Managing Organic Matter

Preparatory study report

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Introduction

Sustainability might be a vague term as it is used in different ways. When can you consider a product, a process or a service sustainable? The sustainability-claim is a matter of demarcation. A life cycle analysis is often used to calculate the environmental impact of a certain process or product, and it has to have clear boundaries to prevent depreciation of results. This process can be complicated because many processes are intertwined with others, for example: does the production method of the breakfast of the truck driver of your online-ordered shoe contribute to the level of sustainability of your shoe? And what about the production methods for the fertilizers used to grow corn as feedstock for the animals we eat? In thriving for a 100% sustainable island, like Texel is planning to become in 2065, it should be emphasized that the total energy, food, material, waste, etc. exchange balance with the external world should be zero. One key method is to close the 'loops' of these matters, meaning introducing reusing and recycling to prevent linear pathways in the life of products.

This report contains an overview of the analysis how a future management of organic matter on Texel could look like. The focus is mainly on ways to close the loop of organic matter on the island of Texel. The term organic matter is used in this report to address all sorts of matter produced by nature; by plants or animals. And although there are many ways of interpreting the subject, we decided to focus on the most straightforward, which is the management of organic material being called 'waste'. In a fully sustainable Texel, the full potential of organic matter should be utilized. To change the current socio-technical system of managing organic matter into a future system, elements of the socio-technical system are one by one analyzed to create a profound understanding of the dynamic mutual relations. Concepts from relevant scientific literature are used to gain insight in the complexity of those elements.

Demarcation of the analysis
In the analysis of our sub-system we choose deliberately to demarcate our topic. The management of all organic matter on Texel could stretch out from retrieving resources from the wastewater system to the plants and organisms growing in the dunes of Texel. Also, excreta from farm animals and the use of burning wood by households are all connected to the topic. We choose to focus on the life cycle of the organic fraction of municipal solid waste, because this is a tangible and comprehensible part of the whole. In order to close the loop in our projected 'Circular management', we focus on the production of high quality compost that could be used as fertilizer by the farmers on Texel. Also, we expect to find sufficient information resources about this, since the Dutch municipalities have had organic waste collection schemes in the last decades and there are reasons to believe these schemes are not fully successful.

Part of research group of TU Delft
This report is the result of a preliminary research for the Bubble Week, a week wherein a group of Master students from the TU Delft join forces in the shared goal to research the transformation of the island Texel into a fully sustainable island in the year 2065. Different groups were formed, each researching different sub-subjects. In the Bubble Week, all different future sub-system designs will be integrated to form a united end product.

Chapter 1

Organic matter matters

This chapter is the start of our journey in the research of the sub-system ‘manage organic matter’. Firstly we will introduce the subject and elaborate on a demarcation of our research. We will explain why our sub-system is a crucial part of a self-sufficient Texel in 2065. Then, in section one we analyze the current management of organic matter on Texel and a possible future of it in 2065, by discussing the concepts from literature about socio-technical systems. In the end of the chapter we build

towards a set of research questions and objectives, used as building blocks for the rest of the report.

Section 1; The socio-technical system and sustainability transitions

In this section the main concepts in socio-technical systems and sustainability transitions are explained. Therefore, we have made extensive use of an article by Pesch (2015) and a book chapter by Borraes & Edler (2014). This literature has given us insight in the important concepts in sustainability transitions and the governance of socio-technical systems. Below we will explain individually how we understand and interpret the concepts from the literature being used.

Socio technical system
Judith: A socio technical system is about the interaction of science and technology with society. They are constantly shaping each other. Socio-technical systems imply that technology does not exist on its own. There is interaction between the different elements of the system. A technological system is introduced and after some time being institutionalized. It is embedded in our life, it is a regime. It is hard to change this unsustainable system towards a sustainable one.

Hanna: Ensembles of technical and social elements that interact which each other in distinct ways and are distinguishable from their environment. These systems developed specific forms of production, utilization and innovation which are oriented to specific purposes in society and economy.

Kajan: In a socio-technical system elements from both science, technology and society are considered into a dynamic interaction. The system consists of the knowledge, the technological artifacts, the actors, infrastructure and the interactions in between. The social dimension is important, which consists of the actors, both individuals and groups, that either want change or prevent change to happen.

How to implement change in a socio technical system?
Judith: Change can be influenced by three pillars: the opportunity structures and capable agents in a system (who), the instrumentation of governance of change (how), the legitimacy and acceptance of change (why). These concepts will be explained in the concepts below. The embedding in society and economy is what makes the change, not the innovation itself.

Hanna: Agents, who are individuals or collectors, navigate in complex structures, are struggling for positions, and resources for change, while institutions may offer opportunity structures or options for change activities. The core questions are: how much room for dynamics is available in terms of political bargaining and how structures and acts of power and interests are moveable. The dimensions 'dynamics' and 'actors' reflect the focus on opportunity structures and capable agents. To get an overall understanding about the socio-technical-system, both actors observing institutions, and institutions observing actors, should be shown. To overview the socio-technical-system, the reasons, utility and meaningfulness of fostering change should be framed, together with interests, experiences and motives associated with this change.

Kajan: To implement change in a socio-technical system, one should look into the elements that enable the embedding in society and economy, rather than the elements that build up an innovation. The embedding in society can be called implementation and is affected by three concepts. First, the actors that drive the change -capable agents- and opportunity structures are needed to address the 'who' concept. Then, a stimulating instrumentation of governance of change is needed, referred to as the 'how' concept. The third concept addresses the 'why' and consist out of the legitimacy and acceptance of change.

Opportunity Structures
Judith: The changes and possibilities that are given or looked for to create change.

Hanna: The interplay of the specific setup of the system and the technologies and knowledge. The focus on actions to change and the 'who' and 'how' of the governance.

Kajan: Opportunity structures can be seen as the 'open spot in the forest' for change to happen. In other words, opportunity structures refer to the co-evolution of technology and social institutions, which sequentially or simultaneously generate opportunities for change that agents might take.

Agency & The role of agency
Judith: Agents are the people involved. There are different kinds of agents with different kinds of capabilities and knowledge. The role of agents is crucial as they make the opportunity structures possible and trigger change. Agents are motivated by the expected consequences or by norms and rules. Actors are representatives of the old system. It is necessary to find out and describe what people drives individually.

Hanna: The agency are the powerful actors of the socio-technical system. Agency creates space for individual/collective action as well as for the (re-)interpretation/ re-organization of social institutions. The agents of change can be everyday agents (civil society organizations, lead consumers, non-governmental, organizations, social entrepreneurs, community managers, etc.) or more formalized agents (policy entrepreneurs, firms, researchers, inventors, etc.). These agents have different

capabilities in terms of their resources. Resources and interpretative abilities are crucial features defining the level of capability of the agents, which has to be analyzed by frameworks.

Kajan: Agents are important for change to occur, since they make the opportunity structures possible. Agents are motivated by the expected consequences or by norms and rules. There are different kinds of agents with different kinds of capabilities and knowledge. Governance is that systems are influenced by both societal and state actors. The role of the state can become less important; the societal actors decide what is going to happen.

Sustainability transition
Judith: Transition of the current socio-technological regime into a new, sustainable regime. To manage this transition four elements are necessary according to Rotmans: an arena where people can meet and develop, a vision to be developed, social learning by transition experiments and continuous monitoring of the process.

Hanna: According to Rotmans four elements are needed to realize a sustainable transition, where socio-technical system develops itselves into a sustainable system, namely: a meeting point, a vision, an experiment and constant monitorisation.

Kajan: Sustainability transitions are needed to establish a sustainable society. The transitions can be described as radical and structural changes of society that are caused by a coevolution of economic, cultural, technological, ecological, and institutional developments. In my eyes the focus on long term feasibility and durability are also important features in sustainability transitions.

Socio-technical niches
Judith: These niches are the subsystems we are working in. By working with socio-technical niches the sustainability transition can be worked out on a smaller scale and therefore make sure that the transition will be socially accepted. Research shows that this created a good understanding about these subsystems, but it will not automatically lead to a total socio technical system.

Hanna: Innovations can take place in niches, where rules, institutions, companies and drives are different from the regime. Niches are protected spaces where experimentation with technology, organization and usability. Innovation can be tried out. If innovation got accepted, these can develop by the regime of the total socio-technical system.

Kajan: Niches are sort of protected spaces such as R&D laboratories, subsidized projects, and small markets where users are willing to support emerging innovations. Niche technologies are seen as seeds for systemic change, further leading to transitions.

Strategic niche management
Judith: Strategic niche management is about three essentials for innovation. You need visions about what you want to achieve, you need networks to organize people and you need learning processes for reflection and improvement.

Hanna: The management of niche innovation is strategic organized, where a few aspects are necessary: a vision, integrated networks in the socio-technical system and reflection for further development.

Kajan: The deliberate creation of niches has been called 'strategic niche management'. Three essential core processes are distinguished in niches by SNM: (1) the articulation of expectation or visions, (2) the building of social networks leading to expansion of resources and (3) the learning and articulation process on various dimensions like technical design, market demand and user preferences.

Sustainability transition in 2065 of Texel

In order to create a sustainable, self-sufficient Texel in 2065 the current socio-technical system needs to change. The current regime has to be turned into a new regime. This is not only done by creating a new innovation but this has to be embedded in society and economy. To create change it can be helpful to start in the subsystems.

It is important to create a new niche in the subsystem in order to create sustainable change. Our subsystem of managing organic matter is where to start. People of different initiatives therefore have to be united and find a common goal to make a real change. The opportunity structures for change need to be used by agents to make the change happen. It is important to find out what people of Texel drives individually. Actors will be connected in a network, have a common vision and will learn by doing and reflect on it. Finally, the change needs to be accepted by the agents.

The subsystem is always part of the overall socio-technical system. It interacts with the other elements and subsystems. In this case other niches, or other subsystems, and different disciplines might be used to find a solution for our subsystem of managing organic matter.

In our research it is important to find out what the subsystem is about and how it is part of the total system. Research has to be done into what initiatives are already there, what drives people individually, how they can be united and how change in managing organic matter will be accepted by the people.

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Section 2; Organic matter as a socio-technical system

In ecosystems untouched by humans recycling of organic matter is a given fact. Organisms are made from organic matter and are necessarily part of the cycle of life. Independent from size, age or placement in the food-chain, organisms eventually die and serve as food for other organisms. Also for seasonal loss of biomass this counts. For example: many trees lose their leaves or fruits in autumn, which will end up on the ground near the base of the tree. The trees practically fertilize the soil upon which they grow. Organic matter in human society is not recycled in the same way as in an untouched ecosystem. Humans have effectively interrupted the natural closed loop. We eat the fruits from the trees and feed the tree with chemically made fertilizer to prevent nutrition depletion.

In order to find out what a sustainable, self-sufficient Texel could look like, it is important to research the current state of the subsystems. In this section the current subsystem of managing organic matter on Texel will therefore be explained. The sub-system of managing organic matter is embedded in society and economy. The current sub-system is part of the whole system, which is a regime, that is established, protected by agents and hard to change. Organic matter as a socio-technical subsystem plays a role in a dynamic structure wherein institutions and actors are operating. Actors observing institutions, and institutions observing actors, should be framed to get an overview of this system. Firstly, the process and the elements of the current sub-system of managing organic matter on Texel will be described. Secondly will be discussed, who the different stakeholders in this socio-technical system are including their believing and motivations.

Current import and export

The organic waste - from gardens, forests, households, companies - that has been produced on Texel, is currently transported to the mainland. At the same time, chemical fertilizers used in the agricultural business are transported to the island. This export and import of material in the current sub-system is abundant, realizing that the imported material can be produced with the exported material. Because import and export are present, there are no (geographically pure) closed loops of managing organic matter on Texel. Texel cannot be self-sufficient in this way, as it is dependent on the mainland. Eliminating these practices forms a big opportunity for Texel to become more self-sufficient and sustainable with respect to the organic matter management.

Amount of household waste

The amount of total household waste per citizen in the Netherlands is estimated at 566 kg per year, from which 80 kg consist out of organic matter (CBS (1)). Around 25% of the municipal waste is used for composting (CBS (2)). Combining the amount of citizens of the island of Texel, 13622 in 2014, with the average amount of organic waste per person in The Netherlands per year, 80 kg, suggests that around 1.09 million kg organic waste was produced by the citizens of Texel, assuming the inhabitants of Texel to be comparable to the average Dutch citizen. In the high season for tourism, the amount of people on Texel grows temporarily, causing more (organic) waste.

Collecting the organic household waste

At the moment on Texel an estimated amount of 65% of the total organic waste is collected biweekly from households and restaurants by the company HVC, (HuisVuilCentrale). Since June 2015 a new waste collection system has been introduced on Texel. The goal of this system is to collect more reusable resources so that less waste has to be transported to the mainland. The collection routes have been changed because a different vehicle can be used. New mini waste containers have been introduced. When residents have extra organic waste it can be collected at transfer point 'De Hamster' with a compensation (Gemeente Texel (1), n.d.; Texel Gevoel, n.d. & Groot, 2013). It is clear the municipality acknowledges the importance of collecting as much of the organic matter as possible and has taken some action to improve the separated collection.

Processing organic waste

Citizens of Texel are advised by the local municipality to compost their organic waste in special composting bins, but they do not facilitate them. This is an alternative to the normal way of separating the organic waste and store it in containers that are picked-up by the HVC. By composting at the source end of the organic waste, an overall energy reduction will result since the waste does not have to be collected and processed. Citizens can use the compost for their garden and for agricultural use (Gemeente Texel (2), n.d.). The HVC offers citizens of Texel to pick up centrally produced compost from the transfer point 'De Hamster' to thank the residents for separating organic waste. This is being offered once a year (Grootemaat, 2015). Thus, in the current sub-system the organic waste is both processed collectively and individually.

Agents in the socio-technical system

Waste is produced, collected, processed and regulated by people. These people form different groups being connected in a different way to the sub-system. These groups can be called agents. Therefore it is important to start looking at these agents of the current subsystem. Different agents can be distinguished: agents who consume organic matter

and produce waste, agents who collect the waste, agents who process the waste and agents who make rules about these processes. These agents can be subdivided into smaller groups or individuals. In Illustration 1.1 this agents are visually represented.

Consumers and producers

- Restaurants, which produce lots of waste, are obliged to specific rules, and want to make profit
- Households with their daily family waste
- Producers that cultivate the land and produce a significant amount of organic waste
- Tourists, who are on holiday and want to relax, could be concerned about waste but in a different way since their main issue could be the overall image of the eco-island as an idea

Collectors

- HVC

Processors

- *HVC*

Rulers

- Municipality, who is obliged to focus on nature projects and tries to keep the island in a good shape.
- National government of the Netherlands
- European Union (EU)

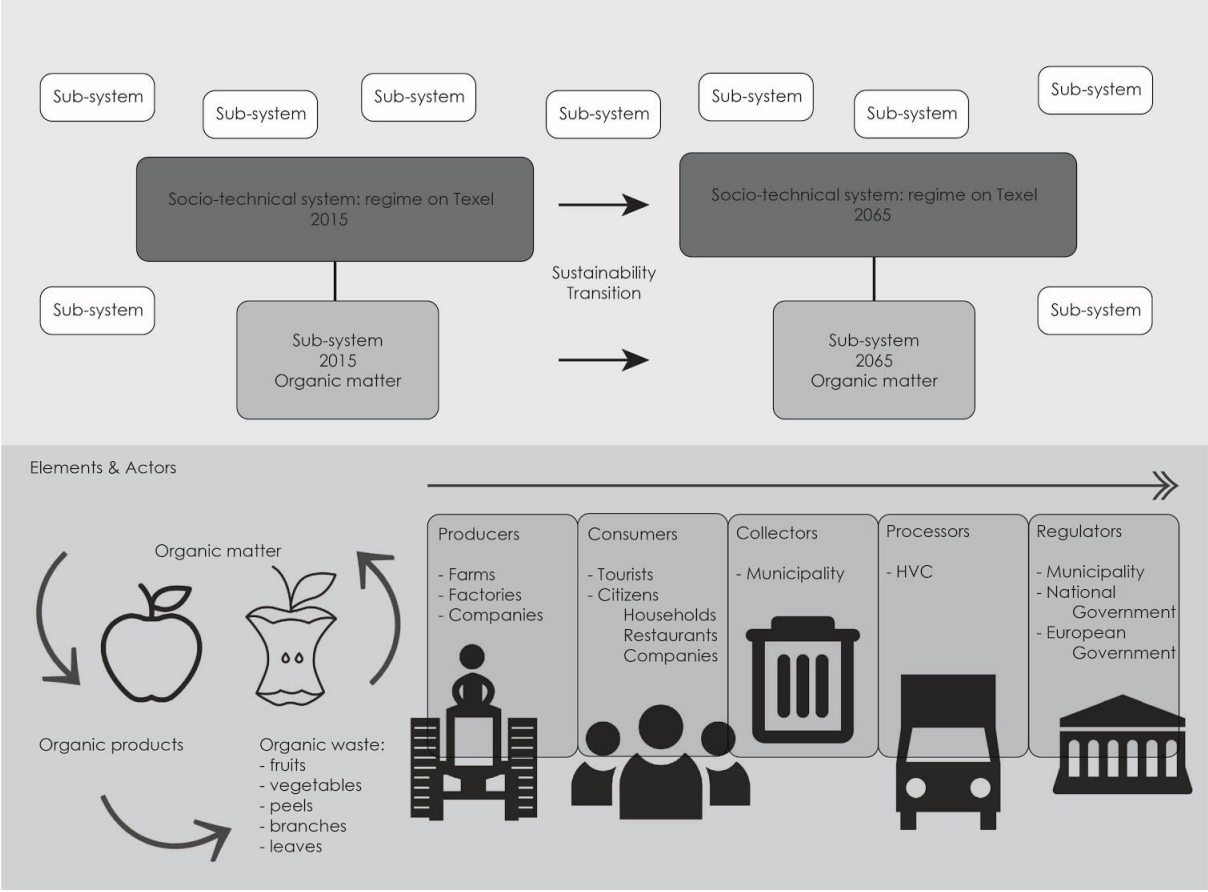
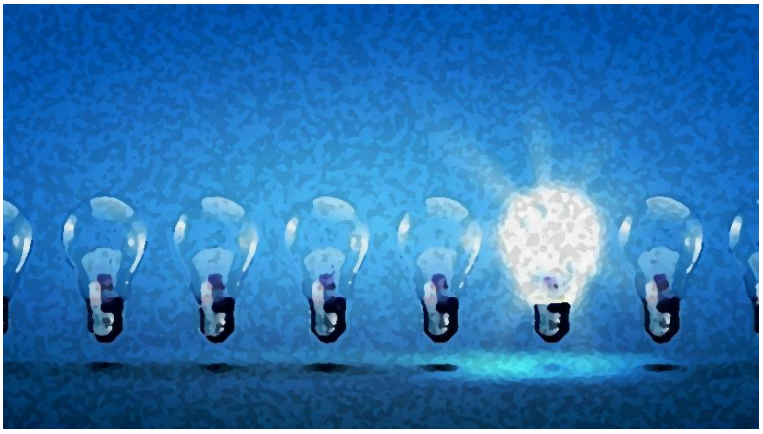


Illustration 1.1: Elements and actors in the socio-technical system and sub-system

Section 3; Future socio-technical system (2065)



How could a 100% sustainable, self-sufficient Texel look like in 50 years regarding the sub-system of managing organic matter? In this section the future subsystem is being explained.

In the future the word ‘waste’ does not exist anymore in the sub-system of managing organic matter. Organic waste are building blocks for food food production and therefore seen as resource. Closed loops will be established for the organic matter, with a minimal loss and maximum recycle efficiency. Organic matter is managed in a new way so that it virtually ‘never’ leaves the island Texel. People are actively involved and are working together to maintain this closed loop, since they have the same goal to live happily on their sustainable island. The inhabitants are proud on their island and tourists are attracted by the image of a sustainable island. They respect the ambitions of Texel and behave accordingly.

Education in the separation of waste is a vital part so that people know exactly which materials should be held apart, and how they should be stored and handled. Planning for waste separation at the source requires specific knowledge of how households work, which can be outlined by the state and the societal actors (municipality, environmental organizations etc.). The effort is worth it because source separation is seen as environmentally and technically preferable and it improves overall economics of the system as well as the quality of the final compost. Even with the best of intentions, contamination cannot be avoided, thus some sort of quality control which may include front or back-end screening may be necessary in most situations and of course, this is also defined by the final product.

Section 4; Research questions and objectives

In order to become 100% self-sufficient the management of organic waste on the island of Texel needs to change. Organic waste is currently exported to the mainland, and chemical fertilizers are imported into the island. This happens at the same time as 35% of the organic waste is not separated properly and is lost in the general waste collection. During holiday times many tourists come to Texel and cause a temporarily increase in waste. As the amount of people will double in these months, the amount of waste is also likely to double.

Organic waste should not exist in the future; it should be turned into fertilizers for food production, as is done in the Cradle to Cradle theory of William McDonough and Michael Braungart. Therefore closed loops must be realized. Organic waste should not leave the island; and the use of imported chemical fertilizers should be minimized. Food should always be used most efficiently. The citizens of Texel need to become aware of the importance to collect and separate waste.

'Reduce, Reuse and Recycling' are three spear points of an effective policy. Within the recycle processes there is a distinction between the known downgrading processes and innovative upgrading processes. The whole procedure may correspond to the circular cities idea of Herbert Girardet's book "Cities People Planet" wherein he suggests that cities should have circular metabolism thus the whole amount of input (goods, water, fuel, timber, food) should be recycled and treated so as the outputs would be new products again, sufficient to satisfy new needs. The whole system indeed would consist out of closed loops some of which would be interdependent on others to achieve the final result.

Research question

"How could the management of organic municipal waste be transformed into a closed loop of organic matter, in order to create a self-sufficient Texel in 2065?"

Sub questions

- What is the maximum realistic potential of recycling organic municipal waste on Texel?
- Which technologies can be used to improve the management of organic matter on Texel?
- Which pathways towards a sustainable future management of organic municipal waste can be drawn?
- Which actors are involved in improving the management of organic waste?
- Which plans for other future sub-systems could potentially cooperate or recalcitrate in the implementation of the future sub system of managing organic matter?

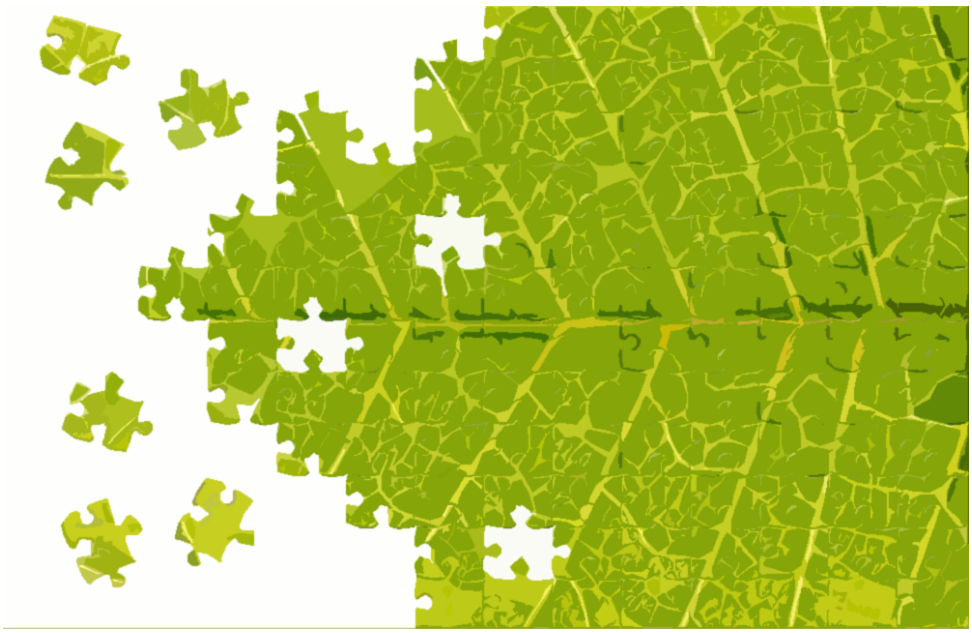
Research objectives

1. Research suitable technologies that can be used to improve the management of organic waste on the island of Texel.
2. Opt a new socio-technical subsystem in which the management of organic waste on Texel is maximally improved and design a plan to realize this vision.
3. To propose this vision to the inhabitants of Texel during the Bubble week in January 2016 and learn from feedback of actors.

Chapter 2
Changes in the daily life

In this chapter the daily life of the inhabitants of Texel in the current sub-system is investigated. The important aspects of the transition towards a future sub-system are selected in order to formulate a design challenge. In the first section we review relevant literature in order to gain insight in key aspects in design for presence. In section two and three we describe daily life in term of the YUTPA model in the present situation and the future situation, respectively. In the last section we elaborate on the necessary changes to establish the future situation.

Section 1; Pro-environmental behavior and value of presence



The pro-environmental behavior of citizens can contribute significantly in the implementation of plans for sustainability. An increased well-being and presence is the personal gain that could follow this behavior. In order to understand this interplay better we used relevant literature and reflect on it individually in this section. In the end we summarize our findings and stress the importance of design of presence for our sub-system.

Value of Presence

Judith: Our experience is changing because of the load of information we get to deal with. Values of presence are experienced differently by their contexts. Values of privacy, integrity and trust are part of the value of presence.

Hanna: In time of media, networks and complex infrastructure, our experience of time, place, and authenticity is changing. Values of presence get different meanings or experiences in a variety of social, political, religious, spiritual, and ideological contexts.

Kajan: The society wherein we live is changing rapidly by the countless possibilities to connect to each other in a virtual way. A 'new nature' is emerging in which key concepts in human interaction like privacy, integrity, trust are redefined. Underlying to this is how we perform and value presence, which is not anymore coupled to natural presence.

Existing Conceptualizations of Presence

Judith: Presence is steering towards well-being and survival. It is not only being physically there but also virtually. Presence is being communicated. New technologies produce new ways for presence. Natural presence is coming together in real life with face to face contact. Mediated presence is virtual contact, online. Merging realities exist, where online and offline interaction create one experience.

Hanna: Presence is essential for well-being and survival of humans. In the era of media, networks, and many complex infrastructures, presence is no longer coupled to physical reality. Presence has acquired new virtual aspects, with completely new dynamics. Designing for the value of presence is not designing for a specific behavior, but for an experience. Presence as a value for complex systems design has a huge social relevance.

Kajan: There are five different conceptualizations of presence distinguishable. These concepts are used trying to mimic natural presence as good as possible to improve certain technologies. Being there, being here, merging real and virtual reality, performing presence and copresence are defined conceptualizations by literature.

Design for Presence (YUTPA framework)
Judith: Design places for meeting, social interaction, collaboration etc. This makes engagement possible. Design for the choice of behavior or for a new behavior. Design for experience is included (Sensations, behavior, reflections and choices). You (relation), being here (place), in the now (time), have a potential to do (action). You in Unity of Time, Place and Action. This framework shows where trust is and what design space is offered there. A different theme with a difference between the one and the other, but where the lowest one is already at the scale of 5, has a basic trust. Therefore the design goal is likely to be achieved.
Hanna: New presence designs and constantly influencing the possible positions of presence. The five key terms that are still connected to presence design during the last two decades are being there, being here, merging realities, presence as the strive towards well-being and survival, and copresence, social presence, and witnessed presence.

Kajan: It is important to include presence as a value for design, in order to facilitate designs that make it possible to engage with others in meaningful interaction and steer towards our own well-being. Designing presence should target specific functionality, such as to facilitate social interaction, collaboration, exchange, marketplace, distributed structures of governance.

Hedonic well-being
Judith: Feeling pleasure and to experience the maximum amount of pleasure.
Hanna: The experiences of hedonic moment can range from a narrow focus on physical pleasures and displeasures, to a broad focus on the presence of benefits and absence of suffering in general. It includes both physical and cognitive preferences and pleasures.
Kajan: To maximize the hedonic well-being, one tries to avoid all discomforts and searches for as much pleasure he can receive. This well-being is rather superficial and short-term, as a physical or cognitive pleasure tends to have a short lifetime.

Eudaimonic Well-being
Judith: Feeling meaningful. It gives a good feeling in a way that it gives a purpose in life. What is intrinsically worthwhile is important, such as close relationships, personal growth and sense of meaning.
Hanna: The eudaimonic view on well-being defines being well as living well or pursuing the right ends. well-being generally define it as a way of living that is focused on realizing valued potentials, or as striving to realize personal potentials. The feeling of 'good' is more complex than hedonic well-being, and has a higher end.

Kajan: A high eudaimonic well-being implies someone is doing the right things for the right reasons. The right reasons are that the person is deliberately choosing to act good and is not forced or influenced by others to do so.

Pro-Environmental Behavior and Well-Being

Judith: Usefulness and effectiveness of people's behavior on the environment are hard to understand and do not result in immediate positive effects. This can lead to distress and decrease of personal well-being. This is only reduced if the goal is perceived to be unattainable. By defining smaller sub-goals people feel still positive. The environmental conditions can become better which gives a better quality of life and in this way the hedonic well-being can be enhanced. The pursuit of intrinsic goals creates Eudaimonic well-being. 'People's self-worth is determined by how moral they perceive themselves to be'. Doing good instead of causing harm is important. A positive effect for the person itself is not necessary. Behaving pro-environmentally seems the right thing to do for a lot of people but not for all of them, depending on the social group they belong to, but it should still be intrinsically motivated.

Hanna: Hedonic well-being refers to positive emotions such as pleasure, while eudaimonic well-being refers to deeper positive emotions such as feeling meaningful. These emotions can be in conflict with each other; one emotion doesn't affect other in the same way. Between relationship of pro-environmental behavior and well-being appears a conflict; on the one hand, behaving pro-environmentally decreases individual well-being, while on the other hand, behaving pro-environmentally increases individual well-being. Behaving in a pro-environmental way may decrease hedonic well-being, while it may increase eudaimonic well-being. Goals for eudaimonic well-being should be reframed into smaller, attainable goals, to motivate people to engage in this behavior and derive hedonic well-being from their engagement.

Kajan: Behavior that has a positive effect on the environment, or causes a reduction in impact on the environment. Pro environmental behavior is for example: shorter showers, eating less meat, using the car less. The relation between pro-environmental behavior and happiness or well-being is ambiguous when comparing literature. Some scientist argue pro environmental behavior is inherent to experiencing less pleasures, while others argue it can enhance a meaningful life and cause a greater satisfaction. In the article by Venhoeven et al. (2013) these perspectives are compared and illuminated with respect to philosophical statements about well-being. Personally I am convinced that pro-environmental behavior will only affect happiness in a positive way, when performed in the right way, which is out of intrinsic and from of an educated intrinsic motivation.

Summary and conclusion

As a conclusion to this section, we shape our individual reflections in a collective summary and point out the importance of the design of presence for our sub-system.

The experiences of time, place and authenticity are changing by the countless possibilities to connect to each other in the digital world. Presence can be subdivided in aspects like privacy, integrity and trust. The fundamental goals of human presence are to increase well-being and chance of survival. Human society has seen a rapidly increase in ways of experiencing and exercising presence, caused by the digital and virtual technologies of the last centuries. In order to design a future sustainable sub-system, attention should be paid for designing human presence. A method for this is to use the YUTPA framework that shows where trust is and what design space is offered

there. When design space is found in a specific element, it should be noted that it is easier to establish more trust when a significant amount is already present, compared to the case that virtually no trust is present.

Well-being consists out of Hedonic and Eudaimonic well-being. Hedonic well-being means a state of being where short term pleasure is most important, together with a tendency to avoid any discomfort or suffering. Hedonic well-being compared to Eudaimonic well-being is more physically and primitively. In Eudaimonic well-being the aspect of meaningfulness and intrinsically 'good' plays a big role. We see Eudaimonic well-being as the long-term deeper type of well-being.

Pro-environmental behavior appears to have an ambiguous relation with well-being. Some scholars state that pro-environmental behavior decreases well-being because it steers towards reducing consumption, which is assumed to increase Hedonic well-being. Others describe an increasing well-being, since pursuing the 'right' thing is increasing the Eudaimonic well-being, and acting pro-environmentally is overall perceived as something rightful to do.

In the plan for our future sub-system, well-being of all stakeholders should not be affected in a negative way. It is important that this objective is communicated clearly to all stakeholders. Therefore, both the tangible and the intangible results of the participation in the sub-system should contribute in the short and long term of people's well-being. To achieve this, we could design the system in such a way that all stakeholders receive maximal transparency, status and overview of the progress made in the sub-system. In detail this could mean for example: regularly publishing calculations of chemical fertilizers avoided processed amount and quality of compost, efficiency of separation, etc.

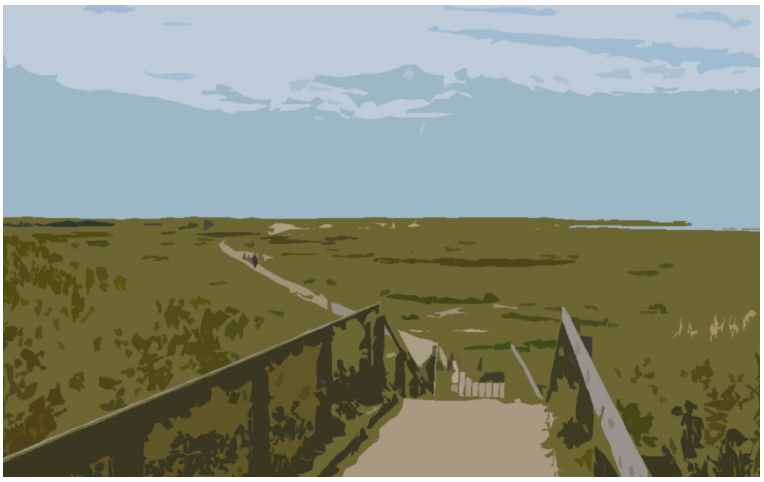
The design of presence in the sub-system of managing organic matter may be a valuable tool to engage more inhabitants of Texel in a more intensive participation. This statement arises from the knowledge that 35% of organic municipal waste is not separated. By analyzing what could be improved to improve stakeholder engagement (using YUTPA), we could incorporate this in our plan to achieve a successful implementation of the future sub-system.

Literature:

Nevejan, C., & Brazier, F. (2015). '*Design for the Value of Presence*.' In J. van den Hoven et al. (Ed.), Handbook of Ethics, Values, and Technological Design. Dordrecht: Springer.

Venhoeven, L. A., Bolderdijk, J. W., & Steg, L. (2013). '*Explaining the paradox: How pro-environmental behavior can both thwart and foster well-being*.' Sustainability, 5 (4), 1372-1386

Section 2; Current life on Texel



To understand the changed human experience in the time of ubiquitous technology, the YUTPA framework can be used. By communication and information technologies, not only our experience of time and place has been changed, but also the way how we relate to others and how to act accordingly. In order to design human experience, Caroline Nevejan presented the concept 'Presence' in her book section and in a guest lecture on the TU Delft. Presence and trust are related to each other and can both be estimated in the YUTPA framework. YUTPA stands for "to be with You in Unity of Time, Place and Action". Nevejan stresses that both concepts are about making trade-offs; choices in design are positioned in (one of) the spectrums you/not you, now/not now, here/not here. The YUTPA framework contains 16 concepts for measuring these trade-offs for presence and trust in individual human experience, clustered in 4 dimensions. For each concept a score from 1-10 is asked, in order to map out the distribution and amount of trust.

In this section we apply the YUTPA framework to two different stakeholders on Texel, a restaurant owner and a tourist. The main goal to do this is to explore the most effective design space to increase trust in the actors of our future sub-system. In the Bubble week in January 2016 we hope to refine these estimates by interviewing people on Texel.

Historic overview
On Texel the inhabitants are used to separating their waste to a certain extend. Since the 1960s the collection and management of waste on Texel has changed a lot (Grondstoffensplan Texel, 2013). Due to an increasing amount and diversity of waste, waste fields were found infeasible and a proper waste management was proposed by the local government. Waste separation and recycling was introduced, separating amongst others glass, metal and organic matter from the general household waste. In the end of the last century the focus of sustainability reinforced the demand for a sound waste management, wherein the principle of reusing and recycling was further investigated by the municipality (Grondstoffenplan Texel, 2013).
Tourist Perspective

The typical tourist is assumed to have a low involvement in the waste treatment of Texel, since the main concern of the tourist is to celebrate holidays or to spend time performing a hobby or sport. This translates into low scores in three of the four dimensions in the YUTPA analysis, shown in Illustration 1 below.

In the dimension of relation, the scores of the functions are 2 or 1 out of 10. It is unclear for the tourist in the current sub-system what his role is in the process of recycling organic matter, as it is unlikely that he experiences a strong relation with reputation. This is because a tourist per definition does not live on Texel and does not build up the same intense community relations and reputation as local inhabitants do. This implies also a low engagement to cooperate in the efforts to improve a management for organic waste. The tourist is not expected to bother too much about nor quantity nor quality of the waste he produces on holiday.
In the dimension of time the tourist is awarded low scores as well, especially in the factors integrating rhythm and duration of engagement. The relation between the tourist and the duration of engagement is perceived to be close to nothing, because the tourist typically stays for a short time, in the peak season in the summer period, on Texel. There is no way of experiencing trust by the tourist in integrated rhythm in the sub-system, caused by the same reason of short visit. The experience of involvement in the sub-system in organic recycling is possibly enabled by the moment to signify factor. This comes forth out of the assumption that tourists may be interested in local products made from recycled organic materials.
In the dimension of action the factors are rated very low as well, between 1 and 3. The tourist is not assumed to experience any reciprocity in the sub-system. The perceived quality of deeds is in this dimension significant but not much. The tourist does not particularly experience a high reward when behaving pro-actively in the sub-system.

In the last dimension the factors are significantly and much higher compared to the factors from other dimensions. In the dimension of place tourists are expected to experience a rather high involvement in the sub-system on Texel, since it is Texel in particular they choose to celebrate their holidays on. The value of the place is therefore perceived to be high. Texel is an island where the respect for nature plays an important role. The emotional effect on the direct surroundings is suspected to be positive in most tourists. Also, experience on the environmental impact of our sub-system is believed to be very sensitive for tourists. This may be explained in the fact that that clean and orderly Texel attracts tourists and a dirty and chaotic Texel might repel them.

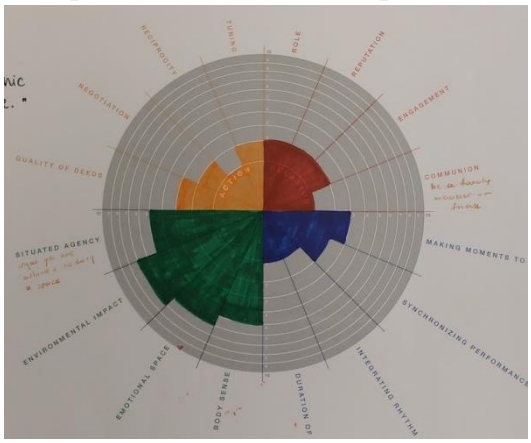


Illustration 2.1: The visual representation of the YUTPA analysis for the tourist's perspective

Restaurant owner Perspective

The relation between the sub-system of organic material recycling and a typical restaurant owner on Texel is very different with the relation between the sub-system and a typical tourist. Several reasons can be put forward to describe this difference, and will be elaborated in the following text.

In the dimension of time the factors in the YUTPA analysis score high, except from the factor 'making moments to signify'. The typical restaurant owner has a great benefit in the structural and the long term characteristics of establishing a rhythm in the waste collection methods, because a restaurant has a continuous flow of waste. The involvement of the restaurant owner in a proper waste removal method is therefore expected to be high. The duration of engagement is therefore expected to be high as well, consequential to this expected involvement based upon the need to lose the created waste. The characteristics of a continuous stream of (organic) waste are reason to believe that moments to signify are not too important for the restaurant owner.
In the dimension of place the involvement is expected to be very high as well; all factors score between 5 and 8. It is assumed to be very clear to the restaurant owner what he can do to participate in the sub-system. Because the restaurant owner is expected to live on the island, the involvement with environmental impact is expected to be very high. This is because nobody is willing to live in a society with a malfunctioning waste management since this pollutes and endangers the environment. The willingness to contribute and actively participate in a sound waste management is therefore expected to be present significantly.

The restaurant owner has an advantage of the removal of the continuous produced (organic) waste. But the quality of deeds to contribute in an advanced separation system is expected to be high as well. He may not only see the waste as a burden but also as an opportunity to do good and thus value participating in the sub-system. The reciprocity of the active participation in a proper waste management can be seen as the relief of the waste produced in the restaurant.
Finally, the dimension of relation contains factors rated between 3-6, still much higher than in the case of the tourist. At the moment, the willingness of the restaurant owner to invest time and effort to separate the waste is not assumed to be high. This is because there is no urge and motivation to do this. However, the role and reputation are assumed to be clear. The restaurant owner knows what his role is and what is expected of him. The effects on the reputation are also clear. Some restaurants nowadays use the participation in sustainable initiatives as a marketing tool to increase their popularity.

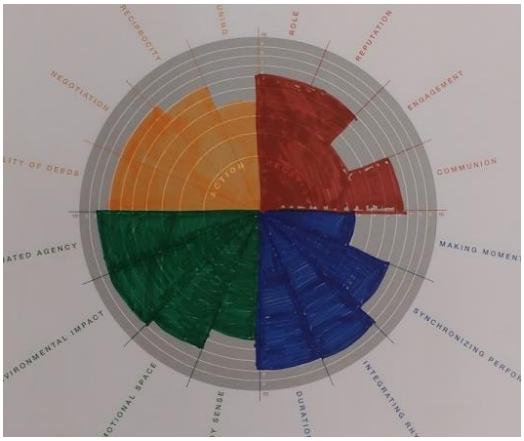


Illustration 2.2:The visual representation of the YUTPA analysis for the restaurant owner's perspective.

Design space
To explore where the biggest opportunities lie to design for trust in our sub-system, the two YUTPA diagrams are compared. The differences form the so called 'design' spaces. The black dotted line in Illustration 3 marks the score 5 edge. The factors received a score lower than 5 are hard to design for since the trust is estimated to be low here. Designing for trust in factors wherein hardly any trust is established is hard and unlikely to be successful. But at the same time, the bigger the difference in the comparison, so the bigger the design space, the more impact it will make.

In the two YUTPA analysis described above all factors in the analysis of the restaurant owner are rated higher than the analysis for the tourist. The differences differ from 0 points till 7 points. Two factors in the dimension of time have a the biggest design space, but are not realistic to design for, since the factors are rated a 1 in the case of the tourist. This also counts for the factors reciprocity and communion, which show a large difference between the two analysis as well.

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Taking into account that a certain trust must be established in order to find a factor which is potentially successful to design for, the design spaces in Illustration 2.3 were judged on two matters: high minimum score (at least 3) and large design space (at least 3 points). The two factors *Quality of deeds* and *Situated agency* came out to have the highest potential to be designed for. Next to that, we realize that the factor *role* and *reputation* are also good candidates to be included in a design for enhanced trust. These factors can serve as a guidance in the design for our future sub-system and will be incorporated in the coming chapters.

Illustration 2.3: A comparison between the 2 YUTPA analyzes and the highlighted design spaces

Section 3; Future life with a closed organic matter loop

In this part the concepts from the YUTPA framework are used in order to describe presence as a value in the design for values positions. The “strive for well-being and survival” plays a central role in all phases of the design process. This design for presence is effectively a meta-design in which structures of governance and structures of participation are designed to be amended over time. Presence as a value in Design for Values needs to address agency of participants and the potential for trust between participants including the system.

Describing our subsystem in the future according to YUTPA we will try to imagine and analyze how people in this subsystem would possibly live and work and define the needs that still are to be fulfilled in the long future by defining where is the most efficient ground for design.

Dimension of Relation
In the close future the basic role in waste management subsystem would be the one of the main citizen-consumer. Since there is a rise regarding the number of producers, the roles change since they start becoming more engaged with the organic waste collection. The reason behind this is lying in the future gain that would come out of organic fertilizers for the crops. As we observe there is definitely a prosperous design space in the facilitation of different forms of **engagement** allowing people and businesses to accept different roles in the separation and recycling of organic waste. **Reputation** has started gaining ground during the last years as more environmental organizations and restaurants have started taking initiatives but there are still possibilities of companies taking the role of advertisement in their own hands. In that way a **shared meaning** may start to come out defining design space as people start getting involved in the management, a meaning that could affect production, collection and community work at the same time.

Dimension of Time

Duration of engagement in the current subsystem is a factor that defines a ground for design space as despite the time devoted to the whole organic waste management procedure (separation, anaerobic digestion, biogas and compost distribution) there is still time to be devoted in spreading the knowledge about this procedure and engaging more state actors to contribute as well as companies. Secondly, **synchronization of performance** between waste separation and production of compost creates a design space that can be explored in which new machinery (plants, reactors) can significantly contribute. Regarding the rhythm integration part there is already a defined space of waste collection and production since we cannot see high potential. Concerning "**moments to signify**," it seems that since more and more people are being engaged in the whole procedure new moments to signify could be established apart from the pre-scheduled meetings of the producers and the sellers. Designing new moments for signifying the way individuals and communities handle their organic waste use may contribute to a new culture of waste management and play a role in strategies for change.

Dimension of Place

Body sense in the case of organic matter is a perception that could be explored in terms of energy (biogas) that could be produced by organic waste. Therefore this energy produced is an element we can feel by using it as electricity and warming our houses. Environmental impact is fundamental in our subsystem since by using biogas and compost we reduce the amount of wasted goods and energy scattered. However, body sense and environmental impact do not define space for design since they come as an outcome that we can just measure. Emotional space is not directly influenced since organic waste management and energy could not literally affect our emotional world, this could be only happen as a metaphor. Situated agency is defined in the simple actions that take place every day from consuming till collecting and separating waste till distributing them and operating the biogas digesters. If more actions are taking place then more people will be able to perform and feel free to contribute to the habitual procedure. Design solution spaces in the place dimension for organic matter are mostly defined in matters concerning the **situated agency**.

Dimension of Action

The quality of deeds in organic matters field can vary since there are so many stakeholders in the system. People that need to have the conscience, distributors that need to be responsible, companies that need to be efficient and organizations that need to make them all co-operate. Still there is place of improvement in teamwork. Tuning human behavior and the production of energy and compost products provides possibilities for the future.

Developments in digestion procedures, support, personal and local aggregation of data on the basis of which energy use can be tuned with human behavior.

In the coming years the energy and compost production could be overtaken by separate users for their own family each. Reciprocity in exchanging waste and products between participants directly affects the lives of the participants. Every participant needs to act honestly in order to contribute for the common goal. On the other hand negotiation plays an important role as well because each of them tries to take the best result regarding the gain from the waste/goods they offer. Therefore the factors **tuning, negotiation, reciprocity**, offers solution spaces for design of smart grids.

We observed that there are many design spaces where values of presence of individuals and collectives are related to the search for well-being. Since the understanding of social

structures is totally necessary in order to accurately design for trust in the future sub-system actors should actively participate in these complex systems and infrastructure. Acting by being present in order to execute our individual agency is fundamental in these kinds of complex systems. Active participation defines presence design and makes the design interactive and flexible.

Section 4; Refining the design challenge

How to make the current sub-system of managing organic matter more sustainable? To answer this question an approximation of the motivation of actors to change their behavior is needed. Clear and direct positive consequences attached to certain action or behavior stimulate people to act accordingly. A positive consequence may consist out of generating good feelings that motivates people to repeat actions and supports learning behaviors.

Hedonic and eudaimonic well-being
A positive consequence of actions could enhance the experience of well-being. The discussion about the exact definition of well-being and the relation between the way of living to happiness goes back to ancient philosophy, and is still going on today. A distinction between two different views was made in chapter 2.1: the hedonic versus the eudaimonic view. Hedonic well-being refers to positive emotions such as pleasure, while eudaimonic well-being refers to deeper positive emotions such as feeling meaningful. These emotions can be in conflict with each other. One emotion does not follow the other. Between relationship of pro-environmental behavior and well-being appears a conflict: on the one hand, behaving pro-environmentally decreases individual well-being, while on the other hand, behaving pro-environmentally increases individual well-being. The eudaimonic and hedonic principle explains this conflict. While behaving in a pro-environmental way may decrease hedonic well-being, it may increase eudaimonic well-being.

Actors changing their behavior
This concept is related to the future system which is developing to a self-sufficient environment. This future system consists of people who have to change their behavior. People at individual level and more higher integrated levels are acting in the same system. The actions lead to emotions that give people satisfied or unsatisfied feelings. One person working improving sustainable behavior outside his personal environment, probably will not remark any difference. These actions will probably lead to a small fulfillment of eudaimonic well-being. Besides this will lead to disappointment, and

decrease of hedonic well-being. One person working on smaller, achievable goals with visible results, to improve sustainable behavior, will probably feel an increase of both views of well-being.

Small, attainable goals
To fulfill people their experience of well-being the goal of eudaimonic well-being should be reframed into smaller, attainable goals, to motivate people to engage in this behavior and derive hedonic well-being from their engagement. It is therefore important to create milestones, intermediate goals that outline a pathway to the main goal. In chapter 4 two pathways will be worked out that describe the way how to get to the sustainable future with closed loops for organic matter on Texel. Within these pathways multiple milestones are projected to create multiple, perceivable achievements.

Different motivations
An important aspect to take into account, is the differences between people their motivations. Living a good sustainable life can be described as a form of pro-social behavior or moral behavior. People who see pro-environmental behavior as good, and people from whom the choice for this behavior is intrinsically, behaving in a pro-environmental way of living is likely to bring eudaimonic well-being. The positive consequence of the increase of eudaimonic well-being will be enough to support people their behavior. For others a result in hedonic well-being is more needed. For this project research should be done about what gives the different actors the feeling of well-being?

Value of presence
Besides the experience of well-being, the value of presence is also an important motivating factor. By implementing new innovation concepts, trust takes place over time, place, actions and relations. To overview and grade the experience of trust in concepts, the YUTPA framework can be used. This frameworks shows values of presence of a specific actor in the systems and shows design space to implement new concepts. During this project the YUTPA framework will be used to find out search areas.

The future sub-system
Following part 2.3 which discussed interesting aspects to be focussing on for the Texel project, a few aspects will be taken into further account. For trust in relation, shared meaning may start to come out as a design space when people start getting involved in the management, a meaning that could affect production, collection and community work at the same time. For trust in time, synchronization of performance between waste separation and production of compost creates a design space that can be explored in which new machinery (plants, reactors) can significantly contribute. Besides according the aspect moments of signify it seems that more and more people get engaged in the management of waste. For trust in place, the aspect situated agency came out, where design solution spaces in the place dimension for organic matter. For trust in action, the factors tuning, negotiation, reciprocity, offers solution spaces for design of smart grids.

The change to sustainable behavior
In order to change the sub-system of managing organic matter on Texel and considering well-being and presence, it is important to map out the consequential change of behavior of the actors. Therefore creating small attainable goals and involving all actors, like citizens on Texel and tourists, is necessary. But how to do so?

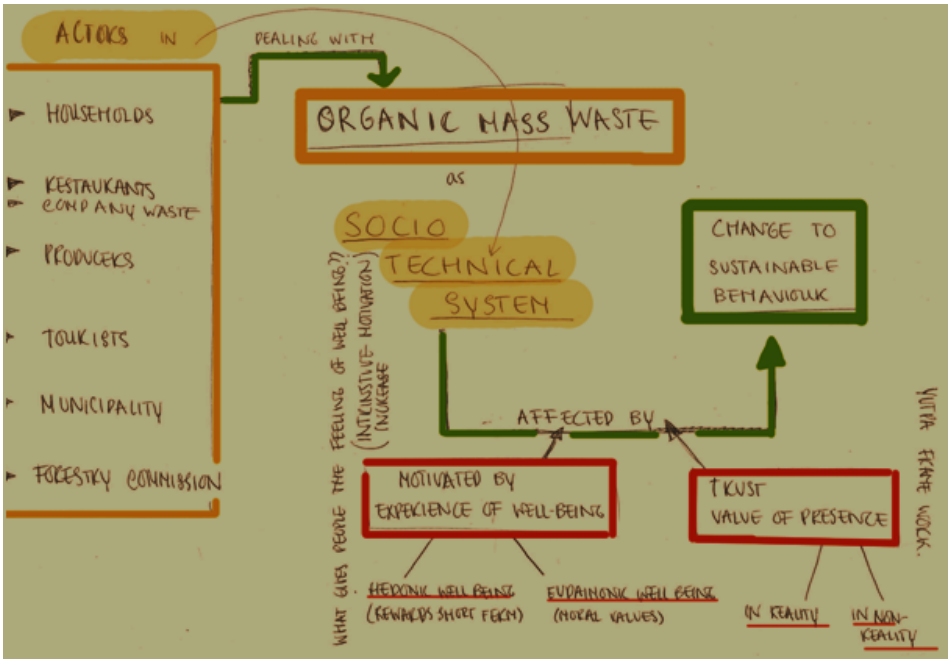
People can be motivated if small attainable goals will be reached. This will create hedonic well-being, as a direct pleasure is achieved. This can be done in many ways. For example, getting compost or other products from organic matter for well separation of organic matter gives people a direct bonus result for their good work. Another example is letting people pay for their general waste, as is experimented with in Breda. In this case people want to create as minimum general waste as possible. Therefore they separate their waste in a good way: the organic matter is separated from the general waste. The organic matter can be used for new purposes then and the efficiency is high, as is now not the case in general.

People can also be motivated by the bigger goal, divided in smaller goals, of making their island Texel into a sustainable island. This will create eudaimonic well-being, as a feeling of meaningfulness. In the end this might even be good for the tourism on Texel, as 'sustainability' can be used as a 'sales item'.

To motivate the tourists, however, is much more difficult, as they do not see direct results. In the case Texel will be known for its sustainability, tourists will feel more responsible for taking care of the island. But when this is not the case, they are likely to not feel responsible for managing their organic matter in a good way. This has to be done for them in the collective processing agency, HVC, as they can separate that waste afterwards.

In order to illustrate the stakeholders and involved entities, Illustration 4 is given below. In this Illustration a list of important actors is shown on the left side. These actors all deal with organic waste material, although in a different way and in different quantities. The socio-technical system of processing organic waste has to be changed in order to establish a sustainable future. To do so, it is important to explore what values and motivation the important actors have regarding the socio-technical system. To actively incorporate trust enhancing factors in the design of change, the current system can evolve into a future system.

Illustration 2.4: Change to sustainable behavior by effectively utilize design spaces.



Chapter 3

Transitions are made by people

Innovations are made by people and come in different forms and sizes. In the socio-technical landscape many factors can contribute in the implementation, as there are also inhibiting factors known. In this chapter we will analyze the socio-technical landscape of our sub-system on Texel. In section one, an individual reflection on relevant literature will be given for a number of key concepts. In section two we will give an overview of the actual relevant trends and initiatives on our sub-system. Building on this overview, we can analyze which current developments are going in the 'desired' direction, described in section three. We conclude this chapter by exploring for wider relevant trends, innovative technologies, initiatives elsewhere, etc, that may be considered in setting out a course for the desired future of the sub-system.

Section 1: Concepts in transition management

In this section we discuss the key concepts from an article of Hargreaves (2013) about grassroots innovations and the role of intermediaries in niche development.

Grassroots innovations
Judith: Small innovations by small initiatives taken place in niches. They might grow to bigger innovations, but some are obliged to stay small. Those are the less 'popular' initiatives, not led by the market. The rules are different than 'mainstream' innovations, which makes it interesting. Those grassroots innovations have to deal with:
- Intrinsic challenges: from the inside, from the innovation itself
- Diffusion challenges: from outside, barriers caused by externals

Hanna: Innovation is small protected niches. The projects are focused on market-based innovations designed for competitiveness, and attempt to replace existing unsustainable socio-technical systems as an area that might be developed. A distinction can be made between two challenges forms of grassroots innovations: *intrinsic and diffusion* challenges. Instinctive challenges have to do with the intern organization, while the diffusion challenges refer to the external influences innovations are dealing with.

Kajan: Grassroots innovations differ from mainstream innovations because they have a different organizational form, a different resource base, divergent contextual situations, alternative driving motivation and the pursuit of qualitatively different kinds of sustainable development. Grassroots innovations challenge existing and unsustainable socio-technical systems, and often attempt to replace them.

Strategic niche management
Judith: Strategic niche management shows and guides how innovations develop and grow. However, grassroots innovations might not grow, but still strategic niche management is useful.

Hanna: A management in where intermediary actors are helping the small-scale, radical innovations to scale-up and form robust niches which are able to challenge and replace current mainstream and unsustainable systems. The protected niches allow experimentation. The niches are crucial for bringing about regime shifts, but they cannot do this on their own.

Kajan: SNM is a theory of how innovations develop and grow, being stimulated or inhibited by factors. SNM looks at these influencing factors and processes and analyzes how they could be harnessed strategically in order to implement more successful and ultimately to challenge and potentially replace existing sociotechnical systems.

Intermediary actors in niche management
Judith: These actors play important roles in developing a niche into for example a sustainable one. They bridge between different actors. They connect the project to the wider world and make sure the project develops. Some projects might fail but the lessons learned will be applied in other projects whereby the whole niche profits and develops. The intermediary actors work in an **institutional infrastructure,** which is a network created by the intermediaries to create a forum for exchange.

Hanna: The intermediaries play a role in helping to build robust niches, by aggregating lessons from many different local projects, establishing an institutional infrastructure for the whole system the innovation is acting in, and framing and coordinating actions in the local projects.

Kajan: Intermediary actors undertake dedicated socio-cognitive work to improve a family of sort like projects/innovations, also called 'global niche'. They operate as boundary organizations engaging in relational work to connect up and bridge between actors. The exchange and distribution of lessons learnt and experiences from multiple local projects is a main characteristic of an intermediary actor. Intermediary actors can be organizations or individuals connecting local projects with one another, with the wider world and helping to generate a shared institutional infrastructure. This with the ultimate goal to support the development of the niche in question.

Literature:

Hargreaves, T., Hielscher, S., Seyfang, G., & Smith, A. (2013). Grassroots innovations in community energy: The role of intermediaries in niche development. *Global Environmental Change*, *23*(5), 868-880.

Section 2; Actual relevant trends and initiatives on organic matter

In this section we describe relevant actual trends, initiatives and organizations related to our sub-system. To start we give an overview of the current state of organic waste collection in the Netherlands, followed by different technologies to process organic waste into compost.

According to HVC ((3), 2013) almost all municipalities in the Netherlands have a waste separation scheme, including a distinction of organic waste. From this organic waste that is collected separately, around 70% consists out of garden material. In total around 1,3 million tonnes of organic waste is processed in 24 locations in the Netherlands. An average household produces around 160 kilograms of organic waste yearly, but only half of this is separated. The products made from processing organic waste have a high potential. According to HVC (2), a full collection box of 140 liters could be processed in enough biogas for a household to cook with for three weeks next to 20 kilograms of compost.

Trends in organizations
Different kinds of organizations have to deal with managing this organic matter. One of the largest organizations of these is the HVC, the waste processing agency. These organizations work with new trends, considering managing organic matter.

HVC

The Huisvuilcentrale (HVC) is a waste processing agency for a large number of municipalities in the Netherlands. The HVC has a separate processing method for organic matter, other than the incineration of general waste. Organic waste is pretreated before insertion in an anaerobic digester. In the process of digestion biogas is produced, which is distributed to the public gas network (HVC (1)). The compost can be used as fertilizer and is free to collect after processing (HVC (2)). HVC is currently serving the municipality of Texel by transporting all the household waste to the mainland and processing it in Alkmaar. The collection of the municipal waste is carried out by the municipality of Texel itself. This example of the HVC shows that this big organization already considers the importance of managing organic matter in a new way. It tries to make the process as efficient as possible in order to process the organic matter into new products: compost and biogas. An estimate of 1.35 million ton of organic waste is lost by inaccurate separation and this translates into an enormous amount of compost and green gas (HVC (3), 2013). From one ton organic household waste 72 cubic meters of natural gas equivalent can be produced. A modified car can drive approximately 1000 kilometers with that amount of gas (HVC (4), 2013).

Promotion for separation

The separation of waste is going better than before, but still approximately 30% of the organic waste ends up with the inorganic waste. This organic waste cannot be used for creating biogas and compost. Reports of promoting teams going door-to-door in the neighborhoods to talk with the people to promote a proper separation. However, the effectiveness is hard to measure since this has not yet being done on a large scale (HVC (5), 2015).

Puro

Not only large organizations but also small businesses take into account the importance of becoming sustainable and managing organic matter in a good way. Puro is a coffee company with a large interest in fair-trade and sustainable development. To minimize the ecological footprint Puro is working together with clients to minimize waste and to reuse the coffee residues. At their website, they propose a number of uses for the residue of coffee. It can be used deodorizer, plant food, compost, insect repellant, and as a compound in cosmetic products (Puro (1)).

In our future sub-system it is important to realize the potential of specific compounds. When specific types of organic matter can be used for specialized products with a high value, ways of extra separation should be considered.

Trends in composting technologies

Composting is the actively managed process of breakdown of organic material in municipal solid waste. Composting is a biological process that is heavily dependent on the composition of the substrate, on the moisture content, temperature and oxygen levels. Systems are designed to manage this process in such a way that yield of compost is maximized and public nuisance or negative environmental impact is minimized. There are a number of technologies being used to create compost out of organic waste material. In a profound overview made by the Composting Council of Canada (CCC), ten composting methodologies that are being used in North America (and Europe) are presented. Three distinctive methods will be stressed here.

Windrows

The ‘windrows’ composting technology is historically seen one of the least costly and most simplistic approaches to process organic waste. Outdoor piles up to 4 meters high are mechanically agitated, in order to optimize the composing process by introducing oxygen. Also, the waste particles break down more quickly by a more intensive turning regime, reducing the composting time. In this way the annual throughput capacity is increased.

Modular In-Vessel Containers
This technology is a static composting method, which means no mechanical agitation while the organic material is in the container. Instead, agitation is provided when material is unloaded. Fans supply oxygen and remove moisture and heat. In most cases, air is introduced at the base of the material and flows up through the composting mass into a headspace at the top. Modular in vessel containers are located outside, cancelling out the need for a building designed for composting processes. This methodology is often used for the active phase of composting, because it is a very easy way of controlling the process and the air treatment, for example.

Anaerobic Digestion
The biological breakdown of organic material in absence of oxygen is called anaerobic digestion. Methane and carbon dioxide are released during this process, forming a mixture of gasses which is called biogas. After purification this gas can be used as an energy source. After digestion the remaining material is a partially stabilized organic mixture which can further be treated in aerobic ‘curing’ process to produce compost. The equipment needed for anaerobic digestion are compared to other composting technologies rather expensive, but this is currently the only large scale composting technology where biogas can be harvested.

People
The people or actors are the ones that consume organic matter and produce organic waste. These actors can be divided into citizens of Texel, local businesses and tourists. How people can deal with organic matter is changing and needs to change in order to create a sustainability transition.

Self-Composting
Instead of depositing organic waste, people can save the organic waste and use it for self composting. Self composting enables users to create compost for the user’s garden. The user should follow instructions, to prevent the production of wrong and polluting gasses. The instructions are given for example by an organization as Milieu Centraal (MilieuCentraal, n.d.)

Local food chain
Food distribution and production takes place on local level. The waste of production and consumption can be used for production again. The biological farms are examples of this concept, which produce organic products like vegetables, meat and cosmetics. The cycle of production, distribution, consumption and recycling takes place on local level,

in small protected niches. An example of a farm that is organized according to this concept, is de Noordkroon. The Noordkroon produces cosmetics out of sheep's wool and sells at different shops at Texel. (De Noordkroon, 2012)

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Section 3; Desired direction of organic matter

In this section we determine which of the current developments in our sub-system are going on the desired future direction and which not.

HVC
Some trends in the current sub-system are already heading in the desired direction, but can be worked out even further. The HVC puts effort in establishing an efficient system of managing organic matter, but is far from reaching closed loops[1]. The HVC could work out further this direction by improving double separation or 'after'-separation, enabling the incoming waste stream to be accurately separated into multiple kinds of organic waste. Not only will organic matter be separated from general waste; even organic matter itself will be separated so that new products can be made from it.

Separating organic waste
Organic waste is already being separated from the other waste, but still 30% ends up with the inorganic waste. Thus this part cannot be used for creating compost and biogas. At the moment organic matter is mostly processed into compost and biogas. To create the most efficiency for processing these products in this current sub-system the technologies have to be improved, as goes for the separation technologies. In the future the technologies for processing each different kind of organic waste should be investigated and developed.
Convincing people

[1] See interview with Leonie Syrier, Appendix 1

In order to create more efficiency in the processing system it is important that the organic matter is separated almost up to 100% - 100% exactly will not be achievable. The residents should be informed about their actions on separation. It is important that they know what the importance of separating organic waste is and how they should do that. Special teams can go to meetings etc. to talk to the people. Rewarding them and showing the results is important to show them the consequences of good separation.

Improvement of the product
Different kind of technologies are available and being developed to improve the quality of the compost. Therefore is also the good separation important. In the end more different kinds of products will be created from organic matter. Some businesses are already working on the production of mushroom from coffee residue. This concept can be brought to Texel.

Central system vs. individual system
The collecting and managing of organic waste is still organised in a central way. Organic waste is separately collected with all the other waste by the central HVC on Texel. They process the waste into compost and biogas. Only once a year the compost is being offered to the residents to reward them for separating waste. This is a good initiative already but takes place too little.
So the current subsystem is organised in a central way. People do not feel responsible for their waste as they do not see the results what happens with it, both in a positive way as in compost or in the negative way that burning it f.e. takes a lot of energy. People need to be made both responsible for the waste by themselves as initiatives should be guided and made central for the community.

Closed loops
The HVC already tries to create circular systems or closed loops as they process the collected organic waste into compost and biogas / green gas. But this is only about solving the problems of the amount of waste that is already there. The organic waste is still seen as waste and not as building blocks for food production. Creating energy from waste is a by-product but seen as feasible since it (partially) replaces fossil fuels.

No more food waste
A system should be designed where no food waste arises. Food that is not needed anymore should be separated and collected really well by the people, because they know their responsibility. Food that can still be used will be distributed to the Voedselbank for example. Food that is not usable anymore will be collected and processed by either the citizen itself or by the central processing company on the island. This food will be turned into compost or into biogas. Citizens will be rewarded for separating and collecting food waste by free compost and free biogas. Tourists will be stimulated to participate in this separating and collecting of organic waste. This will be collected and processed collectively. A change in behavior is important. We start with local grassroots innovations that are guided globally.

Integrated projects and cooperation
Initiatives and projects should work together in order to make the most out of it. Right now waste is exported, while fertilisers are imported. Those flows do not work together. In order to create closed loops, projects and flows should be integrated. People need to cooperate in order to do this.

Section 4; Inspiration for Texel

In this section we explore which relevant trends, innovative technologies and inspirational initiatives exist at the moment.

Inspiring Projects

Separation of Waste
At this moment organic waste and inorganic waste are collected separately. More separation of inorganic waste is desirable as the waste can be re-used then. Inorganic waste can also be transformed into organic waste. By making products, like plastics, biodegradable these products also become organic waste as the product can be broken down organically. These processes take place at Texel as well.

Wind Energy
The development and implementation of wind turbines have taken place in the Netherlands over the last years. Texel offers enough place for the increase of wind turbines. A conflict between tourist's opinions and regimes preferences occurs, though. Tourists prefer less wind turbines because it decreases the beauty of the island. While regimes and sustainability organizations support the growth of wind turbines because of the green energy it delivers. Organizations and municipality are looking for alternative energy resources that are sustainable but less space using, for example biogas. (ECN, 2008)

Change of Behavior
Different organizations and people need to change their behavior. The HVC is already changing their behavior as they are processing organic waste into compost and biogas. The municipality should inform people and offer workshops about what to do with organic waste and how to minimize the amount of waste. The citizen should profit from separating, collecting and processing organic waste. The tourist should feel like separating organic waste is good and an easy thing to do.

Sustainable Food Initiatives
Restaurants, bars and markets are experimenting with new sustainable concepts. Owners of these companies understand what role they have in the change to sustainable behavior. Homemade menus with local and seasonal products are served to the customers.

The Tostifabriek is the initiative of a group of young people that build up a city in Amsterdam to experiment with building, producing and generating energy. The Tostifabriek is a closed loop concept where all the ingredients are self-made and being used for producing the 'tosti' for the customer. The spring and summer season of the year is used to grow grain and feed animals, for the production of ingredients. Local people are invited to show them what happens behind the scenes of the production of cheese, bacon and bread and make them aware of this. When the production season is over, the restaurant will open for consuming the self-made 'tosties' (Jansen Jansen bachra, n.d.)

Reuse of Sea Waste
People create and make new products out of the trash that is found on beaches. This concept called ‘strandjutten’, is arised out of poorness, but nowadays a popular activity on the islands. Artists reuse the trash for new product designs, which are sold or exhibitioned locally.

Inspiration for Texel
The above announced initiatives and projects, trends and developments inspired us in the future sub-system design proposal for Texel. A number of concepts were incorporated in the design process. Four of these concepts will be outlined here.

1. Development of separation of organic matter
The individual and collective separation of organic output should be promoted. Companies and households already separate waste, but the quality of separation is low. Checking the separation and rewarding by the direct result of separation should support people to do it better.

2. Change to sustainable behavior
Sustainable habits should be implemented in people their daily life behavior. Nowaday people are used to a certain standard of living. This standard should be transformed into a standard that can give people the same feeling of comfort, but fits to sustainable way of living.

3. Acceptance of Responsibility
Companies and organizations should accept their responsibility in change to sustainable behavior. The responsibility should be taken into account while making business. Companies can act as a role model as well, though. This leads into a new way of making business.

4. Alternative thinking
An overall aspect that could help people in their change to sustainable behavior is: alternative thinking. How can we life differently?

Chapter 4
Design Pathways

In this chapter we build upon the gained knowledge of the previous three chapters and try to design different pathways to reach a desired future sub-system. A reflection on relevant literature for the design of pathways of sustainable development is given in the first section, followed by an overview of potential technical solutions used in the future sub-system. In Section three we will estimate the values of presence in the future sub-system, building on chapter two. Two different pathways are described in section 4, both with the same goal, namely a closed loop for organic matter on Texel.

Section 1; Discussion of literature

In this week the following literature has been used in order to learn more about designing pathways for sustainable development. This knowledge from literature will be used in the design of pathways for our future sub-system. Two articles were selected: '*Exploring sustainability transitions in the electricity sector with socio-technical pathways'* (2010) by G.P.J. Verbong & F.W. Geels and '*Innovation politics post-Rio +20: hybrid pathways to sustainability?'* (2013) by A. Ely, A. Smith & A. Stirling. In these articles, two kinds of pathways for sustainability are introduced, namely the global green industrialization and the local grassroots innovations. Both can be combined but it has to deal with some challenges that can be overcome by intermediaries that link global and local initiatives together.

Pathways to sustainability
Judith: Pathways are a means of forecasting, exploring what is going to happen.
Two pathways can be distinguished that focus on social and economic issues:
1. Green industrialisation: Global pathway, led by large firms of Public-Private partnerships. This is a top-down approach.
2. Grassroots innovations: Local pathway, which is central in civil society. This is a bottom-up approach, which is participatory, responds to local situations, is driven by citizens and the community and looks for alternatives.

Hanna: Pathways give indications of infrastructures in socio-technical system. These can be separated in 3 types:
- Transformation Pathway: characterized by hybridization of infrastructure
- Reformation Pathway: characterized by globalization of infrastructures
- De-alignment Pathway: more focused on local infrastructures

Kajan: Pathways are possible routes for a development to take place. Different kinds and timing of multi-level interactions could lead to a different development of a certain technology. Four transition pathways can be distinguished (Geels, Schot 2007):

transformation, reconfiguration, technological substitution, dealignment (and realignment). These pathways are non-deterministic ideal types which are influenced by social processes. Depending on the type of analysis, a selection of pathways can be made in order to take only relevant pathways into account.

Hybrid innovations

Judith: Grassroots and industrial pathways are combined. This generates alternative solutions. Actors and mechanisms from both local and global pathways work together. This can be done by creating networks and open source platforms. A new kind of politics emerges. Those are more dynamic, complex and unpredictable. Tensions are created by these new politics. There are seven important aspects:
Appropriation: new models are applied, which the old actors of the green industrialization are not familiar with.
Commodification: demand and supply are important, which result in a business like character of the cooperation.
Risk governance: new risks and uncertainties that have to be dealt with.
Market and nonmarket mechanisms: new economic and market instruments and more focus on the social factors than only on the economic ones.
Investment challenges: by new economic instruments investors are not sure when and how they will get their money back.
Diverse settings: new, unfamiliar arenas have to be worked in.
Distributed knowledge: knowledge is distributed in the network.

Hanna: In the transformation pathway towards hybrid grids existing regime actors adjust to outside pressure and internal regime tensions by modifying the direction of the development. Hybrid innovations involve actors from both non-profit as private sectors. Many hybrids embody uneasy combinations of values that can be described as 'not just for profit', which is a link to both business and motivations for a green and social enterprise.
Aspects which affect hybrid innovations are:

- Appropriation : combining of different oriented models
- Commodification : contrast and interaction between business and eco regime
- Risk governance : regime responsible for negative impacts on innovation
- Market and nonmarket mechanisms: new innovations for sustainability are struggling in already existing business structures.
- Investment challenges: innovations wary on opportunity costs
- Diverse settings : innovations are depended on political alliance building
- Distributed knowledge: knowledge is distributed over technical, business and social directions.

Kajan: The combination of different approaches to science, technology and innovation for development. Hybrid innovations operate across all dimensions, e.g. political, actors and knowledge. We increasingly see innovation processes that involve actors from different sectors, both nonprofit as private, in a dynamic cooperation. The hybrid innovations are able to draw on multiple forms of knowledge and sometimes combine formal R&D sites with community based initiatives.

Green economy

Judith: Green economy results in human well-being and social equity; at the same time reducing environmental risks and scarcities.

Hanna: A green economy can be seen as an economic environment that achieves low carbon emissions, resource efficiency and at the same time socially inclusive.

Kajan: The green economy is an economy where people, planet and profit are all three respected. This can be elaborated in a focus on improving human well-being and social equity, reducing environmental risks and ecological scarcities and achieving resource efficiency.

Rio 1992

Judith: Climate conference in Rio de Janeiro in 1992. There was a division between formal discussions of the politics and discussion of the sub politics of NGO's etc. Still, the focus was on global technological development but also a focus turning into the local actions and practice. There became more attention for the potential of grassroots innovations.

Hanna: During Rio 1992 the focus was on the Limit of Growth, biodiversity and climate changes issues. The final report main subject was 'The future we want'. A report that focused on the practical goals for a sustainable world, instead of focusing innovations how to get there. Besides the paper focused on closing the gap between developed and undeveloped countries.

Kajan: In 1992 there was a large climate conference in Rio de Janeiro, where 108 heads of state and 2400 representatives of NGO's were present. Both formal political negotiations and discussions in sub politics about sustainable development were held, although geographically divided. It has contributed to a juxtaposition of different perspectives on the role of technology and innovation in sustainable development at both local and global levels. In Rio 1992 there was still a large focus on global technological solutions, as it was previously common in international climate conferences, but the recognition of community led action was a breakthrough. This recognition of community led action brought more attention to the potential for grassroots innovation.

3D political agenda

Judith: The 3 D's consist of direction, distribution and diversity. Directions of social, technological and environmental change. This will narrow the options for future pathways. Distribution of costs, benefits and risks, dependent on the chosen pathway. Diversify in knowledge, actors, technologies etc.

Hanna: 3D politics of hybrid innovation describe complex, dynamic and unpredictable approaches than the green industrialization approaches of Rio 1992. These politics deal with more varied and unstable relations between actors, mechanisms and knowledge. These novel politics involve relate to power and control over innovation pathways, processes and results. The politics focus on and integrate social, technical and business aspects.

Kajan: The '3D' political agenda of hybrid innovation are direction, distribution and diversity can act as heuristic in understanding some of the tensions above and for guiding innovation and its politics in these emerging hybrid areas.

Rio +20

Judith: Not only alliances with governments are made but also with organizations and civil society. This allowed space for hybrids. Virtual networks were important to let civil society participate. There was actually little space for nations to be involved and there was little time for reflection.

Hanna: Alliance between regimes and organizations were made. Hybrids between different actors in the socio-technical system were a new focus point. 3D politics of hybrid innovation describe complex, dynamic and unpredictable approaches were used rather than the green industrialization approaches of Rio 1992.
Later on (because of activists of Stockholm) innovations started focusing more on grassroots innovation. Innovations that are developing from bottom-up. The innovations were separated deeper and wider.

Kajan: Rio +20 was a major moment of global reflection about human and planetary futures. We have a better understanding of how innovation interacts with social, technological, and ecological systems in and contributes to transitions at multiple levels.

Conclusion for Texel

In order to create a sustainable Texel in 2065 pathways can be designed to get to this future, as is worked out in section four of this chapter. Those pathways can be either local or global, but they can also be combined in hybrid innovations. To create a network between all the local and global innovations and the actors involved intermediaries can be attracted that are concerned with developing the innovations in a good way, to achieve a good end result.

Literature:

Ely, A., Smith, A., & Stirling, A. (2013). Innovation politics post- Rio+20: hybrid pathways to sustainability? Environment and Planning C: Government and Policy 31: 1063-1081.

Verbong, G. P., & Geels, F. W. (2010). Exploring sustainability transitions in the electricity sector with socio-technical pathways. Technological Forecasting and Social Change, 77(8), 1214-1221.

Section 2; Innovative technical solution for managing organic matter

In this section we explain which technology is needed to connect the current state of the sub-system with the desired future. This is to determine how the transition towards a closed loop system is achieved. Also, we opt for a concept that will stimulate the transition towards the desired future. This concept - 'The Farm' - is an essential part of our main advice for Texel and will be discussed more in detail in chapter 5.

Accurate double separation

The biggest challenge in the transition towards the future sub-system is a (cost-) effective method to accurately perform 'after'-separation of the collected organic household waste. This disables two very important processes in the desired future sub-system. Firstly, products made from a very specific type of organic material cannot be made. Secondly, the quality of products (compost) cannot be maximized effectively. Both these problems can be solved by inventing and integrating new technologies designed to accurately separate several different types of organic matter. At the moment these technologies are not available on the market, and therefore there is a dependency on accurate source-separation.

This source-separation was introduced a few decades ago in the Netherlands, and has been integrated in the daily life of most municipalities. But the accuracy and efficiency are not optimized, noting that 35% of the organic household waste is still found in the non-separated waste (chapter 2). Also, the source-separation is limited in number of types. Nowadays, many Dutch municipalities stimulate citizens to separate general household waste into plastics, paper/cardboard, organics, glass and chemicals. But there are no schemes yet to distinguish and separate between different types of organic waste. And if there would be on, it would be doubtful if citizens are willing to cooperate in this more complex source-separation program.

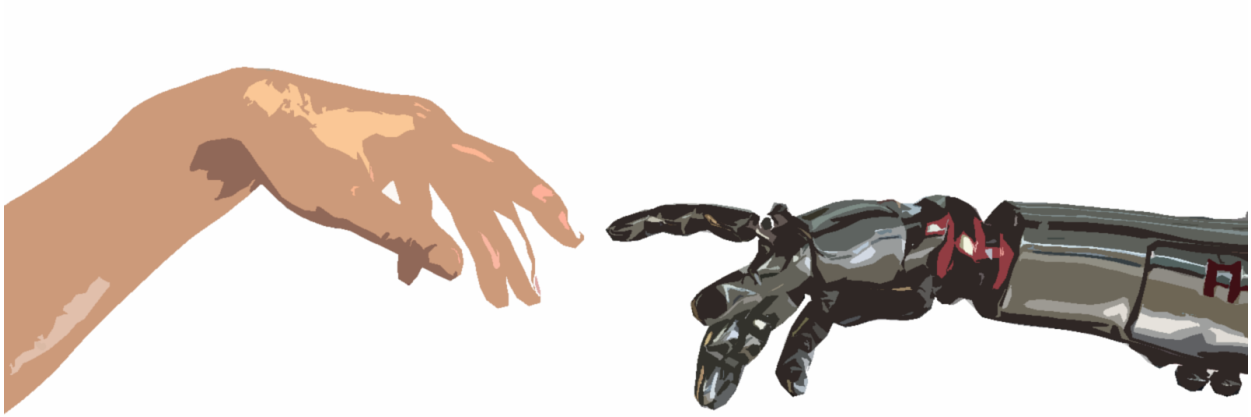
To avoid the need to further differentiate the source-separation, we opt for an integration of technologies performing 'double' separation in the waste processing method. We are aware that the future sub-system how we imagine it will thus be dependent on this new technologies, but it is seen as more realistic compared to optimizing the accuracy of source-separation.

Creating community involvement

Community involvement is an important factor in the implementation of a new technology. In the future sub-system a high involvement could lead to a high efficiency of source-separation. A central place on Texel suitable for education, visibility and inspiration was opted to achieve a higher community involvement. This led to the development of 'The Farm', a conceptual meeting center for all actors that are playing a role in the socio-technical system of managing organic matter on Texel. 'The Farm' will involve the different actors such as the inhabitants of Texel and business companies, tourists and the municipality to realize the farm.

'The Farm' will play a central role in the advice deduced from this report. To fully describe the multiple functions 'The Farm' could have on Texel, a separate chapter will be dedicated, chapter 5.

Section 3; Presence in the future sub-system



In this section we deliver a detailed description of presence in the future sub-system. The prevailing technology in the future of the sub-system will be outlined. Questions like: how will the technologies be embedded in culture and behavior? and: 'how will the elements in the system be interrelated?' will play a central role. Also the way of organization of the rules and regulations in the future system will be discussed.

The Farm as role model
In the future The Farm will act both as a role model and as a central hub for organic matter management. Educational activities will aim for teaching the actors on Texel about the newest technologies in organic waste recycling, and ongoing projects and experiments will show the benefits of accurate and efficient separation, in order to motivate the actors to act accordingly. It is also a main goal to show the value of organic matter to the public, in order to create awareness and by doing so, enhance community involvement and emotional attachment in the process.

Value of food
The way actors treat food will be different in the future sub-system. A main objective in the transition to the future sub-system is to minimize the amount of waste. An essential method to do so is to stress the value of food, so that spoiling food will be most eliminated. This means that the (emotional) value of food will increase. A way of stressing the value of food is to give more insight in the food production chain. Especially when food is locally produced, this could be done very tangibly and personally. The change of increased community involvement in the future sub-system of organic waste recycling is assumed to be significant when actors acknowledge the value of the products and their (local) destination.

Relation to nature
The relation between actors and nature on will become more important, building upon the increasing perceived value of food described above. In a self-sufficient future of Texel the inhabitants will experience the dependency on the land and the food it produces more than in the current situation where both food and fertilizers are widely imported. Also in a broader sense it is expected that the daily life on Texel will become attached to the state of nature on Texel. The nature operates in a certain rhythm and in a sustainable future this rhythm is to be respected. In wintertime less daylight is available

causing low energy and food production. In summertime energy and food are abundant, making storage possible.

Pro-active behavior
Actors will feel personally involved and attached to the process of recycling organic matter, leading to pro-active behavior. Because the outcomes of the recycling process are dependent on the pro-active participation in the sub-system, it is important that this pro-active behavior is stimulated. Once the actors realize the (indirect) personal benefits when participating pro-actively, this will enhance a closer attachment. Especially when the closed loop of organic matter on Texel is made visible, e.g. actors acquire insight in the effect of their actions; this will have a stimulating effect on their behavior.

Knowledge of process
Above elements are partially dependent on an establishment of sufficient knowledge of the process in the involved actors. In other words, all actors have to be informed about the whole process in order to achieve maximum cooperation. This spreading of knowledge will be centrally coordinated in The Farm in the future sub-system. In a well-functioning management of organic matter every actor knows perfectly fine what his/her role is and how he/she can fulfill this role in the best way. The daily life on Texel in the future sub-system for an inhabitant would look like the following example.

Daily life of Theo & Thea anno 2065
Theo and Thea are both born and raised on Texel. They live in the year 2065 and expect their first child in half a year. Twice a week they do groceries in the nearby shop selling both locally produced vegetables, dairy, meat, fruits and -imported from the mainland- products. They cook at home 5 times a week and visit a restaurant or friends for the remaining days. In their kitchen a special garbage bin is installed to make source-separation of household waste very easy. In the last decades food packaging material has been designed in such a way that recycling is made very easy as well. Three times a week a garbage collection service collects their waste, to avoid nuisance of the smells of waste, which is mostly eliminated by the smell absorbing compostable garbage bags. Theo and Thea know exactly what happens with their garbage. They have visited The Farm a few times, to have a sustainably produced lunch and to see the newest developments in the innovative products made from organic waste. The WBR (Waste Becomes Resource) company is located next door to The Farm and is free to visit for the public. The various stages in waste separating (double), processing and purification are clearly visible and the end product is carefully transported to its customers. Purified gas is directly bottled and sold to nearby shops and high quality compost is distributed to the farmers on Texel. To share the profits, the WBR company is funding a big festival on Texel in the summertime, free for all pro-active inhabitants.

Theo and Thea know the nearby farmers by name and have a good understanding of the crops they cultivate. They know that these crops need essential nutrition, fed via the high quality compost from WBR. Although the WBR has a fully autonomous processing method using state of the art separation technologies, Theo and Thea know it can be dangerous to pollute the organic waste with plastics, metals or chemicals. They do not want to cause the farmers nearby any harm and do not want polluted food, so they actively do their best to follow up the separation protocol created by The Farm.

Section 4; Two different pathways

In this section the main objective for the pathways to the future is presented first. After that, we describe two different pathways leading to a future of Texel where a closed loop in organic matter is established. The first pathway is called the 'individual route', characterized by individual collecting and processing of the organic waste. The second pathway is called the 'collective route', characterized by individual pre-separation but collective processing of the organic waste. In both pathways the collecting and processing takes place on Texel, in order to integrate the pathways in the overall aim to make Texel a self-sufficient island of the future. In both pathways the need for community involvement is stressed.

Main objective
A clear definition of the main objective for the pathways should be present in order to avoid misalignment in the outcomes. Coming from the intention to integrate the sub-system of managing organic matter in the overall aim to transform Texel into a self-sufficient future island, we decided to design a future system where no organic matter is imported nor exported from/to the mainland. Additionally, the amount of organic waste produced on Texel should be minimized and the quality and use of the products of recycling should be maximized.

Minimize waste
Although waste can be turned into resources, downgrading in recycling in terms of material quality and energy content is inevitable. Realizing this, it is useful to emphasize that prevention is better than curing. Food waste is to be minimized at all costs in the future sub-system. At the same time it is not realistic to have no organic waste at all. In virtual all stages in the food production some waste is created, e.g. potato peels and apple cores. Next to the food waste, the fraction of organic matter we consider in our

research does also contain the garden waste. Since we do not have the ambition to restrict the inhabitants of Texel to remodel their gardens, garden waste such as leaves, branches, etc, will still exist in the future sub-system.

Maximize quality of products
In order to use the products of the recycling process of organic matter as effective as possible, a high quality is required. There are existing agricultural standards and laws[2] laws (1) requiring compost to have a composition of at least 99,5% organic material with specific maximum values of heavy metals and other non organic materials. These standards are to be met in order to use compost as fertilizer on agricultural lands used for food production. However, it should be mentioned that accumulation of inorganic material could happen on those lands and may lead to hazardous pollution. In the future system on Texel there will be no imported (chemical) fertilizer so the agricultural businesses will be dependent on the produced compost. The aim to maximize the quality of products of the recycling process should thus be as high as technically possible.
Depending on the chosen pathway, biogas can be harvested in the process of recycling organic matter. This gas can be used like natural gas as a high potential source of energy. The purification method of the gas should be most efficient to maximize both quality and use of the produced biogas.

Maximize effective use
When a high quality of products can be achieved, the last connecting step is to ensure the entire amount of product to be effectively used. Briefly speaking this means that all produced compost is used to feed the soil where -preferably- food producing plants grow. Also should the use of biogas, in the case biogas is produced in the process, be maximized. When all products are effectively used, we consider the loop to be complete.

Realistic goals
A closed loop system does not have to imply a 100% efficiency. In the case of recycling organic waste it is seen as unrealistic to strive for 100% efficiency, because of 3 reasons. First, the separation process will not reach 100% accuracy, since this is done by humans and they make human errors. This leads to inorganic materials in organic waste and organic materials in inorganic waste. Second, not all organic waste can be separated. For example, the last bits of sauce in a bottle or the fatty grease left behind in the cooking pan is hard to separate and collect. Third, some sort of organic material can not be used for compost because of toxic compounds. For example, some sort of pine trees contain types of acid that would ruin the quality of compost (Interview HVC).
Although there is research being done to improve the (re)separation techniques after collection of separated waste, this is not expected to solve these problems completely. In order to strive for realistic goals we therefore assumed a 95% efficiency goal per step. These steps will be further explained in the description of the pathways below.

Pathway 1: the individual route
Individual separation, collection and processing
Every household or every company separates their waste individually. Organic waste is separated and collected apart from the other waste. Every household therefore gets a green mini container that can be placed inside their homes. There used to be a bigger green container already which could be placed outside. As people need to change their

[2] *Artikel 17, Hoofdstuk 3, Uitvoeringsbesluit Meststoffen, Ministerie van infrastructuur en milieu.*

behavior, it should be made as attractive and easy as possible to do so. The kitchen is the place where the most organic waste is being produced, so instead of throwing it away with the other garbage, organic waste is collected separately.
Next to the green mini-container every household or groups of households and every company will receive a micro-digester to enable each household to process its own organic waste. The result will be directly visible in the way of produced biogas and compost, which can both be used by the residents themselves. This direct result is assumed to create a high sense of ownership, responsibility and an intrinsic motivation for separating as much organic waste as possible. This machine has to be easy to use for the inhabitants of Texel.

Providing containers, workshops and micro-bio digesters
The municipality will provide these containers, which might be in cooperation with the HVC, as both parties are motivated to act towards a sustainable Texel and want to achieve the highest efficiency in the waste treatment as possible. The municipality also offer educational workshops and provides a manual about 'how to work with organic waste'. These workshops and meetings will ideally be organized in the organic waste center, The Farm, elaborated in Chapter 5.

Milestones
The first milestone is reached when every household or group of households and companies have a micro-digester. The provision of workshops and manuals to ensure a correct use are assumed to be included in the delivery. The second milestone is achieved when no organic matter ends up with the inorganic waste. This can be measured by the company collecting the inorganic waste. The separation of organic waste will be considered maximum when an efficiency of 95% is reached, as described in the main objective section earlier in this section.
The third and last milestone is when the product (compost or biogas) is completely used by the users of the micro-digesters. This can be measured by checking for accumulation. To check the quality of the product, authorities can check if the separation process is done sufficiently and can steer when needed.

Advantages
Advantages of this system are the direct result and therefore the responsibility and sense of ownership among the residents. Biogas and compost can be used in the household or company immediately, which reduces the amount of costs for fertilizers or gas. The products can also be sold to for example farmers in the neighborhood. The need for an integral collection and distribution system is avoided, saving costs, energy and human labor.

Disadvantages
This individual pathway is based on decentralized and small scale devices. Referring to the well-known economies of scale, it is unlikely that the micro-digesters will approach the efficiency of a big digester. Next to that, it will cost more material and investment to produce and distribute 10000 micro-digesters than to build 1 big (centrally located one).
The extremely high fluctuation of tourist visits over the year causes a problem as well, leading to a temporarily accumulation of organic waste.

Pathway 2: the collective route

Separation and collection

In the collective route the separation and collection of waste still happens individually, per household and company. This is stimulated by the green mini containers that can be placed inside the homes and will be provided by the municipality.

Centrally collection

The collecting of the total waste is done by the municipality of Texel. To collect this waste a new vehicle will be used that is suitable to collect the mini containers for organic waste. The biggest change with the current situation will be an increased collection frequency to stimulate the households to participate actively.

Central processing

The collected organic waste will be brought to the a new processing installation on Texel, possibly the old transfer point De Hamster, which will not be a transfer point anymore. In this place, the organic waste will be double separated before being processed into biogas, compost and possibly new products requiring a specific type of biomass.

Convincing people

As there will be no direct result for the citizens it is assumed to be important to convince them of the importance of separating organic matter accurately. The municipality has to put a lot of effort in providing enough educational material in order to keep the inhabitants informed. But it may be necessary to reward people to actively participate. This can be done by for example providing them with free biogas and compost, when a good participation is noted. Or financial savings for the municipality could be shared among the actively involved actors. It is important that such a measure should be introduced under strict supervision, since it must not happen that a direct financial benefit is rewarded for the waste produced. One of the main objectives described in the section earlier in this section is to minimize the amount of waste. The rewards should focus on the quality rather than the quantity of the separated waste.

It is a different challenge to ensure the seasonal tourists to participate in this waste management. Social pressure from off the inhabitants or strict regulations from the municipalities are opted as feasible solutions to ensure an accurate separation. This new processing system on Texel might become a visiting point for tourists, which raises their awareness. This can be combined with The Farm, discussed in section 4.3 and Chapter 5.

Milestones

The first milestone is reached when every household or group of households and companies have a green mini container. The provision of workshops and manuals to ensure a correct use are assumed to be included in the delivery.

The second milestone is achieved when no organic matter ends up with the other (inorganic) waste. This shows that everyone knows how and what to separate. This can be controlled by measuring the amount of organic waste that ends up with the inorganic waste. This can be measured by the HVC for example. The separation of organic waste will be considered maximum when an efficiency of 95% is reached, as described in the main objective section earlier in this section. The third milestone is achieved when the processing of the waste into new products is being optimized. This can be measured in the amount of organic waste left untreated. The organic material will be used to produce

innovative products, biogas and compost. There will be no waste in the production process (3A and B).
The fourth and last milestone is when the all products are brought back into the system. This can be measured if no accumulation of product is observed. To enable this, it is of crucial importance that the products will meet the required quality standards.

Advantages
The biggest advantage of this pathway is the bigger scale. This makes the process more economical feasible and energy efficient. The quality of the substrate and products can conveniently be monitored, since every processing step occurs on a central location.

Disadvantages
There are no direct benefits for the participants (inhabitants) when the waste is processed centrally. This might lead to a difficulty in achieving satisfactory participation. An energy, time and cost intensive collection program has to be introduced and maintained.

Conclusion
Both the individual and collective pathway have their advantages. For the realization of closed loop system also a combination of elements from the individual and collective pathways are possible. The collective pathway is the most suitable for achieving a high efficiency on Texel. All the actors in the sub-system of organic matter are working together on improving the sustainability of the management of organic matter. This is a long term goal. In the individual pathway it is more likely that the inhabitants of Texel are intrinsically motivated to actively participate, since they benefit more directly from their efforts. This is difficult to realize in the collective pathway, since the results are rather indirect and not clearly visible neither. Measures could be considered in order to change this dynamic.

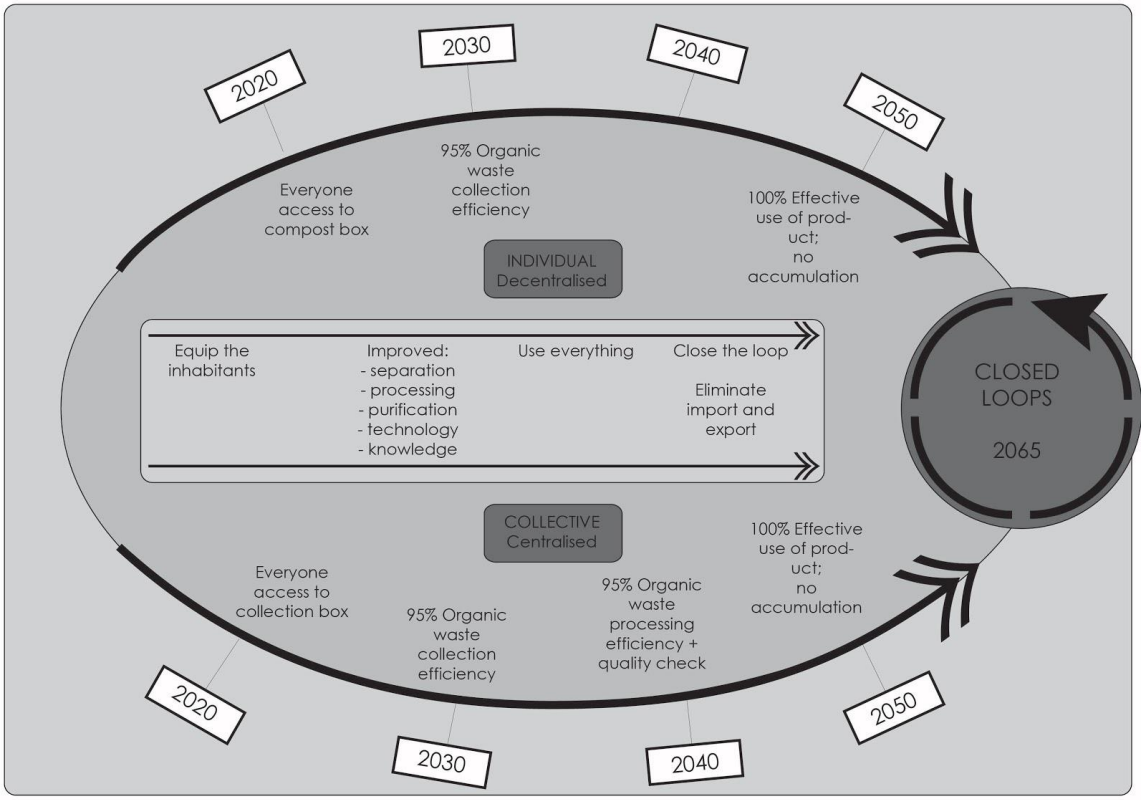
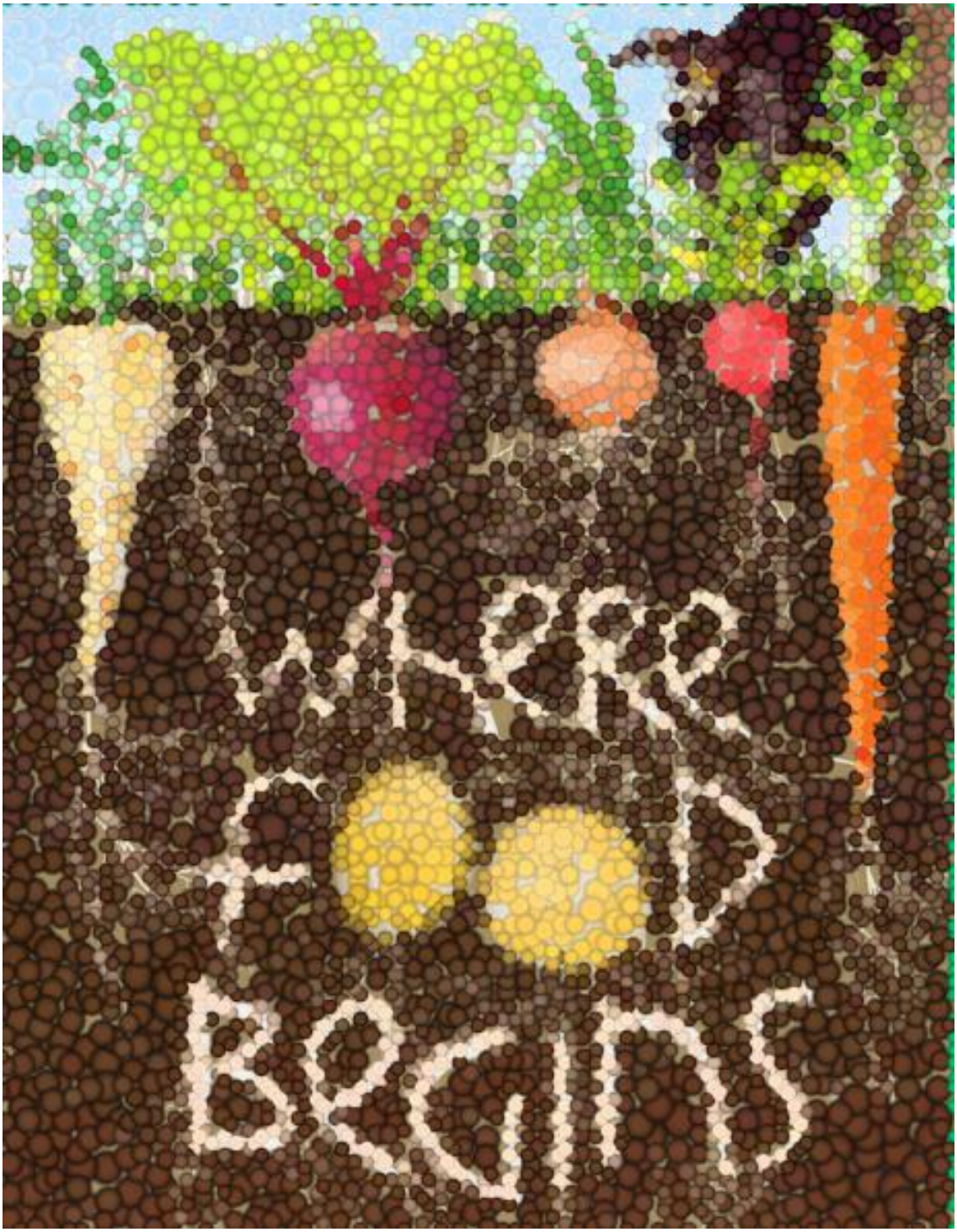


Illustration 4.1: The individual and collective pathway

Chapter 5

The Farm as a role model



Introduction

The farm project on small scale will be a role model for Texel. The Farm will be an experiment center that focuses on education of sustainable behavior, a showroom for new insights, an experimental location for try-outs and a collecting center for experiences and ideas.

The idea of the farm comes from the analysis of sustainable development. Organic matter, motivation, value of presence, transition management and pathway building focusing on sustainable development have been analyzed. This all lead to a design proposal for Texel, a design of two pathways: the collective and individual pathway of organic matter management. Initiatives and trends concerning food management that are existing at the moment inspired us in how to make this idea of the pathways visible. The concepts of initiatives like the Tostifabriek (Jansen Jansen Bachra, n.d.) and Gare du Nord inspired this project. These restaurants are trying to offer sustainable food to their customers, which should keep the quality of restaurant food. Furthermore they try to inspire their customers in sustainable behavior: how to cook and build your own food. In the organization itself ingredients are produced or they are locally collected. These ingredients are being used for the menu that is served. Besides, the menu is dependent on the time of the year. But how will the organic output be managed after consumption?

Other initiatives inspired this project in how to handle with organic output. The HVC vision is implemented in the idea of The Farm. Organic waste will not be seen as waste anymore, but will be seen as input for new ingredients or products. What inspired this project furthermore, is the management of organic output of some restaurants and bars nowadays. Some restaurants make for example use of the trend of making use of coffee residue, to produce other products as mushrooms.

Illustration 5.1: The closed loop system of The Farm

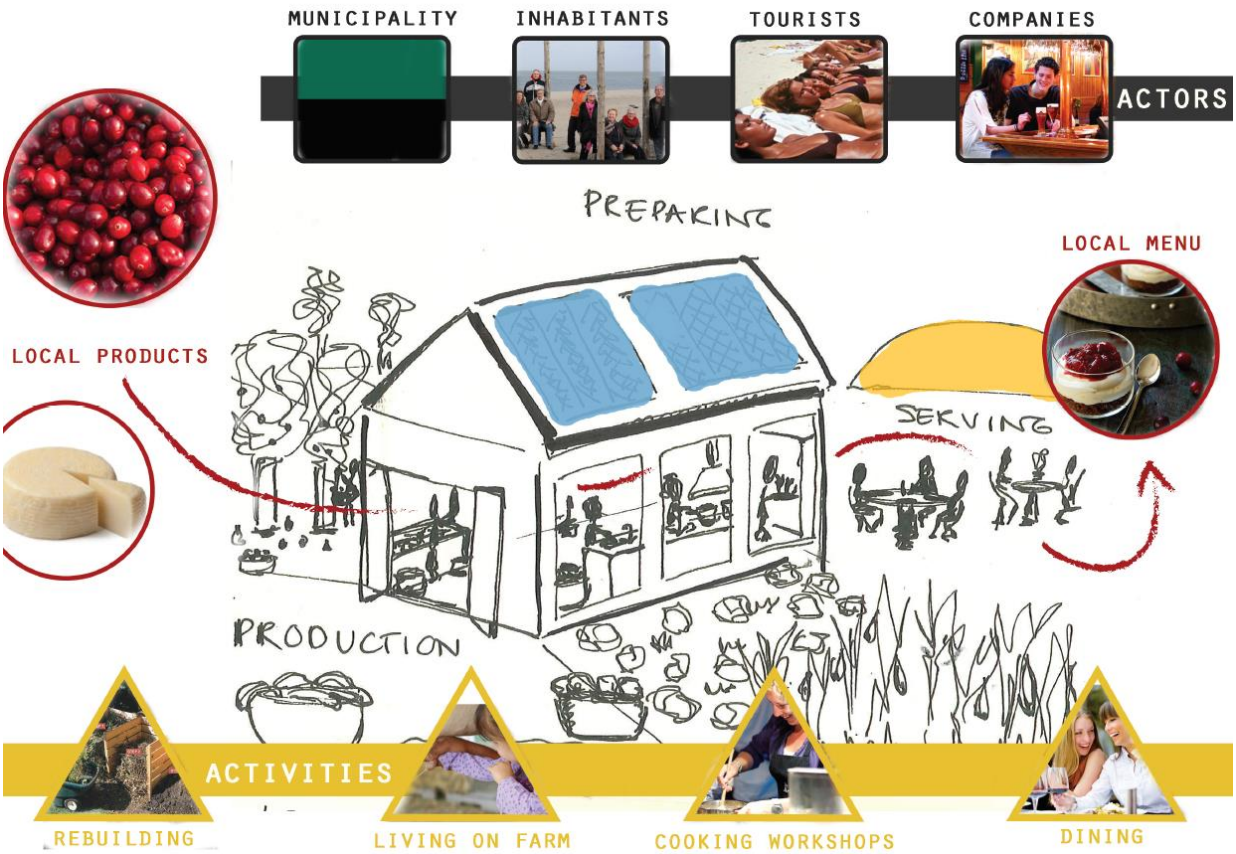


Illustration 5.2: The aim of The Farm, concerning actors and activities

The Aim of The Farm

The creation of homemade ingredients and the way how organic output can be seen as organic input again are brought together in one concept idea: The Farm. This farm should be an example of how a closed loop system can work and it should inspire and motivate people how this can be implemented in daily life. The farm will be a concept that should promote the design proposal for organic matter in 2065, in where the two pathways will exist. The question is now: what does this Farm look like?

An empty building on Texel will be renovated surrounded by a nature that offers place for breeding and stock-breeding, to set up the farm. The farm has among others the function of a restaurant that offers sustainable food and educates visitors about sustainable behavior concerning food consumption. Different actors will play a role in this concept, and different activities will take place.

Actors

Four actors will play a role in the farm: the municipality, inhabitants, tourists and companies. All the actors that play a role in the management of organic matter on Texel are tried to capture together in this concept. Inhabitants and tourists will mostly work for the farm. Inhabitants who work for the farm will be responsible for production, the restaurant and the workshops. The inhabitants and tourists who visit the farm will be responsible for the participation of activities, consumption and bringing leftover food.

The municipality will help to afford the realization of the farm. The municipality will be asked to invest in the concept idea to promote the two pathway proposals, mentioned in Chapter 4.

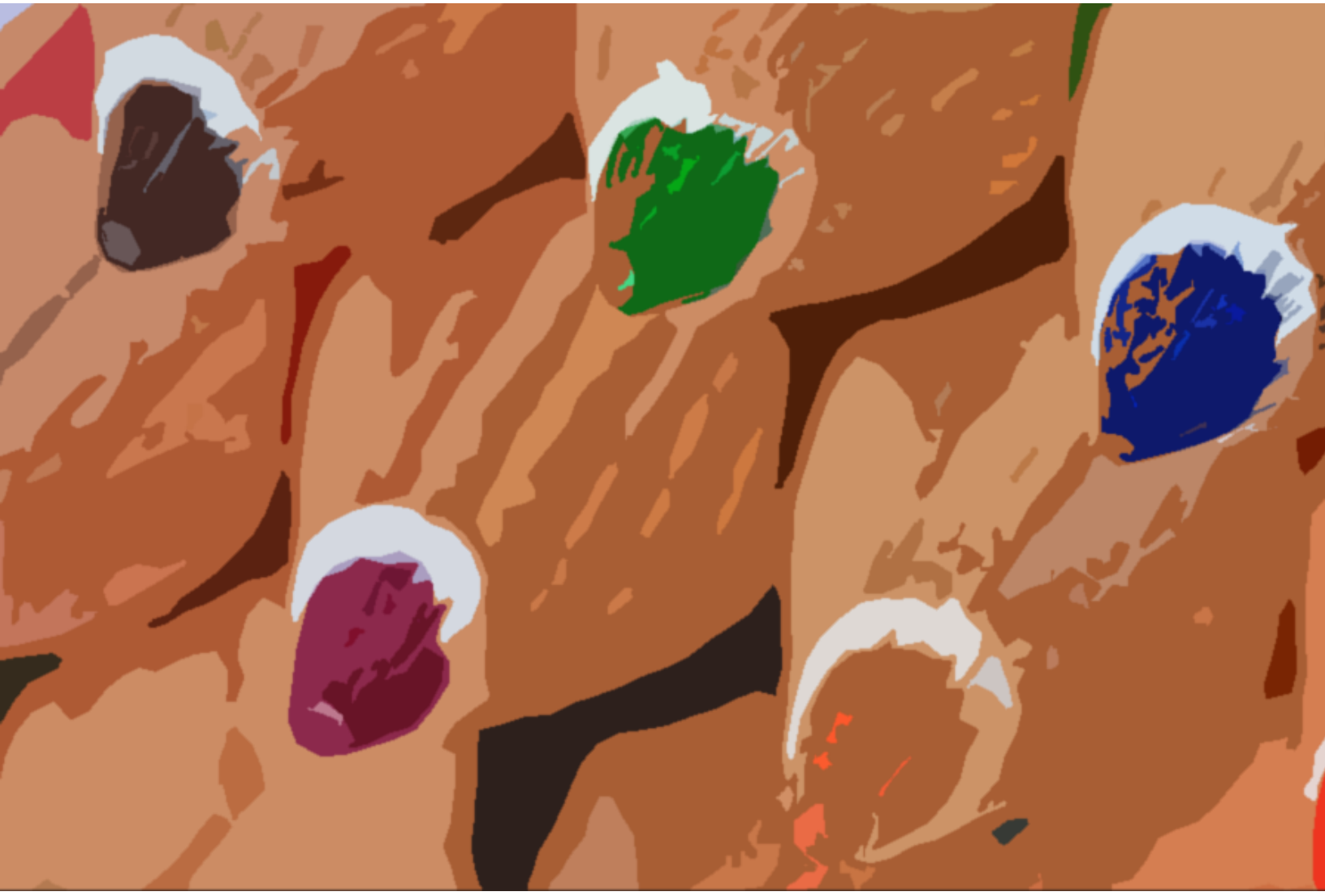
Furthermore the companies will play a role in this concept. The farm will work together with local producers, who can offer products to build up the farm or local producers who can offer non-organic ingredients.

Activities

The most important activities of the farm will be rebuilding of organic output into organic input, and preparation and serving the food for guest of the farm. Besides that the farm will have an educative aspect to support sustainable behavior. Inhabitants of Texel or tourists should get the chance to experience the management of organic matter of the future. This is turned into activities on the farm, as breeding and harvesting ingredients, cow milking and collecting ingredients. The daily life on a farm should be open to experience. Besides that workshops about cooking, harvesting and separating in a sustainable way, will be provided to educate people more about the concept.

An important factor of this design will be transparency. Visitors should have the opportunity to see, apply and learn. While all the activities that are happening on the farm are open to experience, people will get inspired and hopefully motivated to try it themselves.

Chapter 6
Conclusions



In this chapter we first summarize our findings and formulate a conclusion of our sub-system analysis and design. In the first section we also reflect on our research questions formulated in Chapter 1 and formulate answers to them. Proceeding from that conclusion we determine possible frictions with the plans and designs of other groups in our joint research to make Texel sustainable. Not only frictions but also opportunities for cooperation will be highlighted in section 5.2.

Section 1; Analysis and design

Our main objective, as described in detail in Chapter 1 and Section 4.4, is the transformation from a linear system to a closed loop system in the sub-system of treating organic waste. To achieve this transformation we started by analyzing the current state of the sub system and the desired future. In the first chapters we build toward the formulation of two possible pathways, presented in Chapter 4. These pathways both lead to a desired future sub-system where a closed loop of organic material on Texel is established. However, we acknowledge the possibility of achieving this future sub-system by the combination of elements from both pathways when mixed. In other words, a hybrid model would possibly work out as well. In this section we will first answer the research questions formulated in Chapter 1 and then formulate our design proposal.

Answering research questions
The main research question of this research was:

> *"How could the management of organic municipal waste be transformed into a closed loop of organic matter, in order to create a self-sufficient Texel in 2065?"*

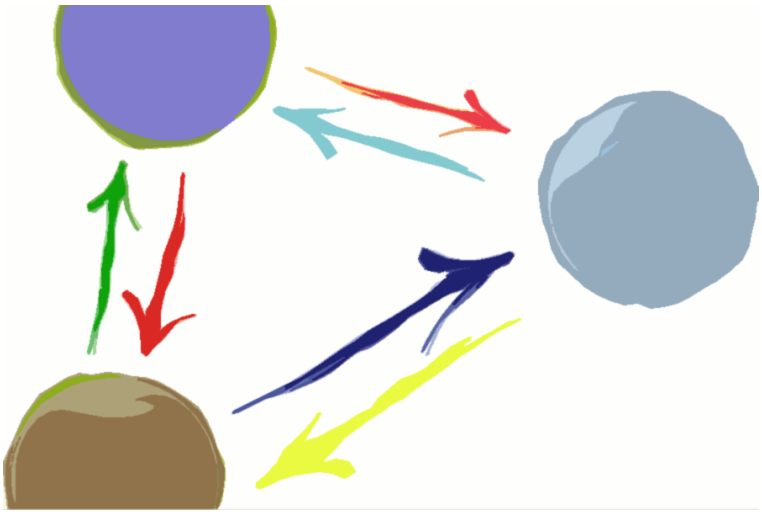
A closed loop of organic matter can be established in two ways consisting out of elements that might be combined in other configurations. The first pathway that leads to the transformation from the current to the future sub-system is called 'individual pathway', referring to its decentralized nature. The second pathway is called 'collective pathway', referring to its centralized and collective approach. There are several milestones per pathway that act as intermediate goals and have to be met in a fixed order. The main assumption made is that a 95% accuracy in the separation process is seen as maximally achievable, taking into account a disproportionate and unrealistic effort to reach a 100%. This serves also as the answer for the first sub question.

Regarding the second sub question, there are several technologies available to improve the management of organic matter on Texel, but for the desired future our design proposal is dependent on further developments in the technology to perform 'double' separation. This means the extra separation of incoming organic matter and possibly the capacity to separate for a typical type of organic material. The value for typical types of organic material was stressed by Leonie Syrier in an interview, giving the production of leather out of fruit scraps and production of medicines out of pine tree material. The involved actors in the future sub-system are the inhabitants of Texel to begin with, with the incentive to create a safe, sustainable and comfortable place to live. The municipality is another big actor, enjoying the independency of the mainland in the future sub-system. Depending on the pathway, a centrally coordinating waste processing company and possibly specialized companies using the resources derived from the waste, are important actors as well. To conclude, the high seasonal influx of tourist makes the 'typical' tourist an actor as well. The last sub-question will be addressed in the last section of this report, section 6.2.

The Design Proposal
The farm project will act as a role model for Texel. The Farm will be an experiment center that focuses on education of sustainable behavior, showroom for new insights, experimental location for try-outs and collecting center for experiences and ideas. The concept of the farm is elaborated in detail in the chapter 5 'The Farm'.

Future research
Since we deliberately demarcate our analysis, we are aware of the bigger picture and do not expect to offer a fully embracing solution. In a sustainable future it could be necessary to retrieve resources from municipal wastewater, as it could be useful to fully use the excreta of farm animals for the production of biogas and compost. These topics could be analyzed in future research to ensure a fully sustainable management of organic matter on Texel.

Section 2; Interaction with other sub-systems' plans



In several team meetings our fellow students have presented their visions on the sub-systems they analyzed. In a few cases this could lead to friction with the implementation of our plan, but also to a possible opportunity to cooperate. In the next paragraphs we will elaborate the potential interactions and our expectations on the plans of other student groups.

In order to find new possibilities for the recycling of specific types of organic matter, we need new ideas and new technologies. The group that analyzed the sub-system of 'sustainable entrepreneurship' want to speed up innovation on Texel. This could be a big opportunity for our vision, when those innovation efforts are directed towards innovative ways to use types of organic waste.

The group of students analyzing how to improve 'feed Texel' focus in their future vision on the increase of local food production. This might be a threat and opportunity to our vision both. By a larger food producing industry you increase the need for fertilizers. These could be imported as it is done at the moment almost exclusively, but we strive in our future vision to eliminate this import as much as possible. However, an increase in agriculture can also increase the demand for compost which will be beneficial in the implementation of our plan, that is focusing on maximization of the use of produced compost. The increase in agricultural activity can also create more organic waste input. This is a delicate topic to address, because it could be seen both as desirable as undesirable the same time.

In order to make the education system on Texel more sustainable, the group of students working on this topic proposed a number of methods to increase the amount of children staying on the island. A possible implementation with their vision will be an integrated scholar program in and around our proposed organic center: 'The Farm'. Students from different ages can be taught about the ways to reduce (organic) waste and how the organic matter will be recycled in the best ways.

In the same line of thought is the cooperation with the sub-system of ‘sustain lifestyles’. Educational programs and workshops could be organized in ‘The Farm’ to teach the inhabitants of Texel in which ways they can contribute toward a sustainable Texel when it comes to the management of organic matter.

A little friction could be mentioned when comparing our future sub-system visions with that of the sub-system ‘How to get there’. The proposed plan of that group consist of a smarter way of transporting waste from the island and (chemical) fertilizers towards the island. In our future vision this practice should be made redundant; enough compost will be made by recycling organic waste to fertilize all the agricultural lands.

When the population of Texel abruptly starts to increase, several frictions among the different visions of the sub-systems occur. The group of students analyzing the sustainable accommodation on Texel proposed a maximization of the accommodation throughout the entire year. This will lead to a significant waste increase as well, because Texel knows a high tourism rate only for a few months of the year at the current situation. We also mentioned a lower involvement of tourists to participate in waste separation schemes, which we see as an essential part in our future sub-system.

Finally we see a big opportunity with the future sub-system of ‘Regenerate inorganic waste’. The students working on this proposed a full reuse of inorganic waste, looking for innovative production processes incorporating waste materials. We see many possibilities of cooperation with this vision, as organic materials can be mixed with inorganic materials (after purification) to create valuable products. An example is coffee residue mixed with plastic fiber to make paper protection sheets (see: Verdraaid Goed).

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