provided as feed. Therefore, it is important to pay attention to the feed regime as a regime that has the capacity of using the pulp. As mentioned in the discourses related to bioeconomy in chapter 2, the Danish National Bioeconomy Panel(DNBP) work with a narrow focus on the future needs for proteins, primarily for livestock. This counteracts a transition towards more plant-based diets and thereby use of pulp in the food regime. "The consumption of proteins from animals will increase by 70% from 2007 to 2030 (…) and there is a rising demand for healthy and tasty food products, produced in a climate-friendly way" (DNBP, 2018, own translation). DNBP can thereby indirectly influence other juice producers we have identified to deliver pulp to feed-producers as it is more climate-friendly than importing soy to use as feed. Thereby they support the use of residue biomass in the feed regime.

Additionally are the landscape pressure in terms of a worldwide growing population and e.g. prognosis that predict socio-economic changes in China which might change eating habits away from plant-based diets towards a more western and meat-heavy diet (He, P. et al., 2018). This is another factor that might push the activities of using biomass into the feed regime due to Denmark's large export of meat to countries like China. On the other side, if you see the future growing population as a reason to promote more plant-based food, the pressure is positive. And this might then result in pressure on the existing feed regimes from both landscape level and from an enforced niche level with e.g. pulp.

The Potential for Residue Biomass in the Food Regime

Below are descriptions of activities that put pressure on applying residue biomass in the food regimes. It will also sum up the contrasting pressure in current regimes:

The predicted future need for meat seems to ignore the niche activities that currently are challenging the application of biomass in the feed or gas regime. PP, seen as this niche innovation, could put pressure on the feed regime that is using biomass as feed or gas. PP is, therefore, supporting the potential food regime use of biomass by applying residue biomass in food. This is enforced by their success in making it a commercialised product that is 50% based on the use of residue biomass. The commercialisation is still very limited as PP is a small shop only known by a limited group of people, mostly Copenhagener's and tourists that randomly pass by the shop. PP is, therefore, lacking the capacity to apply more pulp in the food regime due to the limited amount of products sold.

An example of a company with a larger capacity who could use pulp in its products could be the plant-based food producing company Naturli'. Naturli' is currently experimenting with plant-based-meat-substituting food to be sold at a large scale. Their products are currently available in almost every Danish supermarket. By using residue biomass in their products they could put an even larger pressure on applying residue biomass in the food regime as they would have the capacity to use more of the available biomass compared to PP. This raises the question of why they do not already use this almost-free, sustainable and healthy biomass? We reached out to Mette Lübeck at AAU, who is an external research project partner in a collaboration with Naturli. She told us that Naturli' mainly focus on protein and designing products that fit into the current food regime

(protein rationale) (Lübeck, M., 2019). That being said they have not yet tried to test products with residue biomass. Therefore we believe that a company like Naturli' could be a great actor to put more pressure by applying residue biomass in the food regime, but experimentation with applying e.g. pulp to the products are needed.

Awareness of Equality, Climate Change and Biodiversity - Denmark in Transition

On a national plan, the number of people flexitarians (people that mainly eat vegetables but seldom eat small amounts of meat) in Denmark have three doubled from 3,8% in 2010 to 12% in 2018 (Vegetarisk Forening, 2019). And the meat consumption in the COOP supermarkets in Denmark has fallen 5% since 2015 (COOP, 2019). One could argue that this change relates to landscape pressure from e.g. climate change, which in general has made more people conscious about their food habits (Hedegaard, C., 2019). A focus on decreasing biodiversity and social inequality, as described in chapter 2, could be another way to influence the residue biomass to find its way into food regimes instead of energy regimes. Still, this might be pressured by a non-systemic sustainability perspective, as described in chapter 2. Here the climate change in some discourses is used as an argument to prioritise the use of pulp in the energy - or feed regimes.

As mentioned above, vegetarians as a part of the food regime are growing in Denmark and they could be important supporters regarding the use of residue biomass as food.
On the other side, the landscape pressure from the population and change of diets are landscape activities that challenge the use of residue biomass as food.
Therefore we see multiple factors supporting or challenging the use of residue biomass in the food regime. Seeing these factors as landscape pressure that affects the food regime towards providing residue biomass as food could argue for the need to create more awareness around the factors that supports residue biomass in the food regime. In our case, we will do this by including those factors in our design strategy.

Awareness of Parallel Regimes

We argue that the parallel regimes around the residue biomass system can add important awareness to dynamics that possible influence the biomass' ability or limitations to be applied in the food regime. One example is the system around transportation, which might have nothing to do directly with residue biomass. But currently, regimes like biogas and feed-production depend on infrastructuring systems and these systems therefore currently support the use of residue biomass at gas plants. The biomass is picked up and transported systematically. But what if the same biomass was to be used as food. It would require a change in the logistic systems in regards to keeping the pulp fresh and healthy. It might have to be stored at a certain temperature during transport or be picked up more than one time a week due to shelf life factors.

Sum-up The Larger Dynamics

Pulp finds its way into the waste-, biogas-, feed- and food regime. We have identified and presented landscape pressure in terms of climate change, equality etc and pressure from niche activities such as PP. These dynamics from landscape and niche are influencing the change process(transition) of applying pulp in the food regime.

We need to focus on bringing awareness to the landscape activities such as climate change, bioeconomy trends and dietary trends and niche activities such as Plantepølsen that support the use of residue biomass in the food regime. We can do this by inspiring more actors to apply a broader systemic perspective and promote a foundational view of sustainability. Awareness of the supportive activities will, therefore, be included as essential parts of our design specification. Well knowing that single experiments do not result in a change of the status-quo in systems. We also need to support activities that can use residue biomass such as pulp in the food regime, by supporting awareness building among actors involved with residue biomass. We, therefore, need to support the niche, like PP, and initiators of more niche-activities like the DSS project.

5.2 Contextual insights - Interests and challenges in the case of juice pulp applied as food

Throughout this section, we use the analytical perspectives based on our participatory and explorative approach presented in chapter 3.2. We use these to become aware of the near and context-specific picture of the interests and challenges expressed as central to the actors in relation to pulp - this will be based on our empirical data. From our research among the key actors in our network, we draw different challenges and interests and through that, we see the ruling rationales. This serves to equip us to see what factors to include and which topics to pay specific attention to in order to develop a concept that supports bioeconomy development projects. For this analysis, we will use rationales and challenges as terms to describe the actor's articulation and enactment of their values, matters of concern, interests and knowledge positions. Through a condensation of our empirical and theoretical findings, we identify five topics that represent different rationales and challenges in relation to applying pulp as food: Relationship & Collaborations, Bioeconomy, Pulp as biomass, Valuation and Feasibility. In the following, we unfold the challenges and rationales connected to the five topics.

Relationship & Collaborations
Overall in our research, we found that there is a lot of *dispersed unconnected activities* in the field of applying pulp as food, which hinders a broader mobilisation. This was seen in our observations and interviews at Frankly Juice (FJ), where the quality and project coordinator expressed that the partners in the different experiments have not met. This indicates that the different experiments/niche activities with FJ's pulp, explained in chapter 4, do not know that much about each other's work. At the same time, FJ express that they cannot drive a project of utilising their pulp for food alone and they do not have the proper resources to experiment by themselves. In connection to this, we learned from talking to the FJ's CEO that many of the learnings from the different experimenting activities have not been collected. These examples can be seen as interests and rationalities which do not see or prioritise the important learning aspects of collaborations.

To supplement this, we find that both PP and FJ are not familiar with similar companies that like them respectively produce meat alternatives from pulp Plantepølsen (PP) and supply pulp from cold press juice to pulp-based products. But through our desk research, we find that multiple similar companies actually do exists. One example is the cold press juice production GRO, where approximately 2 tons of pulp per month is utilised in experimental collaborations with e.g Planteslagterne for plant-based meat substitutes, Amaas Restaurant for Beer and Birkemosegaard for compost and feed. Thereby we see a potential and need to connect a larger group of actors to share experiences and mobilise more actors to use pulp as food. But this might be challenged by a lacking awareness of the great potentials of prioritising internal resources to do so e.g. within FJ. This makes us see that we have to consider other synergetic activities in relation to applying pulp as residue biomass from a food system in a food system. As mentioned in chapter 4, FJ and PP are not aware of bioeconomy as a concept. So perhaps an articulation and activation of bioeconomy, might support the collaborations between the actors and serve as a common ground for them to engage in e.g. funding applications and future development projects.

BioEconomy - *The Market Has to Find it Relevant & Interesting*
A general discourse that we discovered in our research is how the economic rationale is dominating and challenging the vision and possibilities to develop new projects using pulp as food. For example, PP express that their wish is to grow big - and mass produce pulp based products to be sold in supermarkets and cantinas. PP explained that the production of the pulp products are too expensive at the moment and the prize cannot compete with e.g. mincemeat that the cantinas normally purchase. The prize rationale indicates that there among the purchasers in a cantina is a balancing to practice as usual, which seems to be meat. The cantinas purchase rationale can hereby, on one hand, be seen as an expression of the dynamics in the food systems where an idea of the need for animal

proteins weigh highest. But it can also be seen as an expression of merely fitting into the current purchase and pricing systems, which do not reflect e.g. sustainability or health.

As discussed in chapter 2, some of the bioeconomy discourses are based on rationales that seek to develop solutions that fit into an existing market. This rationale is also reflected in the case of applying pulp as part of FJ's business. FJ's first priority is to make their juice business profitable - and they show no interest in driving a pulp business project on their own. This is also reflected when talking to a board member in FJ. He showed interest in the idea but primarily asked for business potentials of turning FJ into a Juice and Pulp supplier company. They are not investing in the idea of how to earn money on pulp because there is not currently an existing market around pulp - therefore they are driven by an economic rationale. This underlines the problematics of creating bioeconomy development projects that try to challenge the existing systems - but at the same time wish to follow the mainstream economic rationales. In opposition to this, we find it rather important to support a challenge of the market rationales to prioritise sustainability instead of following status-quo.

The Rationale Behind Storytelling and Marketing
We have observed that using pulp, residue biomass from juice production, in products - is a catchy story to tell (Absalon observation, 2019). Nonetheless, PP has a different vision with their work. They apply a frontstage storytelling where they want to challenge the meat-eating culture - through their sausages, which they call their Trojan Horse. Neither in their food shop nor at their website - www.plantepolsen.dk - is it displayed that they use the residue biomass pulp as an ingredient in their sausages. This decision comes partly from a rationale from PP stating that they are unsure whether the story of pulp, is a good or bad selling point. And partly it is also a result of limited resources at the fairly small start-up.

Being a juice production company and a pulp supplier - could also be a catchy story to tell. Nonetheless Frankly is currently not communicating anything to the public regarding their collaborations with e.g. PP. They want to use their juice as a mean to create awareness about health in terms of nutrients and non-conventional vegetable produce. Like PP, FJ wants to challenge the existing food culture through their juice company by promoting healthy juice to replace soda, milk and other unhealthier products. Again this indicates rationales that do not consider pulp a valuable asset or contribution to their vision.

None of the companies applies storytelling about the great potential of using pulp as food. Which indicates a rationale that does not find it a valuable enough story to sell their business on. Though some could argue that it could be a low hanging fruit in terms of using it as sustainable branding. We hereby see that the rationales behind the storytelling plays an important role in the vision of the company. This show the importance and challenges of highlighting or hiding the residue biomass as a part of the frontstage storytelling in bioeconomy development projects.

Pulp as Biomass - *Safe and Stable Supply*
One of the challenges using pulp as food is the uncertainty around the supply and safety issues. The experiments that currently use pulp, as outlined in chapter 4, are using amounts of pulp that are below the public authority triviality limit in regard to food regulations according to FJ. This indicates a potential challenge of upscaling the use of pulp as food at FJ's since they would need hygiene and safety systems. It is uncertain how difficult it actually would be, in terms of food regulations and permissions. Knowing about FJ's very limited resources on their pulp development side in terms of exploring collaboration opportunities, we initiated a visit to GRØD. GRØD is a chain of food shops that specialize in making porridge, which is located across the street from PP at Jægersborgade, Copenhagen. By presenting the idea of using pulp in their recipes to the chef in the kitchen, the immediate response was interest, but with concerns on supply and safety: "As long as it is safe to use and stable in delivery - we might be interested in using it in our porridge" (GRØD, 2019). This can be seen as a concern that we also have heard from other potential customers.

Additionally, we have through our dispersed backstaging activities casually presented the project for civil people. This has numerous times resulted in initial reactions such as: Can you eat it? - Is it safe to eat? - What does it consist of? (PP observation, 2019). These insights indicate a need to broaden the knowledge of the food safety aspects of using the pulp, and it makes us aware of the potential challenges of whether FJ is able to deliver a stable supply of pulp in larger amounts.

A way to deal with this uncertainty could be to establish a strong group of actors that consent to experiment with the pulp for a limited time - hereby establishing a stable demand for a larger amount of pulp. Such collective process could, when drawing on the findings in chapter 5.1, help stage and support the niche-activities and accommodate the challenges with safety and stable supply. Also, it is clear that both the suppliers and customers need to be informed about different potentials using pulp as food - in regards to health issues, sustainable impact and economic rationale (it has the potential to be cheaper than normal ingredients).

Valuation - *Cultural Change*
Another obstacle using pulp as food is to change the culture around it to see it as a resource instead of a hassle. To the question of what it would take in order to change FJ to become a full pulp supplier, the operation manager stated that they would have to change the backend into another frontend. When observing and talking to the workers at the production line we find that the practical conditions of changing the working procedures to include handling of the pulp might not be that different from the existing process. The containers that currently collect the pulp and is carried to a bio-waste container can easily be replaced by food safe containers. From the operation manager, we were told that the part of the production machine where the pulp goes is called backend [bagenden] by the employees. With a slight smile, the operation manager indicates that he is referencing to the backend of the human body. This indicates a certain culture present at the company. We hereby see that the task of practically changing the ways at the production facility to become pulp suppliers might not be that big a challenge. But a development project also might profit to consider the existing working culture or rationales at the food producer in order to create awareness of the pulp as a valuable material among the employees.

Feasibility - *Customers and Logistics*
In our research, we saw how the lacking involvement of the customers diminishes the future success of using pulp as food. Another aspect that we discovered is the need to incorporate and collaborate around the logistic challenges.
We initiated a backstage activity in the form of an observation study at the food shop as we were interested in getting to know the pulp eaters. As mentioned, PP is not communicating their use of pulp in their sausages. They merely write what ingredients are in their products eg, beetroots, carrot, onion etc. We, therefore, asked the customers if they knew about that pulp was used in the products? Which led us to the finding that the customers buying sausages that day were not aware of that pulp was part of the ingredients. Though all the reactions were positive and just added even more excitement to the customer's experiences. Customers thereby expressed it as an added value that residue biomass was applied in the product. That reaction was mainly based on a rationale of diminishing food waste, but it was also based on health aspects due to the organic and nutritious, especially related to the fibre intensity, qualities of the pulp. With the knowledge from chapter 5.1, we see that PP is a commercial, though minor, actor in the food system. Knowing that some customers have rationales that value food with residue biomass proposes a development pathway to create more niche-innovation activities around edible residue biomass. We thereby see the potentials of involving the users in a development project in order to enhance the likelihood of making the project feasible.

Logistic Challenges
Based on the MLP in chapter 5.1 we are aware of the parallel systems such as transportation infrastructure. This can be related to

the biogas plant and logistics around Daka Refood. Through their infrastructure system, they provide buckets and containers to store the biomass in at the production facility. And their pick-up service is smooth and easy to use (FJ interview, 2019). This gives FJ an easy first choice to go with the biogas solution, which can be seen as challenging to applying pulp to other things, such as food as it would demand more work from FJ in terms of handling the logistics for all of their pulp. Currently, the pulp going from FJ to PP is either delivered by FJ's own delivery trucks or picked up by PP. But FJ express that they do not see themselves as a logistics company, which point to a need to include ways to deal with the logistics if the entire 18-22 ton of pulp is to be delivered each month somewhere else than to biogas. For a bioeconomy development project that seeks to apply pulp to ex. food, we hereby see the importance of involving actors and aspects that considers parallel systems such as logistics.

Sum Up The Contextual Insights

We have become aware of the many rationales and challenges expressed by the actors in relation to pulp. Among others, we see a challenge of dispersed unconnected activities that experiment with pulp, which could benefit from the support of relationship building and enhanced ways to collaborate. We find a dominating economic rationale amongst the residue biomass production company that do not distinctly see the potentials in the application of the residue biomass as food. Connected hereto we also see a potential challenge linked to changing existing working cultures. We discovered that potential business customers find a great interest but also a concern of using the pulp as an ingredient based on safety and supply. We find rationales among customers that favour the story of residue biomass as an ingredient in the sausages, which indicate a potential for additional awareness and involvement of customers in the development projects. We see a potential challenge in handling the logistics if scaling up the pulp supplier part of the juice supplier company.

5.3 Staging and Objects - Strategic Decisions and Objects we Stage in our Design Process

In the following, we use the Tools to Navigate and Stage presented in chapter 3.3 in order for us to uncover the otherwise invisible activities that affect collaborations. We present selected examples from our process design and explain the importance of those elements in relation to create awareness, involvement and collaboration. We find that the Tools to Visualise and Learn presented in chapter 3, works to support awareness and involvement as well as creating a basis for collaboration in the design process in both our back- and front stage activities.

Strategic Working Procedures

One way we used the navigation and staging tools to strategically analyse the landscape we work in and prioritise our agendas by being aware of all the considerations and choices we have made. In the following, we present two examples of such strategic activities accompanied by illustrations.

Figure 14 - Example of our horisontal activites

Case 1 and Case 2 - Horisontal Activity

We argue for the importance of influencing a variety of actors that at first hand might not seem to have much to do with each other. This is reflected in our work, where we attempt to influence activities on more levels. We, therefore, decided to initiate different activities, that include e.g. Plantepølsen (PP) from case 1. Even though our research and design process aimed at designing for the case 2 project Det Store Spisekammer (DSS).

We had tied a knot to DSS at our initial meeting with Gate 21. But since this knot seemed to be loose and unstable, in the initial phase, we decided to tie a different knot to PP. Our decision was based on strategic considerations on the potential synergy relations we could create between DSS and PP. This can hereby be seen as a way to disperse our staging activities vertically to more projects, as illustrated in figure 14 above. The intention was to increase our possibilities of influencing and mobilising a larger group of actors to consider more sustainable aspects in relation to the application of residue biomass from different food systems. We did this while being well aware of the risk that we might not be able to connect the two cases into one common knot. Nonetheless, we are with this activity able to insinuate a relation between them as they become part of our network of supporting projects with bioeconomy to apply residue biomass from food systems more sustainably.

The Danish National Bioeconomy Panel
- Vertical Activity

We decided to participate at the meeting Biotechnology - The Key To A Climate Neutral Future on the 12th of March at AAU CPH because the director from the Danish National Bioeconomy Panel (DNBP) was attending. We had identified DNBP as having important landscape influence in the residue biomass system in chapter 5.1. It was therefore important for us to get to know more about the panel' rationales and values when working in the field of bioeconomy. The DNBP can be seen as an actor at a different oriented level than e.g. Plantepølsen, so the reason to go to this event was to disperse our activities horisontal as well, as shown in figure 15. Some of these rationalities came into play at the meeting, in a project presentation that focused on developing a technology that can produce proteins from algae to use for feeding pigs in Denmark. The sustainable benefits are that we avoid, or minimise, flying soy from Brazil to Denmark and avoid the use of fossils for transport but also avoid deforestation of the Amazon. This project is supported by a large group that believes in the idea of constant or even higher consumption of meat production in the future. This they argue, requires new production methods in order to make meat-consumption more sustainable. Said in other words the challenge can be fixed with new technology. Arguments for this rationale are manifold. One is that it supports the market demand (some projects members are in the meat industry), another is that we need to ensure sustainable meat production. At the meeting, we got the chance to question the panel director directly about the rationales. We asked about why they did not focus on making food from the algae instead of feed? After looking back and forth at each other waiting for one to answer, one answered that this is what the market demands. At the same event, they ran out of vegetarian sandwiches while having bought too many "regular" sandwiches that they had to throw some out.

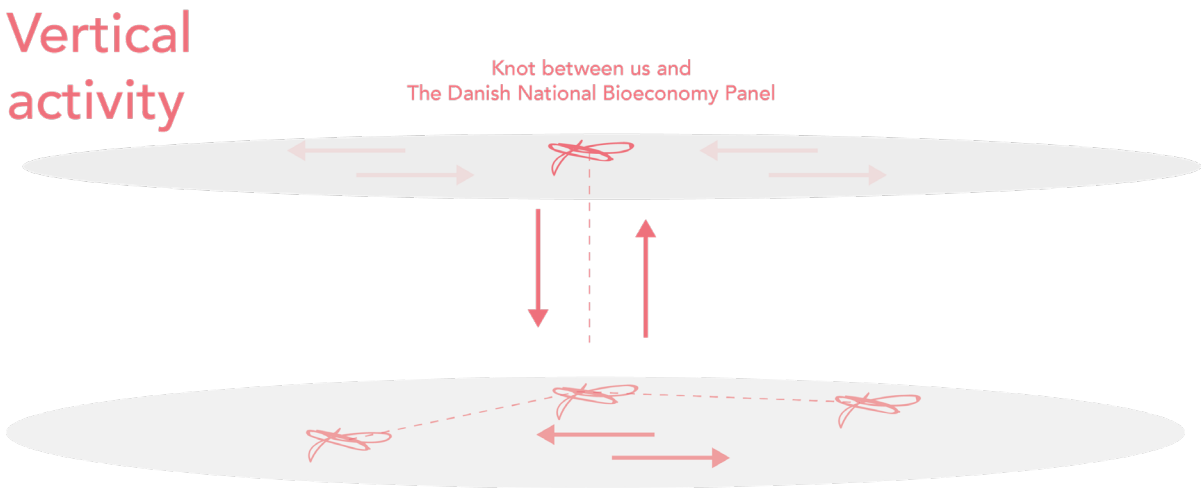


Figure 15 - Example of our vertical activites

The examples with PP, DSS and DNPB makes us aware of the vertical and horizontal importance of the knots we tie in many layers through our activities.

Objects on Stage

Another way we used the navigation and staging tools described in chapter 3.3 was with film and visualisations. They have worked as design tools to support our staging activities. We draw on our Tools to Visualise and Learn presented in chapter 3.4. This helped us see the rationales through the concrete activities we stage and by the objects that are used. In the following we will pinpoint 3 elements, to exemplify how we use objects as part of our staging activities to support collaboration, involvement and awareness through our process.

Mapping and Sketches

Figure 16 is an example of how we have used sketches to facilitate dialogue and negotiation between us internally. Early in the process, we discussed how we could influence the DSS project to include more sustainable aspects in their bioeconomy development project. With the drawings in figure 16 we managed to establish a common syntax and semantic of e.g. tying knots and working with sustainable transition through the activities we initiated. This supported our collaborative design process by representing a visual common idea of how to interpret the work we performed. This made us aware of strategic pathways e.g. how our perhaps small insignificant knotwork might have the possibility to influence the bioeconomy development project in a longer time perspective. In a perspective of a boundary object, one could argue that this made us develop entire new common knowledge of how we should proceed, and thereby our collective understanding established new interdependencies between us.

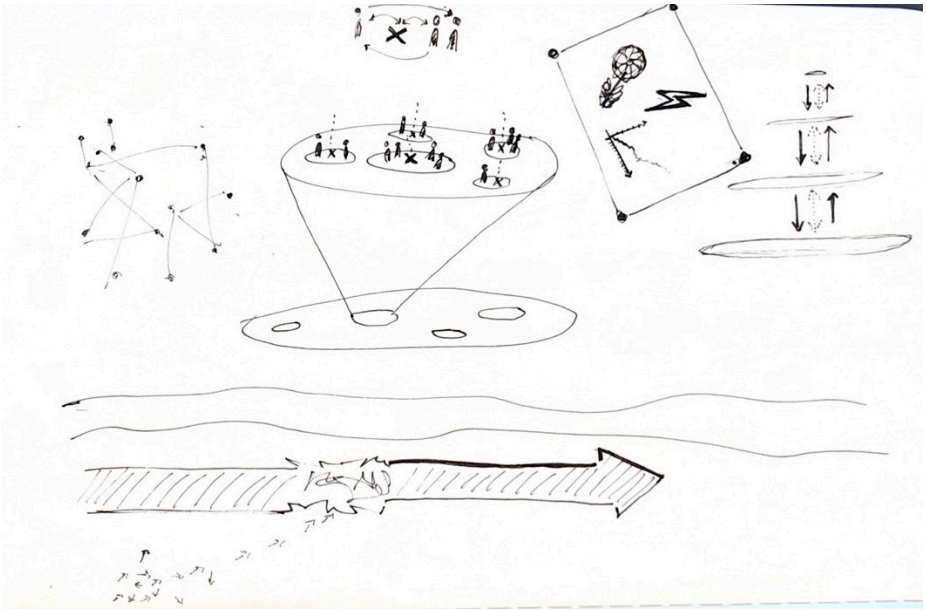


Figure 16 - Early sketch used to create common strategic understanding as foundation for our process.

Photos

Backstage we have throughout the process experimented with recipes to use the pulp at home, which we photo documented exemplified in figure 17. The different backstaging activities are illustrated in figure 18. We activated these externally when we performed observation studies at PP. Talking to the kitchen staff they questioned what can you use the pulp to, other than sausages? The photos on a phone of our own pulp creations and experiments here served the purpose of spreading awareness on how to apply the pulp in different ways to the kitchen staff. Numerous times during the process we were meet with this question. The incident at PP made us aware of kitchen routines and the possible challenges of accustoming new routines among the staff when applying new ingredients such as residue biomasses from food systems. This made us see the potential of developing a visual inspiration material to support our design work.

Figure 17 - Experiments with pulp

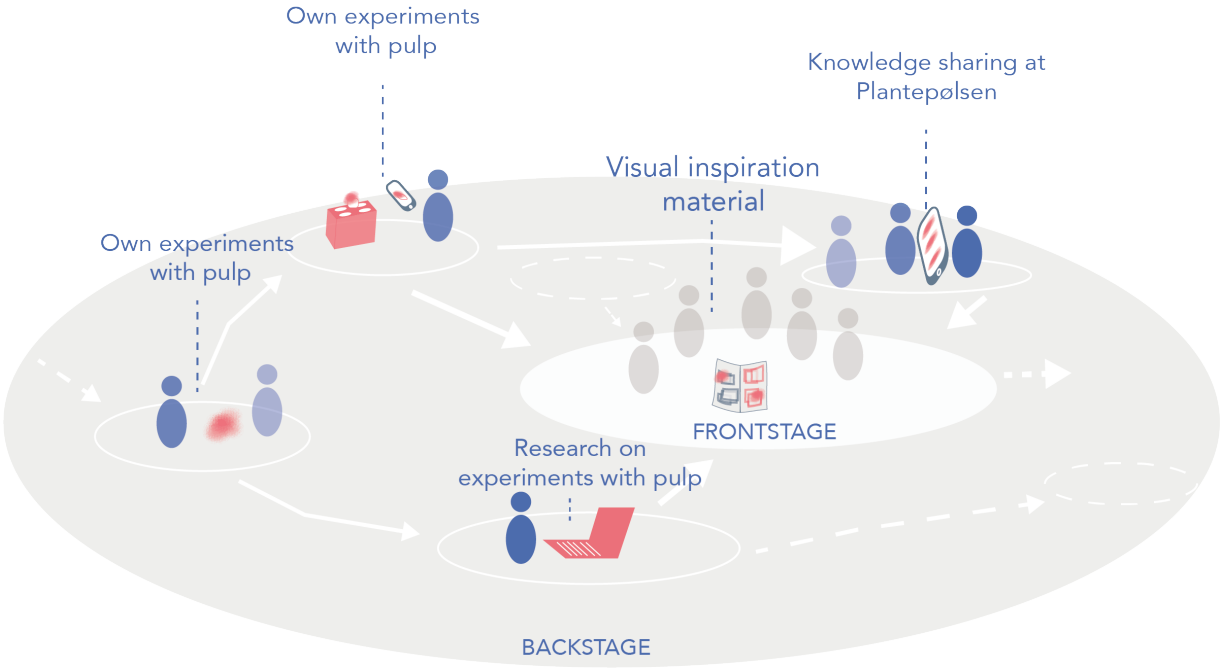


Figure 18 - Backstage experiments with pulp and how they influence the idea to develop an inspiration catalogue for a potential frontstage

Film Recordings
Another example of an attempt to engage actors across hierarchies in an organisational context is our visit at FJ. We planned the activity with a hope to apply our film method, presented in chapter 3.4, and thereby be able to use film as part of the investigation. Thereby we sougth to document the learnings in order to be able to share it later in the process. By staging the visit as a film recording, we managed to enrol, the creative CEO, the Operational manager, the Quality and Product manager, and the workers by the juicing machines. This provided valuable information and insights on the varying and dependent interests, knowledge positions and practices and on the same hand enabled us to spread our agenda of considering pulp a valuable food product within the organisation. With the film recordings as a gateway, we gained access to otherwise tacit knowledge. We learned that the workers at the production facility did not consider it a huge practical circumstance to change the production. Therefore it would for the workers not make a big difference it the backend became a new frontend were not that different seen from the workers by the production facilities (FJ observation, 2019).

Figure 19 - Frame grab from film recordings at Frankly Juice

Figure 20 - Frame grab from film recordings at Frankly Juice

Use Objects!
We find that our Tools to Visualise and Learn presented in chapter 3, works to support awareness and involvement as well as creating a basis for collaboration in the design process both back- and frontstage. Sketches, photos and film have established broad interest in the project and resulted in many requests from our participants for us to stay in touch and refer back the findings in our work. Hereby the objects can be said to serve involvement, common interest and create a basis for future collaboration. Our backstaging work with many tools (visualisations, dialogue-/design tools, pulp experiments etc.) also supported, collaborations internally as well as externally.

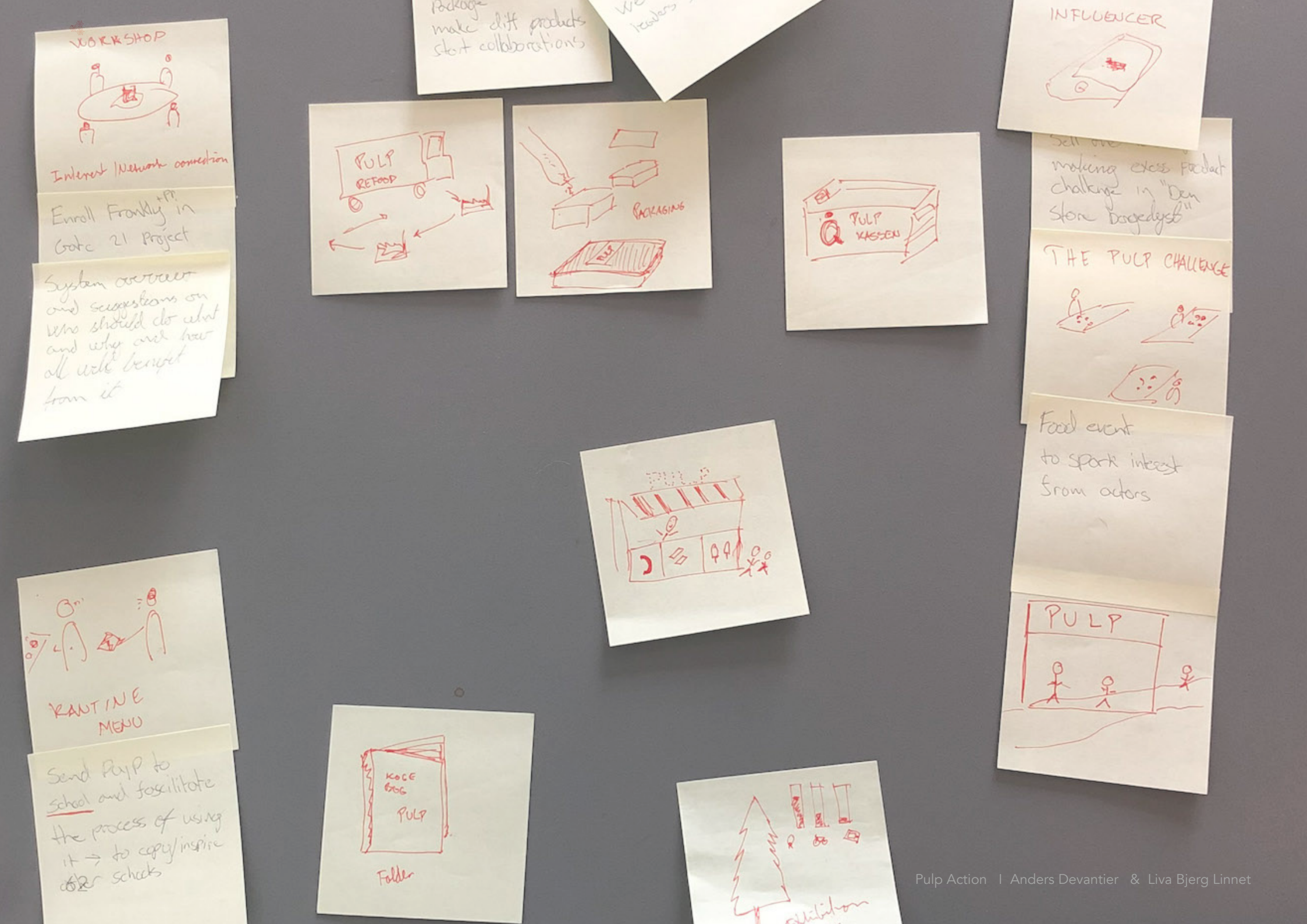
Sub-conclusion - Support of Awareness, Involvement and Collaboration

We draw the conclusion in this chapter that we are able to support bioeconomy projects by becoming aware of the larger dynamics of the case field through MLP. In the MLP we described how pulp, as a residue biomass, fits or can fit in different regimes. Our aim is to apply it in the food regime and we, therefore, identified landscape- and niche- activities that we need to be aware of and include in our design specification. Some of the landscape activities that we need to support is awareness around sustainability, population, biodiversity etc. Niche-activities such as PP are important for the possibility of enhancing a more sustainable application of residue biomasses from food systems and thus need to be supported. We also see a need to support the creation of more niche-activities. Lastly, we become aware that interpretations of landscape pressure in terms of climate change by e.g. the National Panel on Bioeconomy can turn out to have an even worth impact on the landscape. We see a potential to include parallel regimes such as infrastructure in our consideration when making the design specification.

We see the more detailed rationales and challenges among actors related to the case of pulp through our navigation & staging work. Through this, we become aware of a need to support collaboration and network creation and we see the importance of involving the users in the process. We identify context-specific rationales of existing market valuations and potential challenges of changing a work culture - from considering a residue biomass a waste product to make it a part of the business model.

Adding on this we see the importance of considering who and what to involve in a development project and how to do so. On a practical level, we exemplify how visual elements exemplified by film recordings, sketches and photos have worked to support awareness and involvement as well as creating a basis for collaboration in our design process both in back- and frontstage activities.

...so how do we apply these insights to a concept that considers these findings in order to support bioeconomic development projects to apply residue biomass from food systems in a more sustainable way?


WORKSHOP
Interest Network connection
Enroll Frankly +PP in Gate 21 Project
System overview and suggestions on who should do what and why and how all will benefit from it
PULP REFOOD
PACKAGING
PULP KASSEN
INFLUENCER
making excess product challenge in "Den store Bagedyst"
THE PULP CHALLENGE
Food event to spark interest from actors
PULP
RANTINE MENU
Send Pulp to School and facilitate the process of using it → to copy/inspire other schools
PULP
Folder

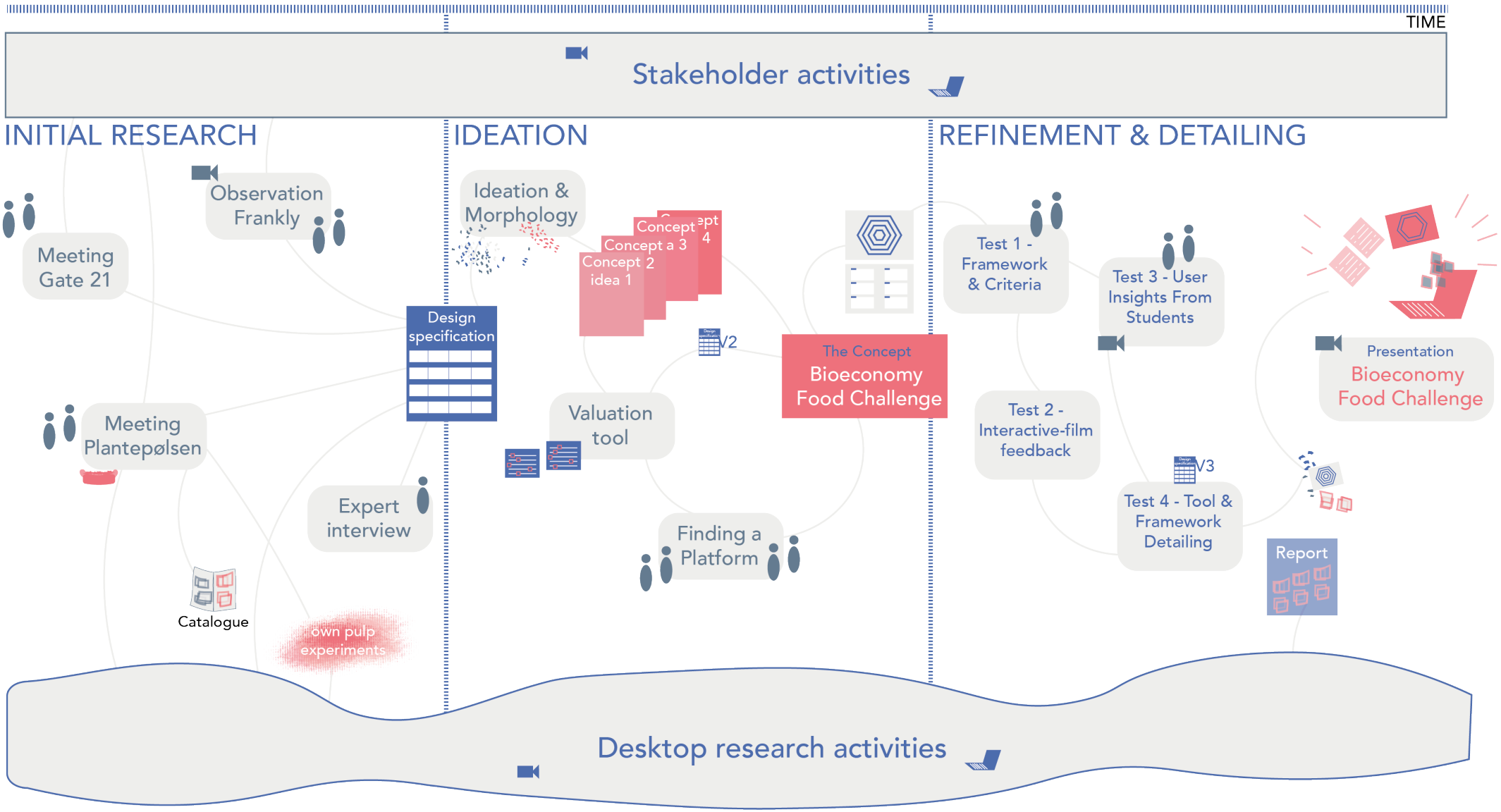
Chapter 6
Design Specification & Ideation

We are designing a concept that is based on insights from our design specification development, chapter 5. We refer to this part as the initial research (figure). This chapter will start with a simplified visual guideline of our design process.

6.1 Design Process

The activities and findings presented in the previous chapters, form the basis for the following chapters. As, illustrated in In figure 21, the design process is far from a linear process, we have included elements such as desk research and stakeholder activities that happened continuously throughout the project period. The visualisation highlights our activities and how some of them are related. One example taken from the previous chapter is our own kitchen experiments with pulp, that was photographed and showed to the employees at Plantepølsen and turned into a prototype for an inspiration catalogue. Another example is how we went from the ideations into 4 concept ideas that we tested and developed into one concept: The Bioeconomy Food Challenge. To refine and detail the elements of this concept we staged activities of different kinds in order to end up with a final concept. The ideation, refinement & detailing presented in the following chapter are results of many activities and iterations, that develops into one final concept, presented in chapter 7.

Figure 21 - Design Process



6.2 Design Specification - an Iterative Tool

The design specifications, described in this chapter, is a way for us as designers to merge the knowledge of the field and design ideas into something that is designable. As described previously a part of our design process focuses on making use of the knowledge from case 1 to apply in case 2. In the design process, we will propose ideas in terms of objects and activities that will be assessed in light of the design specification to help us choose which solutions/activities that create the most value for the project. The design specification consists of categories and can be seen in the scheme, figure 22 on the next page. The first category reflects our perspective on sustainability that is described in chapter 2. The next 5 categories are a further development of the topics from chapter 5; bioeconomy, valuation, relationship, pulp and feasibility. They are, therefore, included as elements in the specification together with sustainability. Lastly, we have added practical project limitations a final element in the specification. The elements of the design specification have been shaped ongoing through the design process which has added more details to sharpen the iterative work with the concepts. The text with pink colour is to illustrate what has been adjusted during or after our ideation process.

When the design specifications were described we made a new scheme, figure 23 with the same elements to be used to set requirements, criteria and wishes for each element. This helped us to further specify and prioritise what aims we want to reach with our design. This scheme was used in the ideation processes to evaluate how well the different concepts performed in each element. The design specification with a scoring system can be seen below. A description of how we rated the concepts follows in the next section.

Figure 22 - Design Specification - Description - How each category is important

Sustainability	Including sustainable aspects in the concept are key. Sustainability has many shapes and rationales depending on who is using the term. In chapter 2, we describe our theoretical background and arguments for how we see sustainability. In short, sustainability needs to be seen and worked with holistically, in a system perspective, that inclines an orientation that considers all earthly ecosystems as interconnected. In chapter 5.1 we highlight positive and negative pressure from landscape and niche-activities. A perspective that we need to include in our design in order to support for a transition in the food regime towards using residue biomass as we see it as more sustainable. Sustainability must be a foundational rationale considered in all decisions of a development project to avoid solutions that support current unsustainable systems in status-quo regimes. Add on after iteration/morph: The design HAS to support a more systemic understanding of sustainability
Bioeconomy	As described in chapter 2, there are huge development potentials in using bioeconomy as a driver for change, due to rising political focus. Though it is far from intrinsic sustainable. Therefore, it is crucial for our design to influence and challenge development and innovation projects to address systemic sustainable aspects on both short- and long-term when working with bioeconomy. DSS (Det Store Spisekammer) and Gate 21 wants to become good at driving development projects with bioeconomy. We see a longer-term potential in creating a design that can tap into their current projects, and suggest sustainable transition pathways to proceed in the future. Add on after iteration/morph: Bioeconomy is a strategic object we are tapping into but the specific design does not need to have bioeconomy in focus.
Valuation	As described in chapter 4 and 5 the pulp is by juice producers considered as a by-product with potential value. But currently, it is mainly a waste expense for them as 99,5% goes to biogas. We want to showcase the valuation framing of pulp as biomass differently. The concept will have to challenge the current valuation and take the full potential of the pulp into consideration. Therefore, it is important to include valuation and awareness in the design concept. Add on after iteration/morph: It is important to create incitements for new food projects to flourish from the pulp or other residue biomass from food systems.
Relationship Building	As described in chapter 5.1, using pulp for other purposes than biogas, is somewhat a task of challenging a current regime. Plantepølsen and other start-ups are trying to do so, though knowledge of the consumers is very limited as we saw in chapter 5.2. Thus, a re-design of the system must address aspects of users in the system. The task of doing such design work is often messy and hard to translate into one recipe. Therefore, a staging framework of the performed participatory design work should be included to some extent. Whereas the design should include user-perspectives and practices in relation to the products and/or service in more steps of the chain.
Pulp	Pulp has the potential as food but is currently being used as feed and gas to create energy. Because of this, we want to use the pulp as food in our concept with the use of prototypes and boundary objects In other words, physical or visual examples of food made out of pulp that can share knowledge between actors and work as an inspirational booster to inspire. If products are shown and/or tasted instead of described it creates a stronger boundary and intermediate tool.
Feasibility User Focus	It is important for us that the design proposals are realistic and can contribute to society. That being said it does not have to fit the current regime and therefore it is not an ultimatum that it can be implemented tomorrow but should serve as a proposal for a future solution. The concept should contribute to relationship building so the future process of the involved actors can support itself and continue without us. Add on after iteration/morph: Feasibility challenges could be, taste, logistics, competing interests(meat industry) etc.
Practical Limitations	The project is limited in terms of financial resources, available network (actors) and their willingness/priority of participating in design activities with us. Time is also a limitation as our project has a deadline approximately two months after the ideation process. Lastly, the project and design solution are very dependent on the skills of the group members e.g. film making, co-design activities etc.

Figure 23 - Design Specification - Requirements

Weight	Topic	Demands (must be met)	Criteria (must be taken in to consideration)	Wishes (nice to)
80	Sustainability	Design solutions that support the development of a more systemic understanding of sustainability as explained in chapter 2	How to support the use of biomass for food and make visible arguments for how and why it is more sustainable. Add on after iteration/morph: How to communicate our understanding of sustainability with a systemic holistic approach.	
100	Bioeconomy	Using biomass in a more sustainable way than the current system. Explained in chapter 2. Add on after iteration/morph: Use bioeconomy to create more sustainable development processes	How to demonstrate a holistic approach and use bioeconomy as a strategic tool. Add on after iteration/morph: How to showcase an example of a sustainable-design-driven bioeconomic development process.	Contribute to changing the discourse away from massive meat production and consumption. Add on after iteration/morph: Showing examples of potentially large economic value in contrast to business as usual.
100	Valuation	Challenge how pulp is valued by demonstrating different view on pulp	How to enrol actors who might not care about sustainability. How to make a concept that supports the idea of including sustainability as a part of the valuation. Questioning what is the solution replacing - and is that desirable/ to whom?	To make the sustainable choice the preferred choice compared to other aspects/values such as the economy
80	Relationship Building	It must include the involvement of actors (humans).	How to make backstage and frontstage actions transparent.	Spread knowledge from this project to other than the involved actors. Involvement of new actors in the system
60	Pulp	The concept must include physical use of pulp	How health aspects of eating the pulp be included	Mobilise a larger amount of existing biomass to be used as food instead of feed or biogas
100	Feasibility User Focus	Add on after iteration/morph: It has to propose the relevance for the involved actors to engage.	How to align the approach with current funding possibilities to support the actors in initiating projects with pulp used as food in the future. Add on after iteration/morph: How to make it attractive even though it might not be profitable short term.	The involved actors will continue the development process of using pulp or other residue biomasses from food systems
60	Practical Limitations	The solution has to be carried out within the project time frame. It cannot ruin our private economy		

6.3 Ideation

Morphology - to Develop and be Specific on Ideas based on Findings

To develop a design concept that fits the above-mentioned specifications we apply a classic ideation process as explained in chapter 3.1. We use a morphology chart as our method to structure ideas and relate them to our design specifications. The morphology chart is basically a grid where each line refer to each of the seven topics from the design specification (see figure 25). During the process, each line will be filled out with ideas, that relates to the specification. From here the task then is to combine the ideas vertically to create concepts. Practically it means choosing one or more ideas from every one of the 7 horizontal criteria lines and combine them into concepts.

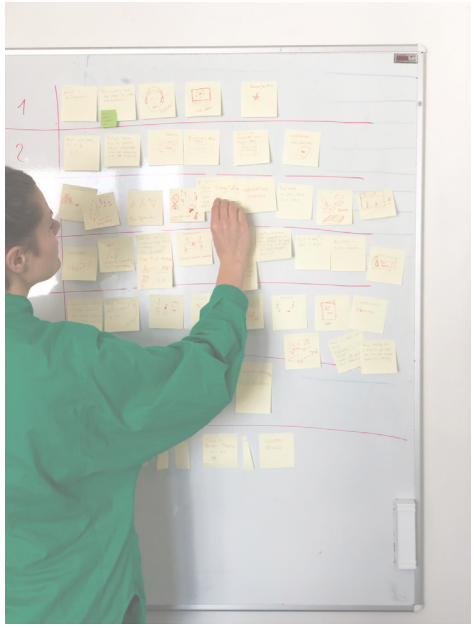
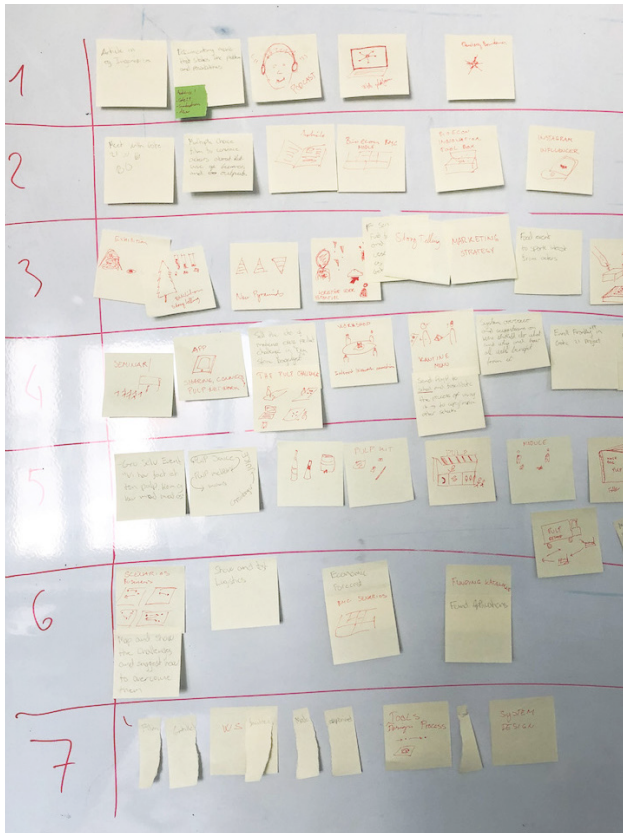


Figure 24 - Ideation with different types of brainstorm activities.

To give an insight on the morphology part of our ideation we have listed the steps here:

- First, we brainstormed for good ideas in general (figure 24). We wrote all ideas that we could think of on post-it notes
- Then we initiated brainstorming rounds for each requirement - 7 in total. (figure 24)
- After each round of brainstorming, we placed the post-it notes on the requirement line and discussed them one by one. Some of the ideas were identical and therefore merged. The general ideas were placed in the requirement lines as well. See fig 25
- We started creating concepts inspired by the ideas placed on the board by paring ideas from each requirement line into one concept. After this followed a discussing of how the requirements could be fulfilled within the concept.

Working with the morphology chart, made us come up with new ideas. But we also developed new interpretations of what the original ideas entailed while we went through the chart by combining the ideas. The ideas and the chart hereby worked as boundary objects in our process, with the result that we developed new common understandings of the meaning with the different ideas. From this process we managed to create ideas that all were related to the 7 topics in the design specification. We ended the morphing process when we had four concept ideas, are described in the next section.



Sustainability

Bioeconomy

Valuation

Relationship Building

Pulp

Feasibility User Focus

Practical Limitations

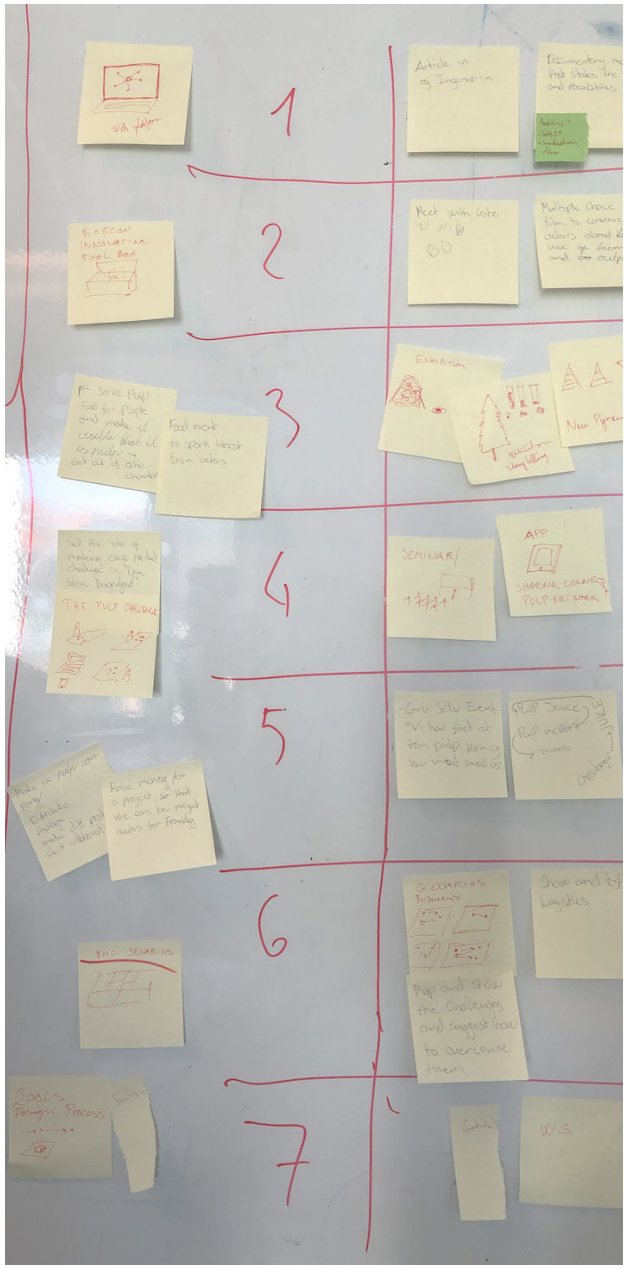


Figure 25 - Morphology chart (left) and example of concept idea 3 (right)

The 4 Concept Ideas

The four concept ideas are briefly described here. Additional reflections and content can be found in appendix 6.1.

Concept 1 - Pulp Action

Pulp Action is an activity located in a canteen/kitchen, which will focus on introducing pulp as an ingredient in cantinas work practices. The aim of the concept is to create awareness of the pulp to be utilised in a canteen context, gather know-how on pulp values in (larger) kitchen settings and investigate and establish alliances for future collaborations and partnership potentials. The concept will result in a catalogue format and film presenting practice scenarios, that can work as a starting point for future projects.

Figure 26 - Experiments with pulp

Concept 2 - The pulp Story

The concept consists of a marketing and branding activity and material, that through a podcast format (figure 27) will bring forward the narratives of the pulp world. The aim of the concept is to distribute the story of pulp as a generator of new unexplored development pathways by displaying alternative valuations of the biomaterial. This shall work as a scenario base for future re-evaluations of 'excess-materials' in business innovation. At the same time, the production process will mobilise actors in the network and unfold unshared insights. Thereby it will serve as a stepping stone to connect the potential partners in a future development process.

Figure 27 - Post-it from concept idea 2

Concept 3 - Pulp Challenge

The Pulp Challenge is a development competition with residue biomass pulp. The aim of the concept is exploring different use of pulp but more importantly to bring different and new actors together who are directly, indirectly or potentially involved with pulp. The challenge could take place in a kitchen with multiple stoves, ovens and cooking equipment for everyone to use. The concept could be shaped to fit into existing tv-shows such as The Great Bake Off [Den Store Bagedyst] to create interest from others, communicate sustainability, bioeconomy, challenge the current valuation and build new relationships. The challenge can be facilitated by us or a co-host such as a tv-host, a chef from plantepølsen etc.

Figure 28 - Den Store Bage Dyst
Photo left (TV2 Øst, 2019)
Photo right (Jubii, 2019)

Concept 4 - Workshop Seminar

The main goal is to connect actors and create a foundation for future projects by e.g enrolling Frankly or Plantepølsen in future Gate 21 projects to create financial space for innovation and testing out business possibilities and limits with pulp as a food product. The seminar will gather people who could be interested in future projects with creating food out of pulp. The seminar will have interdisciplinarity, network-building and knowledge-sharing as three central points. The seminar could take place at Frankly's juice production or in an industrial kitchen with possibilities to experiment with the pulp. Food samples and research elements such as videos, graphs and pictures will act as objects to initiate dialogue and transfer knowledge between the attendants.

Figure 29 - Workshop seminar

Iterations into one Selected Concept

We made several tests that caused iterations of the concept before ending on the final concept. All of the test activities will not be described in detail, but we will, in the following, highlight examples of some of them before ending on the final concept.

Strategic Considerations

In order to test our concepts, we made strategic considerations. As mentioned in chapter 3.1, we see the object of design as both designing a process, but also designing the tools to support that process. The testing is therefore done with the purpose of mitigating risks that the concept will not perform. But also, as a way to work as actively as possible with involving actors as a part of our participatory approach. The testing is a continuous iterative process that runs throughout the entire development process of testing, refining and detailing the concept. These strategic considerations are about how to test the selected concept: what (who) we want to test (it with) and what the plan is for that?
For clarification we describe all our testing activities through the following framework:

Stage:
What is the contextual setting of the activity?

Objects and Activities:
What objects and activities are used?

Purpose:
What do we want to test/get feedback on and why?

Findings and Adjustments:
What are the feedback and what do we learn and take with us?

1. Valuation Tool - Choosing and Adjusting

Stage: Internal activity, April 1th, Copenhagen, AAU
Objects and Activities: Valuation tool | post its' | note tools

Purpose:
As presented in chapter 3.1 we apply an evaluation tool to facilitate our negotiation process of which concept to choose. With paper, pen and post-it at hand, we created a low fidelity tool, figure 30, to facilitate the evaluation process.

Figure 30 - Valuation tool

The intention was that it could act to ensure a visual representation of our individual perceptions of the different ideas. To avoid influencing each other's ratings, we individually rated and wrote down arguments for our choices in each of the four concept ideas step by step. Which afterwards was used to compare and expose differences and dependencies in our assessments.

Findings and Adjustments:
Before we started the rating of the 4 ideas, we discussed which of the design criteria had most importance and therefore would have the most influence in the rating. It was done with the same valuation tool with the possibility of rating each specification topic on a scale from 5=let's do it to 1=could be better). We discussed each topic and our placements on the scale, to reach alignment. This process enabled a further clarification and bridged our different perceptions of the criteria and resulted in a renewed specification of our criteria descriptions. This process resulted in a weighted scale among the seven specification themes.

Then the concepts were rated and discussed facilitated by the tool. This process enabled us to realise that our ideas on what we thought we agreed was the content of the four concepts, still was not completely aligned. Thereby we specified more thoroughly the four concept ideas. The process of rating the concepts made us see new things that we found important to include e.g. that the design has to support a more systemic understanding of sustainability. Therefore, we added these adjustments to the specification afterwards. To diminish confusion we left out the complete list of written individual argumentation on the different concept ideas. Though these can be found in an unedited version in appendix 6.2.

To get feedback on the concept ideas and directions, we went to activate them in a real-world context at a meeting with different relevant actors - including Gate 21.

2. Finding a Platform - Merging Concept Ideas

Stage: EU funding info meeting. An event with the focus on BBI JU (Bio-Based Initiative Joint Undertaking) April 2nd, Haldor Topsøe, Lyngby
Objects and Activities: Phone | notebook | casual talk during breaks

Purpose: We went with an intention to get feedback on our concept ideas to ensure the relevance of Gate 21 and the broader bioeconomy context. The purpose was to present our findings and concept ideas to make us attractive for the DSS project. And to hear about the current status of the DSS project.

Findings and Adjustments:
Presenting our practical experiences Gate 21 was clearly interested to hear our reflections. We stated our concerns for the potential lack of sustainable considerations and how we saw it could be included better through ex. elements and tools in our concepts. The concern was shared by Gate 21. The status for the DSS project was that Odsherred Municipality wanted to make a challenge with students from e.g. Absalon University College, where they wanted them to submit projects with ideas for recipes on how to use the residue biomass from among other root fruit production. We suggested to include more elements than just recipe/product focus and make the challenge address aspects of partnerships, environmental impacts etc. which they found quite relevant as well. Additionally, we presented our idea of creating tools for evaluation and an interactive film that could inspire the participants to a more advanced mindset, by using the case on pulp as a reference project.

From Gate 21 we got the impression that some of the partners in DSS might focus mostly on developing attractive recipes. From our research findings, presented in the previous chapters, we are aware of the many challenges of running development with residue biomasses in more sustainable ways. Therefore, we find it crucial to influence and support the partners to include a broader perspective in the challenge.

In this case, our verbal prototype ended up changing the project, since we got a platform to place our design on. This activity worked to tie a stronger knot to the DSS project and enrolled us on at least the coming group meeting. The feedback made us choose a concept, in the form of a challenge since the DSS project potentially had a great platform with Absalon University College. Therefore, we developed Concept 3 - Pulp Challenge into a merge of elements and ideas from all of the 4 concept ideas and scoped to fit the DSS project more directly by targeting it to students.

The Concept

Bioeconomy Food Challenge

The concept has to support bioeconomic development projects in relation to the Det Store Spisekammer (DSS), to apply residue biomass from food systems in a more sustainable way. We decided to go with the concept - Bioeconomy food challenge. A challenge-call and supporting tools to be developed in collaboration with DSS. The initial target group of the concept is university students from Absalon. Initial ideas for elements are a web-based platform to collect and display all the related challenge-material and make it accessible for a broader public. And hereby support awareness and learning aspects to inspire more systemic bioeconomy project approaches and through this support more sustainable applications of residue biomasses in food. One idea element is an interactive-film that presents the pulp case as a tangible reference story. Through multiple-choice options during the film, the participant is invited to engage in what pathways the pulp can proceed. Another element is to include different tools to support collaboration and involvement of more perspectives e.g. network mapping or sustainable systemic considerations.

6.4 Refinement & Detailing of Concept - Bioeconomy Food Challenge

In this section, we will present a selection of our front stage activities that served to refine and detail the design concept - Bioeconomy food challenge. We have had several other frontstage and backstage activities that have served the purpose of shaping the different elements of the concept. These have worked to keep us on track with our collaborating partners in the DSS project. We have run unplanned testing with various actors, developed mock-ups of tools, tested web platforms and edited film footage of the process. These activities will not be elaborated in this study. But instead, we present a selection of our front staging test activities and connected considerations in the form of workshops and development meetings. They are described in the same framework as used for the initial iterations.

Test 1 - Framework, Expectations and Criteria

Stage: First group meeting between all partners in Det Store Spisekammer (DSS) project. April 26th, Lejre Town Hall.
Objects and Activities: Workshop | criteria tool prototype | interactive-film-toll prototype | food samples | network map

Purpose:
We intend to use the meeting to present our findings from case 1 with pulp through prototypes of our concept. Our agenda was to get feedback and responses to a refinement of our concept. Furthermore, we wanted to explore the ways in which we can influence the development of the challenge to take more systemic sustainability and holistic aspects of the process. Therefore, the purpose was to gain insights on the partners' interests and rationales, and on the relations between bioeconomy and food systems.
By bringing different objects that have the purpose of inviting the participants to discuss/spark a dialogue around what criteria should be a part of the challenge. We transformed our design specifications into six criteria topics that we anticipated might fit into a chal-

lenge format. These were translated into a criteria tool prototype, that we intend to use as a boundary object to unfold the partners' different knowledge positions and interests. We want to test the criteria tool prototype as a potential tool to support the development process in order to include more systematically sustainable aspects.

Additionally, we want to flag the idea of involving the students in shaping one of the criteria. By adding an opportunity for the participants/students to define one criteria they would like to be evaluated on. Thereby the jury (or however the selection process will be designed) can get a better perspective on how the participants think in a bioeconomic context. We developed an analogue tool to test the idea of an interactive-film as part of setting the stage in the challenge. The intention is to show an example of how to think beyond narrow recipe development. Which is important, when creating a development project with at least considerations of broader sustainable aspects. The food samples work as sensible and tactile boundary objects to concretise a utilisation of a residue biomass pulp and showcase the feasibility.

Findings and Adjustments:
During the meeting, the partners' different perspectives were displayed. Halfway through the meeting, we presented our criteria tool prototype, which worked to capture many of the perspectives inside the six topics. In that way, the tool served to represent a common frame for the group to agree on a direction for the challenge frame. Our presentation of the pulp case 1 worked as a boundary object to establish a concrete example to have a dialogue around. With the result that more of the partners used the pulp as an example to support their arguments. On top of the praxis confirmation of the usability of the tools, we also got positive verbal feedback to continue our work with developing design tools to equip the development process with biomass from residue biomass.

Our intention of testing the ideas of including an interactive-film tool was due to limited time not possible. Therefore, we saw a need to test this in a different setting.

Test 2 - Interactive-film Idea Feedback

Stage: Test session May 3rd, 2019, AAU, Copenhagen,
Objects and Activities: books | criteria tool prototype | network map | inspiration sheets | interactive-film mock-up

Purpose:
We developed a set of objects that should serve the purpose to help translation of the idea, of including an interactive-film as part of the concept material, to other actors not familiar with our concept. As reference material, we bought four hardback books with multiple storylines [tvær-veje bøger]. These are books where you by taking choices during the story choose the storyline of the adventure. The feedback on these elements and presentation should give us an indication of how to narrate the idea and what ways to proceed with this part of the concept.

Findings and Adjustments:
The reference material in the form of books and inspiration sheets worked to show how it could work with this type of user involving storytelling. The interactive-film mockup worked to explain and visualise how the elements: network map, criteria tool and the pulp case story can be spun together. Overall we got a lot of positive feedback from the participants and they especially liked the fact that we used the pulp story from case 1 as a reference example to set the stage in the challenge that is about different residue biomasses. The objects worked thereby to facilitate immediate understanding of the format and did not work to go into depth with the specific content. But it made us aware of new considerations we might have to consider. Such as how do we work with dead ends; should we create a scoring system; how do we create mockups, that enable us to go into depth and explain the content convincing.

Test 3 - User Insights from students

Stage: Workshop with food & nutrition students, Plant Proteins in food and diets, May 20, 2019, Absalon University College, Sorø,
Objects and Activities: workshop | criteria tool prototypel post its | film

Purpose:
With a participatory design approach, described in chapter 3, we use interactive objects, in this case, the criteria tool prototype to involve the students. They are intended to support the dialogue between us and the students and to support the development of new knowledge and to create interdependencies between students. The purpose of the workshop was thereby to get an understanding of the students' knowledge-foundation and their experience with how previous projects has been staged. In order to identify potential areas that might benefit to be supported. More precisely we sought to gain an understanding of how the students as users understood the system around residue biomass which is reflected in the criteria.
An additional purpose with this activity was to showcase the value of involving the users in such development processes to Gate 21 and the DSS partners. Therefore, we decided to film the workshop session, to be able to transfer that knowledge to the DSS project.

Findings and Adjustments:
Through this user-driven design approach, we got valuable insights on how the criteria can be understood by students at Absalon. Through the workshop, the feedback from the students was written on post-its and placed on each criteria and they added new elements to them (figure 30). From this, we identified areas where the students articulated they could benefit from support in term of tools. It would be good to have supporting tools or guides to help us in especially our innovation process. In the assignment, they are assessed on their abilities to address innovation and sustainability. Though when asking them about the meaning of sustainability in their projects the short answer was: it is local and sustainable, which is not a very systemic understanding of the concept of sustainability. Lastly, we experienced that they are not having a critical problem-based approach. This made us realise that they might contribute from having guided questions to consider throughout their process. In this way, we might be able to influence them to consider and argue for more of the systemic aspects of their project. This may support the projects in a way that sustainability becomes more than just It is local.
We managed to film the entire workshop session, which we went home to edit, so we were able to bring some of the findings to the co-creating meeting with the DSS project.

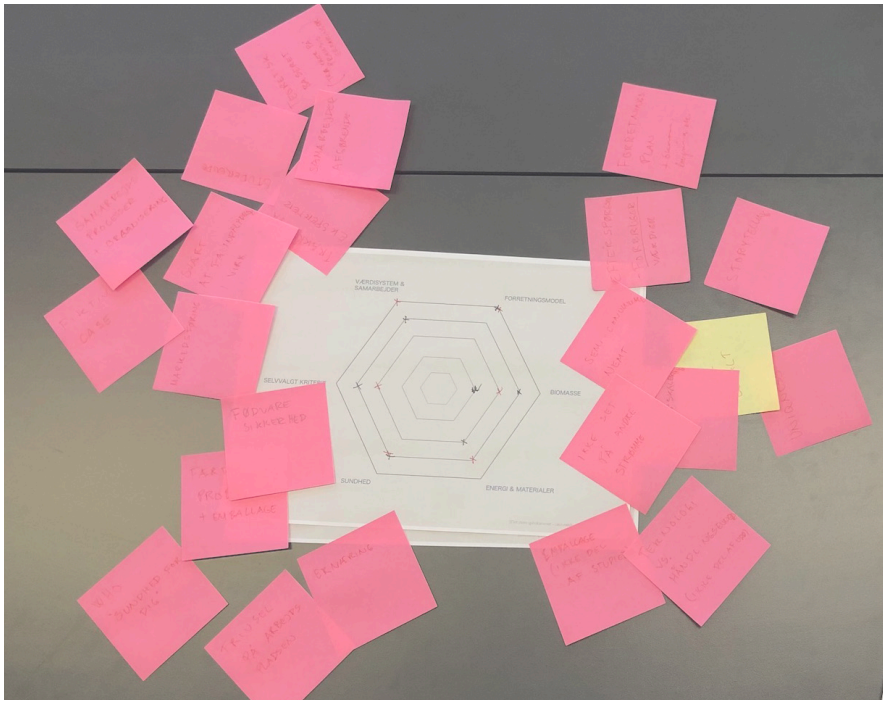


Figure 30 - Criteria tool with insights from Absalon students

Test 4 - Tool and framework detailing

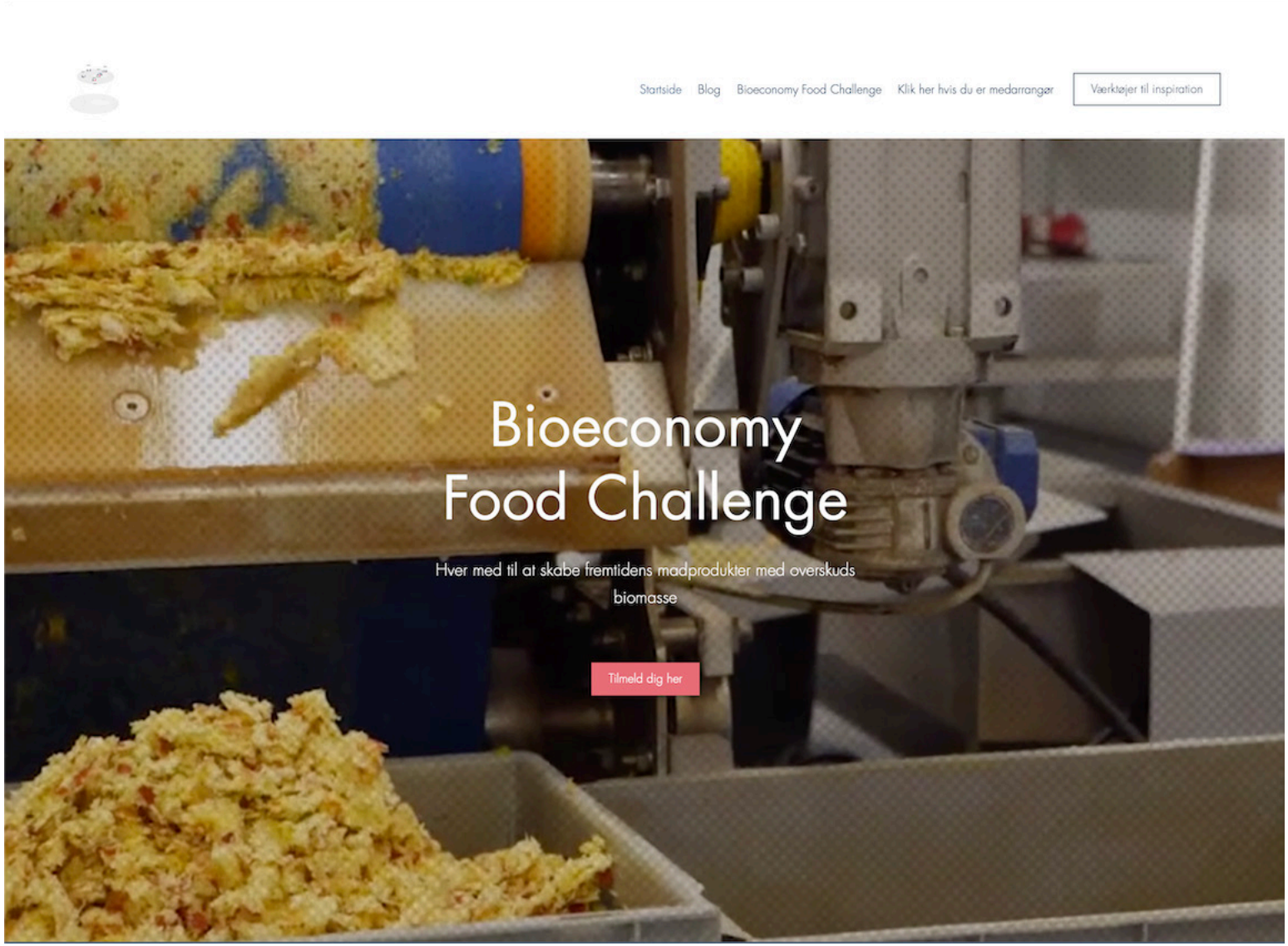
Stage: Co-creating participatory session with Gate 21 and one of the DSS partners, May 27th, 2019, Gate 21, Albertslund
Objects and Activities: Workshop | prototypes of varieties of tools | sketches | slide show | film clips

Purpose:
The main purpose of this workshop was to present and refine the tools and framework for the challenge. We needed to get feedback and alignment with the DSS project in the current direction we were heading. From a phone call with Gate 21 prior to the meeting, we learned that they were keen on hearing about our considerations and thoughts on tools that might support or improve the process of including sustainability aspects in the bioeconomy. To support this, we created a slideshow - to present a brief of our findings and arguments combined with early stage tools and sketches, which we hoped could work to further underline our intention of including elements of a systemic sustainability approach in the challenge. Among others, we made a draft of a potential valuation process, that we wanted to co-develop at the workshop. An additional purpose of the workshop was to test our tools to visualise and learn chapter 3, to see if we were able to use the film clips from test 3 to transfer some of our user involvement insights to the DSS project. Lastly, we wanted to present the idea of including a reference case story on the pulp in the interactive-film tool, to see if they found it relevant to apply as part the challenge material.

Findings and Adjustments:
Overall the reactions we got from the workshop were positive, and they showed interest in the continuing the collaboration after the thesis was handed over through different funding options. The tools worked to establish a framework in which we commonly were enabled to discuss, develop and detailing the tools to be a part of the process. E.g. in regards to the development of a valuation process, we agreed that this should not focus on finding a winner rather we decided to adjust it into a mentor-process where tools should support dialogue with the student projects.
We found that actors outside the DSS project group find the purpose of the challenge to be about lifting ideas to become ready for the market. But internal in the group we decided to focus on helping the students to include broader systemic aspects of sustainability in their projects. With the inputs from the students in the film clips, we decided to change the criteria topic Health [Sundhed] to Quality of life [Livskvalitet]

By presenting the idea of making a platform for the challenge with all the material including an interactive-film, using the same tools as in test 2 (except physical books) we got reflections such as: "It can show people in the food production industry that there are far more products to develop with all the existing residue biomasses that exists" (Gate 21). "Really cool! It kickstarts a chain of thoughts and then you are on track - for many people this is a whole new way of thinking, that you have to get into" (DDS project member). These reactions confirm our thoughts of using the interactive-film with a reference example as a tool to create awareness on residue biomasses from food systems that can be used as new food products instead of being wasted. And on the same hand, we will through the combined tools have the possibility to support a more complex understanding of the earthly systems we all are a part of.

In order to involve the entire DSS project group, we will have to develop one final concept.


Startside
Blog
Bioeconomy Food Challenge
Klik her hvis du er medarrangør
Værktøjer til inspiration
Bioeconomy
Food Challenge
Hver med til at skabe fremtidens madprodukter med overskuds
biomasse
Tilmeld dig her

Chapter 7
Bioeconomy Food Challenge

To support bioeconomic development projects to apply residue biomasses from food systems in a more sustainable way we present the supporting concept Bioeconomy Food challenge. This will be followed by our reflections and expectations to the concept. The concept reflects the specifications and criteria from our research and design work presented in the previous chapters.

7.1 Content of the Bioeconomy Food Challenge

The Bioeconomy Food Challenge, is a framework and tools for supporting actors in a bioeconomy development project. The concept is a challenge inspired by a competition format but with an educational twist and it is intended to to be performed by the members of Det Store Spisekammer (DSS) and the University of Absalon.

It is crucial when working in the field of creating changes in the way residue biomasses from food systems are applied to become aware of the many different rationales that intent to direct the development in certain directions. Therefore, the aim of this concept is to inspire towards a more systemic, sustainable and collaborative approach, and through this support room for participants' to become more reflective and share perspectives and perhaps follow other pathways than status-quo. The elements of the concept will serve the purpose of creating awareness of how a challenge could look/include (front stage). They will also include suggestions on how to support collaboration and involvement in the planning and executing of a challenge (backstage/frontstage). The framework and elements of the challenge are presented in the form of prototypes of frontstage and backstage elements. The elements will be described in this section followed by section a review of how the elements relate to the design criteria.

All the elements are due to the early stage of the development process in a prototype version. And the prototypes will be further developed after the finalisation of this report, as described in the expectation chapter 7.3. The current version of the material can be seen in appendix 7.1.

The five elements are:

1. Web Platform
- A Material Hub for the Bioeconomy Food Challenge

We have decided to place the front stage challenge materials on a website to establish a framework which enhances the accessibility for a broader public. The web format likewise invites involvement and promote an explorative approach. Furthermore, it is a great platform for communicating through film and other visual media. The platform will contain the following elements:

- The Challenge Call
- Collaboration tools
- An interactive-film

The website prototype will be under construction untill the June 19, 2019. It can be seen by following this link:

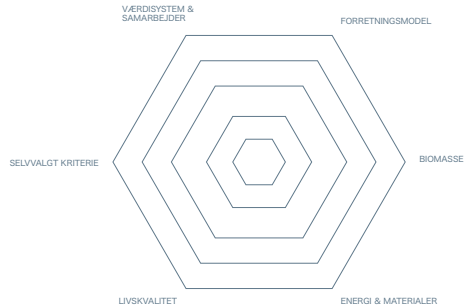
www.andersdevantier1.wixsite.com/bioeconomyisfood

2. The Challenge Call - Background and Competition Requirements

The challenge call will be posted on the web platform. The content of the Challenge Call is a description of the problems with the vast amounts of residue biomasses from food systems - a call for action innovate food products and new sustainable food systems. The call will include submission criteria and tools to guide participants in their development process.

The submission criteria topics are:

Value Systems & Collaborations
Business Model
Quality of Life
Biomass
Energy & Materials



Criteria of Own Choice
Sustainability is not highlighted as one topic to be answered. But it is an attempt to include sustainable considerations in all parts of project topics. The submitted projects will thereby be evaluated on their ability to reflect and include surrounding systemic and holistic aspects. The Criteria of Own Choice add to their ability to reflect and to choose a topic that they think is important for their submission. They will be evaluated in terms of taste, feel and look but also in terms of e.g. energy and material used for production, up-scaling potential of the products, network and health aspects.

The visual story and examples will use Frankly Juice and Plantepølsen, as a reference example of how residue biomass can be used in products. The example can be used as a boundary object when talking about the challenge and as a story to inspire the students to participate.

3. Collaboration-Tools and Descriptions

The tools will be accessible for download on the web platform. They will be placed on a Toolbox site on the website. They will also be linked to the related parts of the film story, presented below. The tools are to be worked with in printed format, which hereby creates a common object to represent and share knowledge.

The five tools are:

Network Tool - to support realisation and involvement of additional actors related to the project and apply a broader perspective of important aspects to include.

Criteria Tool - to facilitate discussions and prioritisations around the challenge criteria. The tool can be used as a way to rate different ideas. The different ratings will create different shapes that reflect how an idea/product is related to the criteria, see the website for an example.

Systemic map - to visualise the journey of the residue biomass used in the project.

Comparison tool - to compare the product to an existing product on the market

Let's talk about the bad stuff tool - A tool to spike critical self-reflection among for the attendees.

4. The Interactive Film

The Interactive film will be placed on the web platform. "The interactive biomass food journey" is an interactive tool that invites participants in the challenge to experience the different problematics and choices that are relevant to take into account when making sustainable innovation. The audience will be staged with the challenge of deciding what to do with the 18 tonnes of pulp from juice that Frankly Juice produces every month. The film stages the different pathways of residue biomass, exemplified through the case of pulp. Hereby the film will present a reference story on pulp. This will work to create interest and raise questions on what rationales decisions are based on in order to address possibilities of using it as food. The film will visually demonstrate different journeys of using pulp, showing e.g how it can be seen as feed, gas or heat production. The film will include aspects that can be translated into the case of the challenge and thereby point to the different tools presented above. The Interactive film will, therefore, show the different outputs and more importantly, the choices one has to make when dealing with biomass. It will take the audience through different scenarios depending on the choices made when working with biomass, just like the old turn-page-adventure books, the slum challenge and the newly released black mirror film "Bandersnatch".

The storyboard for the film can be seen in appendix 7.1 and on the website.

To show how the film could look and the interactive part could work, we have made a high fidelity test film that also can be seen on the website. The prototype film shows the intro and what happens if we follow a couple of steps. The steps are reflected in the storyboard.

5. Backstage Recommendations

The backstage recommendations include visual objects to explain and support how to work consciously with the invisible work of planning a development project in relation to two elements. The visual object will be accompanied by a document with written recommendations on how to work with them. Two elements showed a specific value during design refinement, hence we have decided to include them as a valuable part of the backstage activities when planning the challenge.

The first sub-element is to include a mentoring process. This serves the purpose of including more actors with context-specific knowledge on different aspects with applying residue biomasses from food systems to new food products. But also to include actors with knowledge from surrounding areas related to such projects. We present suggestions for mentors we find relevant to include e.g. Plantepølsen (PP) from case 1. They should be invited to co-develop the final criteria content and acting as supporting mentors during the participants' development of their challenge projects.

The second sub-element is a timeline to discuss and plan front and backstage activities. The timeline will be facilitated by us to the DSS project members to enable a discussion about activities staged as elements in the challenge and activities that should be performed behind the scenes. The timeline can furthermore articulate what this challenge can do for the DSS project in a broader perspective. Both as a frontstage story with media attention but also as a backstage activity strengthening the collaboration among DSS project partners and related actors.

7.2 The Concept in a Design Specification Perspective

Sustainability

The output of the concept is to share our knowledge about the sustainable aspects of residue biomass from food systems as food. We have initiated a collaboration with DSS to provide a potential platform that can perform the concept/challenge. Hopefully, they will consider sustainable aspects from this project in future projects. We suggest that the output "dish" or "food product" that will be submitted in the challenge will be evaluated in terms of taste, feel and look but also in a sustainability aspect in terms of energy and material used for production, up-scaling potential of the products, health aspects etc.

In Test 3, we experienced that the students at Absalon are not having a critical problem-based approach. Critical aspects, therefore, are implemented in the prototype tools. The analogue tools and descriptions support self-critique sustainable aspects. These serve the purpose to enhance reflections among the participants to follow other pathways than status-quo and including more than just e.g. CO2 calculations.
Furthermore, we have proposed a concept that has visible arguments for sustainability in terms of an interactive film, a system tool and a comparison tool.

Bioeconomy
With the challenge, we cling the bioeconomy to the rising interest in non-meat alternatives, by focusing on vegetarian and vegan dishes. The challenge thereby uses bioeconomy as a strategic object to bring attention to other focus areas than biogas, technology development or feed production. Bioeconomy is in this perspective used as a concept to promote more sustainable development processes. We hope with the concept to influence a bioeconomic project in the short-term by supporting the DSS project. On the long term, we hope that our concept will influence the project partners with sustainability aspects that they will apply on future bioeconomy projects.

Valuation
If the audience and participants see the pulp as waste or a product for other uses, such as food, they will experience a new valuation of the material, if meals made out of pulp are presented attractively. The output of the challenge could contribute to external actors valutaion of pulp as food, as well as knowledge on how to work with it as food.. External actors could be other project groups working with bioeconomy.
In order to bring forward the different valuation perspectives, we will introduce visual storytelling in the format of the challenge framework and tools. As an example the Interactive Film is an attempt to bridge and highlight the complexities and different choices and considerations, based on our findings, to include sustainability in valuation framing on the bioeconomy discussion.

Relationship building
New relations can be built during the challenge activities, the process development, mentor involvement, submissions and events. A staging framework of the performed participatory design has been included in the concept. This can be seen in terms of encouragement of user-perspectives and practices like involving Frankly Juice and Plantepølsen to be a part of the challenge in terms of storytelling and mentors. Another example is that we, with the Bioeconomy Food Challenge, invite new actors, such as students to become part of the development process of finding ways to apply residue biomasses from food systems in more sustainable ways. With this platform, we have the possibility to spread our knowledge from this project to other actors and invite them to join.
The timeline element in the Backstage Recommendations is a direct attempt for us to answer to our criteria on how to transfer our methods and encourage our partners to make backstage and frontstage actions transparent. This element seeks to support actors to become aware of and involve them in more strategically considerations, through a visualisation of their planned activities and how they can relate to long term visions in a larger systemic perspective of the DSS project.

Pulp
The concept includes pulp in its physical form as a boundary object. Pulp is presented to important actors in the challenge to spark conversation and imagination among the challenge participants on what can be done with pulp and what are the challenges when working with it in a specific context. Furthermore, the pulp has been used as boundary objects by us when attending workshops in the development of the concept.

Feasibility/user focus
In order to make the challenge an attractive and a realistic concept for DSS and Absalon, we have, through a participatory approach obtained knowledge and wishes from the DSS partners and students at Absalon. We have also engaged with FJ and PP in order to make our work and design solutions attractive to them. An example is that we suggest PP to be a mentor in the challenge. PP expressed a wish for developing workshops and spread their story. Therefore we see this as a way to contribute back to them and connect our partners. Hereby we can spread knowledge from case 1 to case 2 in future real-world activities.
In terms of feasibility of the concept proposed. We have through the collaboration with DSS been provided with a possible challenge platform at Absalon, which enhance the feasibility aspects of the actors we engage with to continue the project with proposed sustainable supporting elements.

Practical Limitations
Absalon and the DSS project group have not agreed on a challenge collaboration yet. The platform for the challenge is not confirmed yet as. Furthermore, the DSS project-group might not like the ideas we propose and therefore the concept will fall to the ground.
Lastly, the timeframe of our contribution to the project is limited to the project time in this thesis. To cope with the factors above we have strategically planned how to present the concept and included considerations about how the concept can perform. The considerations can be seen in the next chapter.

In terms of skills of the project group, we have included elements in the concept, that we comfortably can produce and perform to the SDD group. We are comfortable with producing film, website and graphics to be used professionally as prototypes or even final products. That being said, the concept promotes certain flexibility. Some elements could benefit from expertise in coding for making the website and the interactive film. This, of course, depends on the technical requirement to the final elements and the budget for making those elements. Some of the DSS partners have indicated that they might be interested in involving us as project partners in the project which can minimise the importance of the time aspect, we in our design specification saw as limited to the thesis period.

7.3 Expectations and Evaluation of the Concept

In this section, we present our expectations for the concept. This will be followed by a brief description on how we intent to evaluate and hand over the concept to the DSS partners, and what role we see ourselves play in the future development with DSS and bioeconomy.

Expectations to the Concept

We hope the concept will support the project group in their future work with navigating the DSS bioeconomy project in a sustainable direction, and that our collaborative activities thereby have worked as inspiration to their work with framing development processes on applying residue biomass from food systems in a more sustainable way. Thereby we expect that the concept will spike interest for food as bioeconomic focus among project people at DSS, the enrolled municipalities and their stakeholders. We hope to affect future projects that deals with residue biomasses from food systems to shift focus from e.g. feed, gas and biotechnology to food and new collaboration patterns.

We expect the concept to create awareness of the hidden rationales and system dynamics to people involved in the challenge. We hope the tools will work as boundary objects to translate important perhaps intangible and complex sustainability aspects into concrete actions among the participants in the future challenge but also among the partners in the DSS. Even though the interactive film and web platform is only early prototypes, we hope that they can act to spark interest. The partners in the DSS may find it supportive to include such formats or other related design tools that can help highlight hidden rationales, system dynamics and thereby open the discussion on sustainability aspects in bioeconomy. We expect that the tools will serve the purpose of encouraging the participants to involve more actors in their process and work to support collaboration between these actors in the bioeconomic project.

Lastly, we hope that the concept might create an increased interest from the DSS group to connect with Frankly/Plantepølsen - and the other way around.

Evaluation of the Concept

On the 18th of June, we are participating in a meeting, here we facilitate a session where we hand over and share our concept and knowledge to the entire Det Store Spisekammer project group.

After the finalisation of this report but prior to the meeting we will do a last refinement of the concept elements which we will present to the meeting. Here we will use the elements actively in a workshop format, so the project group members will experience them in practice, and we will discuss the future pathways for the concept and the DSS's challenge. We will share the feedback from this evaluation on the exam at the end of June. As part of our last refinement work, we will plan a meeting with the intention of involving Plantepølsen, in order to get feedback on the material and to present the idea of making them a part of a mentor corps in the challenge.

The success criteria for our project is not necessarily to deliver a plug-n-play solution to be implemented in the challenge planned to run in the Autumn. More our success will be if our process and design concept can manage to influence the future process in Det Store Spisekammer and connected activities to include more of the systemic aspects that we introduce through the prototypes of the supporting tools. We hope thereby that the elements and suggested framework in our concept, Bioeconomy Food Challenge, can constitute a systemic sustainability foundation that will raise awareness, invite to involvement and encourage new collaborations, by being a part of the Det Store Spisekammer project. We, therefore, hope to get the rest of DSS partners enrolled in our take on a bioeconomy challenge and include elements in the challenge.

Personally, we hope to get invited to the project in the future, but it depends on project funds and if they see our work benefitting the further development of their bioeconomy project.

Pulp Action I Anders Devantier & Liva Bjerg Linnet

Chapter 8
Conclusion & Perspectives

8.1 Conclusion

In this project, we have investigated activities related to the concept of bioeconomy and residue biomass from food systems. With these insights, we have worked to design a concept with the aim of supporting participants in bioeconomy projects to use the residual biomass from food systems in more sustainable ways.

We intended to make actors working with bioeconomy consider more sustainable aspects, in this case by creating awareness on applying residue biomass in the food regime instead of using it as feed and gas production. We unfolded controversies within bioeconomy through a systemic sustainability view and elaborated how dominating perspectives in bioeconomy has a focus on designing for status-quo. We challenged that perspective by proposing a new sustainable valuation of bioeconomy with an environmental earthly sustainable focus instead.

First of all, we learned through our research and analysis that a sustainable transition in the view of the whole multi-level perspective (MLP) is influenced by many systemic factors. These include both multiple landscape trends such as increasing population, climate change and biodiversity loss that can be seen to pressure the existing regime of using residue biomasses from food production in energy or feed. We saw how niche innovations, that tries to challenge the current regime, are challenged. But they are also in a position to benefit from the increasing landscape pressure. From looking at the discourses related to bioeconomy we learned how different interpretations and rationales shapes the dominating discourses.

When combining staging & navigation approach with MLP we developed a designable framework that enabled us to make activities that consider broader socio-technical and earthly systemic dynamics. We conclude that by translating this into an operationalizable concept with tools in the form of film and visualisations we are able to share our perspectives and to some extent, influence participants in the project to consider more of the surrounding sustainable aspects. We argue that one needs to change the focus to include surrounding elements, actors and factors and be brave enough not to design solutions that fit status-quo. Meaning that in order to influence the bioeconomy to move in a more sustainable way one has to include ways of establishing and running new collaborations across companies, organisations, political institutions, experts etc., and challenge existing unsustainable regimes.
Simultaneously we have found that a focus on the design process through a participatory and explorative approach is a crucial factor that determines the possibilities for pushing a sustainable agenda into a development project. With our navigation and staging work, one could argue that we have managed to contribute to a larger mobilization of making bioeconomy related development projects with food consider sustainability.

We have in our exploratory ethnographic research experienced a lack of knowledge-sharing among the practitioners in the field of development projects with residue biomasses from food systems. Through our design process, we saw that introducing tools as part of backstage activities can work to support common ground for the partners in a bioeconomy development project like Det Store Spisekammer. We have experienced how these tools can help relationship building and collaborations between actors and thereby enable knowledge sharing and - development across different fields. Therefore, we find it important to include dialogue and design tools that encourage the participating teams to consider possible collaboration possibilities in their network and at the same time but also the physical system around the biomass. In this way, actors might be more likely to engage if they see, act and become a part of shaping the process and the desired sustainable direction. This might also contribute to a larger mobilisation and engagement of actors. The tools have been developed and adjusted with the users and are therefore included in the challenge to guide and support for sustainable aspects. This includes the criteria tool which we have seen as an eyeopener for participants in terms of including a systems thinking in their considerations.

Based on our research and analysis we developed a set of iterative design specifications to be capable of developing a final concept. With brainstorming methods, various design tools. multiple testings and iterations we developed a concept that, with our insights, might support the application of residual biomass from food systems to be used more sustainably. In this case in the bioeconomy development project Det Store Spisekammer (Translation: The Large Pantry). We developed a final concept - Bioeconomy Food Challenge. With the concept, we want to create attention on using the residue biomass in the food regime and support actors in a bioeconomy development project.

With tools and a framework, we seek to inspire a competition format but with an educational twist, it is intended to be performed by the members of Det Store Spisekammer) and the University of Absalon. We suggest that we by including, tools among others as an interactive film element, can invite the audience to take action by clicking through an experience of manny choices one should consider when initiating development project with residue biomass. The experience will be shown through the prototype of an interactive film that explores the case scenario of Frankly Juice and Plantepølsen and asks the audience to consider what to do with the biomass.

The two cases Det Store Spisekammer and Juice pulp have provided us with a contextual foundation for the insights and suggestions for sustainable support elaborated in this thesis. We argue that awareness, collaboration and involvement are crucial factors that play significant role as way to support the residue biomass to be applied in the food regime. This enhances reflections on following other pathways than status-quo and include more than just e.g. CO2 calculations in the sustainable assessment of a development project. We have elaborated how the case of pulp and other innovation activity can challenge that view. The findings are therefore only representing challenges and conditions specific to this context. Every collaboration has unique constellations, boundaries and possibilities that. therefore, should be considered individually for every bioeconomic project. That being said, we have attempted to share our knowledge around the cases that can be applied as a reference example in related projects. We hope that this approach will be further developed in future projects.

8.2 Perspectives

In our journey into the world of bioeconomy and residue biomasses we met many interesting pathways that could be beneficial to follow. Below are three aspects we find interesting to dive into for a future exploration.

There are many aspects to investigate in relation to utilising the enormous masses of residue biomasses from the food system. We have in this project used the concept bioeconomy as a way to legitimise and push for the need to talk about sustainability in relation to these development projects. A concept that can be said to be even more popular these days are circular economy. As mentioned in chapter 2 bioeconomy is among some practitioners called circular bioeconomy. It could be interesting follow the connection between these two concepts - how this might open new pathways towards perhaps more sustainable application of the residue biomasses. This perspective points to very important aspect of bioeconomy and application of biomass, namely the renewable and circularity aspect. Draw lines to circular economy with the ambitious aim of keeping goods in a closed controlled circle. Having a circular bioeconomy could mean, In the case of using residue biomass, that resources are kept in a loop. So that the nutrients to grow the crops is returned to the earth after it has been harvested, processes, eaten…. and returned to the field as human manure. The chain falls off when the biomass has to return to the field in order for the biomass to become somewhat circular. There are currently only few systems in Denmark that are experimenting with using human waste from the sewer system as manure. This is sad as all the nutrient from human waste currently goes to waste or even worse, ends up in oceans that currently is over fertilised.Circular bioeconomy, in this case, would need a system that can support the circularity by completing the circle. This a wicked problem, as it involves multiple actors with many different interests and it has to disrupt with current social aspects like e.g. using human manure as fertilizer and more technical aspects a redesigning the current infrastructure of our sewer systems. This problematization is necessary to address and it adds to our point of a needed holistic and earthly approach in order for bioeconomy to become more sustainable. This could raise questions to the circularity aspect of bioeconomy projects.

With inspiration from Dalkmann, H., et at., (2007) with the framework on mobility, Avoid-Shift-Improve, we could apply this focus on the case of juice production and other bioeconomy projects. In this project we have not challenged the fact that juice is being produced in the first place and that it by default produces a lot of residue biomass. One could argue that we only suggest ways to improve the production of juice by using the residue biomass more sustainable. In this perspective, we have only looked at a part-element of the system and tried to improve that. But what if we focused on finding ways to shift production methods? We could also look into how to avoid residue biomass from being produced at all. With this approach, it could be relevant to map streams of residue biomass and gain knowledge from how it originates to investigate how residue biomass can be avoided. Juice production, for example, is not a necessity and one could ask if the easy solution might be to eat the fruit and vegetables instead of drinking it and waste half of the biomass as pulp.

One thing that could be interesting to follow in a future project is the aspect of including more of the local communities in the project. Lejre has a strong community of small local food producers named Herslev, here it would be interesting investigate how a mobilisation of local citizens in a community can be a way to support a local distribution and application of their residue biomasses. It could be interesting to investigate it through the lens of the theoretical concept of convivial technology. This concept questions the idea of making development projects with the purpose of becoming more efficient and argue that this is not at all necessarily the same as becoming more sustainable (Greenfield, A., 2019). It builds on thoughts from the limits to growth and brings a conscious de-growth perspective to the table. The focus could hereby be less on business development and more on investigating the possibilities of creating and organising activities to support a strong common platform for people in Lejre. Such communities could perhaps grow out of activities around the application of the residue biomasses from the local food systems into new food communities.

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Appendix