Transitioning Agriculture – A Socio-Technical Perspective

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1 Introduction .............................................................................................................. 5
  1.1 Problem field ........................................................................................................ 5
  1.2 Problem formulation ............................................................................................ 6
  1.3 Motivation and positioning .................................................................................. 6
  1.4 Purpose of the thesis ........................................................................................... 6
  1.5 Choice of method: What I did .............................................................................. 7
    1.5.1 Conducting ethnographical fieldwork at Samsø ............................................ 7
    1.5.2 The field ....................................................................................................... 8
    1.5.3 Interviews and fieldwork .............................................................................. 10
    1.5.4 Transcription ............................................................................................... 10
    1.5.5 Coding and thematization .......................................................................... 11
  1.6 Development of agriculture on Samsø ................................................................. 12

2 Science and technology description ........................................................................ 14
  2.1 Law of the minimum and the mineral theory ....................................................... 14

3 Theoretical framework ..........................................................................................16
  3.1 Actor Network Theory and Social Construction of Technology ...................... 16
  3.2 Paradigm theory ............................................................................................... 16

4 Analytical framework ............................................................................................19
  4.1 Knowledge paradigms within farming ................................................................. 19
    4.1.1 The paradigm of nutrients ............................................................................ 21
    4.1.2 The paradigm of soil fertility ...................................................................... 22
    4.1.3 The biodynamic paradigm ......................................................................... 23
    4.1.4 The paradigm of communication .................................................................. 24
  4.2 Sustainable development opposing structural development ................................ 24
    4.2.1 Sustainable development – a historical concept of ethics ............................. 24
    4.2.2 Structural development – an empirical concept .......................................... 27
  4.3 How champion farmers, neighborliness and expert assistance influences on diffusion of organic farming 27

5 Analysis and Discussion .......................................................................................29
  5.1 Farmers in category no. 1: Newly educated organic farmers .............................. 29
    5.1.1 Nutrients and fertilizers .............................................................................. 31
    5.1.2 Societal development; structural - and sustainable development .................. 33
    5.1.3 Specific themes for this farmer .................................................................... 35
    5.1.4 The decision of being organic farmers .......................................................... 36
English abstract
This report outlines the matters concerning the sustainable transition in agriculture on Samsø. Samsø is characterized by being one step ahead regarding the sustainable transition in several sectors of the municipality. Empirical data is collected through fieldwork conducted in March 2019 on Samsø. Six interviews were carried out with farmers at their farms, and one interview was carried out with an agricultural advisor in the local advisory service. The tradition of Constructivist Grounded Theory (Charmaz, 2017) is applied in coding and thematizing the empirical data. Participatory observations were made at a small-scale organic farm through different roles such as trainee, farming assistant and roomie. Secondly, a science and technology description of the law of the minimum and mineral theory is carried out in order to frame the fertilizer and nutrient practices of the farmers. Thirdly, the theoretical framework is set as a fundamental premise of the thesis by Actor Network Theory (ANT) (Latour and Woolgar, 1986) and Social Construction of Technology (SCOT) (Pinch and Bijker, 1987). The ANT-perspective is letting me weigh the actions of nature as much as human actions. And The SCOT-perspective is reflected in the way I understand nutrients and fertilizers especially commercial fertilizers. The analytical framework consists of four knowledge paradigms in agriculture developed by Pernille Kaltoft (Kaltoft, 1997) and a description of the historical development of the concept of sustainable development is made in order to oppose the empirical concept of structural development, that is detected in agriculture on Samsø. The concepts of champion farmers, neighborliness and expert assistance (Risgaard, Frederiksen and Kaltoft, 2007) is applied in the analysis as well. In the analysis different themes appear to be important to the sustainable development across different farming paradigms. The most important themes are found to be Autonomy and Collaboration with nature in a successful transition of agriculture.
Danish summary
1 Introduction

1.1 Problem field

In the realm of the current sustainable transition of the Danish society, a sustainable transition in the Danish agriculture is needed to bring down emissions and to support the biodiversity. The agriculture worldwide is responsible for 17-32% of climate gas emissions (E. Olesen, 2010: 25) and nationally in Denmark it is responsible for 21.5% climate gas emissions (Sådan ligger landet – tal fra landbruget 2017, 2018: 40). Danish agriculture is going through a sustainable development accordingly with the rest of society. The Danish government has in the end of 2019 declared a budget with great focus the green transition and Denmark is going to reduce its CO2 emissions with 70% in 2030 (Ministry of Environment and Food of Denmark, 2019). And concerning the agriculture the plan is to take ineligible soil out of farming in order to support biodiversity in reaching the 2030-goal (Ministry of Environment and Food of Denmark, 2019).

In Denmark, the summer of 2017 was influenced by cold and wet weather conditions (Danmarks Meterologiske Institut, 2017) and the summer of 2018 was influenced by warm and dry weather conditions (Danmarks Meterologiske Institut, 2018). It challenged and equipped the Danish agriculture. Danish farmers are always in a transition process adapting to consumer trends and weather events. And this experience of unpredictable weather fueled an adjustment among Danish farmers in respectively finding crops that fit the conditions and collecting water when it is there. The farmers directly saw, felt and experienced two weather extremes, on their fields and economic bottom-lines. Along with this tactile experience with weather extremes, spokespersons for the nature, such as the Danish Association for Nature Conservation (Lundsgaard et al., 2016; Holmstrup et al., 2018) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (UN.org, 2019), have throughout the years described a silent crisis in aspects of the environment and the biodiversity, that is influenced negatively by the agriculture. This crisis is met by the Danish governmental budget for 2020 and ten years ahead in their plan of taking out lowland soils, that are not adequate for farming. But it does not solve the indifferent biodiversity in the areas that stays in agriculture, which can only be changed within each private holding. If farmers have indifferenty biodiversity, they do not react in practice, since they cannot experience it at the economic bottom-line. In the long run the indifferently biodiversity, if it is not secured, it will affect local economies and thereby global economy negatively. And a collapse of food supply sectors will eventually be the consequence of lack of biological diversity. And based on the fact that agriculture is able to collaborate with nature, the premise for this thesis is, that we need to adapt the food supply
sector in order to be sustainable for future generations. So, where the adaption to more extreme weather conditions are happening here and now in order to secure each holding bottom-lines the adaption to the indifferently biodiversity is happening in a slower pace, due to lack of consequences at each farm here and now.

This thesis is a socio-technical study of the organic conversion processes and the green transition processes in the agriculture on Samso. I will be studying drivers and barriers for farmers on Samso to act sustainable as autonomous soil- and nature stewards.

1.2 Problem formulation

*How does agricultural paradigms emerge on Samso and how do they influence the transition into sustainable farming? What are the motives and the barriers for the conventional and the organic farmers to unite in a common perception of sustainable farming?*

1.3 Motivation and positioning

I grew up at a small-scale organic farm in the 1990s, the farm was one of the organic pioneer farms of 1970s, where the first wave of organic farming took place (Jacobsen, 2005). The upbringing at an organic farm conditioned me with an intuition for circular processes of farming, such as composting and knowledge of the organic crop rotation system. It positioned me far away from conventional ideas of farm practice and might have influenced how fair and symmetrical I have been in my analysis of conventional farmers. Organic farming is non the less an officially recognized sustainable farming program and have a certification settlement controlled by the state of Denmark since 1987.

In 2017 I did my bachelor project in the same theme of conversion processes within Danish agriculture. In this we developed a categorization (see page 7) through which we selected and qualified farmers for an interview study. In the project we found that the decision-making processes regarding each farmers decision whether or not to convert into organic farming was of conceptual importance (Nielsen and Bork, 2017).

The nature views of the farmer at the big-scale farm we interviewed in 2017 differs a lot from the nature views from the big-scale farmer I interviewed for this thesis in 2019. This difference exemplifies the fact that every farm is individual (Kaltoft, 1999), and one cannot generalize within one category of farmers.

1.4 Purpose of the thesis

Within Danish agriculture the transition towards sustainable farming and conversion towards organic farming is troubled by an incommensurability that exist among farmers within different farming
paradigms. In order to reach a point where an arena for sustainable development can find place within Danish agriculture my hypothesis is, that we need to bring down or navigate in these incompatible circumstances to find a place where a sustainable development is able to emerge. The ambition is to describe gateways to break down the incommensurabilities.

1.5 Choice of method: What I did
The ambition with this project is to unfold the valuable practical knowledge in the field of agricultural practitioners across farming practices in order to investigate where to find a place where a sustainable development is able to emerge from the bottom-up. This I will unfold through interview data transcribed from 6 semi-structured interviews lasting respectively approximately 75 minutes and through notes from three weeks of fieldwork at a small-scale organic holding. The fieldwork was done in March 2019. The result of my fieldwork will tell something about the momentary timespan I spent in the agricultural sector on Samsø. The agriculture is in a constant flow of development and bespeak the contemporaneous knowledge paradigms and food related problematics.

1.5.1 Conducting ethnographical fieldwork at Samsø
The purpose of going to Samsø in this round of fieldwork, is both to get a natural geographical scope, that will generate an important focus of the thesis and in particular the already existing sustainable development at Samsø, led by the municipality of Samsø. It is an exemplary development and I was curious if this existing general sustainable development on Samsø has influenced the nature view among especially conventional farmers.

In the bachelor project I experienced a turbulence of not doing any specific limitations of the place of the field, other than the categorization of the informants. So, the farmers had very different terms for farming making it very difficult to compare them in their motivations for choosing their farming practices, since the type of land is of great importance whether or not it makes sense to convert into organic farming. Therefore, it was important for me to find a limited geographical area of doing fieldwork, where there were both conventional and organic farming land and where there was soil in – broadly speaking – the same condition. And here the intention was, that it could form a case-study of a limited area. I choose Samsø of several reasons. First, Samsø is an island, which means its geographical limitations is clear-cut and easy to navigate. Secondly, the island of Samsø has its own municipality, which makes a structural limitation to management of the Island that fit the geographical limitation. At last, there are already transition processes going on, though within the
energy sector. This forms interesting questions, such as why these transition processes only are promoted within one professional sector, such as the energy-sector via initiatives such as the Energy Academy. I later found out that the agriculture was a part of the plan of transitioning the island (*Første energiplan for Samsø*, 1997). This realization cultivated new questions, such as which kind of sustainability term are ruling on the island? Is it from a systemic point of view or is the one-dimensional sectoral focus a representation of a reductionistic point of view?

Concerning the energy sector Samsø is a unique place. Today it produces more renewable energy than the islands inhabitants consume. In 1997 the Island won a competition for being a renewable energy project-island that, up until 2007 and further, was going to build an inspirational window for the rest of Denmark and the world for how to make a sustainable transition within an energy-sector at island-community level (VisitSamsoe.dk, 2019).

1.5.2  The field
I entered the field by contacting chief of department for organic agriculture Peter Mejnertsen from LMO Samsø, just before I went from Copenhagen to Samsø. Via Mejnertsen I reached Knud Ravn, who have been working at Samsø for a great number of years and has great knowledge about the development within the agriculture on the Island. I got in contact with Knud Ravn when I arrived at Samsø in the second week of March 2019. I sent him the list of categories of farmers I was interested in talking to and he was helpful with giving me contact-information for relevant farmers.

1.5.2.1  Categorization of farmers
The categorization I made was inspired by the one we used in our bachelor project. The categorization we made in 2017 was:

1) Conventional farmers, who converted into organic farming.
2) Conventional farmers who are in the conversion process towards organic farming.
3) Conventional farmers who are considering conversion into organic farming.
4) Conventional farmers who did not want to or did not consider conversion into organic farming (Nielsen and Bork, 2017: 12).

This categorization was focused around being a conventional farmer - in some kind of relation to organic agriculture – on a scale of being rather close to rather distanced to the organic farming style. We chose this way of categorization with an inclusion of farmers, who did not consider the organic way, to gain insights also from outside the “organic world”, this we found fundamental, since investigated sociotechnical literature concerning the conversion into organic farming was based on
an empirical space consisting of interviews with only organic farmers. And since the Danish agriculture landscape after all is dominated of industrial conventional farms with only 8,1% of the total Danish agricultural area, that is cultivated organically (Holmstrup et al., 2018). So, if a higher conversion rate is wanted, we found it fair to include the conventional farmers in the empirical space (Nielsen and Bork, 2017).

I found an inclusion of conventional farmers important in this thesis’ fieldwork as well. I changed the categorizations a little according to local situated circumstances on the Island. I sent agricultural advisor Knud Ravn a list of seven categories of farmers, where I got contact information for category 2, 4, 5, 6 and 7. I got contact information for a farmer in category 7, when I had a week left of my three week stay at Samsø and I concluded, that it was too late to make contact with this farmer, since I wanted to start the interviews up the following week.

1. Biodynamic farmers
2. Organic farmers, who have been organic for 10 years (plus/minus).
3. Organic farmers, who recently got the Danish organic certification.
4. Conventional farmers, who are in a conversion process toward organic farming.
5. Conventional farmers, who are considering converting into organic farming.
6. Conventional farmers, who are in middle of (or are considering) a conversion process towards sustainable farming.
7. Conventional farmers, who did not consider a sustainable – or organic conversion.

Figure 1 List of the original seven categories of farmers, whereas the bold ones I got contact-information for in time.

I got contact information for category 2, 4, 5 and 6 in time. I got contact information for category 7 too late, so I excluded it. Knud Ravn did not have any contacts for some biodynamic farmers or newly certified organic farmers. I changed the list of categories and included my hosts as category 1. The final list of categories ended up as:

1. Newly educated organic farmers
2. Organic farmers, who have been organic for 10 years (plus/minus).
3. Conventional farmers, who are in an organic conversion process
4. Conventional farmers, who are considering converting into organic farming
5. Conventional farmers, who are in middle of (or are considering) a conversion process towards sustainable farming.

Figure 2 Final list of the five categories of farmers, that I ended up using.
1.5.3 Interviews and fieldwork
In the bachelor project, we constructed the interview guide on the basis on very broad, obvious themes (see appendix 1). In this thesis I constructed the interview guide on already experienced important themes within agricultural practices (see appendix 2), these are extracted from the PhD.-thesis of Pernille Kaltoft (Kaltoft, 1997) and in the analysis-tool of Response Inducing Sustainability Evaluation (RISE) (Grenz et al., 2011). So standing on previously gathered knowledge of my own bachelor project (2017), the work of Kaltoft (1997) and of RISE, the themes characterizing the interview guide are (1) soil, (2) nutrients, (3) fertilizer/manuring, (4) weed, (5) biodiversity, (6) livestock, (7) water, (8) energy and climate, (9) working conditions, (10) quality of life, (11) economy and (12) holding. This focus made the interviews more specific and detailed in character. The common denominator to these themes is sustainable – or structural development – depending on which farming paradigm they emerge in.

The interviews were carried out as semi-structured interviews, where there is space for asking in-depth – or clarifying questions. The semi-structured interview is characterized by its openness for unexpected turns (Tanggaard and Brinkmann, 2015). An example of this, was when the interview with a farmer from category 3 developed into a collaborative brainstorm about how to solve the problems of the Danish food supply sector. This development showed another aspect of being a farmer, that does not concern practices, but also the more philosophical practices on solving societal problems.

I made participatory observation at the farm from category 1, it meant that the information I got were more detailed and in depth, since I formed my understanding of the place over a three-week period of time. Participatory observation in daily farm routines, gave me insights into rhythms and workflows at the farm. I performed my fieldworker role through being both a trainee, assistant and roomie, this gave me different perspectives on the farming life on the small-scale farm. So, the gathered knowledge is more saturated in this category compared to the five other farmers in the four other categories.

1.5.4 Transcription
Every interview was transcribed and the process of aggregating and analyzing the data started in the process of transcription. The empirical data have been at an interpretation journey through my techno-anthropological comprehension apparatus; first it was recorded in the interview-situation, second the sound-file was transcribed into text and lastly the data used in the thesis was translated from Danish to English. The more manipulation in terms of translations, whether it is from sound to text or from
one language to another, one can argue that the higher the risk is for the data to be overworked. On the other hand it is commonly recognized within qualitative research, that “a researcher’s professional and theoretical predispositions, relations and interactions with respondents will in total influence the conduction, content and analysis of data” (Charmaz, 2017 - own translation). So, the researcher is integrated in the data and you cannot fully be objective in your working manner.

1.5.5 Coding and thematization

In order to create a specific and detailed analysis answering the problem formulation I use themes that emerge in practice showing up in the empirical data (Charmaz, 2017). This analytical point of view is developed in the tradition of constructivist Grounded Theory and Situational Analysis. This tradition is a turn in original Grounded Theory, that characterized by its mechanistic and somewhat positivistic method practiced that technical procedures should be used at data (Charmaz, 2017). Whereas the constructivist turn proposes that theory and concepts are emerging from analyzing the data with tools corresponding to the situation.

The constructivist turn of Grounded Theory “perpetuates the original iterative, comparative, emergent and open point of view, (...), and go against mechanistic uses of the method and against the positivistic tendencies of the previous versions of GT” (Charmaz, 2017 - own translation).

Concerning my use of Grounded Theory and Situational Analysis, deductive themes (themes from theory and literature) were already used in the making of the interview guide as mentioned in section 1.5.3. I made a analytical inductive coding that is a combination of induction and deduction (Boolsen, 2015). I made two rounds of coding in respectively the programs AtlasTi and Nvivo. The program AtlasTi crashed and due to self-inflicted causes, many hours of work were deleted just when I was about to finish, so I changed to using Nvivo and did the coding again. The first round of work in AtlasTi that was deleted comprised a larger empirical data analysis represented in maps. Due to lack of time I did only rebuild the themes and citations and I did not rebuild the maps in the second round of coding in Nvivo. Throughout the coding process a list of themes that occurred in more or less in all interviews emerged. The most represented and referenced themes are listed in figure 3 below.
The themes marked with bold are stemming from the literature. These themes are (1) soil, (2) nutrients, (3) fertilizer/manuring, (5) biodiversity, (11) economy (see section 1.5.3).

I chose to use the word frequency tool in Nvivo12 in continuation of the list. This I did in order to get a clean-cut list of most frequent words of each interview. The words are not necessarily a truer picture of what the farmers are concerned about than the first list and it needed my interpretation in order to get qualitative value. The most frequent words of each interview are represented in the analysis in figure 7, 8, 9, 10, 11 and 12.

First the deductively found themes, that are used in the analysis of every farmer are nutrient & fertilizer and sustainable -and structural development as an oppositional theme-pair within the overall common denominator societal development and economy. Second, the 1 to 3 most frequent themes of each farmer are used in the analysis.

1.6 Development of agriculture on Samsø
Organic farming had a though start in the 1980s on Samsø. Agricultural advisor Knud Ravn did tell that 1987 was a major barrier for organic farming to diffuse. It was a year where the weather did not support the organic agriculture at the island and many organic farmers were forced to go out of
business (Interview - Knud Ravn, 2019). Only the farm that today is called Yduns Garden continued as an organic holding.

If organic practices are going to be implemented on the island it might be better off, if the practices are not called ‘organic’. Nature is commonly included as collaborator in for example weed prevention in organic farming, where it is not allowed to use pesticides. Two practices that include nature as collaborator – the no tillage system and the use of cover crops – were successfully introduced to the farmers at Samsø during the winter 2018-2019; both to the conventional and the organic ones. It was introduced via the Velux funded Project Bio Society Samsø 2016-2020. It was introduced both directly to farmers in the project via workshops, but also via the local agricultural advisory service at Samsø, that was hired to make a demonstration project about cover crops (see appendix 3). It inspired many farmers to try it by being involved as peers and by seeing the results of the cover crops project.

Bio Society Samsø is a project lead by the municipality, the project manager Knud Tybirk defines the role of Samsø in development of sustainable agriculture and the role of farmers in the transition:

"Modern agriculture is largely based on science and research, but of course also on local experiences and common sense. One of the ideas was to articulate agriculture of the future on Samsø as a third way, that both takes elements from organic – and conventional agriculture, and outline a new way that the island’s professional farmers must join to define” (Municipality of Samsø, 2019).

During my fieldwork I did observe, that Samsø is home to an extraordinary culture of being in the global transition trend while handling complex problems of local transitioning questions, such as a sustainable energy supply, them self. It is an island with their own municipality, program for transition and their own fund for organic farming on the island. The extraordinary culture of being pacesetters within transitional questions, is in part explained by the above-mentioned nomination from 1997 and in part it can be explained historically in modern time by the cooperation-movement dispersal in Danish agriculture in the late 1800s. The movement did namely arrive to Samsø very late, which meant that the island had to invent their own ways of doing it, to keep up with the development in rest of society (Interview Knud Ravn, 2019). This shapes an interesting environment for fieldwork and observation concerning transitional processes, since the island shows, time after time, how to do and carry out complex transitional and conversional processes within the energy-sector and in part the agricultural sector. The question is therefore how the possible trend for organic farming is able to emerge on the island.
2 Science and technology description
The landscape of tools and technologies used in agriculture is multifaceted and diverse. The most remarkable concept in literature and my empirical data are fertilizer & nutrients since it also contains different kind of themes and worldviews. So, I have spent some time looking into the social construction and the historical development of commercial synthetic fertilizer to investigate the validity of the uses based on the law of the minimum and the mineral theory. To study the historical development, I investigated the law of the minimum and the mineral theory through both first-hand, second-hand -and third-hand resources.

2.1 Law of the minimum and the mineral theory
In the 1840s Carl Sprengel and Justus von Liebig established “Agricultural Chemistry as an example of the power of chemistry to transform an empirical activity like farming or agriculture into a science (Brock, 1997). This endeavor was practiced in experiments of burning plants in order to investigate left substances finding that minerals are an important factor for plant growth and quality (Liebig, 1840). The foundation of the mineral theory is based on these experiments. The mineral theory acknowledge that plant growth depends on minerals and nitrogen besides light, heat, mechanical support, organic matter, water and air. This was later on operationalized with the law of the minimum illustrated in the barrel model to illustrate the concept of the limiting factor (see figure 4). When adding more of the limiting factor it does ‘activates’ the other factors for growth.
It is nitrogen or phosphorus that is most often the limiting factor for plant growth and to generalize nitrogen is most often the limiting factor for growth in Denmark (Thomsen, Husted and Neergaard, 2013). Nitrogen is a great part of all proteins and is by Kaltoft (1997) categorized as a driving matter distinguished from the nutritious matters such as potassium. Nitrogen is most often the limiting factor for plant growth resulting in overapplication, and thereby it becomes responsible for widespread pollution of aquatic systems (Brady, 2014). An overapplication of nitrogen will also result in “(...) excessive vegetative growth (...), plant maturity may be delayed, and the plants may become more susceptible to diseases and pests” (Brady, 2014). Which will in the end promote the use of pesticides. So, the barrel model mediates in part an overapplication – relative to the surrounding environment and the plant – of the substance that is the limiting factor for growth in a certain area. And partly it mediates a goal of having the highest possible yield and not necessarily the highest possible quality. In addition, Kaltoft claims that “The barrel model has erased Liebig’s perception of the principle difference between nitrogen and minerals, the ‘driving’ and the ‘nutritious’” (Kaltoft, 1997 - own translation).

*Figure 4 The operationalization of the law of the minimum illustrated as a barrel. The limiting factor for growth is respectively phosphorus and nitrogen. Plant growth is constrained by the limiting factor that are the lowest stick in the model (Brady, 2014).*
3 Theoretical framework

3.1 Actor Network Theory and Social Construction of Technology

This thesis is based on different sociotechnical theoretical standpoints. The way of thinking and understanding is framed by two sociotechnical traditions: social construction of technology (SCOT) and actor network theory (ANT). They both contribute with tools for sociotechnical analysis, which I will not explicit use in my analysis. They will constitute my theoretical framework and I will later on account for the analytical framework used practically in the analysis (see section 4).

SCOT and ANT distinguish from each other in their view on how science and technology are constructed. The tradition of SCOT believes that technology is 100% socially constructed where ANT believes that technology and artefacts also influence the development of technology. SCOT is built on studies of concrete technology creations such as the bicycle (Pinch and Bijker, 1987), ANT is built on studies of the creation of knowledge in laboratories, where both humans and devices create new knowledge symmetrically (Latour and Woolgar, 1986). Both traditions are working with the process of making a piece of science or technology, which places them within Science and Technology Studies (STS). Closure and stabilization are central terms in SCOT in describing the last part of the process of making a technology, artefact or a fact, win in as the final solution. ANT uses the term of mobilizing when describing the same. The ANT-view of this thesis – is a symmetrical view on humans and nature, letting me weigh the actions of nature as much as human actions. The SCOT-view of the thesis is reflected in the way I understand nutrients and fertilizers especially commercial fertilizers.

3.2 Paradigm theory

As a break with Karl Poppers ideas about verification and falsification, Thomas Kuhns work The Structure of Scientific revolutions was published in 1962. Here he presented his ideas about how a new natural scientific paradigm take over through six scientific development phases. A scientific paradigm consists of overall ideas through which the scientist perceives and investigates the world. A paradigm is the ruling consensus within the scientific community and how it wins over can be explained in the development process cycle of Kuhn:
There are in total five phases in the cycle and before the cycle started there was a pre-paradigmatic phase, where there were many different competing paradigms. The phases unfolded in three different historical periods, the period before a paradigm, the paradigmatic period and the revolutionary period:

0. Pre-paradigmatic period; many different world views ruled alongside each other
1. Normal Science; the ruling idea of the paradigm (the paradigmatic period)
2. Anomalies; insoluble problems with few advocates is occurring (the paradigmatic period)
3. Crisis; anomalies accumulate within the paradigm (the revolutionary period)
4. Revolution; happens when the normal science loses advocates in favor of the anomalies (the revolutionary period)
5. Paradigm shift; the anomaly accumulated to be the new normal science (the paradigmatic period) (Kuhn, 1962).

In contrast to Popper, Kuhn developed his ideas on the fact that natural scientific progress is created by a dynamic, that is characterized by both the natural scientists beneficial contributions to existing theories, and the fact that the scientist does not actually use time in practice for verifying old theories and falsifying new ones (Thyssen, 2012). So, Kuhn is claiming to describe the actual practice of the natural sciences in his disagreement in Popper’s claim of the usability of the verification and falsification as legal explanatory dynamic in the development of science. According Kuhn is the method of “falsification likewise infeasible as verification since theories are networks, that cannot
be falsified in one specific area” (own translation, Thyssen, 2012). He was though agreeing with Popper in rejecting both ideas about induction as a safe way to create knowledge and that theory is a direct descendant from data. Finally they are agreeing about rejecting the idea of an neutral language about data (Thyssen, 2012). The paradigm theory of Kuhn is further characterized by implying that only one paradigm can rule at a time and that it is developed on the basis of an historical analysis of how the development process of science did unfold. So, it gives up that the theory can be used for projecting scientific process and development, but the theory contributes with a language to describe what have already happened. The fact that the term paradigm is developed on the basis of history makes it a historical term.
4 Analytical framework
The analytical framework is placed within particularism endeavoring to understand the culture of farming on Samsø based on its own principles. My ambition is to create a meaningfulness to outsiders of the field by contextualizing the practices of each farmers in a knowledge paradigm. The analysis is attempted build as thick descriptions with different analytical framing tools, that consist of:

- Sustainable development (theoretical concept) versus structural development (empirical concept)
- Four knowledge paradigms developed by Pernille Kaltoft in her PhD thesis in 1997
- Factors influencing on the diffusion of organic farming, such as the presence of champion farmers, the effect of neighborliness and the impact of expert assistance from local agricultural advisors and diffusion of organic farming (Risgaard, Frederiksen and Kaltoft, 2007).

In order to investigate possible gateways to an island fully converted into organic farming, one of the premises of the following analysis is that the farmers knowledge, experiences, values and perceptions are contributing at the same hierarchical level as other more theoretical references. This idea is inspired by Frank Heuts and Annemarie Mol, who are making an alternative expert definition based on anthropological valuation studies on food quality (Heuts and Mol, 2013). They categorize all implicated informants – developers, growers, sellers, processors, professional cooks and so-called consumers – as experts in order to answer, ‘What is a good tomato?’ (Heuts and Mol, 2013).

4.1 Knowledge paradigms within farming
The analytical framework of this thesis consists of the farming paradigms Pernille Kaltoft developed with her PhD thesis in 1997 in continuation of the work of Erik Lange (Lange, 1993). She proposes four different practice-framings as paradigm concerning the organic agriculture. She is developing on Kuhn’s paradigm theory and is proposing a new way of seeing paradigms. She sees a different paradigm structure within farming including agricultural science, soil science and the socio-technical field of farming. She describes differences from Kuhn in her use of the term paradigm in three ways. First, her paradigms are existing in a parallel model and not in a serial model, where one paradigm outplays another, secondly her paradigms are constituted among other things by different branches within the natural science such as ecology, chemical science or alternative scientific views, phenomenological descriptions of nature or semiotically descriptions of nature, and not within one scientific tradition such as in the case of Kuhn the physics, 3) her paradigms are across profession
and are mutual to scientists, advisors and farmers, and not only within science and research. She argues:

*When I after all adhere to the designation paradigm is it due to that character each of them has to be a coherent system of ideas and thoughts. Ergo the paradigms are not based on individual’s comprehension – for example the farmer’s comprehension – but present different mindset, wherein different agronomy scientific, natural scientific and alternative scientific comprehensions of soil, nutrients, fertilizer, weeds and diversity are represented* (Kaltoft, 1997 - own translation).

The four paradigms are categorized in four comprehensions within the organic agriculture; the nutrient paradigm – the conventional understanding; the soil fertility paradigm – the organic understanding; the biodynamic paradigm – the biodynamic understanding and the communication paradigm – the transversal understanding.

![Diagram of the 4 farming paradigms](image)

*Figure 6 Illustration of the 4 farming paradigms, that exist in Danish agriculture across professions.*

Despite Kaltoft is working in the field of organic farming in her Ph.D.-thesis, she recognizes the nutrient paradigm that is ruled by conventional comprehension among organic agricultural advisors and – farmers. This makes it possible for me to use the conventional paradigm setting in analyzing my empirical data, that as mentioned consist of interviews with both organic and conventional farmers. Kaltoft did develop the farming paradigms on the idea that the actual practices not
necessarily reflect the way you comprehend the nature and natural systems – the paradigm (Kaltoft, 1997). In other words, you can be a conventional farmer in practice while reflecting the soil fertility paradigm.

4.1.1 The paradigm of nutrients
The central ideas of this paradigm Kaltoft proposes to be based on the conventional understanding, that is characterized by a focus at nutrients for plants. This paradigm is built on technical science, that many agronomists more or less represents (Kaltoft, 1997: 233), that is a positivistic science, where observations are communicated as theory and are contributing to action with technical solutions (Thyssen, 2012: 599). The organic and biodynamic understandings distinguish from this paradigm in the tradition of making descriptions of the ideas, premises and the philosophy that the farming practices of the two paradigms rely on. Descriptive writings of the ideas, premises and philosophy of the conventional paradigm is absenting, and it might be due to the mindset of technical science being self-sufficient. The mobilized and stabilized knowledge about nutrients rely the work of Justus von Liebig in 1840: “Organic Chemistry in its Applications to Agriculture and Physiology”. The central parts of his work are the fundamental part of the law of the minimum and mineral theory, that is described in section 2.1. He had great influence on the agriculture of England in his time. His work has been mediated and interpreted in recognized soil textbooks (Brady, 1974, 1984, 2014).

This paradigm is reflected in the Danish Agriculture and Food Council (DAFC), that is a business organization that:

- Promotes the political influence of the agricultural and food sector
- Offers a comprehensive range of cost-effective services for its members
- Implements research and development programmes within food safety and veterinary issues, animal health and productivity, animal welfare, environment and energy (The Danish Agriculture & Food Council, no date).

The council focus more and more on 'the sustainable'. In the spring of 2019, the council published a goal on behalf of Danish agriculture of being climate neutral by 2050. And later in 2019 they consummated an agreement about a cooperation with The Danish Society for Nature Conservation.

In spite of these new measures, their goals are defined within this paradigm, where the goal of quantity rules the process and one can argue that DAFC’s concept of sustainability operates within a CO2 – and climate regime.
4.1.2 The paradigm of soil fertility
The central ideas of this paradigm Kaltoft proposes to be based on the organic understanding, which is characterized by a focus on the fertility of the soil. In this paradigm the fundamental idea is that nutrients and fertilizers are added in order to support the soil, that act as a nutrient’s mediator in relation to the plants; a healthy fertile soil will provide the plants with what they need. The science of ecology is central in the organic understanding. When Kaltoft wrote her Ph.D. thesis, organic agriculture in Denmark was based at 10 breeding – and growing rules formulated by Danish Association for Organic Agriculture (Landsforeningen Økologisk Jordbrug) (Kaltoft, 1997) in 1995.

The goal for the organic agriculture was:

1. To promote conversion to organic farming of all farming land.
2. To work as far as possible in closed circuits and to employ local resources.
3. To conserve the soils natural fertility.
4. To avoid every source of contamination in relation to arable practices.
5. To promote arable practices that respect environment and nature.
6. To produce food of highest nutritionally quality.
7. To reduce the use of non-renewable resources including fossil fuels to a minimum within arable farming.
8. To promote that the waste of the cities and the food-industry obtain a quality making it possible to recycle it as fertilizers in arable farming.
9. To give all livestock good condition, that is corresponding to their natural behavior and needs.
10. To do everything that is possible to assure that every living organism – from microorganism to plants and animals, that farmers collaborate with to become allies (Own translation of Avlsregler for økologisk jordbrug, 1995 in Kaltoft, 1997).

Today the Danish Association for Organic Agriculture (Landsforeningen Økologisk Jordbrug) has closed and instead Danish Organic Association (Økologisk Landsforening) conduct the activity of framing organic agriculture in Denmark both socially and technically. The ‘value definition’ of organic agriculture in Denmark is framed by four principles formulated by International Federation of Organic Agriculture Movements (IFOAM). The principles are:

- The principle of health. Regarding all systems of the planet. Both soils, plants, animals, humans.
- The principle of ecology. Emulating and sustaining natural systems.
- The principle of fairness. Equity, respect and justice for every living thing.
- The principle of care. For the generations to come (IFOAM, no date).
The principle of care is also known as the precautionary principle within health and environmental studies and consist of elements from the sustainable development definition in the Brundtland report of 1987, namely that humanity should act with care in order to secure a future healthy planet for generations to come. Further the ‘political strategy definition’ of Økologisk Landsforening is based on five out of the 17 UN’s global goals:

- 6: Clean water and sanitation
- 12: Responsible consumption and production
- 13: Climate action
- 15: Life on land
- 17: Partnerships for the goals

The focus at the soil’s natural fertility and the mindset of collaborating with nature and that every organism are allies is reoccurring in these new value – and strategy definitions. A cycle-mindset is realized with a broader focus at supporting natural systems.

4.1.3 The biodynamic paradigm

The central ideas of this paradigm Kaltoft proposes to be based on the biodynamic understanding, that is a part of the anthroposophy which is characterized by alternative ideas and practices initial proposed by Rudolf Steiner at his agricultural seminars in 1924. According Kaltoft there are two ruling elements to this paradigm, that is the idea of agricultural individuality and the principle of care. The principle of care is also mentioned in the previous section. The idea of agricultural individuality, the overall goal of a biodynamic husbandry is to obtain a local balance both in the combination of different types of land and the combination of crops and the number of species, and in the relative proportion of these. The balance concerns the extent of self-sufficiency regarding fodder for livestock and fertilizers for the fields (Kaltoft, 1997). Elements of this paradigm differs from official recognized science in its way of thinking the spirituality into concrete practices in promoting mobility of the soil. The idea of mobility is that you can leave your material reliance to the body and that you can live in the spiritual as well. The paradigm is also standing upon official recognized science in its practices. It is recognizing the established biological science in its systemic view at farming (Kaltoft, 1997). According Verner Andersen, one can see the biodynamic farmer as a practioner, who are testing hypothesis’ set by Steiner in the 1920s and if they experience that it is supporting healthy growth in relation to all elements of the local environment, they continue practicing it (Skouboe, 2009). Humanity is central to this paradigm where you up-bring the nature, so it is able to give its best serving all living species.
The paradigm of communication
Kaltoft proposes this paradigm as a new one and it is not that established and defined as the three previous presented paradigms. The empirical evidence of this paradigm, Kaltoft represent by the biologist Ane Bodil Søgaard and in part the biochemist Jesper Hoffmeyer.
The central ideas of this paradigm she proposes to be based on the transversal understanding between the paradigm of soil fertility and the biodynamic paradigm. The paradigm of communication is characterized by its focus at the communication in ecosystems and at the quality of food. In food science you operate with the primary – and the secondary constituents in order to describe food quality. The primary constituents are carbohydrate, protein, fat, vitamins and minerals and the secondary constituents is those that rules the flavor, pigment, aroma and the ability of the plants to defend themselves towards enemies, that have an antioxidant effect. The secondary constituents are in charge of the communication with the ambient ecosystem. This paradigm is also characterized by a well-defined view on weeds; it is proposed within this paradigm that the land owner goes into dialogue with the weed and see the type of weed as parameters for the condition of the soil (Søgaard, 1997 in Kaltoft, 1997). This stand in contrast to the weed-view in the paradigm of nutrients, where weeds are an element that should be fought either with chemistry or with other farming tools. The weed-view of this paradigm is more defined than in the paradigm of soil fertility or in the biodynamic paradigm, where weed is a bit more tolerated than in the paradigm of nutrients, in name of biodiversity (Kaltoft, 1997).

The four agricultural knowledge paradigms have been accounted for and in the following different societal development strategies will be accounted for.

Sustainable development opposing structural development
The concept of sustainable development is based on ethical ideas handling experienced mis-development of technological endeavors. The concept of structural development is an empirical concept, that in society is used to explain the exponential growth. It does not have a philosophical or ethical described fundament.

Sustainable development – a historical concept of ethics
Sustainable development is a historical concept and in order to define what sustainable development is in relation to land use in Denmark, it is necessary to look into the Danish landscape of 1760s. At
this time there was no trees left after decades of unplanned forestry and a systematic access to forestry was needed in Denmark and those responsible for Danish forestry at that time was inspired by the German way of orchestrating forestry with long-term planning. The German forester Johann Georg von Langen (1699-1776), was hired by chief of the Royal Danish Forestry Society Carl Christian von Gram (1703-80), to build up and conserve Danish forests through long-term planning and the so-called Gram-Langenske forestry agreement was made in the 1760s (Arler, 2014) and together with the later on established forestry agreement in 1805 a continual forestry was secured though with the utilitarian reason of changing sources for energy into coal (Kjærgaard, 1991; Arler, 2014). So, a sustainable forestry was established in the 18th century based on the reasons of production of coal as a source for energy, that some will claim acted as co-creator of today’s climatic problems that are the main reason for today’s concept of sustainable development. The shift in sources for energy might also be co-creator of the today’s wealth of the global north.

Through the beginning of the 20th century a concern for the tolerance of the environment was established by among others Aldo Leopold. It was a concern, which both fostered a focus at the increase in population but also on the idea that the tolerance of the environment was not static and could be widened through a change in the way of using tools, believing that technological and scientific progress could be actors in widening the environmental tolerance (Arler, 2014).

The idea that the use of new technologies could substitute natures base work was opposed by Henry Fairfield Osborn (Osborn, 1948 in Arler, 2014). In addition, William Vogt – an American environmentalist – claimed that “progress will only postpone the problems and will make the catastrophe so much the more violent, when it finally strikes” (Vogt, 1948 in Arler, 2014 own translation). Both focuses formed the concepts of sustainability in last decades of the 20th century.

In 1972 both the Stockholm agreement was made within United Nations, and the Rome clubs report ‘limits to growth’ (Meadows et al., 1972) was published. The Stockholm agreement was concerning reasons and solutions for environmental problems. In high income countries the reasons were declared to find place in the unregulated industrialization and a technological mis-development (Arler, 2014). Hans Jonas formulated the Imperative of Responsibility in 1979 and ascribed the onrushing technological development new dimensions of responsibility (Jonas, 2008). The imperative of responsibility is a principle that involves elements of precautions in terms of taking care of the environment in order to sustain human activities.

Sustainable development is finally defined in 1987 in the United Nations report ‘Our common future’ also known as the Brundtland Report named after the for former Norwegian Prime Minister Gro
Brundtland, that was chairwoman in the World Commission on Environment and Development (WCED) that wrote the report. Sustainable development is defined as development that “(...) meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987).

At the conference in Rio in 1992 the practice of reducing the environmental harm was connected to economic development and sustainable development was in addition confirmed as an ethical standard (Arler, 2014). The precautionary principle was recognized globally after the Rio conference in 1992. In 1998 a consensus fell within World Health Organization (WHO) on the following definition of the precautionary principle: “when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically” (Kriebel et al., 2004).

In 2015 United Nations agreed upon 17 global goals and 167 targets for sustainable development until 2030. UN’s 17 global goals are an operationalization of the sustainable development concept defined in 1987. In 2017 and 2018 the concept of sustainable development was influenced by turns in economic theory initiated in 1980s, that take trends from 1972 ‘limits to growth’ into consideration. In 2017 the concept of ecological economy was launched in a teaching program for high schools in Denmark by among others the professor Inge Røpke. The main idea of the concept is “(...) that human societies can be understood as biological systems – metabolic organisms, that are kept alive by circulation of energy and materials” (Røpke et al., 2017 - own translation). That is a limited area with limits to economic growth. In 2018 Kate Raworth published Doughnut Economy, where she also proposes a model for society in which there is upper environmentally limits and lower socially limits for economic growth (Raworth, 2017).

The concept of sustainability of today rely among others on the perception of the tolerance of the environment (Arler, 2014) and the focus at the increase in population seems to be absent. The concept of sustainable development is a very broad term usable for every layer in society. It can be practiced from an everyday life level to a corporate or governmental level. This is a democratic force in converting the society sustainably.

Regarding the agriculture, different actors respectively define and operationalize sustainable development within agriculture. The Sustainable Agriculture Initiative (SAI) defines sustainable agriculture at their web page as:
“(...) the efficient production of safe, high quality agricultural products, in a way that protects and improves the natural environment, the social and economic conditions of farmers, their employees and local communities, and safeguards the health and welfare of all farmed species” (Sustainable Agriculture Initiative Platform, 2019).

A research team at Bern University is working in the field of operationalizing the concept of sustainable agriculture and have developed a tool called Response Inducing Sustainability Evaluation (RISE) (Grenz et al., 2011, 2016). It is an interview-based method, that promotes sustainable development, at farm level, based on the sustainability-definition in the WCED report from 1987 taking not only the economical bottom-line into consideration, but also the social- and the environmental bottom-line (Grenz et al., 2011).

In society the sustainability term might sometimes be reduced to mere climate gas reductions from being a much more diverse and complex term, that operates within many themes.

4.2.2 Structural development – an empirical concept

The concept of structural development did emerge in my empirical data both in the pre-fieldwork phase and in the interviews. It did not show in the literature as a concept and it has been difficult to find theoretical definitions of it. Structural development is an industrial concept and is steered by an idea of endless exponential growth that is decoupled from planetary boundaries. Many economists before the industrialization did initiate this idea. First, it is a point of relevance, that nothing is able to grow exponential for eternity, since the appearance of some sort of constrictions is inevitable. Secondly, it does not make sense to talk about a steered exponential growth, when the theme is collaboration with natural systems and cycles. Opposing production systems that is within a build environment.

In the empirical data, sustainable development and structural development is emerging as each other’s oppositions; sustainable development represents an inward-going growth focusing on the quality of both economic, social and environmental growth. Structural development represents an outward-going growth focusing on the quantity and the economical bottom-line.

4.3 How champion farmers, neighborliness and expert assistance influences on diffusion of organic farming

There are different terms and concepts, that are relevant when investigating motivational factors for diffusion of organic farming. Based on the hypothesis “that a wide range of factors had influenced
the different distributions” (Risgaard, Frederiksen and Kaltoft, 2007) of dense areas of organic farming in north west Jutland, Marie-Louise Risgaard, Pia Frederiksen and Pernille Kaltoft has found three specific factors that influences on the distribution of organic farming. Their study is based on interviews in two different geographical areas of north-west Jutland, that had the same economic – and bio-physical conditions for diffusion of organic farming, however there was a high difference in the density of organic farms in the two areas caused by socio-cultural barriers and promoters. These barriers and promoters were condensed in different factors. The three most significant factors are:

1) the presence of champion farmers
2) the effect of neighborliness
3) the impact of expert assistance from local agricultural advisors (Risgaard, Frederiksen and Kaltoft, 2007).

First, if pioneer organic farmers succeed, they have the opportunity to act as champion farmers which have an effect on how the socio-cultural acceptance is realized. And likewise, if they fail, it has an effect and the organic practice is not accepted (Risgaard, Frederiksen and Kaltoft, 2007).

Secondly, distances between farms are an important factor to the diffusion organic farming. Risgaard, Frederiksen and Kaltoft call it the neighbor effect. For example, they found that small distances between the farms promoted neighborliness and cooperative practices in one area, where in the other area, long distances combined with large differences in type of production are the main reason for why there are not a cooperation between the organic farms (Risgaard, Frederiksen and Kaltoft, 2007).

Last, it was found that local agricultural advisors act as opinion multipliers:

(...) agricultural advisors are known to be ‘‘opinion multipliers,’’ exercising a great deal of influence on farmers’ choices. Therefore, a negative attitude towards organic farming here may result in would-be converters continuing to farm conventionally. Such situations have been reported by several authors since the 1980s (see Lampkin, 1993) and remain a problem today (Risgaard, Frederiksen and Kaltoft, 2007).

Summing up, the economic and bio-physical conditions made conversion possible in these areas. But whether or not a high number of conversions successfully took place were steered by norms and values synthesized in the three empirical factors found in their fieldwork. Namely how close organic champion farmers is placed to other organic farmers, how dense the organic community were in the area and how the advisory service was positioned in the local community.
5 Analysis and Discussion
I will make descriptions of six farmers and their worldviews in order to describe their practices and how they perceive the world. Further, I will present the following deduced themes, in the frames of each farmer: as nutrients and fertilizers, societal development (structural - and sustainable development). The development of the use of commercial fertilizer is a consequence of the industrial development. Increased sales demanded commercial fertilizer and commanded it out to the market. It outmatched the sustainable development and nature.

I will also present the induced themes, which are specific to each farmer, these were revealed by the word frequency tool in Nvivo12. After which, I will describe the specific decision of each farmer in order to outline why they chose their current way of farming. The decision was found to be an important concept to grasp the individual farmers; it insinuates a transition or a movement from past, present to future. Analytical induced themes will appear along the way of the analysis.

The farmers are anonymized by name in the analysis. For more elaborated thoughts on the categories of the farmers see page 8 figure 2. After each introduction a word cloud will be presented in order to let the reader get a fast overview of what inductively found themes are in each interview. The word cloud shows the 50 most frequent words in each transcribed interview. So, the words can both be something the farmers are, do or produce, or something that they are not, do not do or do not produce.

In the analysis I will further distinguish between the term’s conversion and transition. Conversion I will use for descriptions of the official process of getting a certification for organic farming. And transition I will use in descriptions of the process of going from one knowledge paradigm to another and from one practice to another.

5.1 Farmers in category no. 1: Newly educated organic farmers
Ida and Alfred are a couple that meet at Kalø’s Organic Agricultural College in Rønde in east Jutland. During their stay at the college they were interns at the farm Fokhol in Norway and at the farm Stengården in north Zealand. The farms were both 110 ha. in size.

Just before their stay at Kalø organic college of agriculture had come to an end, they took over a small farm on Samso in January 2018. They are now keeping a little area of land that is in total 14 ha. They cultivate approximately 10 ha of them. Despite only having been farming on their farm for one season in the autumn of 2018 they won a prize and the title of being Organic Farmers of the Year 2018 by the Danish supermarket Netto. Their customers are locals and tourists that use the farm shop, and they make deliveries to two folk high school and one ‘efterskole’. Further, they are part of community supported agriculture (CSA).
They employ one subsidized part-time worker, who help with practicalities year around and one farming-assistant who is working full time during season together with 3-4 voluntary assistants helping out sew, thinning & up-potting, plant out, water the plants, weed the fields, to harvest and keep their shop running.

They produce a diverse amount of vegetables with approximately 180 different varieties every year and they hold 300 chickens in two chicken runs, that provide the holding with approximately 8,000 eggs per month and keep the soil fertilized. The farm is owned by a joint-stock company Samsø Økojord, that is managed by a foundation called Samsøkologisk, that was initiated by the association Økologisk Samsø. Ida and Alfred rent the place from Samsø Økojord, it is Ida and Alfred’s responsibility to run the business and they earn any potential profit.

The place has been cultivated organically since 1987 by Ingvar, who inherited the place after his dad who kept a small conventional holding for growing vegetables.

From the word cloud below the reader can get an overview of what is important to the farmers Ida and Alfred and what we talked about during the interview.
The following sections is initiated by going through the themes of nutrients & fertilizers and the societal development concepts; structural-and sustainable development. Thereafter, I will go through the themes soil and Samsø, that are the most significant themes from the interview. Lastly, I will analyze their decision process behind their choice of practicing organic farming.

5.1.1 Nutrients and fertilizers
Ida and Alfred act as organic experimenters in regard to a fertilizer-technique, that they are rather alone in implementing on Samsø. They are the only ones on the Island trying out surface-composting, with this they stand out from the other farmers; they do not depend on other farmers in their local community to succeed with a new technique before they try it out. Alfred say:

(...) we spray with biological substances; in our case we namely spray with lactic acid bacteria for this project called surface-composting. Right now, it is still an experimental pilot project that we are trying out (transcript, Ida & Alfred 2019).
They started out the pilot-project last season by spraying at a minor area and this year they tried it out on a larger area of one hectare. Alfred explained with a lot of practical knowledge the process of surface-composting thoroughly. The process is initiated by spraying with lactic acid bacteria on a green grass field. The lactic acid bacteria you spray is a sort of a ferment. Afterwards the very top layer of the soil is milled. And then it has to sit for a week before you can see how the bacteria has broken down the grass until only lignin remains. This part of the process makes the nutrients accessible. When the material has been broken down, you mill the surface again. It is a way to store carbon in the soil. In the long run there will be so many active bacteria, that you only have to spray once. But in the beginning, you have to spray twice, with a week in between, to keep the metabolism process alive (transcript, Ida & Alfred 2019). This could place them in the knowledge paradigm of soil fertility, where the focus is on the condition of the soils and how they can support natural systems.

Instead of using new technology to overcome the natural limits, Ida and Alfred are using techniques and technologies to work within the limits of an area they are able to hold and take care of; the self-stated limits. The farming industry in general is known for overcoming the natural limits to growth by an increase of power and technology at the expense of biodiversity, fertile soil and safe groundwaters. Putting out working limits to our food-production is needed, else will nature do it in terms of soil erosion and collapse of ecosystems (Meadows et al., 1972; Raworth, 2017).

Surface-composting is part of the system of regenerative agriculture, that is a system of farming practices and principles which regenerate the nature in the practices of farming. This regenerative agricultural system is defined as a farming system that “increases biodiversity, enriches soils, improves watersheds and enhances ecosystem services” (Terra Genesis International, no date). Ida and Alfred’s use of surface-composting is inspired by the agronomist Martin Büchert Beck, who is consulting on regenerative agriculture. They are not defining themselves as regenerative farmers as such (Ida & Alfred, 2019).

Besides experimenting with surface composting, they also experiment with composting seaweed and using it as fertilizer. The experimenter role in regard to fertilizers is supported by their decision that they would not go to the mainland to pick-up manure:

*Alfred*: We made it clear from day one, that we will not import manure from other places than Samso. That is, we will not buy any from the mainland. Because it is simply too foolish to transport manure that far. And as far as possible we want to be self-sustaining with nutrients. (...) we have a fraction from the chickens, and we have tried to compost some seaweed this year (...) that we just need to experience the effect from (transcript, Ida & Alfred 2019).
So, this decision pushed them into the experimenter role and support them in trying out different possible sources for nutrients on the Island.

Ida reflects upon the fact that the plants contain natural matter from the air; the plants take just very few nutrients away from the soil if you use the right kind of nitrogen-fixing plants. Which means that the soils can be kept fertile in the long run if for example legumes are used in crop rotation. She references the experiments that Liebig made to establish his theory in the 1840s, to conclude that the nutrients come from the air, if you sow the right nitrogen-fixating plants. The nutrient flow in the soil may be inaccessible to the crops that are grown at the field and the nitrogen-fixating plants do support the nutrients in making them accessible to the crops.

*Ida:* (...) if you burn of a cabbage, there is not that many minerals left in it; there is namely much water, there is much carbohydrates, that comes from the air. And then there is proteins, that also comes from the air if you got the right nitrogen fixing plants. Ergo, there is not many natural resources left, that comes from the soil. Danish soil is actually very nutritious (transcript, Ida & Alfred 2019).

By this reflection it is clear, that she uses the theoretical knowledge that she has learned at the agricultural college. It also shows an ecological focus, that is based on the idea of nature’s own cycles of nutrients, that Liebig recommended to make use of in the agriculture (E. Siebeneicher, 1996 in Kaltoft, 1997). Nitrogen-fixating plants are cover crops that make the soil fertile with accessible nutrients; the root-bacteria make the nutrients accessible from the air (Thorup-Kristensen, 2005).

5.1.2 Societal development; structural - and sustainable development

They have been running the business of the farm for a year, so they have not yet established an economy, that can pay themselves a proper salary. They need to grow in part to pay themselves but also in order hire a farmer’s assistant, that can support the farm on yearly basis. They live a simple life with very few expenses. In the period from 2014-2018 farmers families with 1-2 employees in Denmark earned 678,000 d.kr. in average per year (Nørtoft, 2019). Alfred reflects upon what a proper salary is to them and think that 200.000 d.kr. each would be much relatively to the lifestyle they have; they do not own the farm and they do not have kids.

*Alfred:* (...) And what a proper salary is in relation to this, we do not yet know. Because in that way we live, if we should pay us selves 200.000 d.kr. each, that would be much. But that is also because we live lightly. But on the other side from a societal perspective, then we are supposed to reach that point where we can pay our selves perchance 200.000 d.kr. each. (...) I usually say when people ask concrete questions, that I think we should reach a point where we have a turnover
at around 1.200.000 – 1.400.000 d.kr. with those costs we have now, in order to both pay one assistant and ourselves (transcript, Ida & Alfred 2019).

This place them in an awry position to the general societal development. In regard to payments it also makes them stand out in the group of farmers I talked to; their focus at the holding lay more or less entirely on the soil and the outside areas, on which they depend on to be respectively fertile and functional. They do not have a housing-loan in the bank, and they remain their financial autonomy. Alfred and Ida strive towards a sustainable growth, that grows inward, instead of a more outward structural growth. Alfred redefines the growth term:

Alfred: (...) growth is not necessarily, that you must get bigger and everything should go one way. Because I think you also can grow inwards, and it is that idea that could be great to get redeemed here. Instead of saying that we have a great business, (...) we want to be able to say that it is going great now, how do we support it to get even better within the financial frames we have now. So, we are not forced to make investments and we can make all the small margins (instead) and get this to be as good as possible within the context we have now. Because then I think we stand with much more freedom (transcript, Ida & Alfred 2019).

He establishes a growth concept, that focuses on growth within the natural environmental limits. Further their autonomy term is defined by ‘not having to invest’; they believe they get more freedom from being independent in terms of economy.

They experienced the structural development on firsthand concerning the numbers of small-scale farmers.

Alfred: We have a neighbor, who is called Hans Christian, who is a lovely old man, who unfortunately will retire next year. He has around 15-20 hectares as well and did have vegetables also at round about four to five hectares. And there has always been a collaboration between him and this farm. And when he is out of business next year, well, then there will not be any in the neighborhood that we will collaborate with. And of what I understand, because there have been all these small holdings on Samso, there have been these collaborations, but it has disappeared, yeah, like in rest of Denmark (transcript, Ida & Alfred 2019).

Next year Ida and Alfred will lose a collaboration with another small-scale farm in the neighborhood and it is a general tendency on Samso that there have been many small holdings, that were part of a bigger collaborative network. This development is what the joint-stock company Samso Økojord is trying to counteract by buying the small-scale holdings on Samso and lease them to start-up farmers "who, in this way, have better conditions to start up and focus on the development of the ecology at the farm/organic farm" (Samso Økojord, 2019, own translation).
Regarding the agricultural development in society towards a mechanistic perception of nature is framed by financial reasons and the urbanization, that got more people away from the food-production at the countryside, meaning consumers could not see how food-production was done. Ida elaborates on why the development took a turn away from system thinking:

Ida: (...)

Ida makes the strong statement that pesticides are made to kill, which supports her argumentation against it. She also implies that we have to move on from the historical reasons for why we still use pesticides in agriculture, since we now know more about the connections and we know that the pesticides will end up in the groundwater.

5.1.3 Specific themes for this farmer
The two most frequent inductive themes from the interview with Ida and Alfred was the soil and the island of Samsø.

5.1.3.1 Soil
In general, they are not necessarily talking about soil as a decided theme, but they rather have it as a focus when talking about different types of farming systems, such as regenerative and conservational agriculture. But in the following Ida talks about soil as a theme and she reflect upon what makes a healthy, good soil.

Ida: Then if you have some plants, that facilitates a healthy soil, that is where there are various sorts of bacteria, mycelia, nematodes, rove beetles, etc. That is a soil that have a cycle, so the plants will be supplied with phosphorus; we have soils (in Denmark) that are rich on phosphorus, but we do not have healthy soils; there is no connection between the plant, bacteria and the soil and phosphorus. A connection that are able to supply the plant with phosphorus (transcript, Ida & Alfred 2019).

If the soil is healthy it will supply the crops from the natural flows of nutrients. She defines a healthy soil as a closed resource cycle, where the diversity is high. This confirms my placement of Ida and
Alfred in the paradigm of soil fertility, where you believe in the fact that every microorganism supports each other in a network of biodiversity.

5.1.3.2 Samsø
Ida and Alfred came to Samsø primarily because of the constellation of the farm, which they could rent by Samsø Økojord. Ida had only been on the island a few times and Alfred had never been on the Island before they moved there. Alfred was a bit concerned about the possible village gossip, but the fact that there are approximately 3700 inhabitants on Samsø eases the gossip a little (transcript, Ida & Alfred 2019) (Samsø Kommune, 2019). Ida and Alfred’s business with the farm is vulnerable to the potential gossip on Samsø, since they are newcomers and stand out in their farming practice. In one hand, this shapes a barrier for them being organic farmers in a local community on Samsø, but on the other side they are supported by the local community because they are young.

Alfred: I think the locals in general welcome you kindly. I believe that everyone on Samsø are welcoming the young people. No doubt about that. And it is no matter who you are, in spite of some people also think that we are idiots just because we are organic farmers and because we do what we do. Or that we are weird or what they are thinking. Then they will welcome us among them. Just because we are young. Just because you have that title then you are welcomed. And it is great (transcript, Ida & Alfred 2019).

And because of their experimental behavior combined with their success they are acting as champion farmers (Risgaard, Frederiksen and Kaltoft, 2007) in the community, which might be an important factor for the general conversion trend on Samsø.

5.1.4 The decision of being organic farmers
Their decision of being organic farmers came to them respectively very natural due to their upbringing. Alfred made it clear that: “(...) it is a matter of course that I choose to be an organic farmer; (...) So, it was because I am against the use of pesticides and I was pro better animal welfare” (transcript, Ida & Alfred 2019).

The reason why it is a matter of course for Alfred to be an organic farmer can be explained by the immaterial inheritance he got from his parents. His mom worked as a laboratory technician in a company, that had unsustainable chemical waste-practices that she could observe and tell about, around the dinner table. And his dad has been very keen on the idea of self-sufficiency. One of the factors for Ida’s decision can also be explained in the presence of immaterial inheritance. Her mom had a big garden where she grew up. In this garden her mom grew a lot of different crops and flowers (transcript, Ida & Alfred 2019). These immaterial inheritances shaped their way into the organic
agricultural college where they met and decided to go to Samsø to take over the organic small-scale farm.

5.1.5 Summing up
Their ways into organic farming was framed by their respective upbringings with ideas of organic gardening as immaterial inheritances. Ida and Alfred are working within the paradigm of soil fertility being champion farmers who support local sustainable development within agriculture.

5.2 Farmer in category 2: Organic farmer, who have been organic for 10 years (plus/minus).
Malthe is number four in the line of generations at his farm. It has been in the family since 1869. He went to Kalø Agricultural College at Djursland in the late 1980s, which was before it merged into an organic agricultural college. After Kalø he went to the agricultural college of Næsgaard (1799-2009). He keeps the farm with fields for crops and have done it organically since 2002. He primarily grows grains for flour. He makes the flour himself in his own mill that he invested in recently. He has three varieties of wheat; dinkel wheat, wheat of Øland and common wheat. And two varieties of rye; secale (slash-and-burn rye) and common rye. He is interested in old varieties of grains, but still keep some of the common varieties for economical safety reasons. Secondly, he keeps red clover for seeds and nitrogen-fixation especially for the wheat-fields. He also got broad-beans almost entirely for the reason of crop-rotation and nitrogen-fixation. He does not have any farming assistants, and to keep the farm going he sold the farming machineries and hired a company to do the work at the fields. From the word cloud below the reader can get an impression of what is important to the farmer Malthe and what we talked about during the interview. The most significant themes are grain & flour and the farm, these themes characterize his passion and production.

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1 In 1897 the first group of pupils started at Kalø Folk High School at Djursland in east Jutland (the school later developed into Kalø Agricultural College). In 1982 the Organic Agricultural College in Vendsyssel in north Jutland opened their first year of teaching. In 2003 the two schools merged into one at Djursland and became Kalø Organic Agricultural College (https://www.kalo.dk/historie/).

2 Næsgaard agricultural college was placed in south Zealand. The first year of teaching was 1799 and it closed down in 2009. Today it is remained as ‘efterskole’.
In the following sections I will analyze the deduced themes nutrients & fertilizers and the societal development concepts; structural -and sustainable development. Thereafter, I will analyze the induced three most frequent, more specific themes, that is characterizing the interview with Malthe: grain & flour and the farm. Lastly, I will analyze his decision of choosing to practice organic farming.

5.2.1 Nutrients and fertilizers
His nutrients practice is focused both on picking up manure and on using large-scale organic crop rotation. He uses red clover and fava beans. The theme of nutrients and fertilizers is not as strong in the interview with Malthe as with some of the other farmers, since his focus is upon the mill and flour production and not as much as on the field practices, at least in March when I visited.

*I have red clover for seeds, which are nitrogen engine for especially the wheat fields. Then I have fava beans entirely for the sake of the crop rotation and because...*
they also pick-up nitrogen by themselves, but also to have some crops other than grain (transcript, Malthe 2019).

This describes his cover crop practices with the use of red clover and fava beans. Being a farmer producing grain takes relatively long time from you sew until you harvest.

The green field out there, it is seeded in august last year. The other crops such as red clover stand out there for one and a half year, but you do not feel it in the same way, since you have got another crop on top of it (transcript, Malthe 2019).

He uses clover to fixate nitrogen for the grains he is producing, that means that it takes resources in terms of time, which he thinks, is better than the alternative which is to buy expensive commercial fertilizer (transcript, Malthe 2019).

5.2.2 Societal development; structural - and sustainable development
Malthe feel a societal economical hierarchy that are keeping the food-prizes in the intermediary companies low, which can explain why many farmers struggle economically. The farmers profit did not grow along with the qualification in terms of better techniques and better machines and neither along with the rest of society. The profit went elsewhere (transcript, Malthe 2019). The structural development in society had an effect on him as farmer. The farmer is the one taking care of the land and food production and have a high connection with nature and natural cycles. The supermarkets or other intermediaries pushes the farmers into a situation that might shape barriers to higher the connection between nature and humans, because they need more efficiency and produce more in terms of quantity in order to gain profit. Because this condition of supermarkets and other intermediaries ruling the scene for commerce supports a structural development that natural cycles and food production does not fit into.

Malthe: And the one that is lowest in the hierarchy is the farmer, and it has always been like that. Back in the days the farmer should be the courtier for the landlord. So, I think that it is strong market forces that are going to hold the food prices down. And all the linking actors that are in-between they just push downward and when they reach the farmer, they cannot push any further; the farmer cannot be pushed extra (transcript, Malthe 2019).

He experiences that the farmer is lowest in the societal hierarchy regarding who is setting the premises for commerce. At some point the societal pressure in terms of structural development forced him to convert into organic farming with focus on quality instead of quantity, since he could not make his practices more effective than it was already. He chosed the niche-production of making flour of self-produced grains, this makes it possible for him to live from his farm:
Malthe: (...) it is a niche that safes me – without the mill I would not have had the farm today, that is for sure. Then I would have had the farm as a hobby farm, and I would have had a job besides farming. And I am very fond of the mill and I like that kind of work, and it is nice, and I enjoy it (transcript, Malthe 2019).

The conversion into flour production is what that keeps him going both economically and in regard to job satisfaction.

*Structural development* function in productions, that does not depend on the weather and seasonal changes or other natural systems or cycles. In many cases it is expected from supermarkets or other intermediaries, that the idea of a production-factory will fit an agricultural production. Supermarkets or other intermediaries expect that they can order a certain amount of a field-produced crop half year or more before it is ready for harvest. Supermarkets or other intermediaries expect in many cases that the field or a farm function like a factory. Malthe compare the farm production with the production of cars at a human-build factory:

> Malthe: (...) a car factory is able to plan its production into every detail from they push the assembly line or until they begin to role sheets, then there will go so and so many hours and minutes before that car is ready for this and that car is ready for that. And this means, if you have a costumer, (you can say) it will last so much time before what you ordered is ready. And then the things just go around, day and night. An oatmeal fabric also runs like that, (...) if they just get the raw material they need in time. When the raw materials stem from a context, that operates with something living, that are depending on season changes, then it starts to be difficult (transcript, Malthe 2019).

The farm or the field does not function like a factory, and you are not able to plan out every little detail, since food-production relies on weather and seasonal changes. And the point, made by the farmer Ida, about consumers started a dis-connection to the country during the industrialization and urbanization, which decoupled them from the food-production and how it is done can also explain the supermarkets decoupled expectations.

Sustainable development, as a many-faceted term fits better into the food production industry, since it acknowledges natural cycles in production systems. But the term of sustainability is influenced by a lot of uncertainty concerning what it actually means, which could be explained by the many facets it contains. Malthe reflect on the complexity of the term of sustainability. In practice some would argue that it is more sustainable for the soil that you do not interact with it, by using the no tillage system, but on the other hand the no tillage system, the way conventional farmers practice it, is only manageable if pesticides are used according Malthe (transcript, Malthe 2019). In theory the no tillage system in organic agriculture, machines in terms of a harrow and use of natural cycles replace the use
of chemicals, which means that groundwater is not contaminated, and the biodiversity is not opposed, and is more sustainable in regard to drinking water for future generations. This many-faceted-ness of the sustainable farming practices do not necessarily configurate barriers to the sustainable development in agriculture on Samsø, but it frames a controversy, between different farming paradigms. The conventional farmers, who adopted the no tillage system, act as opponents to organic farmers despite they agree in the fundamental idea of collaborating with nature by using some of the ecological principles in their agricultural practices. The controversy is a barrier to the diffusion of organic farming.

The development on the island of Samsø affects the sustainable development because in several sectors there is a tendency to think and act circularly. The organic farmer Malthe do not only practice sustainability in his agricultural farming practices but also in his electricity-production and in his reuse of waste for heating.

*Malthe: if you are going to look isolated at it, I contribute more to CO2-savings, because I have a big electricity-production, that operates on the wind. And all the other practices I do at the farm, it is (among others) recycling waste to heat (transcript, Malthe 2019).*

These concrete practices in circular economy are examples of the green transition that is taking place on Samsø, and it is also an example of a farmer who is in the mindset of system thinking to make his farm sustainable.

He has experienced the conversion of going from conventional farming to organic farming. And the conventional farming was characterized by a growth that was influenced by the structural development at his farm. During the financial crisis he realized that this kind of growth was not sustainable. So, he changed to a sustainable growth focusing on the quality of what he already had during his conversion into organic farming. This kind of growth can be called inward-going growth.

In the following he is reflecting on his ideal way for him to farm.

*Malthe: The most obvious answer would be to buy plenty of more land, that I have tried, and it went wrong during the financial crisis, so, the 80 hectares I got left, is what there is left to the main property. It lies around the farm. I had 80 hectares extra, that I had to sell to survive. And I think, if I was completely autonomous and was able to, then I would conserve this as it is. The mill should be considerable bigger, my silo facility down there, would be much better; even bigger and then I would sell a lot flour and I would visit all farmers over here, where after they would convert into organic farming (transcript, Malthe 2019).*
In his ideal view of his business he would go all in on the flour production and conserve the grain fields he has. The growth should be in a network of farmers on Samsø that produce organic grains and not at his individual farm. And he already initiated building this network on Samsø:

Malthe: (...) I am addressing farmers around here and last year I bought grain from the neighbor over there. (...) I have announced to the next farmer, that I am interested, he is arriving to a point where he can produce something for me, because I do not have enough soil on my own. And instead of buying new land, which is not economical possible for me, and if it was possible it would not be that way I would go. I am going to develop the business and buy up grains during harvest season. That would be the obvious thing to do (transcript, Malthe 2019).

He chose networking instead of growth in areal size. He is an actor that spread the idea of practicing organic farming on Samsø, which support the diffusion of organic farming on the island, since he is making it possible for farmers to sell it locally to him in a deal that also support his colleagues. So, the way he is not entirely discharging economic growth, he is not growing in land area but in produced flour.

5.2.3 Specific for this farmer

The most frequent inductively found themes for Malthe are grain, flour and the farm.

5.2.3.1 Grain and flour

The properties of grain and flour were not a theme as such in the interview I had with Malthe. Grain and flour are rather a term for a proper economy to Malthe; It is the main source for his income. And as mentioned above collaborations on grain are important to him. The grain production was initiated before he got his mill and it was initiated by a demand for flour-grain from Per Grube from Mørdrupgaard in North Zealand. Per should use two different varieties of wheat for a flour-project with the Danish TV-chef Claus Meyer. According to Malthe, Per contacted him because he was starting a flour-project and would be sure to have a stable harvest by spreading the growing areas on a big geographical area (transcript, Malthe 2019).

This is an example of how farmers work their way around the dependency on weather and seasons change in organic farming by collaborating with each other. You cannot change the weather, but you can build networks across the country to be resilient to a possible no profit situation in one area due to the weather. They accept the terms of nature’s own cycles and work together to gain profit.

Some of his costumers are characterized by putting orders very unexpectedly just few days before deadline (transcript, Malthe 2019). Being a good customer, placing orders on an understanding of the farmers work conditions, is a hard-fine balance. You can act like the above-mentioned supermarkets,
who make big orders of a harvest, more than half a year before it is even harvested. And you can act like Malthe’s customers, that place orders days before they expect it to be ready. None of these customer-practices shows understanding for the production condition formed by natural cycles. His customers came to him in the beginning, because they have heard about him in the organic grain and flour producers’ network and he experienced a field of high demand (transcript, Malthe 2019). Being in a field of niches producing organic flour for baking, he did not need to contact customers.

5.2.3.2 The Farm
The high frequency of the farm-theme for Malthe reflects the fact that he grew up at the farm and much of his development-engagement lay at his farm and the infrastructure for production. As described in the introduction of Malthe he does not have any employees anymore, which release time for these engagements.

The average age of farmers in Europe is rising as well as in Denmark. The young farmers in Denmark is unable to buy farms and start a farming business, due to several obstacles. Both due to the fact that more and more people, including young people, moves to the cities (Danmarks Statistik, 2019a) and due to the high prices of the land. So, structural support is needed to support young people to stay, so the generational shift can happen to secure future Danish farming. Malthe reflects on how we can be inspired by Italy and how the shift happens there to support Danish generational shifts. In Denmark, the banks are by the economical roar where in Italy it is the family themselves, that are by the roar:

*Malthe: (…) For example, Italy. They have a whole other culture in the domain of farming, because when a family farm shifts its owner in the family, then it is just the next that is taking over (…) It is father and son and grandfather perhaps, that have the farm; so, it is the young one who takes over, (…) he is not going to (buy the farm). Here in Denmark you have to buy the farm from your parents, so we sit financially hard (…) because if one’s father has been really good, then he must not just give the farm away to the son; you need to buy them at public value minus some small regulations. And that makes the big difference (transcript, Malthe 2019).*

The market has taken over in Denmark in regard to farm-ownership, and that pushes many young farmers away from the possibility to even try buying a farm because of the high prices.

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3 “As reported in the 2016 Labour Force Survey (LFS), in the EU-28, 31.8 % of the agricultural labour force was below 40 years old compared to 42.4 % in the total working population. 59.2 % of those working in agriculture were 40-64 years old, against 55.2 % of the overall working population. 9.0 % were older than 64, compared with only 2.4 % in the total working population” (Eurostat, 2017).
5.2.4 The decision of converting into organic farming
When he was still a conventional farmer, he had a hard time seeing how he could gain profit from the hectares he owned at that time. In 2001-2002 he experienced a wave in organic farming in Denmark and he started to investigate the potential profit to pick up if he converted. He could see from his calculations, that converting into organic farming would not bring a profit, but he believed that there was progress in demand for organic products (transcript, Malthe 2019). And he decided to convert. The decision was supported by experiences of how nature can support and not only being an obstacle to the production. The experience happened few years after he converted into organic farming, where he was experimenting in producing grains for baking, and to compensate for the possible loss in the field of baking grains, he had a lot of hectares with one type of grain - triticale, it is a combination of rye and wheat. It is developed to be resistant to pests, and therefore it gave a stable yield the first couple of years. But a year, one of the pests, called yellow rust, the crop was supposed to be resistant to, mutated, and he lost 80 % of the yields that year (transcript, Malthe 2019). The conventional way of farming, would have been able to use pesticides in this situation, staying in a mindset that nature is something that should be fought and not collaborated with. He thinks that it is wrong to cultivate plants to be resistant to specific pests, that are out there, since the pests will only mutate and then you will need a solid economy to cover for what is lost (transcript, Malthe 2019) and a new kind of crop that is resistant to the new mutation.

So, in the end it keeps the farmers dependent on the banks to make loans to cover for lost yield and on the market for plant cultivation to make new resistant’s in the plants until a new mutation happen. And this is a barrier for the very important autonomy, that is a driver for most of the farmers I have talked to during the fieldwork. Malthe lost his economic autonomy when he experienced the 80 % loss and made a loan in the bank to cover it (transcript, Malthe 2019). From that experience he learned, that it is better to grow many varieties on the field instead of one variety in majority. When he has a high diversity in types of grain “It's kind of like they can handle it because they're not 100% resistant, they receive a little, but they can handle a bit of it all, so they get through it” (transcript, Malthe 2019). His coping with this experience supports his decision in converting into organic farming by moving him the nutrient paradigm to the soil fertility paradigm.

5.2.5 Summing up
A complexity exists in the sustainable farming concept, that frames a controversy between different farming paradigms might be a barrier to the diffusion of organic farming. And it might as well shape a barrier for the conventional and organic to unite in common sustainability perceptions.
Malthe is supporting the diffusion of organic farming on the island by spreading the idea of practicing organic farming on Samsø in his practices of making it possible for his colleagues to sell organic grain locally to him. His experience with losing yield formed his way into the soil fertility paradigm which support his decision to convert from conventional farming to organic farming.

5.3 Farmers in category 3: Conventional farmers, who are in an organic conversion process

In this category I interviewed two farmers. First, I will present Lucas and the important themes that the coding revealed. This will be followed by an analysis of his decision of converting into organic farming. Secondly, I will present Noah and the themes that revealed by the process of coding and this section of category 3 will be finalized with an analysis of Noah’s decision-making process.

Lucas is born and raised at the mid-Island at a small household with approximately 7 ha. land, seven cows and 12 pigs. His family have been at the Island for many generations. He went to the Agricultural College of Malling in east Jutland. In 1988 he started up a berry-production at a farm at the south-Island and today he keeps 500 ha land whereas 30 of them is for the berry-production. He grows grains, oilseed rape and kale at the remining. He is a part of the cooperative Samsø Bær, that was initiated approximately 15 years ago. He has converted his rye and broad-bean production into organic production and in April 2019 he ended a three-year long conversion process and got he the organic certification. He has three employees on yearly basis and during season with tipping point in mid-June, he approximately employs 100 season-workers from east Europe.

From the word cloud below the reader can get an expression of what is important to Lucas and what we talked about during the interview. The most significant themes are berries, strawberries and the island of Samsø and organic farming.
In the following sections I will analyze the deduced themes nutrients & fertilizers and the societal development concepts; structural -and sustainable development in the context of the interview with Lucas. Thereafter, I will analyze the three quantitative induced themes organic farming, strawberries and berries. Lastly, I will analyze his decision of choosing to convert some of his fields into organic farming.

5.3.1 Nutrients and fertilizers
Lucas’ fertilizer practices are built upon the use of conventional manure from the island and the cultivation of fava-beans in his crop rotation and in the future when the island lack even more manure, he might be having clover in his crop-rotation.
Lucas: Right now, we buy or get some conventional manure from the island. And then we sow some broad beans, that are nitrogen fixating and are not getting manure. And the fertilizer you are going to use there, you must move it to the rye field. We are going to plant rhubarbs now the 7th of April. They are having much fertilizer, it is the challenge with rhubarbs, they are very demanding on fertilizers. So, they are going to be planted where the broad beans have been, or you have to give them extra manure and then we are going to save it other places. But we lack conventional manure and alternatively you are going to grow some clover as well (transcript, Lucas 2019).

Despite he only has converted the rye and fava-bean production into organic farming, his fertilizer practices reflect an adaptation of the organic fertilizing practice, which places him near the soil fertility paradigm concerning the field productions. He still is in the nutrient paradigm concerning his berry production. It is very hard to grow organic berries because of the fertilizer-problem. The problem with fertilizer might come from the fact that he is fixed in the conventional mindset concerning the berries. On Samsø the tradition is to have e.g. clover in between the rows of berries, but according Lucas, it is only possible in conventional farming due to the use of herbicides and more innovation is still needed in this area of organic production. It is hard to have for example clover in between the rows, because it will spread into the rows and then you would need to spray with herbicide, which only makes this fertilizing practice suitable for conventional berry-production (transcript, Lucas 2019). He is not keen on the clover practice yet in organic berry production; he have not yet experienced or heard about a success with using clover as fertilizers in the organic berry-production. The perfect fit would be to grow something that does not spread but stays where it is sown (transcript, Lucas 2019).

He is scouting for organic berry fertilizer practices that he can take into use and have heard about an experiment, where the experimenters investigate how much nitrogen they can keep in wrap-bales, growing the clover elsewhere and wrap it up in bales to save it for later use. But it would be even smarter to find a solution for keeping it in between the rows of berries in order to save time (transcript, Lucas 2019). And because it is what they are used to on Samsø. He reflects the nutrient paradigm in his way of thinking of the crops, that should be kept clean from weed. He is open-minded and is ready for new organic methods that fit into the way they do it on Samsø (transcript, Lucas 2019).

There are not nutrients enough in the agriculture according to Lucas so experimenting with new methods is needed in order to fill in the gap of needed nutrients. He attended to a lecture about surface composting, a practice Ida and Alfred is trying at their farm. In the following he reflects that he is not an experimenter himself, but that he is depending on the ones that are.
In1: Yeah. We (...) attended a lecture and it is super good. It could be fine, if you could find a compromise, because we agree on plants needing fertilizer. No matter how much organic you are, if they are not getting fertilizer or nutrients, then nothing will grow. So, you get the nutrients so you can get the plants to grow. Then you do better with weeds and other things. So that is why you are (experimenting), because there are just not enough nutrients (transcript, Lucas 2019).

Lucas is asking for a compromise between the organic way and the conventional way of farming, which reflect that he is just in between the nutrient paradigm and the soil fertility paradigm; he sees the good things in what Ida and Alfred is doing with the use of surface composting in the fertilizer practice, but he is focusing on the plants need for nutrients and fertilizers, placing him in the nutrient paradigm.

5.3.2 Societal development; structural - and sustainable development
Each farmer experiences the societal development in some way or another. Lucas describes his experience:

Lucas: Our economy in general has just gotten worse. So, we are a group that operates with the same salary and then we just become more efficient all the time. So, my mom and dad had approximately 7 hectares (land) and I run 441 hectares of land. And we still only get rye bread and liver pastr, you see. So, every time demands have been put on us, we have just become more efficient. Without getting anything out of it (transcript, Lucas 2019).

He describes the structural development of society taking place in his holding as well, but as he describes farmers did not become richer when they became more efficient. This kind of development shapes a paradox when the development does not take place in a factory environment but in natural systems, where depend on fertile soils and good farming land. When you can grow 63 times original size during one generational shift without gaining capital it might indicate that the economy of the development in Danish agriculture is out of balance. It might indicate that the structural development we know from factory sites do not function in the terms of farming.

In the following Lucas tells about how the lack of practical knowledge among politicians, who regulate on Danish agriculture, influences the work of farmers. Lucas experience a lack of connection between the countryside and the Danish parliament, that eventually create an increase of numbers, rules and regulations, that are meaningless to the farmers and barriers for each farmer, since it takes time away from the real work that creates profit.

Lucas: Well, right now, those who are being wise about farming have no sense of agriculture and have never worked with agriculture. And it is, of course, easy to sit in Copenhagen and have a lot of attitudes and ideas that you just suddenly come
out with; now you must do this, now you must do that. And then you sit completely; ‘but it is not possible, or it will get completely crazy when you just come up with such ideas without knowing’ (…) And there are simply so many rules descended, so it is absolutely crazy (transcript, Lucas 2019).

There is many prohibitions, rules and regulations nowadays concerning how to farm. It creates barriers to the farmers. This might call for a change in the regulatory machinery for how to regulate so it fits to the workflows of the farmers.

The question for Lucas is how to make profit while changing down in productivity and effectivity, right now the structures of agriculture does not allow it: “And there is a lot of people that has a lot of attitudes to things and would like us to go down to a lower level and that is actually ok, but then we just do not make any money” (transcript, Lucas 2019). This disconnection in the way you regulate on agriculture and the structural development shapes barriers for the farmers to transition their practices into more responsible practices – responsible to their economy, mental health and the natural environment. Lucas describes the structural development in practice. Farmers are compensating for the lack of income by getting better at what they already do; they qualify their farming practices by investing in new and bigger machines. Because of these investments, farmers depend more and more on banks to ascribe loans, which create another barrier to their motivation for doing a farm business – the autonomy.

He gives an example on the imbalances in the economy of the development of agriculture. The grain prices have not followed the general salary development among farmers and agricultural workers. In the following he explains the salary development that he has experienced since he stopped working in labour market:

Lucas: There has been a development, but it has just not followed the rest of the development. And we just compensate for that by being even better (…) When I stopped going to work, I got approx. 78 kroner an hour and now my people get twice the hour, but I do not get double for grain or double for all the other things, so that’s why. And we have to compensate for that by just buying bigger tractors and bigger sow machines (transcript, Lucas 2019).

Lucas explains the imbalances in the economic development between what he is paying his employees and what he is earning on selling grain, which are influencing his economy negatively and make him depended on the bank and consequently loosing much of his autonomy. He explains it as a reason why the agricultural machines had gotten bigger despite it was not being a need seen from an environmental local perspective.
Additionally, he finds an imbalance between the efforts and the amount of money he earns. He compensates from this imbalance by being more effective by investing in bigger machines. But it ends up in the pocket of the supermarkets. Broadly speaking, 95% of earnings from the added efficiency goes to the supermarkets. And he explains that they are hard to negotiate with: “But then we try to negotiate with the supermarket chain and something like that, but they are totally unreasonable. Completely” (transcript, Lucas 2019). So, the key to transition of the Danish agriculture lays in the hands of the customers according Lucas:

Lucas: Yes, and that means that the way we farm now, it is not just about being bad to the animals and polluting the groundwater and such, it is because it is the most efficient and cheap way to produce food, that is relatively healthy. So that's why you have to go back and say, well we the customers would spend a little more money on it and then you can get more biodiversity and all the other things in return (transcript, Lucas 2019).

The consumers expect cheap food, which motivates the farmers use of the most efficient and cheap production practice, producing relatively healthy food within the frames that are set by the consumers. Consumers also expect a higher biodiversity and clean groundwater. According Lucas cheap food and high biodiversity and clean groundwater does not fit together. If the consumers see and practice the connection between their personal economy and higher biodiversity and clean ground water and other environmental issues, the farmers could align.

But in this controversy, there is an important actor that play a role worth noticing namely the supermarkets and other intermediaries. They make the supply available for the consumers. So, on one hand, one can argue that the demand-pattern of the consumers is created by the supermarket. The supply-demand premise build on the idea that the consumers freely make a demand that the supermarkets make their supply from. This seems not to be the case in practice. One can ask questions like: Based on what concrete ideas and knowledge do the supermarkets make their supply? Do they believe in the idea of a simple supply-demand model? In that case, how do they let the consumers freely make the demand? There is a risk of this shapes a false supply-demand premise. On the other hand, in Denmark there is an example of supermarkets, that is owned by a consumer co-operative called Coop amba, where consumers have the opportunity to actively participate in board- and general meetings concerning supply- and associational decisions. Consequently, this might create shops with supply reflecting the consumer group of the specific area.

If you think in relation to the triple bottom-line of the economic, the social and environmental, the way you farm nowadays, that Lucas explains, reflects a view where economy is a premise for being
a farmer and the possible caring for the environment. That is an economy which is bigger than the environment. This shapes a paradox, since economy is human-made – the environment is not, which means that the environment will exist independent on humans. The environment has natural-given limits, where the human-made economy depends on groundwaters and ecosystems to be functional and healthy. So, one cannot use the three bottom-lines that are equal in size; the economical bottom-line should act within the limits of environment (Raworth, 2017; Røpke et al., 2017).

It can be overwhelming with so many development opportunities; there are so many ways of farming you can choose between nowadays and according Lucas it is characterizing the time we are living in:

Lucas: (...) It is an exciting time because there is simply so much change compared to when my parents started, they all went one way. Now there are 15 paths to choose from; ecology, biodynamic, do you have to plough or not. Well, there are simply so many directions that you have to make your mind up about (transcript, Lucas 2019).

He compares the amount of opportunities of today with the amount his parents were to choose between. The amount of opportunities has soared since the 1940s, where the entire agriculture was focusing on one way; on increasing yields every year for a growing population. Today there are many different farming practices to choose from in order to stay within the planetary limits (Raworth, 2017).

The deduced themes nutrients & fertilizers and societal development has now been presented and in the following the three induced themes organic farming, strawberries and berries that are specific for the farmer Lucas, will now be presented.

5.3.3 Specific for this farmer

5.3.3.1 Organic farming

Lucas is new in the field of organic farming and he is just discovering the struggles you can have as organic farmer with weed and insects.

Lucas: Yes. But we are new to organic farming. But we have kind of known about it and seen how to do and something like that. (...) but it has also been affected by animals. There are some animals that eat all the leaves. So, it is a huge challenge, I do not think those who say, 'now it all must be organic', that they realize how many years they will not get any berries (transcript, Lucas 2019).
The theme of organic farming concerns the struggles and the normativity the farmers experience from the consumers in the cities. He is experiencing a disconnection between the consumers and the terms of organic production, which shapes an unintended unaligned (to natural seasons) demand for organic berries that just make the import of organic berries rise, which undermine Danish organic production berries, that in the end undermine Danish organic farmers’ economy.

The roles of the supermarkets concerning the prices on organic products is not aligned with what it actually cost to produce organic goods; according Lucas they sell organic goods much cheaper than they cost to produce. Lucas has before explained how the supermarkets play an important role in regard to misunderstanding the seasonal effect on farmers economy and in the following, he explains yet another misunderstanding regarding agriculture: “(…) because the supermarkets believe that organic products should not cost anything. But organic products just have to cost more, that's just it. You do not have that much yield” (transcript, Lucas 2019). When you farm organically your yield is lower compared to conventional farmers yield, hence prices on organic goods should compensate for the smaller yield according Lucas. The fact that supermarkets does not practice this might reflect another disconnection between the purchaser and the terms of organic production. This might in the end make the consumers used to cheap food making them demand cheap food. To make a higher connectivity between the supermarkets & consumers and the terms of production that the farmers work in, it might be necessary for the supermarkets to take a higher responsibility. On the other hand, it might also be necessary for the farmers to demand more of the supermarkets and the consumers.

Lucas is content with the general research and development within organic farming in Denmark and he tells about an organic farmer, Axel Månsson, who runs a huge holding on 2000 hectare and 120.000 chicks. Månsson experiments and acts as pioneer in the field of use of robots in regard to pest control at the fields, this is inspiring Lucas in the field of organic farming. The use of robots in agriculture might reflect the nutrient paradigm; instead of using pesticides, yet another human-made mechanical tool is used. This might undermine the possibilities for an eye-opener regarding natural pest-control and the collaboration with natural cycles. I will elaborate on the effect of eye-openers in the next section about Noah.

5.3.3.2 Strawberries
Strawberries takes up the biggest part of the berry-production of Samsø Bær and to describe the ‘disappearing’ seasons concerning food production, he uses strawberries as example. Import of
products and use of greenhouses makes the seasons disappear which in the end influences Danish farmers economy negatively.

Lucas: *Back in the days, our strawberry season was only three weeks. (...) It was damn easy and delicious. Now we pick strawberries for ten weeks. Plus, there's someone who’s starting (the season in the greenhouses) (...) And when you have the set-up, then of course you want to try to stretch the season and then there is someone who extends another month with greenhouses and tunnels and at the other end too: So, you can get strawberries for almost six months now, and when you cannot get Danish strawberries, you just import them from Spain. So, you do not get that season; You never get the product that is in short supply, where you can see that the prices will rise and it will be a real good year, because then they just import it, (...) (transcript, Lucas 2019).* 

Lucas explains his concern for the global competition and how it affects farmers economy. Consumers has gotten used to go shopping without a sense for seasonal influences on what is actually possible to grow in Denmark and a demand for strawberries very early in season and almost year around rises along with the influence from supply imported from Spain for example. This is in turn, a good picture on how the supermarkets affect the consumers demand regarding the previous analysis. Danish supermarkets could take responsibility in this matter in order to support terms of production in Danish agriculture, but the idea of supply-demand might keep them from taking this kind of responsibility in practice, since it keeps them in the belief that they actually supply according the demand. By importing goods, that also can be grown in Denmark, you partly decouple consumers from the land, that is stirred by season and in part you undermine Danish agriculture and - farmers discouraging them from experiencing economic peak seasons regarding fruit and vegetables production.

5.3.3.3 *Berries*

In order to expect higher prices for the berries they have to process it, which was the reason for Samsø Bær to be established (transcript, Lucas 2019). But it was not easy, since the prices on their products would not rise automatically just because they are processed Lucas explains. And the production on Samsø 20 years ago were characterized by high yields of berries and vegetables. These have been shut down (transcript, Lucas 2019), which might be due to the challenges in making the expenses to a minimum being cost competitive.

He talks about the challenges in organic berry-production in the following. He is forecasting that the organic gooseberry production they are in charge of, production-wise, is going to be a challenge,
since there are not many organic berry producers at the market. Which means they are rather alone in handling the possible challenges:

Lucas: We function a bit like entrepreneurs for someone who has just started one hectare of organic gooseberries, where we do the practical work. And it's going to be a challenge, and everything that is eco-berry now it is just starting up. There are not any (who have been at the market as organics for long). (...) The last blackcurrants and redcurrants that were in Denmark they have been converted to organic farming and it is because of a huge subsidy.

We went visiting someone called Thy Øko Bær, in Thy of course, who have put out a whole lot of different kinds of berries, but they were not tall; they were just started at that time. And how it went, we do not know exactly. But they are very new. They are definitely pioneering. But it's just really hard. Compared to if you raise potatoes, where after 60-70 days you have peeled them back up. Then you have harvested them. But blackcurrant may have four years before you even harvest anything (transcript, Lucas 2019).

He is telling about how the last blackcurrant and redcurrant producers are closed down or converted into organic farming. The close-down might be explained by the strong cost competition at the global market. And to compensate for this the state compensates by huge grants on 4000 d.kr. per hectare per year disbursed ultimo 2018 for berry producers (The Danish Agricultural Agnecy, 2017). This might motivate berry producers to convert, but Lucas is still not convinced due to the practical fertilizer and nutrients circumstances.

Thy Økobær, who he is mentioning in the above citation, is still existing and have potential for becoming a champion farmer in the local community of Thy, making it able for organic berry production to diffuse locally.

It is risky to produce organic berries economically speaking, since you cannot be sure, even after the four years that you have to wait for the berry-bushes to grow and have a reasonable yield, that the berries will go free from pests. As Lucas emphasize it takes a pioneer to go into that field of organic berry production (transcript, Lucas 2019).

Now the deductively and inductively found themes are analyzed and in the following Lucas’ decision of converting his rye and broad-bean production and his consideration of converting berries into organic farming is analyzed.

5.3.4 The decision
On the paper he is certified organic farmer in the rye and broad-bean production since April 2019, where he ended the conversion process of three years. Though he is still transitioning from the nutrient
paradigm to the soil fertility paradigm and he is reflecting ideas that originate from both paradigms, which might shape some conflicting perceptions of elements of his farming practices, such as how to work with weeds and pests. That might be an obstacle for him to fully enter the soil fertility paradigm. He is flexible in his business in regard to make small conversions and transition in order to align with the consumers. His decision of converting and partly transitioning is stirred by the consumers; if they want to buy organic products then they will produce organic products (transcript, Lucas 2019).

5.3.5 Summing up

He is near the soil fertility paradigm concerning the field productions, but he still is in the nutrient paradigm concerning the berry production. His way of thinking of weed places him in the nutrient paradigm.

The subsidies for organic farmers are meaningless to Lucas as long the fertilizer obstacles in organic berry production exist.

His decision of converting and partly transitioning into organic farming is framed by a consumer demand (transcript, Lucas 2019). If the consumers see and practice the connection between their personal economy and higher biodiversity and clean ground water and other environmental issues, the farmers could align. Lastly, the economy of the development in Danish agriculture might be out of balance.

Now the themes of the first farmer in category 3 have been analyzed and in the following the themes from second farmer will be analyzed.

Noah is born and raised at the farm and inherited it in 1989. He went to the agricultural college of Ladelund for three months and to the agricultural college of Bygholm for nine months. When he inherited the farm, he had 475 pigs and when the bank demanded that the pig-production should end, he started up the conversion process towards organic farming in 2015. He initiated the conversion process with 40 ha. grain in 2017 and after a great harvest that year, he converted the rest of his land in 2018 into organic farming.

From the word cloud below the reader can get an expression of what is important to Noah and what we talked about during the interview. The most significant words are organic and Samsø.
In the following I will first go through the deductively found themes of nutrients & fertilizers and societal development. And after that I will go through the inductively found themes revealed during the coding of the interview with Noah. And after that I will analyze the decision of Noah of converting all of his fields into organic farming. His decision distinguishes from the decision of Lucas in the relative numbers of hectares converted. Noah choose to convert all of his hectare into organic farming.

5.3.6 Nutrients and fertilizers
Noa reflects on the lack of livestock and manure on Samsø and how it might affect the diffusion of organic farming on the Island:

Noah: And Samsø doesn't have too many cattle, so we do not have a whole lot of manure. We cannot convert all of Samsø at all, there is only three farmers, that have animals, I think. (...). Well, I buy manure by the manor down here. And if they
suddenly want to convert everything into organic farming, well then, they have to use the manure themselves. (...) There's one more. Then I could buy from him maybe, and then I just need something from Jutland. Well, it has been so wrong that I bought chicken manure three-quarters drive into Jutland (...) (transcript, Noah 2019).

The fact that there are very few farms with cattle on Samsø is a problem to a possible conversion of all fields on Samsø into organic farming according Noah. More cattle are needed in order to make a potential total conversion of the Island. Picking up fertilizers and nutrients outside the Island is an obstacle according to Noah, since it takes time and resources from other farming practices. He tells, that he have been picking up 300 tons of manure from the mainland just after Christmas 2018 and he needs to pick up 150 tons after Easter 2019 and supplementing with green manure such as broad-beans and clover: “It's the hardest thing over here to get that fertilizer. Broad beans are nitrogen fixating and clover collects as well. So, it helps in that account” (transcript, Noah 2019). One can ask the question of why he did convert his farm from not only conventional to organic, but also from a holding with livestock to a holding that only produces crops. In the interview he described that some of the reason was lying in the fact, that he is about to wind down in his farming practices including his morning practices; he wanted to skip his early mornings in the stables, despite that he is now lacking livestock manure. The lack of livestock manure on Samsø shapes different kind of barriers to the diffusion of organic farming on Samsø. Partly, the practical barrier there is in picking up manure in the mainland in terms of time and resources and in part the more structural barrier that is ruling in the bank sector on Samsø.

He has been experiencing streams of nitrogen in the soils of the field, which resulted that he only used three kilo nitrogen his first year of organic farmer. This he would never have found if he continued as conventional, where he used 150-200 kilo nitrogen each year. After he have used the streams in the soil, he is using 100 kilo nitrogen, which is the maximum of what organic farmers are allowed (transcript, Noah 2019).

He reflects theoretical knowledge concerning fertilizers and nutrients despite he works in a field of practical knowledge:

Noah: Clover and grass they want potassium and it is in straw residues and such. There is also something in the manure, but not enough. Phosphorus, it is in manure, there is a lot in chicken droppings and phosphorus it must be there for it to burgeon and grow vigorously. And nitrogen, but it is the same I think, that is what it grows from. It must not lack anything, because you will lose yields (transcript, Noah 2019).
He is aware that the crops must not lack any of the fundamental nutrients such as potassium, phosphorus and nitrogen in order to yield. This knowledge builds on the barrel-model made from knowledge (figure 4). The organic farming movement used Liebig’s findings on nature’s own cycle of nutrient flow and the conventional instrumental farming practices used the model of the barrel developed on the basis of the law of the minimum (Kaltoft, 1997). This model is justifying adding commercial external fertilizer, reflecting a view of the soils as a factory and the model work well as a good picture on the balanced systemic way fertilizers work with each other in order to make a proper yield. On the other hand, the model reflects an instrumentalized and mechanic way of visualizing how plants do yield. It is reflecting the nutrient paradigm. This might be counteracting Liebig’s more structural findings on nature’s own ability to recycle the nutrients, which reflect the soil fertility paradigm (Kaltoft, 1997). In establishing an argument about the scientific basis for conventional fertilizer practices, Kaltoft (1997) claim that the soil scientific textbook by Nyle C. Brady (1974) does not represent Liebig’s understanding of a principal difference between nitrogen and minerals in the illustration of the law of the minimum, the barrel model (figure 4). Nitrogen is a driving matter and minerals are nutritious matter; they contribute to different kind of growth. Looking into newer textbooks from 1984 and 2014 you find that they still not distinguish between nitrogen and minerals in the barrel-model (figure 4). The problem Kaltoft (1997) claim to be in the fact, that nitrogen is often the limiting factor and according the barrel-model where the distinguishing is not happening, one should add more of the matter that is the limiting factor, but since nitrogen is categorized as a driving matter and the mineral is categorized as a nutritious matter you get a unbalanced growth according to power of growth versus quality of growth (Kaltoft, 1997). Bottomline might be that there is no scientific evidence that validates practices with commercial fabricated fertilizers. On quite the contrary Liebig did recommend and was advocating for accumulating humus and organic matter by using manure in order to increase fertility of the soil and nourishment for the plants (Liebig, 1840). In addition, the focus has changed from 1984 to 2014 in the soil scientific textbooks by Brady. In describing the law of the minimum. The textbook from 1984 focuses on mechanisms and combinations of the matters and factors that influences on plant growth: (...) the supply and availability of plants nutrients and the general mechanisms by which soils can make these nutrients available (Brady, 1984). And in the textbook published in 2014 they are focusing on the system of the matters and factors that influences plant growth. In fact, increasing the amount of a nonlimiting factor may actually reduce plant growth by throwing the system further out of balance (Brady, 2014). It is a systemic view on soil and plant growth and they suggest a synergy or interaction between the
nutrients: (...) the increased growth obtained by applying two nutrients together often is much greater than the sum of the growth increases obtained by applying each of the two nutrients individually (...) (Brady, 2014). Being on the edge between human-made and ecosystem ‘made’ in agriculture, it is hard to define best practices. Noah is acting as farmer within the theoretical knowledge of the barrel-model, hence within the nutrient paradigm that might not acknowledge the differences between nitrogen and minerals. This could be a barrier for him to transition into the soil fertility paradigm, hence the philosophy of organic farming.

5.3.7 Societal development; structural - and sustainable development

Noah: Well, I hadn't thought there would be so many changes when we started. We have been involved in a lot. Well, hectare subsidies were not a thing when I started. Then it came and we got money without doing anything, it meant that the land price did rise, and we gave more for the land we bought, so we didn't keep them after all. The old farmers who did sell got the money (transcript, Noah 2019).

He describes the indirect effects of the hectare subsidies that farmers in Denmark can get from the state, these are according Noah not supporting the initial intention of the subsidies. The direct effects and the intention of the subsidies are that they compensate for the economic loss many farmers experience due to an imbalance in prices for produced crops, such as grains, legumes and rape, compared to the number of working hours farmers put into the production. The economical loss might be explained by the fact that Danish farmers are competing in a global market where the economy does not correspond with the Danish economy. Meaning that the Danish farmers have to lower the prices of their products being able to sell their products without being outplayed in the market by cheaper products from different economies in other countries. So, the subsidies are meant to work as consolation, but that is only with short-term effects. In the long run the effect of the subsidies spread as ever-widening circles in the economic system that farmers work in, promoting higher prices for the land, according Noah. Further, the subsidies are coupled to the size; the more hectare the higher subsidy. This supports the general structural development in the focus on hectares. A change in focus of the subsidies from hectare to quality of the crops a more sustainable development might be promoted.

To work-around the economic obstacles many farmers are caught in, a co-operative movement have emerged, it is a movement that are buying farms and renting them out to newly educated farmers, to make it possible for them to start up a farming business. This movement might support a sustainable development in Danish agriculture. But according Noah this movement is not the answer to the
economical obstacles many farmers are working in, since the co-operative movement will minimize the autonomy you have as an independent farmer. He does not believe in the movement:

Noah: Because they (the owners) would interfere too much; we want to work that much because we are in the game. Well, we feel the consequences (of eg. bad farming) ourselves and it is us we work for. And we work hard, and we are passionate about it and we also work on Sundays if that is what it takes. So, it has to be like that. Otherwise, there is not that production and perseverance (transcript, Noah 2019).

He believes that the reason why farmers have a great production perseverance is because of the autonomy they have in all links in the production chain. They are in a position where they able to fit their decisions into the terms of production. Economically it takes a lot of hectares to make the business run profitable as a conventional farmer due to the structural development that is ruling in many aspects of the societal development and as well in the agricultural development. In the following he tells what could have happened if he has continued as a conventional farmer: Then I should have been out working (in labour market to get it running around). (...) It takes so many hectares for it to run around (transcript, Noah 2019). Due to the physical efforts, you put into your work as a farmer it was not a part of his individual plan to scale up, on the contrary he has been planning to scale down the older he gets. So, he needed to make a turn-around and actively retire from the structural development, in order to avoid economic breakdown or a scaling-up solution.

5.3.8 Specific for this farmer

5.3.8.1 Organic
The theme organic appeared in relation to fertilizer, the global competition, structural development, the bank and colleagues in the interview with Noah. In the following these different sub-themes will be described and analyzed.

On Samsø it is a barrier for the diffusion of organic farming that there is not enough manure to use for fertilizer at organic fields. This could potentially shape barriers for conventional farmers to convert, because they know it would cause hardships. The solution for Noah is to pick up chicken manure 45 minutes drive into Jutland (transcript, Noah 2019).

The structural development makes many farms in Denmark shut down and the remaining are motivated to scale up in size and according Noah this is due to the international competition.
and Russia produce cheap organic products that are exported to Denmark among other places and according Noah the structure of the market does not support Danish food production:

Noah: So, there will be fewer and fewer farms, because they can operate a much bigger area. Yes, but he (Jørgen Steen Nielsen) is right, but I think it comes from outside the most of it. The conventional ones are embattled with rules, it costs them to run agriculture in Denmark, but the worst competition comes from outside. Ukraine and Russia, they make organic products, they sell grain to Denmark and they don't buy any organic over there themselves (transcript, Noah 2019).

Noah is partly agreeing with Jørgen Steen Nielsen, who is a Danish biologist, journalist and writer who have been writing about environmental issues and sustainable development for 30 years. Nielsen is postulating that it is small regulations during a long-time span that created the structural development and the need for the Danish farms to scale up (Nielsen, 2017). On the other hand, according Noah the need among Danish farmers to scale up was created by the effects of a global food-market. The outside pressure might eventual outplay Danish farmers from their own market, making the issues with the connection between consumers and farmers who produce their food even bigger.

Noah recognizes an ‘organic-fright’ that rules among banks, among some conventional farmers and at some conventional advisory services on Samsø. The fright consist of not seeing opportunities in conversion or in organic farming itself (Risgaard, Frederiksen and Kaltoft, 2007).

The banks negative attitudes towards organic farming minimizes the number of opportunities for farmers who need to make a change in their business in order to stay in business. The banks attitudes and actions are over-ruling all economic autonomy there might be left by the farmer. Noah tells about what the bank do if they estimate a farm to be hard to sell:

Noah: I can tell you that it is a carnage what they make up behind our bag. There is no autonomy left for us. (...) We earn too little and then if they suddenly notice: ‘woops, it may be difficult to sell that farm’. And if the price then is less for the property there, well then you suddenly have no equity, or it narrows in and then the risk becomes too big and then they will call the neighbor, who has money, (and ask) if he wants it. And they will in most cases, but I was not interested in selling (transcript, Noah 2019).

Noah experienced that his bank wanted to sell his farm, before he converted into organic farming, without him consenting. He made a turn-around and converted into organic plant-growing without any support from the bank:
Noah: Well, they didn't believe in organics; when I said organic plant growing, two men sat in front of me, looking down the table; that was not the answer they had expected. They thought that they could sell the farm now (transcript, Noah 2019).

The lack of manure on Samsø might be an indirect reason for some of the ‘organic-fright’ in the bank. They might know that organic farmers struggle in finding manure locally. The ‘organic-fright’ on Samsø is also fostered by the cold weather in 1987 on Samsø (interview, Knud Ravn 2019). The fright for organic farming might also be supported by two local stories about the tragic destinies of two different organic farmers; one committed suicide in his own field on Samsø and the other had a bad economy and he tried to save it by converting into organic farming, but he went bankrupt. These two sad stories proved to the rest of the farmers on the island that organic farming was not a solution and the stories stopped the diffusion of organic farming on the island for at least three decades and might still be blocking the diffusion.

He went to school with many of his current farmer-colleagues and they have a bond that support a cooperation between them. Despite of this he happened to be an outsider the moment he converted. He experienced that they suddenly did not speak the same language and did not understand each other. He experienced being an outsider in terms of critical questions, concerning his economy as organic farmer (transcript, Noah 2019). This is also based on the ‘organic-fright’. In the following he defines the eco-fright among his colleagues:

Noah: They don't believe it; they don't even believe what I say even if it's facts. I do not want to convince them, but I can tell them what I experience, what I have earned per hectare, but they stand there like that and do not take it. Like a stone; getting water out from a stone (transcript, Noah 2019).

According Noah, it is a matter of belief among his colleagues, if they listen to his experiences with his new successful economical bottom-line. The question whether you are conventional -or organic farmer might be a matter of identity, which can explain the belief-system ruling whether there is a fundament for diffusion of organic farming or not.

5.3.8.2 Samsø
As mentioned above it is not possible to convert all of Samsø into organic farming, since there is not enough livestock to support it with manure. That is one of the themes that occur in relation to the theme of Samsø in the interview with Noah.

The structural development had shown its dark side at Tunø, where there is no agriculture left. The agriculture at Tunø, that is a small neighbor island to Samsø suddenly experienced it to be unfeasible (transcript, Noah 2019).
The consequences might be alike those on Tunø, if more farms with livestock and a bigger local supply of manure is not established on Samsø. On Tunø all agriculture closed down due to expenses on transportation of manure and grain (transcript, Noah 2019).

Another theme that appear in relation to the theme of Samsø is the role of the bank. The bank is an institution that might have very little understanding of the processes that are in agriculture. The decisions the bank make is all about the economical bottom-line, which does not surprise. But it is surprising that they are making decisions on behalf of so many independent farmers forcing them to shut down one by one. Noah explains that it is only recently discovered among farmers, what powerful role the bank plays in Danish agriculture. Noah experienced an institutionalizing attitude by the bank towards him, but he acted autonomously and made a study on his own on which opportunities he got, and he found that organic plant growing could be profitable for him in the long run (transcript, Noah 2019).

Before he made the conversion into organic farming, he experienced how the idea of the interest rate swaps could turn around his business in less than half a year. The interest rate swaps are an example of how the bank exploit the trust of the farmers in undermining the importance of inform the farmers about the high risk there is in relation to the swaps. Since the financial crisis many farmers went out of business due to enormous economic loss caused by the interest rate swaps (Danmarks Statistik, 2019b). Noah explains how it worked for him in practice:

Noah: it’s a hocus-pocus, the bank didn’t even know what it was them self. It was so risky. I got a 5,000,000 kroner one. And fortunately, I got an account where I could see how it went every day. And it could jump 40,000 (kroner) a day. There, I realized, you cannot control it. And then the sleepless nights began. It was fluctuating - even in minus. Then it started to go up, 250,000 (DKK) and then when it was half a million (DKK) in plus and that was only three months after I got it (transcript, Noah 2019).

He got out of the deal by paying 250.000 DKK. Many other farmers did not safe themselves from the consequences and closed down their businesses (transcript, Noah 2019). Interest rate swaps is opaque, and it is difficult to figure out the mechanisms in it. These opaque offers might be a barrier to general development within farming and agriculture in terms of having a Danish agriculture that is thriving economically, environmentally without compromising on the wellbeing of the farmers.
5.3.9 The decision

His decision of converting into organic farming was influenced by an imbalance between the structural development and his working energy. He is getting older and had decided to scale down in his productivity including transitioning his production as well, from livestock to only plant-growing:

Noah: (...) I had to make a turn-around and we got the idea with organic crop growing. It suited me well; I stood with the 475 sows and they did not give enough, and I would not grow the livestock to 1500 sows and to have eight Ukrainians employed, I simply did not want that. And I also doubted that there was profit in it. So, it was good to convert at that time. Well originally, I also wanted to be a farmer because you are able to wind down a little, the older you get. That was what I had seen before, but it is a little difficult nowadays. But that's how I did it (transcript, Noah 2019).

When he was still a conventional farmer with livestock, he had the opportunity, on one hand, to get 1025 more sows and have eight employees in order to gain profit on the short term. Or on the other hand, he could achieve his goal of winding down and make a conversion into organic plant growing. He started the conversion in 2015, which was a year characterized by an increasing number farmers that demanded a conversion-screening, the demand increased with 328 % from 2014-2015 (Lundsgaard et al., 2016).

The conversion process for Noah ended in 2017 and in the following year he an eye-opener experiences that supported and strengthened his decision of converting into organic farming. The experience was about a flock of starlings, that arrived the first year when he had a field of organic fava-beans with lice in just outside his kitchen window. He was circling around the field and did almost not dare to watch it. When he was conventional, he would go out and watch the field once in a while to check for lice or other pests, where after he would align his spraying practice to the type of pests he found (transcript, Noah 2019). Now he experienced that he was unable to deal with the problem in an instrumental way, because he converted into organic farming. He experienced that the forces of nature were on his side, just because he waited. The starling flock arrived just few days after he found lice in the broad beans:

Noah: And I was out checking, and damn many lice arrived, but then some ladybirds also arrived, but they arrived a little too late. But then 200 starlings arrived. They flew around in a week or so out there, they ate lice. I had a really good yield. Almost like a conventional. So, it was a really good experience (transcript, Noah 2019).
This experience convinced him that it was the right decision to convert into organic farming, and it supported his decision very early in his transitional process going from the nutrient paradigm to the soil fertility paradigm supporting him being successful in his transition. You cannot control the natural support systems; you can only adjust to it by supporting the natural systems by for example not using pesticides and making habitats for beneficial animals.

5.3.10 Summing up
The lack of livestock manure on Samsø is a barrier to the diffusion of organic farming on Samsø. Noah is in a transition process of going from the nutrient paradigm to the soil fertility paradigm. A positive experience with natural immunity of high crop diversity, convinced him that it was the right decision to convert into organic farming.

The subsidies support the general structural development in the focus on hectares. A change in focus to quality of the crops could form a sustainable development.

‘Organic-fright’ is a definition of the attitude that are found in the nutrient paradigm supporting a incommensurability between the organics and the conventional on Samsø.

Sad stories on the island stopped the diffusion of organic farming for at least three decades and might still be blocking the diffusion.

In order to avoid the consequences of the structural development, farmers need to act on the urgency of a local supply of manure and start having small-scale livestock around the island.

5.4 Farmer in category 4: Conventional farmer, who are considering converting into organic farming
Oscar have been employed as inspector at Brattingsborg Manor since 2016 and is in charge of the land, the livestock and the forest. The manor has been kept as a farm by the Samsø Shire since 1676. Oscar keeps 2500 ha. land in total whereas 1140 of them is cultivated. At the manor he and 10-11 farming-assistants. They grow winter – & spring wheat and rye, oat, malt barley and oilseed rape. He is educated as agrarian economist. He stands out to the above analyzed farmers in his relation to organic farming. He has never tried it in practice and when he talks about organic farming it is based on assumptions and calculations about practices of organic farming made during the process of consideration. In 2017 Oscar started out considering converting all crop-fields into organic farming.

From the word cloud below the reader can get an expression of what is important to the farmer Oscar and what we talked about during the interview. The most significant words are soil and helping, these will be described later in this analysis.
First, I will analyze the deductively found themes of nutrients & fertilizer and societal development concepts; structural -and sustainable development. Second, I will be analyzing the two most frequent themes revealed in the word frequency tool: soil and helping. Lastly, I will analyze the decision of Oscar of considering organic farming being a big-scale conventional farmer.

5.4.1 Nutrients and fertilizers
At Brattingsborg Manor they produce grain for flour, which mean that they use the practice late fertilizing with nitrogen that support high quality concerning the protein-level in the crop. It is called it late-fertilizing:

Oscar: Yes, it is plain nitrogen. We do late fertilization; it is called a protein fertilization; when the axis it just protrudes from the stem, just as it starts to grow, then we fertilize (...). There are different strategies; whether you go for the quantity or whether you go for the quality and the protein content (transcript, Oscar 2019).
The quality of the crop is for Oscar connected to the use of nitrogen fertilization, in which you support the protein level in the crop. He is using cover crops of different sorts; both nitrogen-fixating and common ones. It has been introduced in their farming practice since they started out with no tillage system. The cover crops they use are, among others, black radishes, a mixture of black radishes and vicia, a mixture of black radishes and phacelia and some peas. Whereof vicia and peas are nitrogen fixating.

_Oscar: Especially since we have converted to a no tillage system, then you will know that you need to have some more material in the soil. It is the thought about that one must have the fertility of the soil improved (transcript, Oscar 2019)._

He became aware of the fertility of the soil and that nutrients are not only for the plants but also for the soil through the no tillage system introduced via the project Bio Society Samsø.

5.4.2 Societal development; structural - and sustainable development

Oscar is imagining the future agriculture as a fusion between agricultural practices – a fusion where you take the best from conventional farming and the best from organic farming and is dominated by robots, machine learning, GPS, digitalization and a focus at beneficial animals (transcript, Oscar 2019).

This reflect an instrumental point of view and he is describing the precision agriculture, that helps out in the sustainable transition according to Oscar. Precision agriculture consist of farming practices, where tools such as digitalization and pesticides rules, that is within conventional farming. This idea and practices stand in opposition to the ideas and practices within the knowledge paradigm of soil fertility, where focus is on collaborations with nature and actions are building on an idea that natural systems are able to support a sustainable agricultural production (Kaltoft, 1997: 244). His idea and practices of precision agriculture reflects the nutrient paradigm in the focus at tools and techniques. This focus is motivated by agronomists, that in many cases represent the technical science (Kaltoft, 1997: 233) – a positivistic science, where observations is communicated in terms of theories and is contributing to action with technical solutions (Thyssen, 2012: 599). Despite being in the nutrient paradigm, he has discovered the effect of beneficial animals but has not yet experienced it in practice, since there is not space for high biodiversity in his fields due to the use of pesticides.

In addition, sustainability is according to Oscar defined by a input-output relation, when the input is lower than the output the production is sustainable – economically speaking (transcript, Oscar 2019). So, this sustainability definition is promoting a focus at the quantity of the produced crops. He is privileged in having approximately 1140 hectares to manage and it is possible for him to reach
economic sustainability in his production. Further, it is also because of the size of the production that it is possible for him to invest in new technical digitalized tools optimizing effectivity. He explains what he thinks of the climate and environment debate and how he thinks it is detached from professionalism and conditioned by feelings:

\textit{Oscar: So, I don't mind that we have to be environmentally and climate conscious, not at all, I really like the basic principles and the idea of it and of course we have to take care of it. But the hysteria that is going on all around, just to get some votes here and there, I find it rather disturbing, it's not the professionalism that determines in those situations. It is the feelings. (…) These are the feelings of the people; those Copenhageners who think we are polluting, but have to collect drinking water 100 km out in the fields because the cities have polluted their own, but it is us out here who are being shut at (transcript, Oscar 2019).}

According Oscar the climate and environment debate are not only defined by lack of professionalism, he is also implying that the debate is defined by a disconnection between the countryside and the cities. He agrees that we have to be more environmentally and climate conscious, but describes it as climate-hysteria, when it is people’s feelings that determine whether or not they agree in political climate and environment measures. He claims that Copenhageners pick up drinking water from the countryside while they are blaming the agriculture for polluting the water. Danish Regions had investigated the source for soil – and drinking water contamination and it is a complex field of investigation due to many different known and unknown pollutants. Soil contamination is in risk causing ground water contamination. Pollutants in soil nearby old landfills all over the country is in risk of ending up in the drinking water, but only 19000 out of in total 98000 suspected grounds might be problematic (Olsen \textit{et al.}, 2019). Numbers about the water-environment might have caused the misunderstanding of Oscar, since soil contaminations caused by old landfills nearby the cities that possibly will end up in water-environment takes up 10 %, where soil contamination caused by pesticides that possibly will end up in water-environment only takes up 4% (Olsen \textit{et al.}, 2019). The water-environment is defined as streams, harbors, lakes, fjords & coasts and do not include groundwater. On the other hand, waterworks drillings is nationally speaking most often closed down due to contamination by pesticides (Olsen \textit{et al.}, 2019). So, concerning the groundwater in Denmark the use of pesticides in conventional farming is a threat. The use of pesticides is a big field of controversies influenced by themes such as nature versus economy and country versus the city, and I will not elaborate more on this since the theme of groundwater and pesticides is not noticeable in the other interviews.
Their stock of pigs increased from 200 – 750 since the current manor owner took over in 1985 until now. And the inspector has plans of increasing the stock:

Oscar: (...) When the landlord of today took over the manor (…), it started up again. And so it was with 200 sows and 400 sows in a period and now we have 750 sows (...) and I am planning for an expansion up to 1100-1200 sows and (the total process of) slaughter-pigs, then we will come up with 45-47000 produced pigs (a year) (transcript, Oscar 2019).

This shows how they are able to fit into the structural development in practice due to the size and economy of the manor. The local abattoir on Samsø closed down due lack of suppliers caused by the structural development (transcript, Oscar 2019). This might have been a challenge for the general pig production. He is standing in the nutrient paradigm in imagining how organic farmers might fertilize their fields with expensive commercial green manure, but he is non the less imagining a future agriculture without borders between agricultural knowledge paradigms:

Oscar: (...) it should not be either-or; you have to find a production method where you can use the best of both worlds. That is to get the beneficial animals to help in the conventional part, but where it is ok to use some conventional manure to get some nutrients in the soil. And so, it is also using some pesticides, but it must be very accurate when using it. That's probably how I think it is (transcript, Oscar 2019).

Future farming should be conditioned by collaborations with nature in terms of beneficial animals, combined with the use of conventional manure and the use of pesticides in the frames of precision agriculture. The collaborations with beneficial animals might not succeed due to the framing is set within a rather positivistic science framework where a mechanic and reductionistic worldview rules. The contradictory about his idea of future agriculture, is that pesticides will support beneficial animals. Beneficial animals live in an eco-system that is opposing the rather mechanical agricultural system he describes.

5.4.3 Specific for this farmer
5.4.3.1 Soil
Despite the fact that they use very big farming machines being distant to the condition of the soil he values having a sense for the soil’s condition in terms of numbers of living earthworms:

Oscar: Yes, you have to do this all the time, you have to have a sense of how good your soil is. Well if you take a shovel into the ground out here, so if there is about 5-8 earthworms, then you have a good structure in the soil; A soil that is in really good condition (...) an airy soil, that is where they want to be too and you do not
have a particularly compact soil where there is no oxygen. At the same time the soil bacteria are also helping (transcript, Oscar 2019).

His focus at the soil’s condition is unusual for farmers that are in the knowledge paradigm of nutrients, that typically have the focus at the crops above the soil (Kaltoft, 1997). In his description of a soil in good condition he brings up the view, that the soil is a living substance with bacteria that support the growth of crops. This places him near the knowledge paradigm of soil fertility. The pivot of the conventional perception of farming is plants call for nutrients & fertilizers (Kaltoft, 1997). So, within the nutrient paradigm fertilizers is added to meet the need of the plants. Oscars awareness of the soil bacteria might influence on his fertilizer practices to focus more on fertile soil and adding nutrients to meet the need of the organisms of the soil, transitioning into the borderland of the soil fertility paradigm in the long run. His way of viewing and focus at the soil is conditioned by the no tillage practices that is widely spread among farmers on Samsø due the project Bio Society Samsø initiated in 2016, that is promoting a circular agriculture (see appendix 3 and 4). The use of the no tillage system was initiated at the manor just before Oscar was hired:

Oscar: (...), but I know about it from where I was before, so the whole idea of being able to get the beneficial animals and something like that to help; I like that idea. And otherwise, I think somewhere that in the long run it will probably just be the new standard for us, maybe not quite organic, I really hope another variety of organic farming will come (...) (transcript, Oscar 2019).

Oscar is content with the ideas of collaborating with nature and the no tillage system allow him to practice these ideas. The system is an element from conservation agriculture system, where you support biodiversity in the soil by building up humus by reducing tillage of the soil. The system is building on three principles:

1. Minimum soil disturbance.
3. Cropping system diversity, crop rotations.

(European Conservation Agriculture Federation, no date).

The use of no tillage system supports a minimum soil disturbance and for Oscar it revealed the use of cover crops, that helps to build up humus and soil fertility: “(...) our earthworms out there, they need some material to work for, we have to have carbon sequestration in the soil that causes the soil's fertility to be improved” (transcript, Oscar 2019).
The use of cover crops supports the maintenance of permanent soil covers while sequestrate carbon from the atmosphere to the soil and feeding the earthworms with organic matter. Oscar feel supported by nature (earthworms and soil bacteria) in his practices.

Oscar: (...) the landlord tells us that he can see that the earth's ability to hold on to the water and something like that becomes much better over time. We do not have those dry clay-hills anymore. It has become more fertile, it is, of course, organic matter that also helps to retain moisture in the soil. So, it has become much more homogeneous to work with (transcript, Oscar 2019).

He is still new in the practices of collaborating with the nature in the field of no tillage practice, so he speaks very theoretically about the effects of no tillage cultivation and refer to the experiences of the landlord. The landlord’s experiences of the successful effects of no tillage practice combined with Oscars vision for no tillage being a new agricultural standard might support the erasure of the old tilling-norm on Samsø supporting an improved biodiversity.

5.4.3.2 Helping
This theme is both about the nature helping in agricultural practices and about synergy effects of the employees helping in optimizing the farming processes. Nature helps out in the farming practices and he likes some of the principles in organic farming that is used in the above mentioned no tillage system (transcript, Oscar 2019).

This way of seeing the nature as an actor helping out in farming practices might support a diffusion of elements of organic farming benefitting the sustainable development on Samsø.

5.4.4 The decision of considering conversion to organic farming
During the winter of 2018-2019 they were numerating an economical effect of a potential conversion of their fields into organic farming. He does not see himself as particularly organic thinking. But he saw some economic opportunities in organic farming, which was the reason for him to consider a conversion (transcript, Oscar 2019). The no tillage system they are applying at their fields put him nearer the paradigm of soil fertility as mentioned. His decision considering whether or not to convert into organic farming is also impacted by the theme of getting help from nature.

5.4.5 Summing up
Oscar is in the nutrient paradigm, where tools and technical solutions rules. He has not yet experienced the contribution from high biodiversity in practice, since there is not space for high biodiversity in his fields due to the use of pesticides. Though, he is aware of the microbes in the soil
being beneficial for soil fertility and is practicing no-till. He is in the nutrient paradigm but might be transitioning into the borderland of the soil fertility paradigm in the long run. His sustainability perception is promoting and motivating a focus at the quantity of the produced crops. Future farming should be conditioned by collaborations with nature and with the use of conventional manure and the use of pesticides in the frames of precision agriculture According Oscar.

5.5 Farmer in category 5: Conventional farmer, who are in middle of (or are considering) a conversion process towards sustainable farming.

William is keeping a farm, that his granddad bought in 1926. He inherited the farm in 1994 and he has run it conventionally in all 25 years. At that time his mom and dad ran the farm with 23 dairy cattle with a production of approximately 163,000 kilogram milk per year and approximately 30 ha of land. He went to three different agricultural colleges before he took over the farm. The schools were: Dalum at Fyen, Bygholm in east Jutland and former Ladelund in south Jutland. Now he has around 105 dairy cattle, that produces 1102,5-ton milk per year. Further they have 50 cattle slaughtered every year for meat and they also sell some bull calves every year. At the fields he produces grain, beets and grass with clover for crop rotation and feed for the cattle. He has one assistant to help out in the stable.

From the word cloud below the reader can get an expression of what is important to the farmer William and what we talked about during the interview. The two most frequent words are cattle and milk.
In the following I will first analyze the deductively found themes of nutrients & fertilizer and societal development concepts; structural -and sustainable development. Second, I will be analyzing the two most frequent themes revealed in the word frequency tool: cattle and milk. Last, I will analyze the decision of William of being a conventional farmer being in constant flow of sustainable development.

5.5.1 Nutrients & fertilizers
Nutrients and fertilizers are not a strong theme within conventional farming, since it is a commercialized product. According William, it is a stronger theme within organic farming, where they struggle in order to have enough nutrients for their fields. Conventional farmers just buy synthetic commercial fertilizers when they need it (transcript, William 2019).

Figure 12 Word cloud of the 50 most frequent words in the interview with William.
One of the essential nutrients that all farmers need is the mineral phosphorus, that is most often added in too high amounts in general in the Danish agriculture. There is around 12 million tons of phosphorus in Danish agricultural soils and it is estimated that around 400 tons are washed out to the water environment every year (Svennevig, 2010). “Jens Christian Tjell (...) emphasize, that an accumulation of phosphorus still happens in agriculture because phosphorus is added from commercial fertilizers and fodder in higher amounts than the amounts that disappears” (Svennevig, 2010 - own translation).

Instead of buying commercial phosphorus in mineral supplements for his livestock William uses rape fodder for as source for phosphorus:

*William: (...) it is also a result of us starting to use more rapeseed than soy. Previously, we only used soy. But during the last 10-15 years we started using more and more rapeseed. And rapeseed is consisting of a lot of phosphorus, actually. So, we don’t need as much phosphorus in our mineral mix (transcript, William 2019)*.

This is a matter of practical concerns of getting all nutrients his farming systems need in order to yield properly every year. His concerns rely on having a balanced mineral score in relation to what the plants need regardless of how much phosphorus the soil contain. His focus is in other words more or less mechanistic and in his view, it is nutrients for the plants placing him in the knowledge paradigm of nutrients.

Phosphorus is a non-renewable resource and it is estimated that it will be a scarce resource in 30-100 years (Svennevig, 2010; Djursing, 2017). It does not necessarily mean that it is a sustainable practice to use rape as a source for phosphorus. A sustainable phosphorus practice would require that the rape was grown without commercial synthetic fertilizers and instead grown with recirculated phosphorus.

As Ida mentioned in the first section of the analysis above, the soils in Denmark are very rich in various nutrients including phosphorus and nitrogen is most often the limiting factor for growth in plant-production. This means that research and development is needed and going on among Danish technical researchers in order to figure out how to circulate the phosphorus before it ends up in the water environment, where it cannot be extracted from. An example of this is the research and development project at the University of Aarhus lead by Finn Plauborg and is a collaboration between Institute for Agro-ecology og Institute for Bioscience. They are testing and developing drainage-solution in order to catch nitrogen and phosphorus (Hansen, 2018).

William wants a more integrated exchange system for minerals between the food-production in the country and the waste-production in the cities, but he also reflects the problems of the high reaction capability of phosphorus that make it stick to heavy metals (transcript, William 2019).
Regarding the sustainable development within conventional farming he speaks about which kind of precautions they generally take in the agriculture to meet the regulatory demand for more sustainable farming practices, but he concludes that it is difficult to come up with more precautions to take, in relation to discharges of nutrients to nature from agriculture.

*William*: You can say, that the discharge of nitrogen from agriculture has also become a lot lower, because we have gotten better at utilizing the manure. It has to be run out in tubes, and it must be [deposited]. We don’t drive out all year and stuff like that. (…) We have taken all the low hanging fruits (transcript, William 2019).

According William the conventional agriculture has done all they can do in order to, for example, lower the discharge of nutrients to the environment. Precision agriculture is a concept, that depend on smart-measuring technologies, that the conventional farmers have been using in order to act more economic and environmentally sustainable. New digital measuring devices make it possible for wealthy farmers to be more precise in applying pesticides and fertilizers. It was discussed, in February 2018 at a conference held by the Ministry of Environment and Food of Denmark (MEFD), whether or not new smart-technologies could replace environmental requirements in Danish agriculture. The Danish Agricultural Agency within MEFD acknowledge that farmers increasingly make use of digital technologies for monitoring and analyzing their fields:

“If these data can be used for telling more precisely how much fertilizer plant exactly need and thereby optimize the farmers distribution of fertilizers in the field, it will give profit both business-vice and environmentally. And if these data also can be used as documentation, when the agriculture is going to reduce outwashing of nitrogen to the water-environment, the precision agriculture will act as instrument in future focused regulations” (Danish Agricultural Agency, 2019 - own translation).

The practice of using cover crops in the crop rotation system among conventional farmers on Samsø became a trend along with the introduction of the no tillage practice on Samsø according William:

*William*: You regulate little things, that does not make a big difference. You can say that all those who do cover crops do their part, we have probably gotten a little better loving them, than we have been before. (…) it’s especially the no tillage people (transcript, William 2019).

In the local agricultural advisory service is the agronomist Knud Ravn acting as opinion multiplier in the theme of cover crops through his work in the Velux funded project. From the beginning, when cover crops was introduced in 1999, it was not a popular practice among farmers, who agreed upon
that the practice was a barrier and it was common to speak of the cover crops practice as a harassment-crops (Appendix 3 p. 14). The experience the farmers get by using cover crop is initiating a trend which is supported by the work of Ravn. “many farmers have acknowledged that the former growing practice wear out the humus content – especially in the production of potatoes and vegetables” (Appendix 3 p. 14).

He gained solid practical knowledge from growing up at a farm and by practicing farming for 25 years. For example, he knows that if the rape turns red, it is the lack of phosphorus causing it.

*William:* (...) We do not necessarily look at the small molecules and say that they are the problem. We probably learned that at the agricultural school, but we are thinking we can't go and do that every day. But you can say, that it is something you take into account when you make a fertilizer plan, you think about whether the soil should be chalked and all that. The acidity in the soil and the unessential, we do not spend any time on (transcript, William 2019).

The theoretical knowledge learned at the agricultural college turned into practical knowledge, that he uses when making a fertilizer plan. So according William, numerating is a job for the theoretical workers in the local agricultural advisory service. So, what the advisors mean and do is incorporated into the practices of each farmer. One can say that that work as opinion multipliers both through what they write about but especially through practices of for example making drafted fertilizer plans

*William:* In1: Yes, but we can forget what I learned in agricultural school. Basically, it is still the same. But we get (a fertilizer plan) drafted by a plant growing expert every year. He composes a fertilizer plan for us. It is based on the fact that we get soil samples every five years; how is the phosphorus; how is potassium; how is the reaction number. And things like that. It is regulated by what it needs; what do the crops need. He has a program to calculate what it needs. And that is how we fertilize. The nutrient balance (transcript, William 2019).

In theory, this method of getting a picture of the nutrients balance of the soil every fifth year, should compose a true picture of what needs to be added and how the fertilizer plan is constructed. Despite it take departure in the condition of the soil, it is composed with a focus at what the plant’s needs. A recommendation from Aarhus University is based on correlation studies showing that there is a good correlation of the amount of phosphorus in the depth of 0-25 cm and 25-50 cm (see figure 7).
Based on this they conclude that soil sample is recommended to be taken from the upper layer. Meaning that this method does not take the total condition of the soil into consideration because it is not relevant for plant growth placing the method in the nutrient paradigm.

5.5.2 Societal development; structural - and sustainable development

5.5.2.1 Structural development

The concept of structural development appears as a natural condition for farming in William’s practices; he does not explain it as a problem; it is natural term explained by societal development. In practice he had to scale up in the production to keep the same price for the products as back then when he initiated farming:

William: I took over 23 cows (...) I bought a property next to (this one) further up in town, before I bought this one. My dad had 30 ha. – I think. And you can say back then my mom and dad both worked, right. They produced; I think they had a quota of 163,000 kilos of milk for two persons. We are two persons today making a million, which is why we can make it at the same price they did back in the days (transcript, William 2019).

He has been able to follow the development up close since the beginning of the 1990s and he explains it by drawing on the example of milk production. His parents had a quota of approximately 163,000 kilos of milk and today 25 year later he has a quota of a million kilos of milk. In 1983 a settlement for milk quota was agreed upon in the former European Community in order to reduce the milk
production. Denmark got a quota for approximately 4.4 billion kilos of milk that was divided to among Danish milk producers (Jacobsen, no date). In 2015 the settlement ended, and farmers could now produce what they were able to.

He never aimed for scaling up. It happened because of the terms of the mainstream societal structural development. It was necessary to scale up during the 25 years he has been working in order to have a revenue to hire an assistant. But it was also something that just happened due to the structural terms of production: ”And I had no plans for it to get bigger than it is now. Not even before. It has never been a goal to be huge” (transcript, William 2019).

Along with scaling up William experienced the arrival of more and more regulation, rules and control, which influenced on the important feeling of autonomy. More autonomy was dominating 25 years ago.

*William: Well, there is no one who tells you what to do today. Well, so you can figure that out for yourself. As long as you pay your bills, then people may not care what you do. So, it is freedom, but it is not at all as distinct today as it was 25 years ago, so there are many more rules and many more controls and thus it is a jungle. It is hard to get through without doing something wrong that you must not do* (transcript, William 2019).

The reason for the arrival of more regulation and farmers feeling less autonomous can be explain in the technological development and the diffusion of digitalization. On the one hand digitalization opened new possibilities for acting more sustainable within conventional farming in terms of the concept of for example precision agriculture. On the other hand, digitalization made the regulative banning-practice possible. The regulative banning-practice is taking place through applications that the farmers have on their smart phones. As mentioned in the chapter about Malthe, one of the main motivational factors for the farmers I have talked to is the autonomy. The autonomy is counteracted by the rising numbers of regulations made communicable by the smart phone.

*William: (...) but the fact that it became illegal, as much as it does now, is something that has come within the last five years. So, it is completely escalated now, so you also should not report the spraying journals [...] , you were more free. So yes. So, this one * referring to the FarmTracking application *, it is really good, and I can report it right away* (transcript, William 2019).

He both experienced an escalation in the numbers of regulations within the past five years and an optimization of practices in terms of time-use, practices that before was done as paperwork. The application ‘FarmTracking’ was published by Seges in 2015.
Now-a-days it is a risky business to have a small-scale farm. William points out that the structural circumstances are not made for small-scale farming and gives an example with the CVR register, that is a centralized register for all companies in Denmark:

William: So, people simply did not want to and have a small-scale farm, there are simply so many laws and regulations and if you just miss the point somewhere, and a controller comes, then you can lose all your profit. (...) It is simply too risky, (...). It is simply a hassle. (...) It is because you have to do it all, whether it is small or big, then you have to meet all the rules anyway. Even if you only have two cows going, you have to be registered in the CVR register and it costs something every year. So, it exceeds the value of the two cows, so it can never cohere. And I give the same thing, even though I have a hundred cows and the one who has a thousand cows gives the same. (...) It is much to do with all those rules that one cannot (fulfill) (transcript, William 2019).

The point is that the prize for being in the CVR-register is not differentiated to the size of the company, meaning that it promotes big-scale farming and is an enormous barrier for small-scale farmers.

5.5.2.2 Sustainable development
Concerning sustainable development, the theme of the disconnection between the countryside and Copenhagen arises through an example of the infrastructure of waste. William points out, that the society in general and in particular the countryside has been through a sustainable transition concerning infrastructure of waste, which, according to William, is not recognized by opinion leaders of society in cases where the farmers again and again are blamed for environmental damages. People do not remember what improved in the environment since the 1970s and William advertise for recognition of this in the debate (transcript, William 2019).

The point here is that he does not feel like he counteracts nature in his practices, he cares about its totality and to follow its cycles in which he is working in. The problem of overdispersal of fertilizers in general in the conventional agriculture remain unsolved and could be addressed by welcoming farmers into the problem-solving table as peers. This is what the municipality of Samsø did as a part of the Velux funded project Bio Society Samsø 2016-2020, through which the no-tillage practice and a greater focus at biodiversity is trending among conventional farmers including William.

The municipality held 6-7 theme days during the winter, that William attended. He gained insights on biodiversity & no tillage and carbon balance and how it creates a better investment in the future, and he liked the idea (transcript, William 2019). So, the municipality of Samsø gained results within initiating sustainable transition of a conventional farm by drawing the farmer to the table as peer.
At the farm they have a low energy consumption. Electricity is mainly used for cooling down the milk. From that process of cooling milk comes heat, that is reused in their house.

*William:* We have had the cooling-heating system for 15-17 years. Before that, we had something where you also took the heat from the stable, so it has been here for 30-40 years. (...) So, relatively to a pig farm for example, we do not have a large energy consumption. We have no fan running in the stable, so it is natural ventilation, so what we use electricity for is to cool down milk (transcript, William 2019).

5.5.3 Specific for this farmer

5.5.3.1 Cattle

Despite William is running a livestock of around 105 cattle, it is not his main nerding area. He is most passionate about planning and management.

*William:* I almost think I don't know if I say I am an expert, that's a big word, but something like management, not just management of my employee, but also management of oneself, so what are we going to do, when should we make it, should it be today or should it be tomorrow, or what is best. (...) So, I would say, it is cattle, that is my profession, but when I talk to some other cattle farmers, I easily think 'surprisingly, I do not know much about cattle'. I like to take care of the cattle, (...) but it is not where I am fully competent (...). I like it and like to take care for them, it is not that, but I am not completely nerdy with cattle (transcript, William 2019).

As already mentioned, the influences of digitalization are many-faceted in both creating barriers and motives in farming practices. In the case of the livestock, digitalization is helping him out to keep track of the many cattle. He uses the webpage [https://smartkoen.dlbr.dk/](https://smartkoen.dlbr.dk/). Here each cow gets a number and in addition basic information such as the birth year, liters of milk per year, liters of milk it gave last time, when it calved last time and the health is registered in the web page. Based on this information he is able to make decisions in relation to each cow; if for example he should replace a cow with a younger one (transcript, William 2019).

Digitalization also made it possible for him to let the livestock grow in numbers.

*William:* (...) I remember from the time I started, there were also some who were going to have a lot of cattle, but it often went wrong with them, it was that they had no control over the cases, you simply cannot control so many cows. You are simply not able to remember the different cows; you simply have to have a system and you did not have that back in the days (transcript, William 2019).

Without the webpage he would not be able to have the number of cattle he got today, and he experience that the webpage makes farming much easier.
5.5.4 The decision
For William is transition processes omnipresent in his farming practice. As farmer you have to be ready for transition depending on the weather or new consumer trends.

5.5.5 Summing up
The CVR-register promotes big-scale farming and is an enormous barrier for small-scale farmers.
William cares about natures totality and to follow its cycles in which he is working in.
The municipality of Samsø is initiating sustainable transition of conventional farming successfully.
It was very difficult to define which farming paradigm he is in due to his focus on management practices.

5.6 The paradigmatic landscape of all six farmers
Ida and Alfred from category 1, are placed in the soil fertility paradigm by upbringing and education.
Malthe from category 2, have been in the nutrient paradigm and is now in the soil fertility paradigm which support his decision of converting into organic farming. The experience with losing yield formed his way into soil fertility paradigm.
Concerning the two farmers from category 3, Lucas might stay in the nutrient paradigm alienated to the terms of nature where Noah is already transitioning into the soil fertility paradigm having experienced the support from nature.
Oscar from category 4 is in the nutrient paradigm but might be transitioning into the borderland of the soil fertility paradigm in the long run.
The farming paradigm of William from category 5 is hard to define due to his focus on management. See the figure below.
Figure 13 Illustration where each farmer is place showing the 'total picture'
6 Conclusion

Of agricultural paradigms I found the nutrient paradigm and the soil fertility paradigm emerging among the farmers. The biodynamic paradigm and the communication paradigm seem to absent. Some of the farmers practices elements from more paradigms at a time and elements from the paradigms seem to be fluid.

Empirically speaking, the farmers must experience tactile, eye-opening experiences to change their basic confidence in nature in order to act sustainable. Further if everybody in the neighborhood are of a certain belief it takes a lot daring to be of another belief. Practical eye-opener experiences can change this neighborhood effect. Through this Techno-Anthropological investigation I saw that a barrier to getting experiences supporting confidence in nature might be the use pesticides.

I further saw that different perceptions of structural development appear among the farmers. Some see the structural development as a natural force and some see it as a market force, this affect the willingness to convert into organic farming.

I found the following grounded concepts of autonomy and connection between countryside and the city represented by a farmer-consumer relation, organic-fright vs climate-hysteria and collaboration with nature emerging in the analysis of the deductively and inductively found themes. The grounded concepts are influencing the sustainable transition in agriculture on Samsø in different ways.

Autonomy:

Farmers motivational factor for farming is nourished by their autonomy. Feeling autonomous comes in different varieties and support a sustainable development. First, Alfred and Ida are financial autonomous being able to make their own decisions in terms of farming practices. Secondly, Noah is autonomous when he chooses to convert into organic farming because he knew that it would save his business. And third, William is feeling less autonomous because of the rise in numbers of regulations.

The fact that supermarkets and other intermediaries rule a commerce, that support a structural development, that natural cycles of food production does not fit into, shapes a lack of autonomy among the farmers. Lastly the banks attitudes and actions are over-ruling all economic autonomy there might be left by the farmer.

Connection between countryside and the city:

Is represented by a farmer-consumer relation. Consumers being distanced to the food production shapes an unbalanced demand pattern in relation to the sustainability agenda of society.

Organic-fright versus climate-hysteria:
The controversy between farming paradigms is formed by an incommensurability and a focus at differences in contribution to the sustainability agenda.

Collaboration with nature:
The sustainability perception varies among the farmers depending on which farming paradigms they are in. The theme of collaboration with nature has potential for uniting farmers across paradigms. In addition, the theme of collaboration with nature is shaped by the project Bio Society Samsø and support a common ground for farmers across paradigms to unite in common perception of what a sustainable agriculture is.
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