

## Farming for food security

– A critical study on the transition to post-fossil agriculture in Sweden

*Jordbruk som stärker matsäkerheten*

– *En kritisk studie kring omställningen till ett postfossilt lantbruk i Sverige*

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**Credits:** 30 credits

**Level:** Second cycle, A2E

**Course title:** Master's thesis in Rural Development and Natural Resource Management

**Course code:** EX0777

**Programme/Education:** Agriculture Programme – Rural Development

**Place of publication:** Uppsala

**Year of publication:** 2018

**Cover picture:** 'The horse draught farm'. Photographer: Ebba Ulfbecker

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**Online publication:** <https://stud.epsilon.slu.se>

**Keywords:** agricultural politics, food security, resilience, transition, climate mitigation, agroecology, sustainable intensification, the Rural Development program, contingency, rural development, discourse analysis, policy analysis

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## Acknowledgements

I want to thank my supervisor Camilla Eriksson for giving me the possibility to participate in her research project “Can we produce food during crises? Vulnerabilities and resilience at farm level in Swedish agriculture”, at SLU. The project is financed by the Swedish Civil Contingencies Agency (MSB) and Future Agriculture, a research platform at SLU. It has been invaluable for me participating in the exploration of an important societal- and environmental challenge like this.

Not the least, thanks to all you farmers, entrepreneurs and visionaries, who gently welcomed my visits and interviews. It was a true pleasure and inspiration to meet people like you, who produce food in the most noble way and take care of the land that feeds us.

Ebba Ulfbecker, April 2018

## Abstract

This thesis addresses the preconditions to achieve a transition to fossil free agriculture in Sweden, to increase farm-level resilience and food security. Swedish agriculture is today highly dependent on imported fossil-based inputs, such as diesel, agrochemicals and protein feed. This makes the food supply vulnerable in case a crisis would block the access to these. If agriculture would transform into a fossil free state, based on recycling systems of local and bio based resources, energy and nutrients, the production would be maintained even during crisis. Therefore, the *agency* of agroecological- and sustainable intensification farming systems is investigated, which suit into this fossil free vision. The issue of food security has reappeared in the political context, after being absent in almost twenty years. It is much due to the Defence Act published in 2015, which included planning for food security (Swedish Government, 2015). Considering this, research is necessary for increasing knowledge about how food contingency can be adapted to these uncertain days.

It is a critical study which includes a qualitative interview study, a document study and a literature review. The material is collected by deep-interviews with six farmers and entrepreneurs, who work with agricultural systems highly divested from fossil-based resources. The document study consists of a textual analysis of four key national policy documents influencing the agricultural- and environmental development. The inquiry is conducted through Fairclough's relational-dialectical approach to critical discourse analysis (Wodak; Meyer, 2016).

The analysis showed that there were rather good preconditions achieving a transition to sustainable intensification of agriculture due to the expanded agency of these kinds of farms. This depended on the farmers' belonging to the dominating discourse of *eco-technological fix* for agriculture, which made them supported by the political, economic and cultural structures. The eco-technological discourse encourages technological solutions to solve environmental problems in a profitable way. However, sustainable intensification had less possibility to divest all fossil-based inputs, because the economic capital is higher valued than the ecological capital. Still, the radical sustainable intensification practice and the agroecological farming practices that together could have the potential to divest all fossil-based resources, were marginalized by the structures of society and did thus had less agency and worse preconditions. It depended likely on the high environmental ambitions of these farming systems, which challenged the modern agricultural sector too much. Moreover, it was also due to the agroecological farming's connection with the alternative discourse of *eco-centric fix*, emphasizing profound ecological concern and social justice. Though, the agroecological approach creates *strong sustainability*, by considering social, ecological and economic capital and long-term improvement of life-opportunities. The agroecological approach contributes to regenerate agricultural land, strengthen the biological processes and the eco system services that makes food production possible without external inputs. To increase farm level resilience and food security, both agroecological farming and radical sustainable intensification practices will be needed to complement each other and provide solutions to a diversity of farm contexts. A transition to a post fossil agricultural paradigm requires improved preconditions for these farming systems, especially in the political field. It could be obtained when the political context, the economic system and the cultural values applies a strong sustainability view and include the discourse of eco-centric fix.

**Keywords:** agricultural politics, food security, resilience, transition, climate mitigation, agroecology, sustainable intensification, the Rural Development Program, contingency, rural development, discourse analysis, policy analysis

## Sammanfattning

Följande studie undersöker förutsättningarna för att åstadkomma en omställning till ett fossilfritt lantbruksparadigm, för att öka resiliensen på gårdsnivå och därmed matsäkerheten i Sverige. Det svenska lantbruket är idag starkt beroende av importerade fossil-baserade insatsmedel, såsom diesel, konstgödsel, bekämpningsmedel och proteinfoder. Detta utgör en sårbarhet för livsmedelsförsörjningen ifall en kris skulle blockera tillgången av dessa. Om lantbruket skulle ställas om till fossilfria alternativ, som grundas på kretsloppsbaseade system av lokal och biobaserad energi, resurser och näringsämnen, skulle produktionen kunna upprätthållas i större utsträckning även under kris. Därför undersöks *handlingsutrymmet* för olika lantbrukssystem som stämmer in på detta, vilka antingen är inriktade mot agroekologi eller hållbar intensifiering. Frågan om matsäkerhet har kommit upp på den politiska agendan för första gången på över tjugo år. Detta beror mycket på totalförsvarets proposition som implementerades 2015, som resulterade i ett återinförande av planering för livsmedelsberedskap (Sveriges Regering, 2015). I ljuset av detta behövs ny forskning som bidrar till att öka kunskapen om hur livsmedelsberedskap kan anpassas till vår komplexa samtid.

Studien är kritisk och inkluderar en kvalitativ intervjustudie, en dokumentstudie och en litteraturgenomgång. Materialet baseras på sex djupintervjuer med lantbrukare och entreprenörer som arbetar med lantbrukssystem som i stor grad fasar ut fossila resurser. Dokumentstudien inkluderar en textanalys av fyra centrala nationella policydokument som är betydelsefulla för lantbrukets- och miljöns utveckling. Studien är utförd genom Fairclough's variant av kritisk diskursanalys, kallad för relationell-dialektiskt tillvägagångssätt (Wodak; Meyer, 2016).

Analysen av resultatet visade att det fanns goda förutsättningar att uppnå en omställning till hållbar intensifiering av lantbruket på grund av ett utökat handlingsutrymme för dessa typer av gårdar. Detta berodde på lantbrukarnas tillhörighet till den dominerande *eko-teknologiska diskursen* inom lantbrukssektorn och att de blev stöttade av de politiska, ekonomiska och kulturella strukturerna. Den eko-teknologiska diskursen uppmuntrar teknologiska lösningar för att hantera miljöproblem på ett lönsamt sätt, som t ex eldrivna traktorer. Hållbar intensifiering av lantbruket skulle dock inte kunna bidra till att fasa ut alla fossilbaserade insatsmedel, eftersom prioriteringen av ekonomiskt kapital skulle hindra det. Däremot skulle de lantbrukssystem med radikalt hållbar intensifiering samt agroekologisk inriktning ha potential att tillsammans bidra till en utfasning av de fossila insatsmedlen, men dessa praktiker var marginaliserade av samhällets strukturer och hade därför mindre handlingsutrymme och sämre förutsättningar. Detta berodde sannolikt på de höga miljöambitionerna hos dessa lantbrukssystem, vilket utmanar den rådande lantbrukssektorn för mycket. Därtill berodde det på det agroekologiska lantbrukets koppling till den alternativa *eko-centrerande diskursen*, vilken prioriterar djupgående miljöhänsyn och social rättvisa. Dessa lantbrukssystem kan dock erhålla *stark hållbarhet*, vilket innebär en hänsyn till sociala, ekologiska och ekonomiska värden samt att långsiktigt förbättra livsförutsättningar. Det agroekologiska lantbruket kan bidra till att återuppbygga jordbruksmark och stärka de biologiska processer och ekosystemtjänster som gör matproduktionen möjlig utan externa insatsmedel. För att öka resiliensen på gårdsnivå och förbättra livsmedelsberedskapen, kommer både agroekologiska praktiker och radikalt hållbar intensifiering av jordbruket bli nödvändiga för att komplettera varandra och erbjuda lösningar för en mångfald av lantbrukskontexter. En omställning till ett post-fossilt lantbruksparadigm kräver förbättrade förutsättningar för dessa jordbrukssystem, framförallt inom politiken. För att det ska bli möjligt behöver policy, ekonomiskt system och kulturella värden anta ett starkt hållbarhetsperspektiv och inkludera den eko-centrerade diskursen.

*Nyckelord:* lantbruk, matsäkerhet, resiliens, omställning, klimatanpassning, agroekologi, hållbar intensifiering, jordbrukspolitik, miljöpolitik, landsbygdsprogrammet, livsmedelsberedskap, landsbygdsutveckling, policyanalys, diskursanalys

*If you are doing the right thing for the earth, she's giving you great company.*

Dr. Vandana Shiva

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# Introduction

Access to food is essential for all human beings. The food must satisfy our needs of energy and nutrition for maintaining an active life. We always need food, regardless of our income level or crises that occur. If these aspects above are accomplished for a household, region or a country, it relies in a state of what is called *food security*. (FAO, 1996) This is normally the case in welfare states like Sweden. Yet, food shortage can emerge if a societal disruption occurs, such as trade disruptions, natural catastrophes, or war. Recently, the risk of these crises to happen in Sweden was increased, mainly due to a tense security situation that evolved around the Baltic sea. This made the Swedish government to strengthen the National Defence and resume the civil defence planning in 2015, in which preparedness for food security was included (Swedish Government, 2014/15:109). Two years later, a National Food Strategy was approved with the goal of increasing food self-sufficiency (Swedish Government 2016/17:104). These policies has contributed to a revitalized political activity around food security, after being dormant in Swedish politics since the end of the Cold War. However, much progress is needed for achieving an acceptable level of food security preparedness. At present, the food stuff will not last long in case of a societal disruption, much because of the dismantled food storages and the diminished food self-sufficiency (Eriksson et al, 2016). The maintenance of the agricultural production becomes even more important in this situation, which calls for critical investigations about how farming can secure food supply in times of crises.

The food security agenda in Sweden has mainly focused on ideas of intensive production and rationalization of agriculture, to achieve a high food self-sufficiency. This productivist ideas has justified a use of external inputs which boost the production, such as artificial fertilizers, pesticides, concentrated feed and fossil fuels. According to a new research study made by Eriksson et al (2016), this increased dependency of external inputs has made Swedish agriculture extensively vulnerable for crises and war. In case the supply of inputs gets disturbed, for example by a trade blockade, the agricultural production ceases (ibid). The most significant vulnerability according to the study mentioned above, was the dependency of fossil resources, because it is interwoven in the whole agri system. For example, machinery, tractors and transport vehicles are diesel powered, drying and storage of crops as well as heating buildings needs oil, agrochemicals are petroleum based and fertilizers are produced through natural gas (Tomczak, 2006; Johansson; et al, 2013).

Earlier in Swedish history of contingency, storage of these external inputs was established to maintain the production in case of war (Andersson & Brorsson, 1991). However, these storages became dismantled in the end of the Cold War. This fact makes the primary production even more important for maintaining the food supply during a crisis. Additionally, long-term solutions are necessary for maintaining food production during a crisis, which considers climate change and do not impose negative effects upon the environment. The foundation of the agricultural paradigm needs to change to achieve resilience, i.e. has the capacity to resist changes and maintain its condition if a crisis occurs (Holling, 1973:18). This issue is investigated in the research project “Can we produce food during crises? Vulnerabilities and resilience at farm level in Swedish agriculture” at SLU. This Master thesis is an integrated part of this project.

One way to increase the resilience in Swedish agriculture and approach long-term food security, would be transforming agriculture into a post fossil state. It could be achieved by replacing the fossil-based inputs in the farms with local and bio-based inputs, as well as on-farm recycling of energy, resources and nutrients (Björklund, Helmfrid, 2010; Gunther, 2003). Ideas of system ecology underpin this kind of resilient farming, which can be found in approaches like agroecology, regenerative agriculture, permaculture and biotechnological solutions for production of renewable energy and fuels. One condition to implement a transition to these kinds of farming systems, would be increasing the

knowledge about what preconditions there are for scaling up these agricultural practices at a national level. In this study, this is approached scientifically by investigating what broader world views and ideologies, called *discourses*, that categorize these farming practices approaching a fossil free state. Discourses create certain “trajectories”, which lead to different paths of agency to fulfil the farming strategy in society, depending on what power position the discourse embodies (Fairclough, 2010). In this inquiry, it is of importance to realize the farms’ connection to the wider institutional context. Policies, or political ideas formulated in steering documents, are highly influencing the possibilities for achieving a transition at a societal level – because policies hold power (Shore et al, 2011). Moreover, the farmers who divest fossil resources, are very much steered by policies because of the EU payments for agriculture and also by national regulations for climate mitigation and environmental conservation. Therefore, key policies of agriculture, environment and climate are explored for what discourse/-es they encapsulate, and to what extent they support or hinder the scope of action for scaling up fossil free farming to a national level. By doing this investigation, I hope to increase the knowledge about how to achieve long-term food security and an agricultural paradigm categorized by resilience. I wish it could be an incentive for the development of further policy changes.

## Research aim and questions

The aim of this master thesis is to describe the preconditions for achieving a national transition to post fossil agriculture in Sweden, to improve farm-level resilience and food security. I achieve that by investigating the agency of social actors to perform a farming system extensively independent of fossil-based inputs. This is explored by analysing how discourses and other social elements such as politics, cultural values and the economic system, affect the social actors’ agency. The study is conducted through a critical discourse analysis with inspiration from Fairclough’s dialectical relational approach (see in Wodak; Meyer, 2016). The aim is explored through following questions:

- How do discourses and other social elements affect the agency of social actors (farmers and entrepreneurs) to practice a farming system extensively independent of fossil-based inputs?
- What agency does key policies of agriculture and climate, give to various farming systems approaching a fossil free state?
- What can the overall agency of the farming systems say about the preconditions for achieving a transition to post-fossil agriculture and thus, increased farm-level resilience and food security in Sweden?

## Research methodology and design

To describe the aim and answer the questions above, the thesis is conducted in a qualitative research approach which will help me understand meanings of human perspectives or actions (Cresswell, 2014:4). My inquiry is based on the philosophical assumptions of social constructivism and a transformative worldview. The social constructivist worldview considers that subjective meanings of humans’ perceptions and actions are constructed by interactions with other people, places and things (Cresswell, 2014:8). The transformative worldview has emphasis on addressing marginalization of groups in society and the necessity of social change to make justice and rehabilitation for those (Cresswell, 2014:9).

Therefore, the research must consider perspective of the people that are affected and suppressed (ibid). A research which is in line with the transformative worldview is related to politics and is associated with critical theorists, such as Norman Fairclough who is a prominent scholar figure within the theory and methodology of critical discourse analysis (CDA). In this thesis, I will use this Fairclough's approach to CDA, which I will describe further on.

My investigation follows a cross-sectional design, which is to explore and compare several different units at the same time (Bryman, 2012:59f). I choose this research design because I intend to make one interview each with several actors who represent different kinds of solutions concerning reduction of fossil fuels in agriculture and varied key policy documents for agriculture and climate.

### Data-collection

The data-collection proceeded as follows. At first, a literature review was made of earlier research and facts about food security and food contingency in the Swedish context. Moreover, literature was reviewed about alternatives for fossil free agriculture, which resulted in climate adapted farming, agroecological practices and sustainable intensification of agriculture. In order to set the scene for the empirical material, I also read literature about the context to sustainable and climate adapted farming in Sweden and the policy field that influences this kind of agriculture.

The empirical data was collected in two steps, firstly deep-interviews were made and then policy-analysis was conducted. I made deep-interviews in order to capture the perspectives of people and what made sense in their lives, in accordance with qualitative methods (Kvale, Brinkmann, 2009). I chose six farmers and entrepreneurs who work towards achieving fossil free agriculture, or those who I considered to practice a fossil free strategy but did not themselves have the intention to do that. The selection of these were strategic, because I needed empirical data which were representative for different kinds of strategies that I considered to be highly fossil free. At first, I made a literature review of earlier research about climate adapted farms reducing their use of fossil fuels. I discovered two main streamlines about climate adapted farming; one mainly focusing on biotechnical solutions and the other on agroecological practices (these solutions will be further described in the background). After that, I consulted researchers at SLU and agricultural practitioners about which farms and enterprises that could suit my investigation. The chosen farmers and entrepreneurs are thus mostly in the forefront of endeavours which aims to realize fossil free agriculture or which I regarded to match with fossil free strategy. The recipients make up an equal division and variation between the two streamlines of climate adapted agriculture.

The interviews were semi-structured, meaning that I followed a set of themes and key questions, but it was also open for putting different questions depending on who I interviewed (Teorell; Svensson, 2007). Through this method it is possible to explore what makes sense in the life of the recipient. (See the question guide in the appendix.) The interviews were recorded and then transcribed, which I needed to fully understand their statements and to get quotes for the analysis. I sent the transcriptions to the recipients for ethical reasons, which gave them a possibility to make changes. I made the recipients anonymous, by changing their names and the farm or company name. However, it might be possible to trace who they are, because there are not many farms that resemble them.

Additionally, I wanted to make interviews with political actors who had crucial influence over agricultural policies in Sweden. Therefore, I did also interview Elina Matsdotter - environmental and climate expert in the Federation of Swedish Farmers (LRF) and Stefan Kjellman, the council minister and responsible for the crisis prevention and food contingency. Though, I tried to make interviews with other governmental officials as well, but they did not have time to participate. Therefore I decided to remove these two

interviews, because they would not have been sufficiently representative for the agricultural and environmental political context. Instead, I chose to make analyses of policy documents for agriculture and climate. This made the selection strategic, because I had certain requirements that steered what documents I chose. I selected updated and central policy documents by searching for the ones that were the most influential policies on the Swedish agricultural development. Moreover, I did also select national policies for climate and environment that steer the general goals and measures for all the sectors in Sweden, because these are a precondition for the climate and environmental ambition for agriculture as well. I pointed out four policy documents; The Swedish Rural Development Program (Government Offices of Sweden, 2016), the National Food Strategy (Swedish Government, 2017). A Climate Policy Framework for Sweden (Swedish Government, 2017) and Initiative Fossil Free Sweden (Swedish Government, 2016).

### Analysis of data

The analysis of the interviews is conducted through critical discourse analysis with inspiration from Fairclough's dialectical-relational approach (Wodak; Meyer, 2016). That method and theory was suitable for my inquiry, because it helped me to capture how discourses and other social elements such as political context, economic structures, institutions and cultural values affect the scope of action for individuals and groups in society. Moreover, it could unlock what preconditions there are in the political, economic and cultural context for various farming systems.

The empirical data are analysed and theorized through interpretation, called hermeneutics (Kvale; Brinkmann, 2009). It is the core method of qualitative research in social science, which is needed for understanding the perceptions of humans and motives that lie behind their actions. Therefore, this method makes it possible to come closer to "truths" about human actions and ideas. Knowledge which is produced through this kind of social science approach, can never be absolute and completely objective, because researchers interpret a phenomenon through their own perspective. Thus, the researcher must be aware of her or his own worldview and how it might affect the interpretation. The power relation between the researcher and the interviewed person and the questions that the researcher asks do also affect how the interviewed answer, which must be taken in consideration in the analysis. I tried to take these facts into consideration when doing my interpretations.

The analysis of the interviews is initiated by compiling the data in themes, which were in line with the CDA. It was made by summarizing the obstacles the farmers experienced in their agricultural practice, what difficulties they perceived to implement their farming system at a larger scale and what solutions they suggested for overcoming the last mentioned difficulties. After that, I made a textual analysis in order to capture what discourse or discourses they mainly belonged to. Further on, I searched for what agency the interviewed actors could have, by looking for how they were represented in the texts and what might have caused their difficulties. Then I could make conclusions of what agency could represent each discourse connected to the chosen farming strategies.

The analysis of policy documents was executed through a short version of CDA, due to the short time-frame of the thesis project. I applied a deductive method by searching for concepts in the policy documents that supported fossil free farming more or less— on the one hand concepts connected with agroecological farming and on the other hand words associated with sustainable intensification. This method helped me explore to what extent the chosen farming systems were represented in policy texts and what it could tell about their scope of action in the political context.

## Validity and reliability

In order to make the study valid, the inquiry must measure the research aim and the research questions (Eliasson, 2006:16). My interview questions were designed to measure the research aim, which contributes to a good validity. An eventual indication of reduced validity is my selection of policy documents. There may be other policies for climate and environment in Sweden which could be more influential for agriculture and the society, but due to the limited time and scope of the thesis it was not possible to investigate that further. This does also limit the validity to some extent.

Validity also concerns generalization – if the results can be applied in another similar phenomenon (Eliasson, 2006:17). I consider the generalization of the interview data as satisfying, because I have an even dissemination of agricultural strategies that approaches fossil free farming. Still, I would have liked to include a few more farming strategies, and thus made some more interviews with other farmers approaching a fossil free state, such as the intensive permaculture farms (ex Ridgedale), “Market Gardener”-approached farming (ex Under Tallarna) and productivist arable farming with agroforestry. However, due to the time that was lost when engaging in trying to get in touch with governmental officials, politicians and agricultural political lobbyists and this effort only resulted in two interviews – which could not be included in the thesis. This limited my time for data-collection and made it impossible to interview other farmers as well. Yet, it could be a possibility for further research to investigate the movement of agroecological farming in Sweden and the power dynamics that influence its’ expansion.

In qualitative research it is quite difficult to generalize, due to the fact that each situation is unique. Therefore, it is important to theorize the empirical data, in order to make sense of the unique situations and the reality of humans (ibid). The study becomes theoretically valid if the theorizing is consistent with the definitions of the theory – that the researcher has understood the definitions correctly and how they should be applied. One aspect of the theorizing in this thesis could diminish the validity, because the analysis of the policy documents was a short form of critical discourse analysis and it was also made deductively. It might have been more grounded and reliable if I made an entire critical discourse analysis by doing inductive interpretations of the meaning of the whole policy texts. Though this was neither possible due to time-shortage. Still, I consider the theoretical validity of my whole inquiry as good, because I have carefully studied critical discourse analysis (CDA) by Fairclough and other interpreters of CDA such as Jørgensen and Phillips (2002) and Wodak and Meyer (2016). I have also come to results which are similar to other research, such as Levidow (2015).

Reliability is a concept that concerns if the study can be repeated and provide the same result. However, researchers in qualitative research often argue that it is quite difficult as well, because every situation is unique as stated above (Eliasson, 2006:14). This is especially the case when the interviews are not fully structured, and thus the questions can vary depending on what person is interrogated. However, the main questions were the same and therefore it could be possible to make a study which approaches my inquiry.

# Theoretical outset and guiding concepts

## Critical discourse analysis

Critical discourse (CDA) analysis is chosen for understanding and explaining the preconditions to achieve a transition to fossil free agriculture in Sweden. CDA is an established method in social science aiming to analyse what ideas, knowledge and underlying structures that influence human action through studying how these are expressed in spoken or written language (Jørgensen, Phillips, 2002). It is crucial to understand what ideas are guiding human activities in a society, because it reveals what culture/values is dominating in a population. The culture could in turn contribute to social problems, such as abusive power relations, inequality, lack of freedom or insecurity. (Wodak; Meyer, 2016) How can language analysis say something about such social problems then? Through language, human mind is channelled and is developed through interaction with others. This process creates our ideas and in turn, our actions, behaviours and finally, the larger social and cultural structures. Therefore, language contributes to construct the social reality and does also help to reveal what ideas that underlie a social problem. (Danielsson, 2009:47) Thus, CDA is based on the philosophical assumption that the reality of human beings is socially constructed (Cresswell, 2014).

In critical discourse analysis, the ideas or culture described above, is called a discourse. Fairclough is a prominent figure in CDA and explains discourse in several ways, such as “the language associated with a particular social field”, “a way of construing aspects of the world associated with a particular social perspective” and in more general terms as “meaning-making as an element of the social process” (Fairclough, see in Wodak; Meyer, 2016:87). However, a more precise definition is found in Marry Webster Dictionary (2016): “the mode of organizing knowledge, ideas, or experience that is rooted in language and its concrete contexts”. Discourse is also closely related to Thomas Kuhn’s concept paradigm, concerning the prevailing set of ideas and beliefs in a specific period in science/a society, which decides what questions should be asked for, what answers are given and how a experiment/practice is performed (Kuhn, 2012). The concept ‘paradigm’ will be used to better understand that a transition to a new post fossil agricultural paradigm concerns a transition of ideas and beliefs. Though, the concept paradigm has many other nuances as well, but for this thesis, they would not have any function.

There are many ways of analysing discourses. Fairclough’s dialectical-relational approach to CDA is chosen for this thesis, which is a version of CDA that emphasises the dialectical relation between discourse<sup>1</sup> and other social elements (Fairclough, see in Wodak; Meyer, 2016:87). Discourse is socially determined, but does also shape other social elements, such as power, institutions, social relations, cultural values and beliefs (Fairclough, see in Wodak; Meyer, 2016:87). The relationship to other elements is central and its’ essence varies according to context, space and time. Therefore, this discourse approach is a post-structuralist perspective where both structure and individual agency creates discourses, which contribute to human action.

The dialectical-relational approach to CDA, analyses discourses by investigating a social problem. This is done by tracing the sources and causes behind it, the struggle against it and the opportunities to solve the problem. (Fairclough, see in Wodak; Meyer, 2016:87ff)

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<sup>1</sup> Note that Fairclough (2016) uses the concept *semiosis* instead of *discourse*, which is the more general definition described above. Though, in this thesis I choose the concept *discourse*, because it is the most established concept and I think it will be easier to understand the analysis by considering this.

The interview questions concern these aspects above, which are also considered in the analysis. The CDA can reveal how discourse and its relationships with other social elements can contribute to unequal power relationships and in which ways it can have implications on human well-being. Applying it in the case of this thesis, it is a problem that agriculture in Sweden is dependent on fossil resources, which both have implications on climate impact and food insecurity. In case of crisis, it can lead to food deficit for Swedish citizens. It can also increase climate change effects which threatens both human societies and ecosystems around the world. The critical discourse analysis can show what prevailing discourses that contribute to or resist this problem.

As presented before, CDA focus on the relationship between language use and socially and culturally characterized structures. To fully understand the nature of the discourse and how it works, Fairclough argues that an analysis is needed on the three dimensions of a discursive event: the concrete text, the discursive practice and the social practice (Richardson, 2006:37). The text dimension is revealed by drawing out the function and the form of the text, with focus on linguistic features. This is done by identifying key words in the text, semantic relations between words and what meanings are attached to them. This contributes to identify the discourses, context and perspectives that are inherent in the text (Fairclough, 2003:131). Connecting the analysis with other social or political theories are crucial to know what kind of discourse it represents (see next paragraph “Eco-technological fix and eco-centric fix for agriculture”). The discursive practice refers to the process of the production and the consumption or interpretation of the text – i.e in which context the text was produced and how the reader interprets and make use of the text, which is called a discourse analysis. The social practice is about the texts’ and the discourses’ relations to the wider institutional context or the society and culture. (Richardson, 2006:37-39). The questions that could be asked for the last dimension are: What can this text say about society in which it is created and the society it is produced for? What influence does it have on the social relations, power, institutions and beliefs? Could it contribute to maintain or reduce social problems such as injustice, inequality or lack of freedom? This is where the analysis becomes critical.

How then could the critical discourse analysis help identifying agency of farmers to perform a fossil free farming system? And how does it connect to discourse? The *Agency* of farmers for example, depend much on what discourse that the farmers belong to and what power position that discourse has in society. *Order of discourse*, is a concept for the set of discourses in a society or community, the set of different ideas and ways of meaning making (Jørgensen, Phillips, 2002:141f). Within this order, some discourses are dominating or mainstream while others are marginalized, alternative or opposing (ibid). The greater power position of the discourse, the larger potential of agency for those people, groups or institutions who embodies it.

*Subject positions* help to visualize agency, which is the package of rules for how to live and behave in general, which the discourse provides (Neumann and Dukler 2003:104). Thus, it is the space within which various people or groups can act, but can as well limit the action to be taken (Fairclough, 2010). Subject positions can be investigated through identifying how the prevailing discourse in a text represents a social actor. It can be conducted by searching for the representation of a social actor, such as *inclusion/exclusion* and *activated/passivated* (Fairclough, 2003:145). Exclusion is described in two ways; by suppression or backgrounding. Suppression happens when the social actors or social events are not mentioned in the text at all, backgrounding is realized when the social actor or social event is found in few places in the text, but deserves to be mentioned more times. A social actor is passivated when he/she is affected by actions of others in a social process and activated when being the one who make things happen. (Ibid) It is the order of discourses in the society, which contributes to the inclusion or exclusion of people or events.

However, a social actor could either accept the subject position given or neglect it, challenge it or even change it. When accepting it, the person also accepts the role of being a



*subject*. Then it can work as a catalyst for a certain language, culture, ideology or knowing – i.e. discourse. Moreover, a social actor can also be a subject to the actions of others, when their actions get extensively affected or steered in a process – either positively or negatively (Fairclough, 2003:145) Subjects have a role in the social and cultural change. This is because they both work as producers and products in the maintenance or change of discourses and social and cultural structures (Jørgensen, Phillips, 2002:16). For example, an agricultural policy can provide a certain subject position for how a farmer should be and act, in order to obtain payments. Let us say that the minimum requirement for payments is to cultivate four hectares of land. Many farmers do for that reason, only invest in more large-scales farms to obtain these payments. Then they suit into the subject position that the policy's discourse provides and accept the role as a subject. This is how a hegemonic discourse is reproduced. Yet, many farmers might own less land than four hectares, but think they are real farmers anyway and do not want to become larger. Then they can challenge the policy and its discourse, by for example doing political lobbying for small-scaled farming to be included in the policy.

This is how I have interpreted and made use of critical discourse analysis with a dialectical-relational approach. The overall focus of the analysis is to understand what agency the social actors (farmers and entrepreneurs) have, which could tell something about the preconditions to achieve a transition to fossil free agriculture. The analysis is initiated by identifying what discourses are prominent in the text by looking for key concepts and statements, which is the text dimension and the discursive practice. Here comes the application of other social theories, which will be described below. Then follows a compilation of what obstacles the social actors experience. After that, I trace how the social actors and the connected farming system are represented within the obstacles – are they passive or active, included or excluded? This is where I investigate how the social actors are affected or treated by other social elements, such as actions of others, political institutions, economic structures and cultural values. From this, I can understand the power position of the particular discourse connected to the farming system, and what agency it provides. Finally, the analysis above connect to the social practice, by discussing what it says about society and the preconditions to achieve a transition to fossil free agriculture in Sweden.

In this thesis, the analysis will partly be applied on policy documents. I will only look for representations of the social actors and events associated with the farming systems chosen for the thesis. This is due to limited time frame of my thesis. When policies or policy documents are mentioned, I refer to steering documents or political suggestions. Policy documents embody power, because it channels the actions of political ideas. It do as well represent a hegemonic discourse - what kind of knowledge is most favourable belonging to in terms of power and money? Therefore, policy documents tell something about how power is organised and how political control takes place in a society. (Eriksson, 2013:51) Thus, political ideas - which are represented in the policy documents - do also have power to influence citizens' values and agency (Danielsson, 2009:71).

In order to make the CDA operational, it needs to be complemented with additional theories about the context of the empiri. This thesis' empiri comprises the sustainable agricultural field in Sweden, which focuses on climate and environmental adaption practices that divest fossil resources. Therefore, I will present concepts that covers ideas which underlie this field in the paragraph below.

## The eco-technological fix versus the eco-centric fix for agriculture

There are many different alternatives practiced today for increasing sustainability in agriculture in Sweden. I conclude that these alternatives are characterized mainly by two contrasting streams of ideas, which I choose to call: the *eco-technological fix* and the *eco-centric fix* for agriculture. These are grounded in ecological sociology, concerning the

philosophical assumption that the anthropocentric society has caused the environmental devastation (Mol, Spaargaren, 2000). However, these concepts represent two different schools of thought about how to deal with the ecological challenges. They are inspired from Warren Belasco's concepts 'anthropological fix' and 'technological fix', concerning different streams of ideas about the solution to the global food crisis. However, I modified them by applying 'eco' in front, to ease the reader's understanding of the meaning of the concepts.

The *eco-technological fix* for agriculture emphasizes profitable technological solutions to environmental problems. It is inspired by the theory of ecological modernisation, which evolved in the social and environmental liberal sphere during the 1980s. The intention of this perspective, was to achieve environmental restoration by political change (Jänicke, 2008; Mol, Spaargaren, 2000). Eco-modernists stressed the importance of integrating environmental considerations into the capitalistic system (Mol, Spaargaren, 2000). The practical alternatives that fit this view, are eco-efficiency and modernized technology, because they provide both growth and ecological restoration (Jänicke, 2008). In Sweden, there are many of these climate-mitigation techniques applied in agriculture, such as on-farm biogas plants which produce renewable energy and waste products used as fertilizer.

Though, there are some critique to this school of thought. Martin Jänicke, professor in ecological modernisation, claims that the ecological modernization theory tends to eliminate environmental efficiency due to growth processes. Further on, both Jänicke and Mol and Spaargaren (2000), argue that eco-modernism is not enough to create a long term sustainable development, because ecology is not the prioritized objective compared to social and economic concerns. This view is also criticised by neo-Marxists for dealing insufficiently with power relations and social injustice, which derive from unequal distribution of environmental problems among groups and classes (Mol, Spaargaren, 2000).

The *eco-technologic fix* is also associated with the concept of *weak sustainability*, in contrast to *strong sustainability*. These concepts derive from resource and environmental economy, concerning a measurement of sustainability through the value and use of capital (Ayres, et al, 2001). The weak sustainability worldview does mainly involve economic development and claims that sustainability is achieved through non-decreasing growth – in terms of welfare development - from generation to generation (Brekke, 1997). This view is most common among economists, especially neo-liberals, and argues for a continuation of consumption and growth to provide welfare to society. The weakness of this assumption, is that economic and manufactured capital are regarded as substitutable to natural capital. The consequences are resource depletion, because natural capital is mostly a finite resource (except renewable energy etc). Once natural capital, let's say minerals extracted from a mountain, are manufactured as a tool, it cannot return to the original state (Ayres, et al, 2001). According to Ayres, van den Bergh and Gowdy (2001), the weak sustainability view cannot be reconciled, if it does not imply a different economic perspective than the linear growth model. It needs to match the cycles, diversity, and unpredictability of complex biological systems, and take buffer-capacity into account. For example, if the whole lifecycle of the production and the use of the technique is life-supporting for humans and the environment, it will create the so called 'circular economy'.

The concept *eco-centric fix* involves a deep interest and worry for how food is produced and consumed. It connects to the worldview of radical ecologism and deep ecology which emerged during the 1970s. This theoretical view is based on a more profound environmental concern, by questioning the very culture and structure of the western industrial society. (Belasco, 2008; Mol, Spaargaren, 2000) It criticises the materialistic growth society to be responsible for the ecological crisis. (ibid) Instead, this ideology prioritizes ecology before social and economic issues, and emphasizes radical environmental goals. Additionally, it stresses the need of social and cultural change, due to the social struggles and inequalities connected to environmental devastation. One example of social change is equal distribution of resources and environmental problems around the world. Further on, cultural change is how to redesign the values and behaviours of humans,

to adapt to the limits of the nature and to create a better relation to the living Earth. (Belasco, 2008; Mol, Spaargaren, 2000)

Belasco (2008) describes how this eco-centric view is expressed within the food sector. It emphasises more traditional values, methods, and low-tech solutions to feed the world in a fair way. Practical examples of the eco-centric fix ideas for agriculture are permaculture, agroecology, community supported agriculture (CSA), regenerative agriculture and small-scaled subsistence farming. Other examples are relocating food by connecting consumers with farmers and promoting consumption of local and organic food which respects animal welfare (Belasco, 2008). Though, this view is confronted with the difficulties of larger societal implementation of the ideology, like making political reforms (Dobson, 1990, see Mol, Spaargaren, 2000:37). Rather, these ecological principles are practiced mainly through personal and community commitment and a green lifestyle, according to Dobson (1990).

The eco-centric fix is similar to the *strong sustainability* concept. That is, according to Brekke (1997) and Daly and Cobb (1989) non-diminishing life opportunities (see Ayres, et al, 2001:4). This should be achieved by conserving or maintaining different kinds of capital: economic, social and ecological. Because ecology is equally valued as the other capitals, it could seem that the environmental is prioritized because it is not usually highly valued. It is based on the insight that the ecological systems and its' components have invaluable functions and values for humans, and our socio-economic system must treat them likewise. In addition, the rights of nature are recognized. Therefore, it is argued that the natural resources cannot be substituted for by human or physical capital. But still, the natural capital is essential in the production and consumption of welfare society. It does however not claim to preserve all biological components of the planet, because it would be impossible. The utility of this view, is valuing and classifying the natural capital, which provides a conservation of the ecological parts and processes which is critical for maintaining life opportunities. For example, pollination and fertile soil for food production, clean drinking water, fresh air, photosynthesis, biochemical cycles and so forth. (Ayres, et al, 2001)

# Background

The background presents the field of food security in Sweden. It is introduced by a historical perspective on the policy arena of food security. Further on, the focus is narrowed to farm-level vulnerabilities and its' implications on food security, where former research is presented. That section leads to alternative visions for Swedish agriculture, that addresses profound resistance to crisis like climate change, trade disturbances, natural disasters or war. The chapter ends with an introduction to the empirical field; fossil divesting-farming systems in reality and within the policy structures.

## A historical perspective on the food security policy framework

The policy agenda for food security in Sweden is characterized by the World Wars. When the World War I took off in 1914, extensive food shortage and rationing was needed to manage the crisis. It took place even though the food self-sufficiency rate was measured to 82 percent by the war outbreak, which is rather high. (Andersson, Brorsson, 1991) The national food supply was not sufficient due to crop failure and unavailability of imported protein feed and artificial fertilizers (ibid). A new contingency system was developed due to the war experiences, in which food security was a crucial part (Andersson, Brorsson, 1991; Eriksson et al, 2016). Thus, the food security agenda became influenced by the defence policy, but also by the dominant political ideas of agriculture (Eriksson et al, 2016).

The policy of food security required to establish governmental security stocks, to storage food stuff and agricultural inputs such as diesel, artificial fertilizers and pesticides and spare parts for machines and vehicles (Eriksson, et al, 2016). During this period, in the beginning of the 20<sup>th</sup> century, the agricultural policy changed from a family-based, subsistence and mixed small-scaled farming approach into ideals of productivity and market-based agriculture (Andersson, Brorsson, 1991) (Gadd, 2009). This new approach emphasized fossil fuel-powered machinery and the use of artificially produced agrochemicals, to increase the production output as well as economic growth (Thompson, 2010; Belasco, 2008). Another important part of the contingency system, was the voluntary mobilisation of farmers and their cooperation with state authorities, called 'Farmers' Block-Organisation'. When WWII approached, they started to share resources, materials, manpower and draught animals as efficient as possible within a region, to maintain the food production for the state (Lantbruksstyrelsen, 1991). Other crucial factors securing food supply, were the access to farm labour and high food prices, which was an effect of the agricultural politics and a dense rural population. These preparations and factors resulted in a higher food security when the World War II took off; only modest food rationing was necessary. (Eriksson et al., 2016; Andersson & Brorsson, 1991)

After the wars, food security became an even more important issue in the agricultural politics. A political aim was introduced to achieve high rate of food self-sufficiency, to hinder dependency on imported food. This aim was highly influenced by the blockade from the Nazi power and the exposed geographical location of Sweden. A blockade scenario would result in food shortage and deficiency of inputs to agriculture, depending on the insufficient or non-existing national production of these inputs. Therefore, the storages of food and agri-inputs were maintained to a level that the production - including changed diet habits - could supply the Swedish citizens with food for several years. The state continued to strengthen the contingency system during the Cold War, because support from other military powers could not be insured due to the alliance neutrality. (Eriksson et al, 2016)

In the end of the 1970'ies, economists criticized the political aim of the high food self-sufficiency, because of the high costs required for maintaining the storages of agri-inputs (Bolin et al, 1984; Hedlund & Lundahl, 1985). Eventually, the entire contingency system was regarded to be too expensive and inefficient, which resulted in a dismantling of the food security system in the end of 1980; the agricultural sector became deregulated, the policy aim of food self-sufficiency rate was abolished and the security stocks were closed successively (Eriksson et. Al, 2016). Furthermore, the Cold War had ended and there were no other obvious threats to the national security. Still, the planning for contingency was maintained until 1995, when Sweden became a member of the European Union. The national agricultural politics as well as the planning for food security, was then replaced by the EU policies, such as the Common Agricultural Policy (CAP). Eventual food shortages occurring in a member state, would be solved through the common trade market within the EU, according to the Solidarity Clause (Eur-Lex, 2018). Though, there are no other policy aim for food security, such as a food self-sufficiency rate.

More than twenty years later, the food security issue is now vitalized again in the Swedish policy context. In 2015, a new Defence Act was published, due to the increased threats towards the National security (Swedish Government, 2015). The policy act provides increased funding for the military sector and for governmental authorities to resume the planning for civil defence. The field of food security is a significant part of the civil defence, though there is no state authority who has an overall responsibility for the entire food supply chain. The National Food Agency has the main responsibility for the coordination of securing food supply during a short-term crisis - after the level of primary production. There is no association which organise farms during war or crises, like the Farmers' Block Organisation. However, the mentality is different today, because farmers do not have such sense of state solidarity to organise the food production voluntary during crisis, like in the past. The general Swedish farm produces food rather for business profitability, according to former research (Sollén Norrlin, 2016). In sum, much work lies ahead to increase the societal preparedness for food security – especially at farm-level.

## Farm-level vulnerabilities and its' implications on food security

The entry to the EU caused structural changes in the Swedish agricultural sector. The integration with the EU common trade market and the international market, resulted in an increasingly libertarian and global steering of the sector. (Eriksson et al, 2016) The advancement of the rationalization and the specialization of agriculture, contributed to decrease the number of farms substantially; one-third has closed and most of them are dairy farms (Statistics Sweden, 2016). Many of the remaining farms have become larger in scale and more specialized in the production (ibid). This expansion of productivist and globalized agriculture, has as well contributed to an increased dependency on imported inputs, such as diesel, agrochemicals and protein feed. In case of crises, there are neither any state security stocks which can supply farms with these inputs. This agricultural development has resulted in a reduced self-sufficiency rate, both for food and the means for producing it. Though, the measurement of the self-sufficiency rate ended in the 1980'ies, when the contingency system was lastly dismantled. The only official data is that imported foodstuffs constitutes half of the monetary spending on food in Sweden, according to a study made by The Federation of Swedish Farmers (LRF) in 2010. These facts described above, indicate that this lack of preparedness at the primary production level, is likely to cause food insecurity in case of crisis. Yet, there are few research studies made about this topic within the Swedish context, even though its' significance for society.

A central point in former research has been vulnerabilities at farm-level, i.e. sensitivity for disturbances. It is essential for understanding food security and strengthen the preparedness for it, because vulnerabilities can threaten the capacity to produce and supply

food in case of a crisis. The former studies are mostly done by SLU researchers, of which I Andersson and K-J Brorsson are the most prominent among the earlier research. Andersson and Brorsson (1991) made an extensive research report from the period of the last dismantling of the contingency system. The study was a historical investigation of how farm-level vulnerabilities changed from 1940 to 1990. Additionally, it explored farmers' attitude to society's requirement to secure food supply during a crisis or war. Five farms were investigated in different regions in Sweden. The study concluded that the vulnerability in the agricultural sector as well as in single farms, had increased during that period. In the 1940's, agriculture was not much mechanized, instead horse draught was mainly used in the production. After the introduction of tractors and machines, a dependency on fossil fuels arose. The yield from cattle had also doubled, why the import of protein feed needed to expand. Farms were electrified to some extent in the mid-20<sup>th</sup> century, but during the following fifty years it escalated. Further on, working labour were more accessible in the past –around 60 percent of the inhabitants lived in the countryside during the 1940's. The development of mechanization did also require advanced technical knowledge. The loss of competent farm labour was thus another vulnerability. However, Andersson and Brorsson (1991) highlighted that the alternative and organic production are more resilient for disturbances, because they do not use imported artificial fertilizers and protein feed. Still, the changed agricultural policies and preconditions, imposed farmers to expand the production, which reduced farmers' sense of solidarity as food producers. That is problematic in terms of food security, because society trusts farmers to always produce food for the people. That is why it is possible for the majority of the citizens to work with something else than farming. Yet, there are only 1,7 percent of the Swedish population working in the agricultural sector, which is not enough labour to produce sufficient food in a sustainable way during crisis (Swedish Board of Agriculture, 2017).

Recent research is made by the Swedish Institute of Agricultural and Environmental Engineering (former JTI), which investigates the consequences of deficiency of fossil energy in the Swedish food production. Their analysis show that a long-term deficiency of diesel would result in food shortage and even famine. (JTI, 2013) Moreover, the project that this thesis is part of, made an investigation of farm-level vulnerabilities in 2016. The selected farms represented a variation of general production branches in Sweden; dairy, crops, pork, broiler, beef, mixed small-scaled production, and horticulture (Eriksson, et al, 2016). The study concerned how a blockade would affect these different production branches, to evaluate farm-level vulnerabilities and resilience. The results revealed that a blockade, which makes inputs inaccessible, would cause large obstacles in most of the production branches. These inputs do all involve fossil resources to some extent, directly or indirectly. The direct resources are mainly diesel, heating oil and engine oil. It becomes indirect, when fossil fuels are used in the production of agrochemicals and in the crop-production for animal feed, these are then imported mostly by diesel-powered transports. (Tomczak, 2006, Johansson, et al, 2013) Still, the use of diesel was considered as the major vulnerability, due to crop-production's dependency on fossil fuelled-powered tractors and machinery. The crop-production is regarded as particularly important to maintain during crisis, because it is interlinked with many other production branches as well - supplying feed to cattle and food to humans.

In sum, the former research show that the productivist and fossil-dependent approach that has been dominating almost a century, has successively increased farms' sensitivity to disturbances. That's why new visions and solutions are needed for the agricultural development, to maintain food supply in the future. These new visions also need to consider sustainability challenges such as climate change, environmental problems and social issues like human rights, wellbeing, justice and animal welfare.

## Visions for a post fossil and resilient agricultural paradigm

New visions for agriculture are necessary, which addresses profound resistance for crises. It calls for an alternative agricultural paradigm, which breaks the old era of dependency on imported fossil resources. Farming needs to work with nature, not against, according to a UN-report about how to solve the global food crises, written by 400 researchers (2008). A national transition to fossil free agriculture, would increase the resilience and at the same time, consider the challenge of climate change, environmental problems and social issues.

In the divestment of fossil resources, we will instead become more dependent on local and vital ecosystems to provide the biological resources, energy and nutrients needed for food production (Björklund, Helmfried, 2010). This could be achieved by applying a mindset of system ecology on farming, by integrating the functions of nature into the planning of society (Gunther, 1993). Recycling, cooperation between systems and material- and energy efficiency, are core functions which characterize ecosystems (Gunther, 1993). According to Eriksson et. al (2016), Gunther (2001) and Björklund & Helmfried, (2010) these processes reduce vulnerabilities in agriculture. By closing cycles of nutrients, energy and resources as locally as possible by means of biological processes, fossil agri-inputs could be replaced. Further below, I will present various existing visions of fossil free agriculture, which are to different extent in line with system ecology.

Maybe the most common-sense perspective of fossil free agriculture, is the neoproductivist approach to agriculture, emphasizing 'green' industrial farming (Lewidow, 2015). In this sense, 'green' does refer to climate and environmental adaption techniques, replacing fossil energy, fuels and agrochemicals with bio-inputs and renewable resources (Guthman, 2004, in Lewidow, 2015). This approach includes the 'sustainable intensification' agenda, which emphasizes intensive use and amount of technology, knowledge, land and natural capital to achieve sustainability (Royal Society, 2009, in Lewidow, 2015). Maintenance of the large-scaled and market-driven agriculture is a central idea, but with the condition to reduce environmental impact. For example, the use of agrochemicals is minimized in order to protect the harvest, but in the same time it reduces the toxic effects on ecosystems. Another example is a biogas plant that processes manure that provides biogas and biological residues that can be used as fertilizer, which can be regarded as a recycling system. In the result section, I will refer to this model as the *eco-technological fix* for agriculture.

The agro-ecological approach, is often seen as the opposite to the perspective described above. The characteristic of agroecology is to apply ecosystem processes and services in agriculture, which is similar to the system ecology mindset (Lewidow, 2015). Its' purpose is to increase eco system services, biodiversity and permanent cultures by applying a holistic perspective (Funes, et al, 2002). Adapting scale, often downsizing to middle- and small-scale, is promoted for adapting to the farm's production and increasing ecosystem services. This is emphasized to achieve feedbacks and recirculation in the farm so that energy and resources are optimized. (Björklund, Helmfried, 2010; Belfrage, 2014; Lundberg, Moberg, 2008) A variation of scales, i.e a plenty of different biotopes within the farm increases the biological diversity (ibid). Further on, the farming is practiced with a combination of traditional and modern methods to achieve the most eco system services, increased amount of harvest and energy and nutrient self-sufficiency, for example by intensive labour, use of draught animals and also tractors for heavier work are motivated (Heider; Boonstra, 2017; Johansson, 2013) Models of agroecological practices are micro-farms with biologically intensive cropping systems, like the french "Maraîchage" or "The Market Gardener"-approach, permaculture and agroforestry (Fortier, 2014). Regenerative agriculture and biodynamic farming are other practices of the agroecological approach, which perceive the whole farm as a natural entity (Granstedt, 2012). It emphasizes rebuilding of the original qualities of nature, such as soil fertility and nutritious and resilient plants. Additionally, it stresses the interconnections within the farming context and surrounding ecosystems, like on-farm cycling of nutrients and energy between crop

production and animal husbandry. (ibid) This vision will be referred to as the *eco-centric fix* in the results.

Cuba offers one of the few examples of transforming agriculture into a fossil free state, which can thus provide important lessons on how to succeed with this transition. During the collapse of the Soviet Union, Cuba's trade collapsed as well because 85 percent of the trade constituted a partnership with European socialist countries. (Funes, et al, 2002) The majority of the fuel, machinery, spare parts and two thirds of the food stuff were imported from the Soviet allies (Funes, et al, 2002). When the crisis occurred, the investment capacity was reduced to 40 percent and the import decreased by 75 percent, including food stuffs. Furthermore, fossil fuels and animal feed concentrates were diminished to a third, fertilizers to a fourth, the supply of pesticides were halved, which did all seriously affect the food production and supply. (ibid) This led to an even greater need of increased food production at a national level. It resulted in a large governmental restructuring, with fundamental policy shifts and serious governmental resources supporting the agroecological approach (ibid). Thus, old knowledge about gardening techniques were revitalized, like intercropping and manuring, and new knowledge and techniques was applied, like bio-pest controls and bio-fertilizers. One precondition for the introduction of agroecological farming, was that Cuba had a history of small-scaled and agroecological farming, especially before the introduction of modern agrochemicals. Examples of policy implementations were governmental support to the urban-, family- and community gardening movements, renewal of the animal traction, reduction of agricultural specialization, decentralized cooperatively owned farms instead of state owned and introducing farmer's market with free market conditions (Funes, et al, 2002). The food shortage that had occurred during the crisis, was highly overcome due to these policy shifts and thus food security was obtained. (Funes, et al, 2002).

However, often these approaches, the sustainable intensification- and the agroecological one, stand in opposition to each other, but instead they could be integrated and perceived as complementary. Farming is highly context specific and needs to be adapted for its' specific location. (Heider; Boonstra, 2017) Jointly, these visions could deliver fossil free agriculture, ensure farm-level resilience and increase national food security?

## Context to the empirical field

The empirical field consists of various farming systems approaching a fossil free state and Swedish policy documents, which highly influence these systems. The empirical investigation includes an exploration of what agency are given to each of the farming systems, and what they jointly can tell about the preconditions achieving a national transition to fossil free agriculture. Further below, I will briefly describe the Swedish context to the farming systems and the policy documents chosen for this study.

There are 171 400 active farmers in Sweden at present, which both include fulltime and part-time jobs. It accounts for 1,2 percent of the national employment. There are 63 000 farms, and the average size is 40 hectares. (Swedish statistics, 2017). During the last years, an increased environmental and climate concern has been spread in the Swedish agricultural sector. For example, the amount of land with organic production has doubled since 2006, from 225 430 hectares to 553 100 in 2016 which accounts for 18 percent of all agricultural land (Swedish statistics, 2018). Organic can be regarded as an approach to fossil free farming, because it doesn't use fossil-based agrochemicals and in some of the certifications, such as 'KRAV', the farms must use renewable and bio-based energy – but diesel-powered tractors are an exception. Climate adaption initiatives has increased, like sustainable intensification- and renewable energy and fuel alternatives. According to an inquiry made by the Swedish Board of Agriculture, 56 % of 7500 interrogated farmers had a sense of responsibility to climate adapt their farms (2013). Parallel to this, a new green



wave is recently spread around Sweden, striving for self-sufficiency of food at an individual and a local level. Emil Sandström, researcher at SLU, claims that this depends on increased climate and crisis awareness (2018). This movement can be measured in the exponential increase of digital forums and practical courses starting up at general level of education, concerning small-scaled organic farming, self-sufficient life-style, urban farming and so forth (Jones, 2018).

The farms and enterprises chosen for this thesis represent a combination of the agricultural streams mentioned above. These are selected for being in the forefront of different farming systems in Sweden that intentionally, or unintentionally, approaches a fossil free state. Other farms chosen are instead picked because they perform a method which reduces different indirect fossil resources to a large extent, like agro-chemicals, import of fodder etc. Some of the farming actors interviewed had rather environmental concerns as motive, or ambitions for a particular lifestyle. Therefore I call them “farming systems approaching a fossil free state”. In order to investigate the possibility for nationally scaling up these farming systems, it is crucial to include the political context. The preconditions for implementing this change does much depend on politics. This thesis will focus on the Swedish policy context, which is described below.

The climate adaption stream is to be seen in the agricultural politics as well. The Swedish agricultural sector is steered from the EU Common Agricultural Policy (CAP), which is responsible for the subsidies for European farmers (Swedish Board of Agriculture, 2017). It consists of two pillars, the first pillar includes direct payments, which helps farmers to stabilize revenues and to deal with the unpredictable market prices (Radonnaud, 2018). The second pillar is the EU Rural Development Policy (RDP), which concerns the social, economic and environmental development of rural areas (Nègre; Moller, 2018). It contains three axis, of which the first concerns the improvement of the competitiveness in agricultural- and forestry sector. The second focuses on improving environment-, landscape- issues and climate mitigation. The third axis is about development of the quality of life at the countryside, increase the diversity of entrepreneurship initiatives and favour the economy in rural areas. (Swedish Board of Agriculture, 2018) Additionally, the European RDP supports the Leader rural development methodology, which implements Local Action Groups that formulate local development strategies (ibid). Thus, it is mainly the second axis which concerns climate and environmental issues, and to provide support to fossil free initiatives.

Every member state has scope of action to influence the RDP, because the program shall be nationally adapted. In Sweden, the Governmental Authority of Finances has the main responsibility together with the Swedish Board of Agriculture, to formulate the RDP (Swedish Government, 2015). That is why I will investigate the Swedish RDP in the result, because there is a possibility to influence climate adaption of agriculture. Yet, in 2016, the Swedish political context became more receptive for agricultural issues, which led to the creation of the National Food Strategy (2017). The policy focus on increasing food self-sufficiency and improving competitiveness in agriculture. This policy is as well chosen for analysis of the result, because it is the only national policy concerning goals and funding for the Swedish food production and consumption, until 2030. (Swedish Government, 2017)

The climate adaption of agriculture and the divestment of fossil resources do as well become steered and influenced by the national environmental politics. In Sweden, the environmental politics is seen as one of the many good examples for environmental action in the world (Björstig; Eckerberg, 2016). Key environmental policies for divestment of fossil resources at present are “A Climate Policy Framework for Sweden” (2017) and “Initiative Fossil Free Sweden” (2016). Thus these are chosen for the empirical investigation. However, there are many other policies which influence the agricultural policies, not the least concerning international trade. Due to the time- and space-limit of this thesis, I will only focus on the ones described. In following chapter, the empirical investigation of the farming systems and the policies will begin.

# Results

The result is structured and conducted as follows: the first section of the analysis includes a presentation and analysis of the agency of farmers, i.e. social actors, to perform a farming system approaching a fossil free state. In the following part, I explore how these farming systems are represented in key policy documents of agriculture and climate in Sweden. After each of these parts, summaries are made which include the conclusions drawn from the analysis and the answers to the research questions. When answering research question number three, the analysis becomes critical, by investigating the texts' relations to reality, i.e. the social practice, and what this can say about the ability of the Swedish society to achieve a post fossil and more resilient agricultural paradigm.

## Farming systems approaching a fossil free state

In this phase, an analysis is made of the agency of the social actors approaching a fossil free farming state, which answers research question number one. This paragraph works as an introduction to how the text analysis is performed technically, semantically, and structurally. The theorizing of the analysis is made by describing how the social actor's express obstacles in the performance of their agricultural strategies, difficulties to implement them at a national level and which solutions perceived to overcome the difficulties. These questions capture what discourses the social actors belong to, and how other discourses, actions of others and the additional social elements influence their problems and agency. The hierarchy of discourses in society contributes to provide more scope of action to those belonging to the hegemonic and most powerful discourse in society.

I introduce each text of a farming system with a short description and the ways it divest fossil-based inputs. The text does then consist of descriptions about obstacles the social actor experiences in the farming, and his/her visions about the possibilities to implement the agricultural strategy at a larger scale. The texts are interwoven with statements or words in italic, which represent the most common and important statements. Moreover, I describe how these words and statements are semantically related to each other and what meaning, context and perspective are connected to them – i.e. what discourse they belong to. In this phase, I connect the statements to the discourses of *eco-technological fix* and *eco-centric fix* for agriculture.

To capture the agency of the social actors, I trace the subject position, or the package of rules for the way of living and behaving in general that the discourse provides. This is conducted by identifying how the farmer and the farming system is represented within the obstacles expressed. In this phase, I investigate how the farmer is treated and affected by the social elements: political institutions, economic structures, and cultural values. This is done by searching for representations of the social actor, such as inclusion/exclusion and activated/passivated. Exclusion can be understood in two ways; by suppression or backgrounding. Suppression happens when the social actor is not mentioned in the text at all, backgrounding is realized when the social actor or social event is found in few places in the text, but must be mentioned more times if they would be included. (Fairclough, 2003:145) This helps me understand the power position of the discourses that belongs to the farming systems, i.e. the dominating aspect of the orders of discourse, and what agency it contributes to. Then, the analysis is connected to the societal level and the preconditions to transform Swedish agriculture to a post fossil paradigm.

## 1. A renewable and energy efficient farming system

The Renewable Energy Company is owned by three large-scaled conventional farms. The farms are 160 hectares, 220 hectares and 485 hectares, mainly producing grains and rapeseed. 95 % of the fossil fuels used in the farms are replaced to renewable ones in the tractors and machines, transports, grain dryers and heating systems. The farms use as much bio-based fertilizers and manure as possible, which is complemented with artificial agrochemicals produced with fossil energy but the GHG emissions are purified with nitrous oxide. The company has also formulated a model for divesting fossil fuels and reducing greenhouse gas emissions, based on a life cycle analysis of a whole farm or other business, including the chain from production to transport to customers (see “Östgötamodellen”). The company sells biofuels and extension services to other companies, farms, and the public sector as well, which are based on their model. The empirical data below is obtained from an interview with Erik, one of the company owners.

The main obstacles occurring was associated with the political structure. Erik argued that the *tax system increased the costs* for farmers wanting to do a transition to biofuels. RME and diesel are priced the same at the gas stations, but farmers only get refund for diesel taxes. Their tractors are RME-powered, a biodiesel based on rapeseed, which therefore creates a cost increase in comparison with running on diesel. Erik criticized the government for creating a *competitive advantage* for using fossil fuels in agriculture. Still, he was positive to the governmental support to farmers, but he said it should have been socioeconomically more beneficial by removing the employer's fee. That would both increase the *competitiveness* in agriculture and *reduce import of fossil fuels*.

When Erik was asked about his opinion about other farmers' capacity making a transition, he concluded:

“There are probably many farmers who have already changed their minds and want to do it, but they do not see the economic space making the transition due to the tax situation.”(Erik, 2016. The author's translation)

However, Erik claimed that The Renewable Energy Company could cope with higher cost of biofuel, due to their successful off-farm biofuel enterprise. Yet, he mentioned that other farmers, who don't have an additional profitable enterprise, could not handle the cost increase. Still it limited the agency of the company, because of the extra costs which could have been used for something else. This indicates that the political institutions affect their agency. It could also show that the discourse of the government and the agricultural business include norms for taking diesel-use for granted in agriculture. This provides a subject position for what is 'right' for farmers.

Further on, Erik criticized that some biofuels were exempted from taxes, such as HVO, a fuel consisting of biological waste products. He described that currently, everyone wants to buy HVO, because it is cheap and less problematic than RME. Erik worried about the risk of reduced supplies of HVO, because the production of both HVO and RME are limited. This made The Renewable Energy Company starting from mainly selling RME and HVO alongside, to shift to 80 percent HVO and 20 percent RME. This statement describes that policy factors and the economic structure of the market did highly influence their business' agency, which made them change their business supply a lot. It also shows that some renewable fuels were disadvantaged in the political structures, while others were favoured. Yet, this did not make them unable to maintain their fossil free farming system, because they adapted to the economic and political system and its' connected discourse.

Another expression connected to obstacles, was that Erik perceived a resistance from vehicle suppliers. This happened when the company proposed a *conversion of their agricultural vehicles to renewable fuels*. The vehicle suppliers had a negative attitude towards the conversion and did rather recommend them to stay with fossil fuels, because it was 'less problematic'. However, The Renewable Energy Company succeeded to persuade the vehicle suppliers to convert the vehicles, because the company owners were rather

determined. This points out that their agency became affected by the vehicle supplier's cultural values, because its' opposing discourse proclaimed "business as usual". Still, this did not hinder them in the transition, but the persuasion might have been energy consuming and did therefore somehow limit their agency. It does still indicate that Erik and his partners were active social actors, making things happen. Though, it means that it is a higher risk for other farmers to become limited in the transition, because many might trust vehicle suppliers having the "right" knowledge about what is best for tractor use.

Erik's statements point out an ideology of social libertarianism, advocating lower taxes and governmental support to the business sector. The environmental and technical standpoint is also clear, when emphasizing biofuel-powered tractors. This mindset addresses a discourse of eco-technological fix for agriculture.

The new political directive about reduction duty for fuel enterprises was an obstacle to scaling up the company's agricultural model at a national scale. The reduction duty force petrol companies to include some percent of biofuels in the purchase. Erik argued that it might reduce the production and use of pure and 100 percent renewable fuels. Because of that, people might suppose it is sufficient using partly renewable fuels. Furthermore, it could reduce the motivation for producing and purchasing pure biofuels, according to him. This partly indicated an exclusion, a kind of backgrounding for hundred percent biofuels, which The Renewable Energy Company used and purchased.

One solution for overcoming these obstacles, was *refund of taxes* on renewable fuels rather than governmental- or EU payments. This indicates a libertarian standpoint as well, which emphasizes improved profitability for companies. He also promoted *favouring hundred percent pure biofuels* and *equal conditions for all kinds of biofuels*. Additionally, he argued for no bio fuels-taxes. Besides, he suggested to remove the employer's fee to increase the competitive advantage by the creation of new jobs in agriculture, instead of refunding diesel-taxes. These ideas both points out a libertarian and environmental standpoint, which does further support his belonging to the discourse of eco-technological fix.

To sum up, Erik's and his company's agency were somehow limited to perform their fossil free farming system, due to the relation to the actions of others in the social elements: political institutions and cultural values. Most of the obstacles that occurred were of political nature. The governmental discourse provided a subject position for farmers' that supported "business as usual". Furthermore, the policies did not favour an entirely green energy use for all sectors in society, including agriculture. Though, the obstacles did not make The Renewable Energy Company incapable of doing the transition, because Erik and his companions were active social actors and adaptive to the political and economic system. This made them subjects to the hegemonic discourse of society. It indicates that the discourse eco-technological fix, did not provide much limitation to the company's agency – rather it enabled the transition.

Though, the ideas behind Erik's statements and the eco-technological fix, do in this sense correlate with weak sustainability (Ayres, et al, 2001). This concept focuses on non-diminishing growth opportunities for achieving sustainability. This is because the company was entirely steered by the market prices, regardless of the level of sustainability. It also describes that this discourse might be in line with the more dominating discourses in society. Some changes in the tax system was his main solution achieving their fossil free agricultural model in Sweden. This would not require an extensive change in the system of the society. It could imply that such a change could be possible within the current social order. Thus, a farming strategy, correlating with the discourse of eco-technologic fix, could be possible to scale up at a national scale. Yet, it could not guarantee a divestment of all fossil-based inputs, because economy and maximized harvest is prioritized – not environmental issues. Though in this case, the environmental emphasis was high and thus were the majority of the fossil resources removed. Still, the use of artificial fertilizers supports the extraction of fossil resources – even though the GHG emissions were purified. It is also a vulnerability that it is dependent on imported fertilizers.

## 2. The green industrial farming- and food system

The Green Industrial Farm has both a conventional and an organic approach and consists of 2200 hectares of arable land. The farm produces many different products such as milk, grain- and rapeseed, flour, vegetables, processed meat, beer and services connected to their hotel, restaurant and farm shop. They produce the milk and the meat from a crowd of 3300 cattle, which makes them one of the biggest dairy producers in Sweden. They try to create a recycling and climate adapted system, by producing all the foodstuff that is served in the restaurant and thus reducing the food transports. To make this farm work, around 100 people are employed. Moreover, biogas is produced from farm residues and manure from their cattle, which covers around 90 percent of the farm energy need. This provides high self-sufficiency of renewable electricity, heating and air conditioning. Yet, the remaining percent consists of fossil-fuelled-powered tractors, but the farms' future ambition is to produce RME for replacing the diesel and to feed the cattle with protein rich rapeseed cake. The following results are based on an interview with the chief executive director Per.

The only obstacle mentioned, was their wish to *reduce the use of diesel in tractors and the emissions of carbon dioxide* from the crop-production. Though, the *time shortage* prevented them from fully engaging in it. It was due to the central aim of the company to produce processed food of all kinds, which made the carbon dioxide mitigation from crop-production lower prioritized. In this case, the divestment of fossil fuels was backgrounded. This obstacle was however not caused by the actions of others, rather on the company's interest and cultural values. This indicates that Per is an active social actor, who makes his own choices and makes things happen.

Another obstacle did also concern time. Per described that it had been time consuming to *learn the new technique* of the biogas plant, which delayed the *effectiveness*. However, he claimed that the farm had been quite effective since the beginning, because it was necessary to obtain loans from the banks. Yet, this obstacle is also due to the company's own choice of technique. Per, and the others running the farm, did in this case prove to be active social actors, determined and steering the process themselves. These arguments above, illustrates an environmental and technical perspective in combination with a libertarian emphasis, which represents the discourse of eco-technological fix.

Per was pessimistic about the possibility making people do a transition similar to their farming system. He thought that agriculture is too *remote* for this generation and that it is a *tough* work, which makes it unlikely that people move to the countryside and start farming. His solution for overcoming this obstacle, was to hand the problem over to the *free market*. When asked about how others could approach their kind of farming, he argued:

“Well, preferably by making money on the farming, and that they are large enough to make investments. Also, being a bit egoistic and to do it all by yourself. That's because this farm is somewhat different. We do something uncomfortable, it takes a lot of personal energy and capacity to keep it together and build an organization like this.“ (Per, 2017. The authors' translation)

The emphasis on the market, capitalism and individualism does further prove the connection with the libertarian aspect of the eco-technological fix.

Overall, there were no actors who limited the agency of Per and The Green Industrial Farm, according to him. The few difficulties mentioned, did rather concern his and the farm's priorities and cultural values. This points out that he was an active social actor and his agency to perform the farming system was not limited. It indicates that the eco-technological fix, does not hinder the agency by influence from other social elements in society, such as politics, economic structures and cultural values. The result demonstrates that the emphasis on the market increases agency and makes it easier to implement more of these farming systems within the political order. Though, it requires a very capital-intensive business, to be able implementing this kind of farm. Moreover, these obstacles show the paradox of belonging to the eco-technological fix, when both economic preferences and

technological solutions could be problems for dealing with environmental problems -which is an aim of the discourse. This is also an indication of weak sustainability, which emphasize non-diminishing growth opportunities for enhancing sustainability and underestimate the ecological values and thus, the possibility to become entirely fossil free (Ayres, et al, 2001). Another sign of weak sustainability is that the farm was partly conventional and did therefore use imported fossil-based agrochemicals, which also make it dependent on imported inputs.

### 3. The self-sufficient farming system based on horse draught

The Horse Draught Farm is an organic middle-scaled mixed farm with focus on self-sufficiency. On their 50 hectares of land, there are pasture and production of vegetables, meat, eggs, honey, fodder and grain for home consumption and for sale to neighbours and friends. There are a high variety of agricultural animals, such sheep, pigs and cattle of rare Swedish breeds, hens, bees, draught horses and leisure horses. There are a few to some dozen of each animal type. Draught horses are mainly used in the agricultural work, which is the characteristic of this farm. The farmer has lifelong experience of horse traction, both by working with the horse in the arable farming, and also for all kind of agricultural work and transport within the farmyard. This replaces diesel-powered vehicles and machinery, but fossil-fuelled tractors are rented few times for heavier work. From time to time, they get extra help from volunteers from the organic farming organisation WWOOF. Though, the farmers couple who run the farm have not chosen animal traction for the sake of being fossil free. The empirical data are collected mainly from the farmer Anders and partly from his farmer partner and wife Emma.

The most frequent obstacles were connected to *draught horses*. The draught horses have a key role in their farming activities, which could explain why it connects to many difficulties. Firstly, there were not enough draught horses on the farm for making all farming activities needed. Earlier, they had more horses in the production, but recently three of their own draught horses were killed by a lightning. They could neither use the draught horses fully, because of time shortage. It was because the farmers *had to work too much* with other farming branches providing more income, such as animal husbandry, meat production and processing. Yet, they had the ambition to fully use the draught horses in all farming work.

Another reason they couldn't use the horses entirely, was because Anders got his leg injured when working with the horses. Even if he wanted to use the draught horses more, it was not possible because of the work with other more lucrative production branches to secure their subsistence. It indicates that the economic system of society limits the agency of those who use animal traction, a fossil free practice, because it is not profitable enough. Additionally, their agency was also limited by natural circumstances in this case, like weather conditions and animal behaviours. These factors are signs of passive social actors, being affected by actions of others or other things, and that they cannot change the situation in the direction they prefer.

Anders and Emma mentioned several times that they and their farming methods were *questioned*. This fact appeared when Anders was telling about the killed horses. Anders and Emma got complaints from people who had written posts in the newspaper, where they argued that Anders' and Emma's animals were carelessly treated and suggested that they could have brought the horses inside before the storm. However, Anders described that the storm was very sudden and that made it impossible to foresee. He also highlighted that animal welfare was a central goal on their farm. Thus, Anders said that those complaining persons might not have written so, if they better knew Anders' and Emma's intention.

Moreover, Anders also felt that he was questioned as a farmer, because he did not dare telling neighbours about all things they did to improve food self-sufficiency. For example,

the cows' milk was sufficient for suppling their family, giving to neighbours and friends in exchange to a service, and also for feeding the pigs to increase the fat content. Anders said:

“But you do not dare telling a regular farmer that you give the cows' milk to the pigs, it is enough using draught horses! They do not think you are a farmer at all. That's how it is. In these modern times, many are tenant farmers, they have full time jobs, they have big tractors which they use on weekends and holidays. Then you are a real farmer!” (Anders, 2017. The authors' translation)

At last, Ministry of taxes questioned them as well, because of the “very” low income of Anders' and Emma's enterprise. Maybe they got low monetary income, but they were satisfied with a self-produced and high “food income”. Moreover, Anders and Emma bought a lot of things at second-hand and their neighbours offered them services now and then, why they did not need much income.

The farmer couple seemed a bit upset and their self-confidence as farmers seemed influenced because they were questioned like that, which contributed to limited agency. This is a sign of being affected by others' opposing cultural values. Moreover, it also indicates that their economical thinking and behaviour did not suit into the ideas of the dominant political system. Thus they become excluded in the policy context. Still, it did not totally hinder Emma's and Anders' agency performing their farming system. Though, the critique in the newspaper and by the Ministry of taxes tells something about how the surrounding community and the government perceive this farming strategy and lifestyle, which indicate the power position of Anders' and Emma's discourse. Their statements correlate with the eco-centric fix for agriculture, which is the idea that agriculture needs to adapt to the limits of the nature by bold change of the farming system and human behaviours. The critique focused on their entire daily life, which could indicate that the farming system did not fit into what the government and ordinary people think is the “right” way to live. In this case, the subject position for a farmer does not include feeding a pig with milk! Therefore, the discourse of eco-centric fix might be regarded as lower valued in the orders of discourse in Swedish society.

Anders often complained about wild boars grubbing the crop fields and grazing areas. This made the fields widely destroyed, resulting in lost harvest and reduced income. The primary cause was the hunters who fed the wild boars close to his land. Anders could neither influence the hunters to stop, *nor being financially compensated*, because the extent of the damage didn't reach *minimum amount of damage within the regulation*. This is another indication of exclusion in the policy context, which limited the farmer couple's agency. They became affected by the actions of others and did thus get passivated.

The main difficulty for scaling up horse-traction based farming was declining growth in society, according to Anders:

“That would be possible in theory, *but then we lose growth – which is a holy word in this society*. The politicians don't dare considering reduced growth, even if the growth is not always good.” (Anders, 2017. The authors' translation)

This thinking is in line with the discourse of eco-centric fix for agriculture, which criticizes the economic priority of the capitalistic society.

Anders' suggestion for overcoming this obstacle, was *favouring self-sufficient subsistence farmers*, like having a few to some dozen animals of each kind, growing vegetables and selling the rest to neighbours. Anders argued that subsidies would be needed, for example EU-payments for using draught horses in production. Currently there are none for this purpose. Anders promoted the benefits with self-sufficient farming, because it would reduce costs for the state, for example when people become healthier, happier and travel less (causes less degraded infrastructure). Additionally, he suggested a *basic income* for all citizens, which could facilitate subsistence farmers.

These statements above, also indicate Anders' connection to eco-centric fix, emphasizing more traditional values and methods, like using draught horses and practicing self-sufficient

and middle-scaled agriculture. A basic income provides income equality between social classes, correlating with the ethical aspect of the eco-centric fix.

In sum, Anders' and Emma's farming agency was limited by actions of others in many different social elements, reducing their capacity to perform the fossil free horse draught method. At first, the economic system was limiting, making horse draught not profitable enough to provide a decent income. Second, natural circumstances like weather conditions and animal behaviour made the farmer couple unable to use the horses in their full capacity. Third, opposing cultural values challenged their self-confidence as farmers. Fourth, the exclusion in policy issues hindered them to get financially compensated, and also that their farming and life-style did not suit into the political system. In many of these social elements where obstacles occurred, they became affected by the actions of others and were passivated. In the relations to other social elements, the power position of their discourse was shown. I conclude that the discourse of eco-centric fix as an opposing and alternative discourse, is in this case lower valued in the order of discourses of the Swedish society. It does also provide less agency.

Still, Anders' and Emma's ideas' and connected discourse, were consistent with the strong sustainability concept, correlating with non-reducing life opportunities and conserving different kinds of capital; economic, social and ecological (Brekke, 1997; Daly and Cobb, 1989, in Ayres et al, 2001). The social capital was enhanced by emphasizing animal and human welfare, health, social justice and reciprocity relations in the local community. The ecological capital was maintained by producing organically and a diversity of food stuffs, performing a recycling farming system by integrating animal husbandry and crop production, which also created nutrient fluxes, biodiversity, open landscapes and many other eco system services as well. Economic capital was conserved by not consuming much, producing more themselves and exchange services with neighbours. Thus, rural development can be enhanced in several ways and contribute to revitalize the countryside by increasing amount of people occupied with farming, because it does not require a high income and it is an attractive lifestyle. Though, favouring self-sufficient farmers, using draught horses and introduce citizen wage, might be a suggestion difficult to introduce within the structures of the current society. It does not correlate with the social liberal governance and growth society that represents Sweden. Then a change of the system is needed, in order to implement this kind of agroecological approach to agriculture at a national scale.

#### 4. The peas-based farming system producing feed, fuel and fertilizers

The Peas-based Company is a stock company, developing and constructing plants for agricultural production of ethanol, protein and fiber from legumes. Lars runs the company and invented the company's concept of producing feed, fuel and fertilizer through production of peas and beans. This is provided by biogas plant and a multifunctional combine harvester, the latter is designed and constructed by Lars himself. The first fully developed factory was planned to be realized in autumn 2017. This is considered as a fossil free farming system, because it replaces fossil fuels, concentrated and imported feed and mineral fertilizers. The data below is obtained from Lars.

At first, Lars mentioned the difficulty by *making people understand* the need and benefits of producing protein from peas and beans. This made it hard selling his products and getting financed. It happened when his project got removed from an energy program in the County Administrative Board, because the officials did not understand the benefits with protein. This hindered an application process for EU-payments that Lars had started, which is also an indication of being excluded from the policy context. Lars became passivated by the actions of political actors, which reduced his agency to implement the fossil free farming system.



Further on, a cost of 16 million SEK was required *to construct the power plant and the combine harvester*, which was very *expensive* for Lars. This made Lars dependent on financial support to implement the construction and put it into production. Recently, he made an application for the grant called “Klimatklivet”, which is provided by the Swedish Environmental Protection Agency and the EU EIP-Agri. He is still waiting for getting them approved, which makes him passivated in a sense. Earlier, he also applied for *governmental- and EU- payments*, but did only obtain a minor grant from a governmental fund. This also implies that Lars was somewhat excluded within the policy context and did thus become limited in the agency to perform his farming system. It indicates that the subject position for climate adapted and sustainable farming did not include Lars’ concept. Could it have been too radical to replace all inputs for modern farming and to reverse the agricultural system? Yet, he solved the financing by creating a stock company which provided private funding. This is a sign of an active social actor and thus it made him able to keep trying to implement the farming method.

Another obstacle he mentioned was connected to *actors leaving his project*. For example, the Federation of Swedish Farmers (LRF) cooperated with Lars’ project twice, but they leaved the project in early stages. Lars thought it depended on the *high costs*, but also due to a competitor who *slandered* him. He mentioned that the competitor wanted to bring Lars down, in order to steal his concept. These factors made his project fail, he thought. In this process, Lars became passivated when he was affected by the different cultural values of LRF and the competitor, which reduced his agency to perform the farming system.

Lars thought a national transition to his farming concept could be possible, if the *plant for demonstrating the concept was implemented*. When farmers could see the practical use and the *profitability* of his concept, more farmers would be interested to invest in such a plant. Then the *market would solve the transition* by itself.

“I have invented this project to make it profitable for farmers, otherwise the transition will not work.”(Lars, 2017. The authors’ translation)

Lars had the vision to implement *500 plants* for achieving a transition to fossil free agriculture in entire Sweden. That would both provide ethanol, fertilizer, protein for animal feed and human consumption. This could then *replace the direct and the indirect fossil resources* in agriculture. The only problem would be if he *didn’t obtain the 9 million SEK* from the Klimatklivet grant, but he was optimistic that it would be solved anyway because of the *profitability* of the plant. Here is the economic aspect the problem and a paradox; the market he wanted adapting to, was a hinder to implement the concept – and the market is regarded as the solution because it will be profitable. Still, his vision shows that he has a strong ecological emphasis, wanting to make divest all fossil resources in agriculture in Sweden. Therefore I categorize this farming system as ‘radical sustainable intensification’.

The statements about obstacles and solutions are highly associated with the discourse of eco-technological fix for agriculture, due to the emphasis on technological solutions for mitigating environmental problems. The profitability and the belief in the market’s power to solve the problem, is a classical libertarian maxim.

Lars got his agency reduced in several ways, because he became passivated by actions of others mainly in the political context, but also by the economic system and by cultural values. The subject position within the policies, did apparently not make room for Lars’ kind of project. This was the case even though Lars’ concept was connected to the eco-technological fix discourse, which correlates with the dominating growth-ideology and environmental supporting-governance of Sweden. Maybe his idea could be regarded as too challenging for the agricultural sector, because the environmental and climate ambitions were too high? Yet, there could also be many other reasons why the applications were not approved. Still, it could be possible implementing this in a larger scale within the system of society, if his concept proves to be profitable. It would also contribute to a real fossil free agricultural sector. Though, according to this mindset, growth is the condition for making a transition to a sustainable society. This relates to the weak sustainability concept, which

emphasizes non-diminishing growth and welfare for enhancing sustainability (Ayres, et al, 2001). According to Jänicke (2008), growth processes tend to reduce the environmental adaptation potential within the mindset of eco-technological fix. It also takes for granted that unlimited growth can proceed forever, even though natural capital is a limited resource. The factory and the biogas plant are also things that must be newly produced, which requires exploitation of additional natural resources. If these could be produced by recycled material, this vision could provide a higher sustainability. This vision is also necessary to provide a climate and environmental sound solution for all those large-scaled productivist farms, which Swedish agriculture mainly consist of. From a system-ecological perspective, it is important to take advantage of the resources and processes that exist in a society or ecosystem, and find how it can be used in as many ways as possible, in a resource- and material efficient way.

## 5. The biodynamic and recycling farming system

The Biodynamic Farm has an organic crop- and dairy production on 100 hectares of land. A biodynamic foundation is the owner and employs the farmer Fredrik. The farm has also a cooperation with an agricultural college with a waldorf pedagogy, with a purpose to develop the whole human capacity. They rear 60 Swedish Lowland Cattle and does also have a few dozens of hens. The milk is sold to a biodynamic dairy nearby. The arable land has a scale that is adapted to feed the livestock with sufficient amount of ley and roughage. The biodynamic principles provide a regenerative approach, focusing on holistic management of the farming context, creating fluxes of nutrients and resources between the animal- and crop production. The milk is based on pasture grazing during the summer and roughage during the winter. Another crucial aspect is improving soil fertility, which is achieved by applying a compost of cow manure on the soil. Additionally, deep rooted crops are used to extract nutrients at deep soil levels. This can be regarded as a farming system highly reducing fossil resources, removing the import of roughage, mineral fertilizers and does also highly reduce the amount of concentrated feed. Besides, the farming machines are electrified and energy-efficiency is maintained, which diminishes much of the use of fossil energy. Note that the farmer Fredrik did not intend being fossil free. The interview is made with Fredrik.

One obstacle mentioned was the problem with *clover decay*, affecting the whole recycling of the farm by reduced harvest, less fodder and less manure. Yet, he was short of time to solve the problem. This was caused by an arson fire that occurred some years ago, which demolished the barn and the dairy. The rebuilding of the farm was expensive, forcing them to obtain social financial support. They could neither pay back the costs for the rebuilding of the barn. Still, the farm income financed the subsistence for Fredrik's family, but not much more. This illustrates that he got reduced agency and became passivated by the actions of others, in this context possibly by opposing cultural values.

The *modest profitability* was another obstacle Fredrik mentioned several times. An input- and output conventional agriculture would be more profitable; rearing more cows that provided higher milk yield, buying more concentrated feed and artificial fertilizers resulting in increased harvest. Though, this was not his intention, because he was a man of principles, with a high sense of environmental concern and animal welfare. However, he argued that his farm production would be more profitable, if the barn hadn't burnt down. Yet, this points out that the economic system did not support this kind of agriculture, because his statements shows that he opposes the most profitable and mainstream agriculture. This connects to the discourse of eco-centric fix, which emphasizes an environmental sound development and animal welfare, and criticizes the economic priority.

Another problem was the absence of EU-payments from CAP (Common Agricultural Policy) for practicing regenerative and biodynamic agriculture.

“It is the CAP-payment system that does not encourage to be an active farmer with a recycling-approach. Absolutely not! The most optimal thing for obtaining the EU-payments is cutting the ley and then go to bed. That is the minimum for getting the EU-payments.” (Fredrik, 2017. The author’s translation)

Nevertheless, Fredrik could get EU-payment for practicing organic agriculture. Still, the quote above indicates that regenerative and biodynamic agriculture is excluded in agricultural policies and therefore not ‘rewarded’. The subject position for being a “good” farmer in the EU policy does not include recycling agriculture like the biodynamic farming. Thus, Fredrik becomes passivated and reduced in his agency to perform his farming practice – by not obtain enough income from the EU-payments. This indicates that the discourse of his farming practice, i.e. the eco-centric fix, is lower valued and an “alternative” discourse, which also reduces the agency. However, it did not limit him to an extent where he could not perform his agricultural system.

According to Fredrik, the economic priority amongst mainstream farmers was the central obstacle for scaling up recycling and biodynamic agriculture at a national level:

“As long as the farmer perceives economy as number one, not much will happen. Then, the price will determine what you are doing. (...) You must consider what is happening on your farm, otherwise you can purchase an industrial property and start selling tires. That’s much easier than being a farmer.” (Fredrik, 2017. The author’s translation)

This is a critique against the capitalistic and neoliberal discourse, characterizing the “normal” farms according to Fredrik. This mindset does further correlate with the eco-centric fix for agriculture, which is negative to growth society and rather puts environmental adaptation as a norm in the farming.

Finally, Fredrik described the solutions for achieving more recycling and biodynamic agriculture in Sweden. The first solution was *integrating crop production with animal husbandry* to achieve a recycling agriculture. He also emphasized reduced farm sizes to obtain compact and effective farm units. That would make it possible taking advantage of the local natural resources and to have an overview of the farming context. Further on, Fredrik highlighted the importance of the *farmer’s interest of regenerative agriculture and to prioritize ecology*. He stressed the importance of first selecting what is suitable from an environmental perspective, and then finding out how to provide income and a decent subsistence from it. Moreover, he described the importance of getting well paid for the food stuffs produced by biodynamic- and recycling farms, and educate the consumers about this. These statements above are as well associated with the eco-centric fix.

In the majority of the obstacles, Fredrik becomes passivated by the actions of others or other things in the political context, cultural values and the economic system. Thus, his agency became limited by those social elements. The biodynamic agriculture seemed to be in opposition with what is perceived as the “right” kind of farming, and thus not become rewarded by EU-payments. This indicates that the discourse of the eco-centric fix, was opposing the dominating discourses in the agricultural sector. Though, Fredrik’s ideas suites Brekke’s (1997) concept of strong sustainability, concerning the conservation of social, ecological and economic capital (Ayres, et al, 2001). This is justified by the actions Fredrik does for conserving the ecology on the farm, and that his vision emphasizes the invaluable functions of the ecosystems and organisms in our society. The economic capital is also regarded in his practice and vision, because he gets an income that covers the family subsistence. Though, the farming system does not provide much surplus that gives a certain monetary buffert, which could be obtained if the political context and the market would support it more. The social capital was developed as well, by the cooperation with the agricultural college many youths are educated about the farming principles that is performed at the Biodynamic farm. Additionally, good animal welfare was also taken into account, which contributes to a conserved social relation to the cattle.

Yet, this farming system belongs to an opposing discourse, which makes it difficult to scale up to a national level. Fredrik’s vision for implementing more recycling agriculture in

Sweden, was to integrate crop- and animal production, take advantage of the natural resources and prioritize ecology. These suggestions might be difficult to implement at a larger scale within the current agricultural system, because it prioritizes economy. A change of the political and economic system and cultural values must be achieved, in order to make this transition fulfilled.

## 6. The urban farming system

The Urban Farming Movement is based on a company, which initiates sustainable farming-, gardening- and food projects within Gothenburg municipality. Local people who are involved in the projects become a part of the company brand, which unites them all and do also constitute the movement. Until now, around 15 farming- and gardening projects have been implemented within Gothenburg municipality, with the idea to introduce “real” farming and food production within cities. A characteristic aspect of their projects, is letting pigs grub and process the soil in city areas, to make urban land arable and to improve the soil fertility. An additional aspect of that element is to establish a contact between agricultural animals and urban citizens. When the soil is processed, the crops are cultivated with help from inhabitants in surrounding communities. The movement has an agroecological approach, open both to traditional and modern agricultural methods, such as animal traction, vertical gardening and aquaponic. The harvest from the different farming and gardening practices are both for home consumption and for sale to restaurants and at markets. I considered this urban farming as an approach to a fossil free agricultural system, by cutting off transports of food from rural to urban areas. Moreover, manpower tends to be the main energy source – rather than heavy diesel-powered vehicles and machines, because the social and participatory aspect of the farming in the city is an important factor of the urban farming system. Besides, the cities contain concentrations of people and thus, less food transports are necessary. The interview is made with John, the founder and the owner of the company.

John mentioned several times that he got *little or no support from governmental agencies and municipalities*. At first, he didn't get financial support from the Swedish Board of Agriculture and the County Administrative Boards. That was in one of the first projects, which was about tilling one of the church's lawns with a pig and to housing the pigs there as well. Additionally, the project included integration among different religions. John assumed that these activities would provide economic support from the EU, but it didn't. Moreover, the municipality's pig permission became removed during the time John initiated pig-projects at different places in the city. He claimed that it was discouraging and a kind of resistance against urban farming, because it did not make the municipality obliged to do animal supervision and to give extension service about animal husbandry. This indicates that there is *no adequate legal framework* for urban farming, which is needed to create a secure food production in cities. Additionally, it points out an exclusion of urban farming within the policy context. Yet, the farming projects continued anyway and they did not get passivated by other political actors, thus the agency of the urban farming movement did not become very limited. It is an indication that John and the movement he represents, are active social actors.

In another project, the urban farming movement created a kitchen garden in an accommodation for addicts. That included an apple orchard, housing hens and sheep and processing food and cooking. This became widely appreciated among the addicts. Though, they became opposed by a municipality official, who supervised their project. The official required them to build a separate kitchen room for storage of dirty vegetables. They could not resist this demand, and thus they needed to invest half a million to construct it. It was devastating for their economy. He thought it was unreasonably to make them invest in such an expensive storage room adapted for larger commercial food vendors, when their

ambition only was to create a small rural farmer's kitchen for increasing the wellbeing of the addicts. This is a food- and health policy issue limiting their agency, making it difficult or impossible for smaller and poorer companies to construct approved kitchens. It indicates that the subject position for food producers in this sense constitute capital intensive business. Still, it did not limit their agency to an extent where they could not maintain the farming project.

The last example of an obstacle connected to the political context, concerned John's renting of municipal land. The land consists of three hectares including a croft, where he is herding goats and practicing agroforestry. This provides ecosystem services, due to the maintenance of the land by planting crops and let cattle graze. John argued that the municipality did not favour his environmental effort, instead, he felt discouraged by paying annual land lease. John argued that he, as a city shepherd and an ecosystem service-provider at municipal land, should get payed for this by the municipality. This is a sign of exclusion of agroecological farming in the municipality policy context, which reduces his agency. However, this did not either hinder John to keep on with the herding and gardening, because it was meaningful for him. However, if this kind of farming practice shall be scaled up, it cannot be un-paid eventually.

*Mistrust* from the public and the governmental agencies was the final obstacle mentioned by John. In the starting phase of the projects, people thought it was a bit crazy having pigs in cities, and therefore John got notified for animal abuse. After a while, the public saw that the pigs were well treated and that urban farming had many good side-effects. This also made the public to develop trust in their projects. Here is an indication of limited agency through opposing cultural values, because the mistrust seemed troubling and stressful in the start.

The difficulty scaling up urban agriculture in Sweden is the low priority of farming in the mainstream urban life, according to John. Moreover, he highlighted the problem with influential media people promoting extensive use of fossil fuels. The Swedish hockey player "Foppa" is one example, who demonstrates his heavily diesel-powered boat in public.

John claimed that change of values is the solution for overcoming these difficulties;

"An important factor is to rethink what we regard as modern and urban life. Should it be stigmatizing to rear goats or growing leeks or producing fish, or should it be an honourable mission to cultivate land and to make aquaponics? This is about how to position these activities; it is an activity hierarchy. You must marketize this as an honourable mission, and that it is a lucrative and strategic activity." (John, 2017. The author's translation)

This solution described by John, includes political support to those trying to build sustainable food models, both in small and large sizes. By using the best techniques and social models, this solution could be achieved. It also concerns another important solution; taking advantage of the social potential and the cooperation capacity within the urban context.

"One must consider the social dimension in order to make this possible – many people must help and support each other. I cannot take care of the pigs by myself. We must be able to help each other. It is not possible dreaming about Foppa's boat when producing food, otherwise farming will become a limitation. Thus, the food has the potential becoming an existential breakpoint." (John, 2017. The author's translation)

These statements mainly point out a discourse of eco-centric fix, because he emphasizes changed values and behaviours for adapting to the limits of nature. Sometimes, he was also positive to environmental techniques and profitable solutions, which could be regarded as associated with the eco-technological fix. Though, I rather interpret it as the mindset of agroecology -which combines both modern and traditional methods for providing the highest ecological, social and economic sustainability. His and the urban farming movement's agency became reduced mainly by the political context, by exclusion in the EU policies, national agricultural policies and in the municipality policies. John's agency

got also affected by opposing cultural values, when being notified and mistrusted during the initial phase. Still, all these obstacles did not limit the agency to continue the urban farming projects, because John and the movement were mainly related to be active social actors. Overall, it indicates that the mind-set of the eco-centric discourse do not suit into the playing rules of the political context. It shows that this discourse is opposing to the dominant discourse, and is thus not highly valued in the society.

Yet, this activities and ideas of the urban farming movement, do correlate with the strong sustainability concept, emphasizing the conservation of ecological, social and economic capital (Brekke, 1997, in Ayres, et al, 2001). The ecological concern was clear both in the Johns' and the movements' actions and in their opinions, by spreading the practice of agroecological farming around in the municipality. The economic capital was maintained by making the farming and gardening activities rather attractive and lucrative and sold at markets and to restaurants. Yet, some of the farming practices was made voluntarily and they did neither obtain economic support or EU-payments for any of their initiatives, which would increase the possibility of more people joining it and make it a potential employment. Not the least, the social capital was highly developed, because it is a grassroots movement where the local people help and educate each other about farming. It also creates a sense of solidarity and community within urban neighbourhoods and integration among different religions and cultural backgrounds. Besides, it improves the resilience in agriculture by increasing the amount of competent farming labour.

The possibility of scaling up urban farming in Sweden, was to make people rethink urban life, marketize farming as an honourable activity, favour sustainable food models in cities and to help each other. Though, it may be difficult making an extensive implementation of urban agriculture in all Swedish cities and towns, because a bold change of cultural values, behaviours and lifestyle are needed. The solutions matching with the discourse of eco-centric fix would only be possible to implement if the system changes – which would be possible but it requires more effort. Yet, John also partly emphasized new technology and being profitable, which can make it easier to implement the urban farming system at a larger scale because it correlates with the more dominating discourse of eco-technological fix. Additionally, the success in this concept is shown in the rapidly spreading urban farming and gardening movement.

## Marginalization of agroecological- and radical sustainable intensification farming

In this section, conclusions are drawn from the analysis of the results made above. It also answers the first research question; How do discourses and other social elements affect the agency of social actors practicing farming systems extensively independent of fossil inputs? Furthermore, I will partly answer question three; What can the overall agency of the farming systems say about the preconditions for achieving a transition to post-fossil agriculture and thus, increased farm-level resilience and food security in Sweden? This text below focuses on the similarities and patterns that appeared in the analysis.

At first, I describe how discourses affected the agency of the social actors and their connected farming system. All farmers but the Green Industrial Farm were limited in their agency - both connected to the discourses of the eco-centric fix and the eco-technological fix - but to different extent. The farmers that experienced most obstacles and were passivated by the actions of others, were firstly The Horse Draught Farm (3), then The Urban Farming Movement (6), The Biodynamic Farm (5) and The Peas-Based Company (4). Three of them were mainly connected to the discourse of eco-centric fix (3,6,5), but The Peas-Based Company was connected to eco-technological fix. This was also clear from the analysis of the subject position of what is a "correct" kind of farming. It supported larger farms, capital intensive business, diesel-use and green-engineering projects in

farming. The farming systems associated with the eco-centric fix, did not suit into this kind of norm in the Swedish agricultural sector. Additionally, The Peas-Based Company which fit into this norm, but got partly excluded from the policy context anyway. Maybe this concept seemed too challenging, because it suggested a reshaping of the whole modern agriculture. The agroecological farming systems and the radical sustainable intensification farming were thus marginalized and their agencies were decreased. These preconditions contribute to a reduced possibility to achieve a transition to a post fossil agricultural paradigm.

Second, I present the conclusions about how farmers are affected by other social elements. As told before, the discourses are co-created with other social elements. These conclusions are categorized in what social elements are most limiting the farmers' agency, in order to understand where the optimal development opportunity is. It was in the political context where obstacles occurred in most of the farming systems (1,3,4,5,6). The actors limiting their agency were the Swedish government, the EU, the municipalities and other policy making institutions. Most frequently it concerned insufficient economic support from the government or the EU. In many other cases, their agricultural practices were excluded in policies (3,4,5,6). Besides, one was included in the beginning, but was eventually removed (4). The renewable fuel company (1) was disadvantaged by using some biofuels, such as RME, because it did not provide refund of taxes. These results point out that different kinds of farming systems divested from fossil resources, often become excluded in the policy context. Presently, the political context is the main hindering factor for transforming agriculture to a post fossil paradigm. Nevertheless, it is also the most crucial element with most potential to develop, and to improve the preconditions to make it possible to transform agriculture to a post fossil state.

Cultural values were the second social element that highly limited the social actors' agency. It was about people questioning the agroecological farming practices (3), mistrust from the public and municipalities when implementing urban farming (6), people slander (4), vehicle suppliers that did not recommend a conversion to biofueled-powered tractors (1), a person set a farm on fire (5) and the priority of food processing diminished the time engaging in reducing the use of diesel in the tractors (2). This indicates that cultural values in society resist or do not prioritize these kinds of agricultural practices. Therefore, they might be lower valued in Sweden, which is counterproductive for the transition. The influence of opposing cultural values did for certain not make them end the farming practice, but it demonstrated a resistance that affected the farmers either by consuming their time or worsen the confidence in their farming practice. If the cultural values would change and highly value the discourse of eco-centric fix, those who try to divest the fossil-based resources in farming would feel encouraged and supported – which would ease the transition.

Finally, the economic system was another social element that limited the farmers' agency to fully engage in their farming strategy. Initially, the farmers of The Horse Draught Farm needed to work more with meat-production and -processing than with horse draught, in order to increase the subsistence income. This was the case even if the farmers' wanted to engage more in the horse draught, which would make them even more fossil free. I concluded that it shows that the economic system did not make animal traction profitable (3). The Peas-Based Company was also hindered from implementing his farming concept, due to the high costs required to construct the demonstration plant (4). The economic system was thus a hinder, because he wanted to create an invention that suited into the capital intensive mainstream agriculture aiming for profitability. Furthermore, The Biodynamic Farm mentioned several times that the recycling and biodynamic farming was not profitable enough, in comparison with the conventional farming. It indicated that the economic system did not support this kind of agriculture. The economic system is thus also an element that determines whether it will be possible to fully transform to a post fossil paradigm. The economic system needs to evaluate these farming strategies higher, in order to make it possible for people to make a living out of it.

The farmers' statements about the difficulties and solutions to implement a transition to a national scale, gave further understanding about the power position of the discourses and what preconditions they provide to scale up these farming systems. Those mainly belonging to the eco-technological fix, suggested solutions suitable for the current system in Sweden. This could be the case because of the farming systems' connection with the hegemonic discourse of neoliberalism and growth emphasis in Sweden. Thus, it contributes to an increased possibility to scale up sustainable intensification practices which is associated with the eco-technological fix. Still, these farming systems, especially The Green Industrial Farm and The Renewable Energy Company, were prioritizing economic values which tended to hinder a full-scaled transition, such as the use of fossil-based artificial agrochemicals. Moreover, the import is as well dependent on a fossil fuelled transport. The use of agrochemicals does in turn contribute to reduced biodiversity and ecosystem services, which makes agriculture more vulnerable and creates a negative spiral of becoming even more dependent on fertilizers and pesticides.

The social actors mainly connected to the eco-centric fix, did rather suggest solutions such as changing cultural values and behaviours, prioritizing ecological values in farming, providing EU-payments to horse draught and self-sufficient farming, and implementing basic citizen wage. These suggestions could in turn reduce growth. I interpreted that these solutions were difficult to apply within the current social order, because great governmental-, cultural-, economic- and social changes would be necessary. Instead, the system needs to be changed for making it possible to implement the eco-centric approached farming systems in a larger scale.

The difficulties experienced by the different farmers and entrepreneurs, indicate that the preconditions in the political-, cultural- and economic system are not yet ready for a transition to a post fossil paradigm. Yet, there are opportunities for scaling up sustainable intensification farming, which can diminish much of the fossil resources. At present, the farming systems with agroecological approach and the radical sustainable intensification farming are marginalized, even if they could provide a full divestment of fossil resources by complementing each other. The agroecological farming prioritized a conservation of ecological values as well as social and economic, and was thus associated with strong sustainability. The ecological capital was regenerated by preserving biodiversity, ecosystems and processes which are crucial for providing the eco systems services and fluxes of nutrients, resources and energy – which must be conserved and functional before fossil inputs are inaccessible (3,5,6). For example, it contributes to regenerate a nutritious soil that makes it fertile and not dependent on artificial fertilizers. The social capital was maintained by emphasizing an attractive and healthy lifestyle (3), providing education to youths and cooperation with agricultural college (5), developing a sense of community and reciprocity in the neighbourhoods (3,6) and increasing the amount of competent farming labour (3,5,6). The economic capital was regarded but often not sufficiently, due to marginalization in the political and economic structures. The radical sustainable intensification farming (4) could contribute with the necessary environmental innovations needed for transforming the use of technology in the existing productivist agriculture at a societal level, such as new solutions for powering tractors or producing new technology and spare parts through a bio based and circular economy. It could also contribute with lucrative innovations that increase the farm incomes.

In the next section of the empirical investigation, key policy documents influencing agriculture, climate- and environmental issues will be analysed. This will connect the single farmers' statements with the societal level, and will provide results and conclusions about the preconditions making a national transition. Moreover, the political context constitutes one of the most important precondition for farmers, because it governs the payments and the ideas which influence the behaviours of farmers.



## Policy documents

In the following text, I make a short form of textual analysis of core policy documents, which influence and steer the agricultural development and climate adaption in Sweden. The aim with this analysis is to answer the second research question: what agency do key policies for agriculture and climate, give to various farming systems approaching a fossil free state? This is done by searching for representations of the farming systems chosen for this thesis. I search for inclusion or exclusion – to what extent are the farming systems mentioned in the text (Fairclough, 2003). This can indicate whether they are included or excluded in the political context – if they are marginalized by the government or not. It will be conducted by searching for the frequency of the term ‘fossil free agriculture’ and other concepts and sentences that approach that, such as ‘recycling agriculture’, ‘agroecology’, ‘animal draught’ or ‘horse draught’, ‘organic agriculture’, ‘permaculture’, ‘urban farming’ and climate adaption of agriculture’ and ‘renewable fuels’ and ‘renewable electricity’ in connection to agriculture. Further on, I identify whether these concepts and sentences correlate with the meaning of sustainable intensification or agroecological farming. The concept ‘organic agriculture’ is an ambiguous concept, but the context will tell which school of agriculture it connects to. If these concepts or sentences are mentioned in the text, they are quoted and italicized. Note that these concepts are a translation from Swedish to English, because all policy documents are in Swedish. This analysis makes it possible to understand what discourses these documents are connected to, in this case I will also use the discourses of the eco-technological fix and the eco-centric fix for agriculture. The analysis can demonstrate in what way policy documents contribute to the agency of social actors who perform fossil free agriculture and what preconditions it provides. It can tell whether there is a scope of action to make a transition to fossil free agriculture at a national level or not.

### The Swedish Rural Development Program 2014-2020

The Swedish Rural Development Program (RPD) 2014-2020 is a national adaptation to the EU’s Rural Development Program within the Common Agricultural Policy (CAP) (Governmental offices of Sweden, 2016). The overall goals for RDP are to “Encourage *competitiveness* in agriculture”, “Ensuring *sustainable management of natural resources and climate action*” and “Achieve a balanced territorial development of economies and communities in rural areas”. (Government offices of Sweden, 2015) These goals shall in turn contribute to the overall goal for CAP called Europe 2020, which is “Smart and sustainable *growth* for everyone”. There are six priorities of the Swedish RDP which are meant to strive for these goals, where especially the forth priority “*Restoring, preserving and enhancing ecosystems which are related to agriculture and forestry*” and “*Encourage resource efficiency and supporting the shift towards a low carbon and climate resilient economy in agriculture, food and forestry sectors*”. This illustrates inclusion of less use of fossil fuels due to climate adaption and mitigation of greenhouse gases (GHG), which concerns an approach to fossil free agriculture. The fourth priority does also include environmental investment measures about supporting organic production, as a means to increase biodiversity. Though, it does not mention fossil free agriculture, agroecology, permaculture, recycling agriculture, horse draught or urban farming anywhere, which points out an exclusion of these farming systems. These practices are neither described in other words.

Every priority contains focus areas, 18 in total, which describe the priorities more in detail. Some of these supports less use of fossil resources in farming to a greater extent than the other, which are: 5c) “encourage a sustainable economy by facilitating the supply and the use of *energy from renewable sources* and increase the *use of decay products* and other

raw material which is not intended to use as food stuff” and 5d) “*reduce the emissions of GHG and ammonia from agriculture*” and 4a) “*restoring, preserving and enhancing biodiversity, including the Natura 2000-areas and in areas with natural or other special constraints and agriculture with high ecological values, as well as the character of the European landscapes*”. The focus areas are also connected to measures, of which some supports an approach to fossil free agriculture. These are investment support for energy efficiency and also for production of renewable energy and fuels both for their own use and for sale (4.1/5c), to reduce the emissions of greenhouse gases and ammonia from agriculture (4.1/5d), to renewable energy (6.4/5c) and also investment support to production and consumption of manure based biogas and digestate plants (6.4/5d). The measures in 4a) include maintaining or increasing the fertility of the soil, reduce soil compaction, activities that increases humus content and to ease the conversion to organic production.

To sum up, the support to a transition to fossil free agriculture in the RDP does mainly concern reduced GHG emission, production and use of more renewable fuels, energy, the use of decay products and digestate and conversion to organic production as a mean to increase biodiversity. These replaces fossil energy and some of the indirect fossil sources as artificial fertilizers and concentrated feed. This points out inclusion of technical solutions which reduce fossil-fuelled agriculture and increase growth, which is similar to the eco-technological fix. However, it does not support an entire transition to fossil free agricultural practices, which makes it excluded. Additionally, agroecological practices such as recycling agriculture and permaculture were neither mentioned, but organic agriculture, increasing biodiversity and soil fertility are quoted. These contribute to regenerate ecosystem services to some extent, because agrochemicals are not used and it supports activities that increase humus content. Though it is not further described what these ‘activities’ include. Yet, it should be mentioned more times to be fully supported and thus it backgrounds the agroecological practices which is a lighter form of exclusion.

## The National Food Strategy

The National Food Strategy (Swedish Government 2017) was established mainly to increase the food production and improve competitiveness in Swedish agriculture.

“The overall objective of the food strategy should be a competitive food chain where the total food production increases, while the relevant national environmental goals are reached, in order to create growth and employment and contribute to *sustainable development* throughout the country. Production increase, both conventional and *organic*, should respond to consumer demand. A production increase could contribute to a higher self-sufficiency of food.” (p.20)(The author’s translation)

This statement shows that both conventional, organic and sustainable intensification approach to agriculture are included. By including both of these approaches, fossil-based inputs like agrochemicals, are promoted and in the same time is organic agriculture favoured – a practice that is more fossil free.

The strategy excludes the concepts fossil free agriculture, recycling agriculture, agroecology, horse draught, permaculture or urban farming. Though, fossil free is mentioned once, but it does not mention that agriculture itself shall be fossil free:

“(…) achieving a fossil free Sweden and a circular and biomass-based economy is challenging but also brings opportunities for green industries and the rural areas.” (p. 38)(The author’s translation)

Overall, the policy emphasizes the broad and vague concept “sustainable agriculture”. For example, it says that it is important for a sustainable food production to contribute to the climate and environmental challenges (p.31) - which indicates an inclusion of climate adapted agriculture. In the chapter that describes the vision of The national food strategy, it

is stressed that agriculture and the green industries has an important role in the transition to a green economy. Still, it is not further described what is meant by achieving a sustainable food production that contributes to green economy. The text often mentions sustainable production in connection with striving to *national environmental goals*, *increased competitiveness* and *resource efficient production* that contributes to reduced environmental and climate impact. It is claimed that the condition to increase the sustainability in agriculture, is to develop *new technology and production systems*, which can contribute to *strengthen the ecosystem services* and *improve the soil quality*. When only looking at this sentence standing alone, it seems to correlate with the agroecological approach. Additionally, it is not defined how these new production systems should look like. The agroecological practices are neither mentioned somewhere else in the text. Rather, the sustainable intensification approach is emphasized. An example of this is that resource efficient agriculture is described as *increasing the milk yield* per cow which reduces the amount of emissions of methane per kilo milk (p.38). In the chapter “The food stuff strategy’s contribution to environmental work”, it is described that agriculture can contribute to a *bio based and circular economy*, by using residues that ensures a *recycling* and use of the raw materials for *production of biofuels* (p.90).

In total, there is support to agricultural practices working with resource efficiency, producing bio energy and recycling residues, striving for national environmental goals, increasing both conventional and organic production and improve growth. These practices are mainly connected to the sustainable intensification approach and thus the discourse of eco-technological fix. They are also connected to a more conventional ‘business-as-usual’ discourse, because conventional agriculture is included. There is an inclusion of climate adaption, but it does not support independence of fossil resources in agriculture. It does even support use of fossil resources by promoting conventional agriculture to increase. This policy does thus initiate a productivist and rationalized agricultural development which caused the vulnerable state that Swedish agriculture has entered. The National Food strategy was formulated to solve the problem with the declining food production and food insecurity – which it might do but agriculture will remain very vulnerable for crises, except the organic production which is less dependent on imported fossil-based resources.

## A Climate Policy Framework for Sweden

A Climate Policy Framework for Sweden (Swedish Government 2017), consists of updated national climate goals integrated with European and international climate goals. The main climate goal presented is that Sweden shall not have any net emissions of greenhouse gases (GHG) in 2045. This policy does also introduce a new climate law for Sweden, containing fundamental decisions about the government’s climate actions. Additionally, it requires planning- and feedback-systems, and annual accounting and action plans for climate. The law was implemented January 2018. The Climate Policy Framework shall cover all sectors of Sweden, including agriculture.

The social events *fossil free agriculture*, *agroecology*, *permaculture*, *recycling agriculture*, *organic agriculture*, *urban farming* or *horse draught* and are not presented at all, but *fossil free* is mentioned three times in the text. It is presented with connection to Sweden’s political goal being one of the first fossil free welfare countries in the world, and was presented in autumn 2015 by the current government (social-liberal and environmental ideology) (p.36). Achieving a fossil free vehicle fleet and *reduce 70 percent GHG* in the transport sector until 2030, those are main goals for reaching this ambition. Also, it is quoted that *fossil free fuels* are important to contribute to this goal. Therefore, the policy focuses on the transport sector and on renewable fuels.

In the presentation of earlier climate action activities in Sweden, agriculture is mentioned in relation to climate adaption. It is presented in the definition of the national environmental goal:

“The amount of greenhouse gases in the atmosphere according to the UN Convention on Climate Change shall be stabilized at a level that means that the *human impact on the climate system does not become dangerous*. The goal should be achieved in such way and in such pace that *biodiversity is preserved, food production is ensured* and other *sustainable development goals are not compromised*.” (p.22) (The author’s translation)

Moreover, agriculture is also described in the chapter Interim goals for 2030 and 2040. The overall goals are that GHG emission in Sweden in the EU ESR sector, which is agriculture, residue management, transports and small scaled industry, all these shall be at least 63 percent lower than the emission from 1990. In 2040 it shall be at least 75 percent lower than the emissions in 1990 (p.29). Further on in the chapter, it is claimed that the suggested interim goals should be reached in a way that allow the maintenance of the total *competitiveness* and the creation of an *increased food production* (p.31). It is described that agriculture and transports release the majority of the GHG emissions, but the *main reduction potential lies in the transport sector* (p.31). This is a sign of backgrounding and thus a light form of exclusion - that agriculture has a secondary priority.

In the chapter “Complementary measures”, climate adaption of agriculture is mentioned once more. The only example of a measure for agriculture is to *reduce the emissions from soils*. Moreover, in the chapter “Summary of interim report of a climate political framework for Sweden”, it says that it is a challenge to reduce the emissions in the transport sector, agriculture and the base industry (p.54). It is also quoted that an increased steering is needed to achieve this and shall be done in a way that is in line with increased competitiveness and creation of new jobs (p.54). These indicate inclusion of climate adapted and competitive agriculture, which is associated with sustainable intensification and the discourse of eco-technological fix.

A Climate Policy Framework for Sweden focuses on reaching a fossil free transport sector and largely diminish GHG emissions in the society at large. Additionally, it promotes to increase the business sector, growth and the creation of new job opportunities. Climate adaption in agriculture is presented few times, and when it is done it tends to be backgrounded and thus partly excluded. Also, descriptions about how climate adaption in agriculture shall be handled is modest. However, agriculture is a sector with high GHG emissions and could as well be required to divest fossil resources – like the transport sector. The agricultural practices described, tend to be related to sustainable intensification and the discourse of eco-technological fix – and increases the agency for those connected to this mindset.

### Initiative Fossil free Sweden

Initiative Fossil Free Sweden (Swedish Government, 2016) is a committee directive launched for COP 21. It aroused from the current government’s ambition that Sweden shall be one of the first fossil free welfare countries in the world. The directive requires a coordinator to strengthen the platform Initiative Fossil free Sweden, aiming to create a dialogue between the government, corporate actors, municipalities, countries and organisations. The central aim is to make Sweden *independent of fossil fuels* in the future, by contributing to *diminish the GHG emissions, reach the national environmental goal “Reduced climate impact”* and *take a step towards the national goal of zero emissions*.

The concepts *fossil free agriculture, agroecology, horse draught, recycling agriculture, organic agriculture, permaculture, urban farming* and *climate adapted agriculture* are not mentioned at all, but not surprisingly, *fossil free* is mentioned several times when initiative Fossil Free Sweden is described. When describing which actors the coordinator will

cooperate with, the National Food Strategy is mentioned (p. 5). Though, it is not specified in what ways Initiative Fossil Free Sweden works and will work with agriculture and its' transition to a fossil free state. It mainly describes the work with dialogue, cooperation and experience exchange between actors who divest fossil fuels. Moreover, they will strive for the national goal to reach zero GHG emissions in the future. This points out that climate adaption of agriculture is backgrounded and that fossil free agriculture is excluded.

To add further updated information about the Initiatives' work, I present what kind of actions are described at their website. In the section "Press releases", the majority of the actions concern *divestment of fossil fuels in transport vehicles*. Additionally, it includes conversion to *renewable alternatives and reduction of fossil energy mainly in industries*. This correlates with the ambition of a hundred percent fossil free transport sector in 2030, which is described in the section "Challenges". Although, one of the news is about agricultural enterprises which has cooperated with Fossil Free Sweden. It is about a challenge, which requires 50 percent of the enterprise members in Federation of Swedish farmers' (LRF) in the county Östergötland, to achieve 50 percent renewable-fuelled tractors in 2020 (Söderberg, 2017). This also indicates a backgrounding, because climate adaption of agriculture is only mentioned once and should be repeated more often to achieve inclusion. The discourse appearing here, relates to the eco-technological fix because it emphasizes technological solutions to deal with environmental problems.

Summing it up, the focus in the committee directive and in the website is to make a transition to renewable fuels in the transport sector and climate adaption of the industry. However, it does slightly present climate adapted agriculture in the committee directive and at the website, which relates to the eco-technological fix. Though, nothing of this indicate how agriculture shall become free from both indirect and direct fossil resources, which is a sign of exclusion.

## Insufficient political support to all kinds of fossil free farming systems

The following text summarizes the policy analysis above, and conclusions are made. The second research question is also answered; what agency do key policies for agriculture and climate, give to various farming systems approaching a fossil free state? The third question about the preconditions for making the transition, is also touched upon.

In all policy documents, fossil free agriculture and the agroecological farming were excluded, and therefore no agency is given to these kinds of farming ambitions. Yet, climate adapted agriculture with a sustainable intensification approach was included in the RDP and in the National Food Strategy, which provides expanded agency for those. Though, conventional agriculture was included in the National Food Strategy, which use many fossil-based inputs such as agrochemicals, diesel and imported feed. This hinders a transition to a completely fossil free agriculture and contributes to maintain the productivist farming development which has made agriculture vulnerable in the first place. Though, the support to organic production is an improvement, which will reduce the vulnerability to some extent.

In A Climate Policy Framework and Initiative Fossil Free Sweden, climate adapted agriculture was backgrounded, because it was sparsely mentioned and was modestly described how to achieve it. Most likely, this is due to that these last documents are general for the climate actions in the Swedish society. However, A Climate Policy Framework for Sweden describes that it is challenging to reduce the GHG emissions in agriculture, because it is one of the larger sectors alongside the transport sector and the base industry. Therefore, the environmental politics should focus more on agriculture as well?

The documents mainly focused on production and consumption of renewable fuels, energy recycling of rest products, resource efficiency and decreased GHG emissions from soils and increasing growth. This indicates an emphasis on environmental technology and

growth, which is associated with sustainable intensification approach and the discourse of eco-technological fix. The results thus show that there is political support to climate adapted agriculture with focus on biotechnological solutions, and these farming strategies are therefore given more agency and better preconditions. Yet, organic agriculture was also included both in the RDP and the National Food Strategy which contributes to less use of agrochemicals. Overall, the farming practices mentioned above contribute thus to less use of fossil-based inputs.

These results correlate with the interview results, which showed that the farms belonging mainly to the eco-technological fix, had wider agency than those associated with the eco-centric fix. This also confirms the conclusions about the agroecological farming, recycling agriculture, permaculture, urban farming and horse draught which were lightly or fully excluded and thus marginalized in the policy context. These are provided less support from the politics, and therefore they are given less agency and have worse preconditions than the sustainable intensification farming. Still, the RDP and the National Food Strategy emphasized increased biodiversity, humus content, soil quality and ecosystem services in agriculture, but they are mentioned sparsely and not further defined, and therefore they cannot contribute to any crucial positive effects on the ecosystems. Furthermore, it cannot contribute to regenerate the agricultural land, by making the soils fertile and the crops, the animals and the farming ecosystems healthy enough to be independent of fossil-based inputs and are therefore more long-term resilient against crises. It does therefore not favour strong sustainability<sup>2</sup> in agriculture, because the ecological capital is not equally valued and conserved as the economic capital (Brekke, 1997; Daly and Cobb 1989, in Ayres et al, 2000). Instead, the weak sustainability view is dominant, with the central aim to not diminish growth in society (Brekke, 1997, in Ayres, et al 2001). Therefore, the policy context does not provide the preconditions and the support that is necessary for achieving a national transition to fossil free agriculture.

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<sup>2</sup> *The social capital is not investigated here, due to time limit of the thesis. I regarded the ecological capital as most important aspect to investigate here, because it is the ecosystems which can provide food without fossil-based inputs.*

# Concluding discussion

The purpose with this discussion is to fulfil the aim of this thesis, which is:  
The aim of this master thesis is to describe the preconditions for achieving a national transition to post-fossil agriculture in Sweden, to improve farm-level resilience and food security. To achieve that, I investigate social actors' agency to perform a farming system extensively divested from fossil resources. This is explored by analysing how discourses and other social elements such as politics, cultural values and the economic system, affect the social actors' agency. The study is conducted through a critical discourse analysis with inspiration from Fairclough's dialectical relational approach (Wodak; Meyer, 2016). The discussion will explore this aim by answering the three research questions. Each question is introduced with a list of the central conclusions written in italic and below there are a description and discussion about it. This chapter ends with a discussion about what these conclusions means at general, especially concerning food security and what policy recommendations it requires.

## **1. How do discourses and other social elements affect the agency of social actors (farmers and entrepreneurs) to practice a farming system extensively independent of fossil inputs?**

- *All farming systems, except the Green Industrial Farm, obtained limited agency by the political context. The farming systems with agroecological approach had most limited agency, due to its' connection to the alternative discourse of the eco-centric fix.*
- *These were marginalized both in the political context, the cultural values and the economic system. The sustainable intensification farming systems had expanded agency, due to its' connection to the hegemonic discourse of the eco-technological fix.*
- *One exception was the radical form of sustainable intensification which had limited agency, maybe due to its' challenging vision to divest all fossil-based fuel, fertilizers and feed in Sweden.*
- *It shows that the farming systems associated with weak sustainability are supported by the political-, cultural- and economic structures – but not those connected to the strong sustainability.*

The results showed that the agency of the farming systems became affected whether they belonged to a hegemonic or a more alternative discourse. When belonging to the more hegemonic one, the agency expanded and vice versa. This became clear when the farms connected to the eco-technological fix (1,2), got modestly affected by obstacles caused by others. Neither were they very limited and passivated by the actions of others in the social elements: political context, cultural values and economic issues. These tended to be active social actors instead. The obstacles they experienced depended rather on personal cultural values or the choice of technique (2), or disadvantaging taxes (1). This indicates that they became more favoured in society, because they belonged to a more dominating discourse in the agricultural sector and society. Therefore, these social actors got expanded agency to fulfil their farming endeavour. Yet, the sustainable intensification approach which relates to these farms, are associated with weak sustainability (Spaargaren & Mol, 2001). In short, the economy will then mostly steer how the farms will act in the end.

The Horse Draught Farm, The Urban Farming Movement and the Biodynamic Farm experienced both exclusion to the greatest extent and were affected by most obstacles

caused by others. These were associated with the agroecological approach and the discourse of the eco-centric fix and were thus marginalized by other actors in the political context, cultural values and the economic system. Still, all farming systems but the Green Industrial Farming and Food System were limited by the political context and the agroecological farming systems in particular. Though, it was one exception in this pattern described above. The Peas-Based Ethanol Company was also one of the actors experiencing most obstacles and got thus reduced agency, despite its connection to the hegemonic discourse. It correlated also with the policy analysis, that fossil free practices were excluded. This could maybe depend on his rather progressive concept which challenged the whole agricultural system, by the vision of divesting all fossil-based inputs in Sweden (agrochemicals, diesel, concentrated feed).

The marginalization in the political context became clear by the subject position, where these farming systems did not suit into what is defined as 'correct' kind of farming. Therefore, they did not gain enough EU-payments or they were not sufficiently supported by governmental-, regional- or municipality institutions. The subject position in the policy framework did rather support larger farms, capital intensive business, diesel-fuelled tractors, and green-engineering projects in farming. When prioritizing ecology, animal welfare, traditional- and recycling methods, the farmers got sometimes criticized and questioned due to opposing cultural values.

Moreover, The Horse Draught Farm (3), The Peas-Based Company(4) and The Biodynamic Farm(5), were also limited in performing their farming endeavour extensively independent of fossil resources, due to the economic system. Either their endeavours or products were not highly valued (3,5), or it required too capital-intensive business (4). These results indicate that the agroecological farming practices and the radical sustainable intensification are not highly valued in society, especially not within the political context. Therefore, it will be more difficult scaling up these farming systems, even though the agroecological approach relates to strong sustainability. When marginalizing the agroecological practices, the possibility is limited to conserve and rebuild critical ecological processes and eco system services such as soil fertility and pollination in agriculture. The social capital that is enhanced I the agroecological approach will neither be accomplished, like increased amount of competent farming labour, improved sense of community and reciprocity in neighbourhoods, increased amount of competent farming labour, expanded population in rural areas due to an attractive, healthy and low-capital intensive lifestyle which need more human labour. The fact that it is difficult to scale up these agroecological farming activities is a severe implication, because it is through these practices food can be produced without the need of fossil inputs. The fossil resources will then continue to be necessary and thus it is less possible that they can be replaced. However, as described in the paragraph 'Context to the empirical field', this agroecological farming practices are already spreading, because it as a grassroot movement as well. Though it might only stay as local initiatives, if it does not become further supported.

## **2. What agency do key policy texts in agriculture and climate provide to farming systems associated with fossil free agriculture?**

- *Fossil free agriculture and the agroecological farming approach were excluded in all documents. Therefore, these farming systems are not given agency.*
- *The sustainable intensification farming approach was included in the RDP and the National Food Strategy, but backgrounded in the Climate Policy Framework for Sweden and Fossil Free Initiative. It indicates that the political context is dominated by the eco-technological fix and does thus give agency to the farming systems belonging to this discourse.*



In all policy documents, the fossil free- and agroecological farming practices were mainly not mentioned and thus excluded. These are not provided agency from the political context and are thus marginalized. Yet, climate adapted agriculture was included in the rural development program (RDP) and the National Food Strategy. The RDP focused on production and consumption of renewable fuels and energy, recycling of residues, resource efficiency, decreasing GHG emissions and increasing growth. The National Food Strategy focused on ‘sustainable agriculture’ – but included conventional agriculture in this context. It promoted expansion of conventional agriculture, which uses fossil-based inputs such as agro-chemicals and imported feed. Therefore, the productivist agricultural approach which has expanded since the mid-20<sup>th</sup> century, will continue to develop and the agricultural vulnerabilities will be maintained. This limits the possibility to make a transition to a completely fossil free agriculture, only dependent on bio-based and local resources. Still, expansion of organic agriculture was also included, which contributes to reduced use of fossil-based agrichemicals and fossil energy. These farming practices described in the policies, correlates mainly with the sustainable intensification approach for agriculture and the discourse of the eco-technological fix. Therefore, these are given agency because it matches with what the politics consider to be a “good” and “correct” kind of farming. Though these kind of farming is not considered as the best kind of agriculture from a sustainability perspective, because the economic is prioritized and not the ecological capital – which is the precondition for agriculture to provide yield without the need of fossil-based inputs.

A Climate Policy Framework and Fossil Free Initiative were highly including the society to be fossil free, which is a precondition for agriculture to become fossil free as well. The policies focused on achieving a fossil free transport, largely diminishing GHG emissions, job-creation and increasing growth in the business sector. Climate adaption of agriculture was thus backgrounded in this context, because it was described in a rather vague way and only mentioned sparsely. Agriculture is a sector with high GHG emissions, and therefore it could be motivated to create more strict climate regulations for agriculture. If the transport shall be fossil free, then agriculture could be as well? In an article at the website of Fossil Free Initiative, farmers in the county of Östergötland were challenged to divest half of the fossil fuels in the tractors. It is a minor advancement towards a fossil free state, and then it is ‘only’ 20 counties left.

### **3. What can the overall agency of the farming systems say about the preconditions for achieving a transition to post-fossil agriculture and thus, increased farm-level resilience and food security in Sweden?**

- *There are rather good preconditions in the political, economic and cultural structures for making a national transition to sustainable intensification farming and divest much of the fossil-based inputs, because this farming relates to the dominant discourse of eco-technological fix. This could contribute to the replacement of many fossil-based inputs, especially to bio based and renewable energy and fuels. It can provide increased farm-level resilience, if these inputs are produced as locally as possible.*
- *The radical sustainable intensification approach had not as beneficial preconditions, maybe because it was too progressive and could provide the technologies and methods that can replace all fossil-based energy, fuel and feed at a national scale through local, renewable and bio-based resources.*
- *The agroecological practices had worst preconditions for being scaled up, because it was connected to the alternative discourse of eco-centric fix and the concept strong sustainability. Though, the agroecology systems had the greatest potential to provide farm-level resilience and food security, because it regenerates agricultural land and ecosystems, strengthens the biological processes and*

*ecosystem services and can thus make the farms self-sufficient on bio-based energy, resources and nutrients in the long run.*

- *Both radical sustainable intensification- and agroecological farming systems are necessary for transforming agriculture to a post fossil state – by complementing each other and providing solutions to different farm contexts.*
- *Therefore, the preconditions for agroecological- and radical sustainable intensification farming needs to be improved, especially in the political context. They especially need support with the economic capital.*
- *Overall, there is a need for change of discourses to include a view of strong sustainability and including the discourse of eco-centric fix in the political-, economic-, and cultural system in order to fulfil a national transition to a post fossil state and achieve resilience and food security.*

A transition to post-fossil agriculture would not yet be possible within the existing political, economic- and cultural system in Sweden. This was due that five of six farmers interviewed had limited agency because of these structures, but also because four of six farming systems were marginalized in the policy documents analysed. Besides, none of the farming systems chosen for the thesis were completely fossil free. What are the incentives for a farmer being completely fossil free, if they cannot get a decent subsistence from it – or if it is not sufficiently required or rewarded by the politics, by the market or by people's opinions? However, it could be realistic to divest many fossil resources by the sustainable intensification approach, because it connects to the dominant discourse of eco-technological fix. The preconditions for these farming systems were rather good, because they were provided agency by inclusion in the policy documents and they experienced less obstacles due to other social elements, such as the political and economic system and the cultural values.

The farmers' views on the possibilities and difficulties to achieve a transition, did further indicate what the preconditions are for scaling up their kind of farming system. The Renewable Energy Company suggested mainly refunding of taxes on all biofuels, and The Green Industrial Farm suggested farmers to be big enough to make large investments. These suggestions would be possible to implement within the current system, but how many have the possibility to become a millionaire-farmer? This libertarian suggestion for agriculture is likely to outcompete both regular- and low capital-intensive farms. Moreover, it raises the threshold for ordinary people to be able start farming. Considering half of the generation of Swedish farmers are about to retire, recruitment of many new farmers would be required (Sch, 2010). Other social consequences of scaling up this approach, would be further depopulation in rural areas and even larger farms, when there is a higher demand on Swedish food stuffs but fewer who can become farmers. It would also decrease the amount of competent farming labour, which is a significant aspect of vulnerability.

What are then the positive implications for scaling up the sustainable intensification approach? It is important that there is agency within the political and economic system to develop technical solutions adaptable for the mainstream existing large-scaled productivist farms today, which reduce their environmental and climate impact and their vulnerability to some extent. It is material- and energy efficient to take advantage of the existing farms potential to produce much food, but without fossil-based inputs and regarding the natural resources finiteness. The sustainable intensification approach can thus not be reconciled if it follows the libertarian maxim of infinite growth. Therefore, it needs to regard the system-ecological principles of recycling of resources and cooperation between systems, otherwise it cannot be long-term resilient – also because fossil resources are finite (Gunther, 1993). However, that is why I argue that we need *radical* sustainable intensification, which also considers to replace the all finite fossil resources with local, renewable and bio-based resources.

There are further motives why there is a need of radical sustainable intensification farming. The quality of biofuels needs to be developed and its' price must be reduced to

outcompete the diesel. Agriculture require tractors and machines for heavy work – even the small-scaled farms need it. Productivist agriculture will be necessary if there are not enough people wanting to be full-time farmers. It is as well necessary for grain-production, because large volumes are needed to produce for example flour. Thus, the sustainable intensification farming increases farm-level resilience to some extent, if the renewable fuels, energy and feed are locally, regionally or nationally produced. If these must be imported, they are as vulnerable for crises as conventional or fossil-dependent agriculture. Moreover, sustainable intensification farming is dependent on imported agrochemicals, but to less extent than conventional farming. It provides further vulnerability in case of a crises, because the production will be highly reduced. Therefore it would need to apply agroecological principles and methods to abolish the dependency on agrochemicals. For example by becoming organic, using methods to improve soil fertility and humus content, a longer crop-rotation schedule, a higher diversity of crops, planting trees to mitigate soil erosion and increase shade and degree of moisture, using smart and natural defend mechanisms against pests and vermin and so forth.

Though, radical sustainable intensification was marginalized and did thus have worse preconditions to be scaled up, like the peas-based farming system (4). It needs to be further supported because it provides the necessary technological solutions that can replace both the fossil-based energy, fuel, feed and fertilizers and increase the economic capital. The concept of the Peas-based Company was to grow legumes in order to make the soil more fertile and produce raw material for ethanol, which would in turn outcompete the imported fossil-based fuel, feed and mineral fertilizers. Though, the very large-scaled farming units, which includes this productivist approach, cannot provide entirely on-farm closed cycles of nutrients and energy and the ecosystem services needed for that purpose. The scale must be adapted to what kind of production it strives for, as well as regulated to a scale that can provide the local ecosystem services and resources (Helmfried, Björklund & Helmfried, 2010). Therefore, this could sometimes provide larger units and sometimes smaller, in order to make the closed cycle as resource efficient as possible. (ibid) The radical sustainable intensification approach could neither contribute to regenerate the ecosystems, biodiversity, biological processes and ecosystem services needed for the farm to be independent and self-sufficient of inputs.

Yet, the view of eco-technological fix for agriculture is neither the most optimal mindset for increasing farm-level resilience and food security. This is because it is related to the Brekke's concept weak sustainability (1997), which prioritize profitability and adaption to the market (Ayres, et al, 2001). Moreover, the strive for growth requires production of new techniques, which in turn requires new extraction of fossil oil, which both cause large GHG emissions and exploitation of natural resources. This unsustainable development happens because it regards the natural resources as unlimited as the unlimited growth. (Ayres, et al, 2001) The priority of monetary growth, will always threaten a bold environmental- and climate sound development. What if the economic and political system could value 'natural' growth instead, through improving ecosystem services, biodiversity and soil fertility? There are already examples of new economic and societal models, such as "Degrowth", "Circular economy" or "Local economy", and "Gross National Happiness". This would be an integration between the discourse of the eco-technological fix and the eco-centric fix, which would make the transition more possible. This would require a structural change of the economic system.

A more optimal mind-set for achieving increased farm-level resilience and food security, would be the eco-centric fix – which would also require a structural change in cultural values. Still, it was regarded as an opposing and alternative discourse at present. The agroecological farming systems connected to this view, were also excluded from the political context and sometimes also from economic system and by cultural values. These farmers experienced the most obstacles and were also most marginalized in their agency to fulfil their farming system as wanted. Therefore, the preconditions are rather bad for implementing a transition to agroecological farming within the current system. This also

correlates with the farmers' view on the solutions and the difficulties scaling up their farming system. The Urban Farming Movement, The Biodynamic Farm and the Horse Draught Farm suggested bold change of cultural values, behaviours and restructuring of the governmental steering, which requires an extensive system change – in other words, a paradigm shift.

It is necessary to achieve this change, because the agroecological farming approach would highly increase farm-level resilience and food security. It depends on its' connection to the strong sustainability concept, which considers the conservation of the social, ecological and economic capital and the long-term improvement of life-opportunities. The ecological capital was conserved by making the soil more fertile, cultivating a high diversity of crops and rearing a variety of animals, integrating crop- and animal production on the farms, providing local recirculation of nutrients, energy and resources, which improve ecosystem services. This makes the farm more independent of external inputs and thus it becomes less vulnerable for crises (Eriksson et. Al, 2016; Gunther, 2001; Björklund & Helmfried, 2010). The social capital was maintained by providing a healthy and attractive lifestyle, a developed sense of community and reciprocity in neighbourhoods, increased amount of competent farm labour and social justice due to a low-capital intensive farming and lifestyle. The agroecological approach could thus contribute to other social spin-off effects, like expanded population in rural areas which also could lead to further economic, cultural and social activities at the countryside.

Still, the economic capital was rather decent, but often not enough to make the farmers able to entirely engage in their fossil free strategy. Neither it seemed that these farmers' economic capital provided any surplus to give extra economic buffet. The economic capital could be higher if they were not marginalized by the political-, economic and cultural structures. Therefore, these agroecological farmers and entrepreneurs need economic support, which can be made by policy change. It must be attractive and possible to make a living from this kind of farming, otherwise these agricultural initiatives will remain at a local level. However, those farmers and their surrounding communities will then achieve a higher food security. Though it would mean that it is the individual's or the community's responsibility to secure their own food supply. That will be rather unfair of the government to not assure the essential and basic services and rights for all citizens in the country. In fact, it should be a basic human right to have access to food, regardless if the country remains in peace or crisis.

Therefore, there must be improved preconditions for agroecological farming, in order to make it possible to transform agriculture to a post-fossil state and obtain long-term food security. A living example of this is Cuba, which proves that food security and resilience are increased by implementing an agroecological and fossil free agriculture with small-scaled farm units at a national scale (see further recommendations in Funes, et al, 2002). When agriculture makes peace with the soil – the soil will also make peace with agriculture, by ensuring food supply in case of crisis. In order to reach this state and make the vision realistic, the political, economic and cultural structures need to apply a view of strong sustainability and include the discourse of eco-centric fix. Furthermore, the agricultural sector can neither become entirely fossil free if not the rest of the society also strives for the same ambition – that is why cooperation between disciplines and sectors are necessary. The actors who embody the power in society, like policy makers, corporate leaders and academics, need to embrace this vision because they influence the economic resources in society and the ideas and behaviours of the citizens. These people could contribute to approach this change, by acting upon the recommendations formulated below. Though, it would only be a start and there is much more research needed to provide knowledge about how to implement this change.

## Recommendations for policy makers

The results show that the preconditions to achieve a national transition to fossil free agriculture are not good enough. However, as motivated before, it is necessary to strive for this change to decrease agricultural vulnerabilities, increase the farm-level resilience and national food security. Here are some recommendations for approaching this aim:

- To create a political directive or policy change which requires agriculture to make the transition. It should include all kinds of fossil free practices, both radical sustainable intensification and the agroecological farming practices described in the thesis. The production of renewable and bio-based fuels, fertilizers and feed must be nationally produced. If the farms import these, agriculture will remain vulnerable in case of crisis. It is also suggested to include these initiatives within the policy documents analysed in the thesis.
- The Rural Development Program is continuing until 2020, thus the conclusions of the research questions can be taken into consideration in the formulation of the next program. Furthermore, officials at the County Administrative Boards and the Swedish Board of Agriculture, could steer towards the farming systems suggested in the thesis. It could be done by educating farmers about it and to help them increase the possibilities to obtain EU-payments. Administrators of the EU-payments do also need to gain knowledge about these farming systems and grant the applications striving to a fossil free state (to what extent that is possible within the policy framework).
- The aim of the National Food Strategy is rather broad - because it promotes both organic and conventional agriculture. This could create a scope of action to steer towards more of the thesis' suggested farming systems. Within the regional action plans of the National Food Strategy, the officials that execute the policy could consider these recommendations.
- The directive Fossil Free Initiative, is a good platform to influence agriculture to transform to a fossil free state. However, it needs another political directive or a policy change to make an incentive for the coordinator to engage fully in the issue.
- It needs cooperation between the Ministry of the Environment and Energy, the rural-agricultural sector of the Ministry of Enterprise and Innovation and also with Swedish Civil Contingencies Agency (MSB). Together, these could formulate a policy of food security, which includes the environmental aspect of making agriculture fossil free.
- Further research about how to practically implement a transition to agroecological farming in Sweden.
- To educate crop- and financial advisors in practical agroecological farming, with focus on adapted scale (Björklund, Helmfried, 2010). For example in higher-education degree, like the agronomist programs at SLU. Presently, these programs mainly focus on large-scaled farming units and sustainable intensification methods. Today, there are only master's courses and a program within the field of agroecology at SLU, which mainly aiming to deal with social and environmental issues at a structural level. Another education is needed which focuses on single farms and the practical gardening- and agricultural knowledge for providing extension services.

- To develop a new organisation for agroecological extension services. It could be formulated through collaboration with experts within this field, like competent course-leaders at general level education, focusing on agroecology, holistic management, adapted- and small-scaled farm units, biologically intensive farming and urban gardening. Another alternative is to create vacant jobs for agroecological extension services within the agricultural associations like LRF Konsult, Hushållningssällskapet and Lantmännen.
- Governmental-, regional- and municipality support to the organic gardening and farming movement in Sweden, described in “Context to the empirical field”. Take advantage of the enthusiasm and work that is already made for increasing strong agricultural sustainability. It may be most practically implemented at municipality-level, because they also have responsibility to increase preparedness for food security:
  - Providing cheaper land-lease for youth interested in commercial small-scaled farming. There are many youths who have the will to start gardening and farming, but buying or leasing land requires high investments. This policy change could be implemented by creating a vacant job for coordinating these farmers and land plots and subsidize land-lease for farmers. Gothenburg municipality is one example that has already implemented this.
  - Like gardeners are hired by municipalities for managing green areas, farmers should be employed for producing food. Note that these farmers should use as local and bio-based resources as possible in order to increase farm-level resilience.
  - Employ as many farmers needed to enhance a large food-self-sufficiency, by counting how much food the inhabitants in the municipality are consuming, how much land is needed for producing that amount of food, and how many farmers that could manage to produce that amount in a sustainable way.
  - See the brochure from earlier research in the project, about what farming branches are relevant for crisis prevention (Eriksson, et al, 2016).

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## Interview data

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- Fredrik, The biodynamic and recycling farm. 2017-03-06
- John, The urban farming movement. 2017-03-13

# Appendix 1

## Interview guide

The interviews were made in Swedish. Here is the English translation of the main questions:

- What made you begin with this kind of farming?
- What brought you to this place?
- Have you experienced any obstacles during the period that you have worked with this farming practice? Could you describe a bit more about these obstacles, please?
- What do you think is the possibility to nationally scaling of the farming practice that you perform?
- What would be the difficulties to achieve that kind of transition?
- What are the solutions to overcome these difficulties?
- Are there anything you want to add?