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Future farmers and sustainability: a case study of newly established farmers in Southern Norway

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Abstract

The industrialization of agricultural production around the world has resulted in an unsustainable direction of development and challenges related to farmers economic profitability, environmental degradation and reduced social living conditions for farmers. To understand how newly established farmers in Norway perceive sustainability issues and plan to practice within economic, environmental and social aspects, I studied ten cases. My overall aim was to explore similarities and differences between the cases based on interviews and observations during farm visits conducted in February of 2017. Newly established farmers chose to develop the farm in a more sustainable direction by adopting following strategies: value-adding and/or higher productivity to generate sufficient income, increased utilization of local resources and/or adoption of technological aids to increase resource preservation, and working to improve societal impact and/or hire employees to get a better quality of life. External forces like political legislations and societal focus stimulate some change. However, personal experience are likely the most important reason for farmers to achieve more sustainable management practices.

Sammendrag

Industrialiseringen av jordbruket verden over har ført til en utvikling som ikke er bærekraftig og utfordringer i forhold til økonomisk lønnsomhet for produsenter, miljødeleggelser og redusert livskvalitet for bønder. For å forstå hvordan nyetablerte bønder i Norge oppfatter bærekrafts problematikken og planlegger å praktisere innen økonomiske, miljømessige og sosiale aspekter, studerte jeg ti caser. Mitt overordnede mål var å utforske likheter og ulikheter mellom casene basert på intervjuer og observasjoner under gårdsbesøk utført i løpet av Februar 2017. Nyetablerte bønder velger å utvikle gården i en mer bærekraftig retning ved hjelp av følgende strategier: verdiskapning og/eller høyere produktivitet for å generere en tilstrekkelig inntekt, økt bruk av lokale ressurser og/eller å ta i bruk teknologiske hjelpemidler for å bevare ressurser, og jobbe for å påvirke samfunnet eller ansette flere for å oppnå bedre livskvalitet. Eksterne påvirkninger som politiske lovgivninger og samfunnsfokus stimulerer noe til endring. Derimot, er personlige erfaringer antakeligvis den viktigste årsaken til at bønder oppnår en mer bærekraftig praksis.

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INTRODUCTION

According to the national parliamentary report St. 9 in Norway (2011-2012) regarding agricultural politics, sustainable agriculture is a national main goal (Landbruks- og matdepartementet, 2011). Agricultural legislations are determined by the government, but within the national framework each farmer can decide to carry out the practices they believe are ideal. As farmer's roles are essential in the development of sustainable agriculture, their choices are often formed by their own understanding of what a sustainable practice is.

Bjørkhaug (2006) found that Norwegian farmers' understanding of sustainability is connected to the practical goal of maintaining agricultural activities on farms. Even though farmers do not comprehend sustainability in a theoretical sense, it is possible to deduce their concerns to a "triple bottom line" definition that includes economic, environmental and social aspects of sustainability. Farmers' background is found to influence their practices, as the farmers own conscience, value system and worldview are based on own experiences (Bjørkhaug, 2006, Schoon and Grotenhuis, 2000). Suess-Reyes and Fuetsch (2016) found that generational shifts often bring new ideas and resources into the farm business, which might result in innovative and sustainable behavior. What we don't know is what changes newly established farmers in Norway plan for when they start farming. I would therefore like to look at ideas about sustainable agriculture among this population of farmers.

In my research, I include both organic and conventional farmers, with different productions and farm structures, as I want to explore how farmers' awareness, perception and plans relate to sustainability indicators. By posing the following research questions, I wish to identify farmers' perception of what a sustainable agricultural practice is, to see how this influences their plans for future development of the farm. In addition, I will provide tentative suggestion about what I think influenced their perceptions and plans.

Research Questions:

How do newly established farmers perceive and plan for a sustainable agricultural practice?

What makes newly established farmers change their farm in a sustainable direction?

First, I will define what I mean by sustainable agriculture and then present the theoretical framework for sustainable agriculture. The framework is a collection of earlier research within the field, which has been the basis for my interview guide. In the methods part I will explain

how I conducted the research and analyzed the data. Findings from the cases will be presented in the results part and further reviewed in the discussion.

THEORETICAL FRAMEWORK

Sustainable agriculture

The Brundtland Commission was the first to define sustainable development as: "development which meets the needs of current generations without compromising the ability of future generations to meet their own needs" (WCED, 1987). Since then, this report has been criticized for aspiring economic growth and living standards that are far beyond what can be considered as ecological sustainable in the long term (Holden et al., 2014). Bell and Morse (2008) claim that sustainability associated with maintenance of environmental quality was related to the idea of carrying capacity and maximum sustainable yield. Both these concepts are developed around the ideas of how population increase or greed can trigger resource-use to a limit that results in systems collapse. Bell and Morse divide sustainability into two visions: strong and weak sustainability. Strong sustainability primarily focuses on the environment or ecological terms and measures physical phenomena as biodiversity and soil erosion, without consideration of financial or other costs by attaining it. Weak sustainability strives to see trade-offs between environmental, social and economic benefits, and is therefore more relevant for this study. The complexity of agricultural systems makes it difficult to measure sustainability, but key components within economic, environmental and social aspects can be used as indicators in this favor. The idea behind the use of such indicators is to identify whether things are getting better or worse. The equilibrium within each sustainability indicator is agreed upon to be sustainable. Ikerd (2008) defines sustainable agriculture as an economically viable, socially responsible and ecologically sound agriculture:

“An agriculture that uses up or degrades its natural resource base, or pollutes the natural environment, eventually will lose its ability to produce. It's not sustainable. An agriculture that isn't profitable, at least over time, will not allow its farmers to stay in business. It's not sustainable. An agriculture that fails to meet the needs of society, as producers and citizens as well as consumers, will not be sustained by society. It's not sustainable. A sustainable agriculture must be all three - ecologically sound, economically viable and socially responsible. And the three must be in harmony.”

John Ikerd, 2008:76

Because of the interrelatedness between these aspects they must all be achieved in parallel. In addition, duration over time is an essential part of sustainability (Bell and Morse, 2008). The carrying capacity within each aspect (figure 1) must be maintained, so that future generations can subsist.

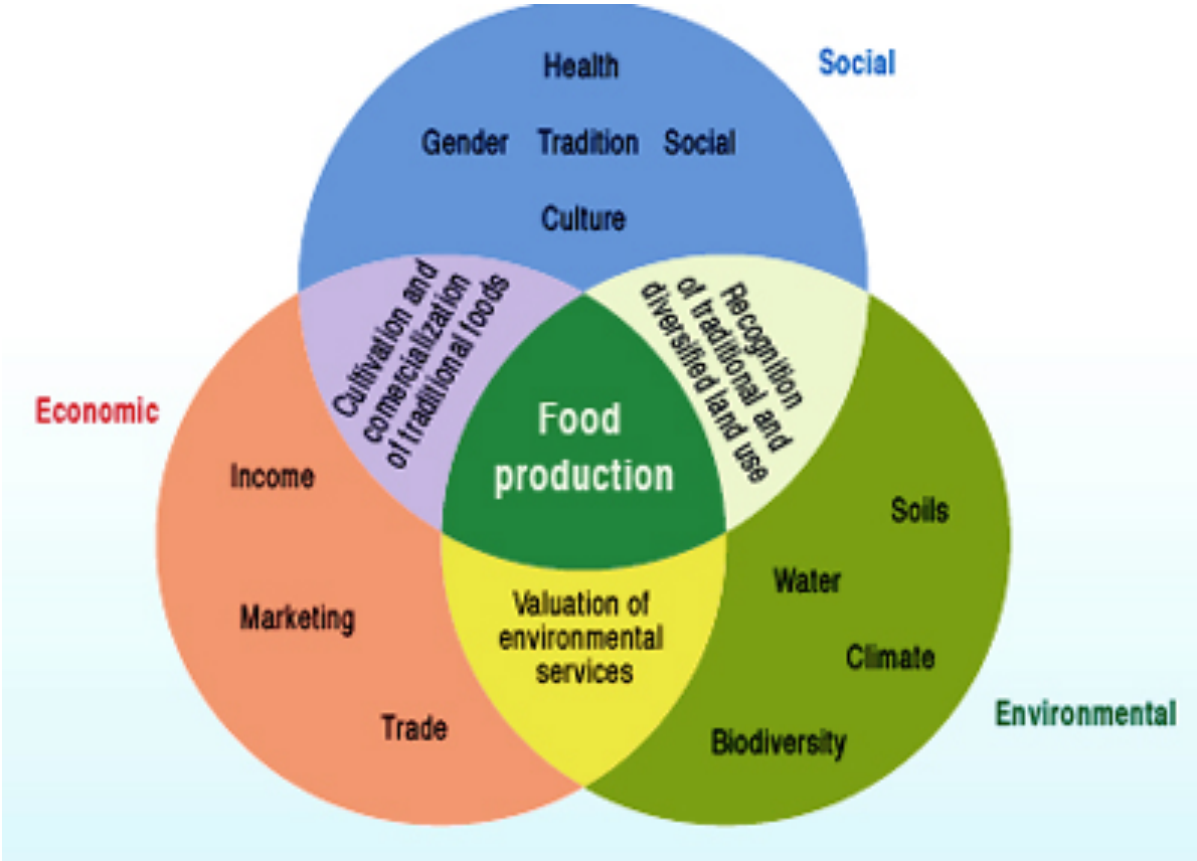


Figure 1: The three interrelated aspects must be balanced to achieve sustainability (IAASTD, 2008).

In my thesis, sustainability include economic, environmental and social aspects of agricultural production, and is therefore what Bell and Morse (2008) refer to as weak sustainability. In this framework, I will present what is considered the problematic issue and possible solutions within each of the three aspects.

Economic sustainability

The industrialization of agriculture and food production has brought economic welfare to some, while most farmers are not reflected in this progress (Donkers, 2014). Although farmers have the important job to producing food for subsistence, the profession involves huge risks, several work hours and often lower wages than the general population (Storstad and Rønning, 2014).

When the returns from farming neither allow farmers to maintain nor expand their production, many farmers leave for better paid jobs outside the farm (Bjørkhaug, 2012). This situation has resulted in a declining number of farmers, which again weakens farmers' academic environment, vibrant rural communities and threatens food security (Storstad and Rønning, 2014, Satterthwaite et al., 2010). The remaining farms have to increase in size and efficiency to stay profitable (Bjørkhaug, 2012), which can result in numerous unsustainable patterns within economic, environmental and social aspects of the farm management. To achieve economic sustainability the income from farming must be sufficient to support farmers, as well as to renew and maintain the farm, something which can be achieved through cost savings or increased incomes.

Sufficient farm income

Over the last decades, the possibility to create a living of farming has become challenging. The majority of Norwegian farms are hardly able to support one person on a farm income (Bjørkhaug, 2012). In 2009 the Norwegian Institute for Agricultural Research estimated an hourly rate of pay to be 107 NOK for farmers (NILF, 2011), while the minimum rate for other professions is 120 NOK per hour (Arbeidstilsynet, n.d.). Only 5% of Norwegian farmers get 100 % of the household income from farming, and half of these offer additional services as part of the farm (Storstad and Rønning, 2014).

Agriculture in combination with other work has long traditions in Norway, but off-farm income plays an increasingly important role in agricultural households (Knutsen, 2014). Nearly three-quarters of farm households obtain over half of their income outside of farming (Storstad and Rønning, 2014). Many farms are supported and kept in the family through off-farm jobs, but when 75 % of the income originates from off-farm jobs it shows an unsustainable direction of development (Bjørkhaug, 2012). To ensure independence from off-farm employment, farmers have increased both farm size and work hours to generate sufficient income for subsistence and farm maintenance (Suess-Reyes and Fuetsch, 2016).

Maintenance and innovation

Nowadays, farmers often must choose between off- farm jobs or innovative strategies to keep the farm-income sufficient for investments needed to sustain the farm (Bjørkhaug, 2012). Innovative strategies like on-farm businesses have become normal to create jobs and achieve economical sustainability (Veidal, 2011, Suess-Reyes and Fuetsch, 2016). The development of

diversified business strategies has been triggered by the low profitability (Veidal and Flaten, 2014), but also; technological developments, growing demand for social services from farms, changes in food production techniques, and as responses to climate change, reduction of fossil fuels and the universal food crisis (McElwee and Bosworth, 2010). Many farms offers additional services, which is defined as business activities outside of traditional agriculture and forestry, based on farm resources (NILF, 2011). These services can involve a wide variety of activities, such as: machine driving, rental of housing, tourism, on-farm activities and value-adding of produce. Services often provide better profitability than productions and are therefore desirable manners to increase their income.

Cost saving and increased income

The continuous cost-price squeeze together with worldwide resource and travelled-food issues have also stimulated farmers to get involved in strategies like value-adding of produce (Horlings and Marsden, 2011). Consumer expectations of high-quality or natural rural resource-based goods and services have made this contribution to local economy feasible.

Fair prices can be obtained if a larger price share goes to the farmer, which can be achieved by fewer intermediaries between producer and consumers (Donkers, 2014). Within organic production, alternative sales forms emerged quickly and helped to reduce the distance between producer and customer (Solemdal & Serikstad, 2015). In addition to higher market prices, reduced purchases for inputs such as feed, fertilizers and pesticides, together with utilization of more local resources can create savings (Rundgren, 2006). These examples could also be used to ecologizate conventional agriculture (Agropub, 2011), and improve farmers' incomes, at the same time as providing environmental benefits.

Environmental sustainability

According to UNs organization for food and agriculture (FAO) (2013) the most urgent needs regarding the environmental aspect is the capability to withstand climate change (Wheeler and von Braun, 2013), decrease greenhouse gas (GHG) emissions (Vermeulen et al., 2012) and pollution (Parris, 2011), and conserve biodiversity and natural resources (Koochafkan et al., 2012). Intensified industrial agriculture uses high amounts of inputs to produce high yields, but without thinking about consequences for ecosystems and scarce natural resources.

Even though alternative approaches to conventional agriculture were developed with respect to sustainability issues, sustainability in agriculture cannot be associated with a

particular farming practice or method (Rigby & Cáceres, 2000). Examples of alternative approaches are integrated pest management, integrated crop management, low input agriculture, agroecology, permaculture, biodynamic farming and organic farming. These methods emphasize recycling of biomass, soil fertility, minimizing nutrient loss, maintaining biodiversity and biological interactions and synergies. Organic farming is, unlike other sustainable farming practices, well defined and controlled by law and certification (Bell and Morse, 2008, Rigby & Cáceres, 2000). The original intention of organic farming was to create a holistic approach to agriculture with wholeness of the system as a goal, but this has to some extent vanished in modern organic production. In Norway, organic farming is primarily regarded as a farming method with extra emphasis on environmental concerns and animal welfare (Solemdal & Serikstad, 2015).

Energy consumption

The global food system is responsible for GHG emissions due to agricultural practices, production of chemical fertilizer and pesticides and transport of food (Vermeulen et al., 2012, Eurostat, 2016, IPES-Food, 2016). Burning of fossil fuel creates GHG that leads to climate change. Climate change includes increased temperatures, droughts, heavy rain and floods, with following acidification of oceans and erosion of fertile soil, which can make future agricultural production challenging (IPCC, 2015).

GHG emissions in agriculture can be reduced by substitution of fossil fuel with CO₂ neutral bioenergy, in addition to measures related to tillage, fertilization, carbon sequestration, livestock production and changed composition of animal feed (Miljødirektoratet, 2016).

Carbon can be introduced to soils directly through the roots and plant residues, or indirectly by supplying manure or other organic material, and kept as organic matter for up to 100 years (USDA, 2008). Additionally, emissions can be reduced by utilizing more local resources and avoiding transport (Power, 2010). The need for chemical fertilizers can be reduced by use of animal manure, and pesticides with well-functioning eco systems. Local grassland can replace imported soya, which also is related to more sustainable solutions on a global level, as the soya industry reduces biodiversity and degrades soil (Hougen et al., 2015).

Soil quality

According to FAO, degradation of topsoil is a result of modern farming methods (FAO, n.d.). Topsoil is considered a non-renewable resource, which takes 1000 years to build. 1/3 of the

world's small fraction of fertile topsoil is damaged to varying degrees. Soil compaction, inflicted by heavy machinery, poor drainage or driving during unfavorable times, reduces crops, in addition to increase emissions of the GHG nitrous oxide (Fylkesmannen Vestfold, 2012). Improper tillage increases the risk of erosion and insufficient return of nutrients impairs soil fertility, which both results in reduced yields.

Trenching provide shorter periods of waterlogged soil and thus less nitrous oxide loss, but also less packing during tillage and spreading of manure (Fylkesmannen Vestfold, 2012, Miljødirektoratet, 2016). Soil compaction can be reduced through use of hoses for manure supply rather than heavy trucks. Reduced tillage techniques are relevant in terms of preservation of topsoil and reduce erosion risks. Well-aerated soils with abundant organic matter are fundamental to nutrient acquisition by crops, as well as water retention (Power, 2010). Incorporation of crop residues can maintain soil organic matter, which assists in water retention and nutrient provision to crops. These measures will also facilitate increased biodiversity in soil such as bacteria, fungi, earthworms and other invertebrates that influence the soil pore structure, soil aggregation and decomposition of organic matter. Microorganisms make nutrients available through nitrogen fixation and decomposition of detritus and plant residues. If soil organisms are not present and active, more fertilizers will be needed to supply plant nutrients (Magdoff and Van Es, 2009).

Resource use and nutrient cycling

The two nutrients that mostly limit biological production in natural and agricultural ecosystems are nitrogen and phosphorus. If these nutrients are lost in nature, which they often are, it can result in complex and harmful effects on natural ecosystems (Power, 2010). Phosphorus exists only in a fixed number circulating between land, biota and soil and between aquatic biota and aquatic sediments (Cordell and White, 2011). Phosphorus is today mined from finite phosphate rock. Estimates say that we will run out of it in 30-300 years, which means that ways to recycle it to farm systems must be found. Also nitrogen is easily lost from fields because it does not bind to soil aggregates properly (Magdoff and Van Es, 2009).

Nutrient loss can be reduced by practices that maximize plant cover, such as minimum tillage and polycultures, that are likely to decrease runoff and increase infiltration of water. Crop rotation, catch crops, green manure and livestock manure can be used to build organic matter which stores nutrients and water in soil (Power, 2010). Cover crops facilitate on-farm retention of soil and nutrients between crop cycles, while hedgerows and riparian vegetation

reduce erosion and runoff among fields. Lighter machinery will reduce packing and erosion and therefore better keep nutrients in soils.

Run-off from these nutrients can easily end up in water together with fertilizer- and pesticide residues were it pollutes water sources and contaminate drinking water (Magdoff and Van Es, 2009, Parris, 2011). New research shows that many pesticides have very long degradation in our climate and that many of them often accompany soil particles into watercourses (Fylkesmannen Vestfold, 2012). Mechanical weed harrowing, ridging, row crop and flaming are alternatives that can reduce the consumption of chemical herbicides.

Encourage biodiversity

Today's farming methods have resulted in reduced biodiversity in cultural landscapes due to removal of habitats, less rotation of crops and use of chemical fertilizers and pesticides (Fylkesmannen Vestfold, 2012, Solemdal & Serikstad, 2015). A review of 16 studies of nine crops on four continents concluded that agricultural intensification threatens wild bee communities and may affect pollination services (Klein et al., 2007). Intensified agricultural management, but also closure of farms and uncontrolled forest growth threatens many endangered species that are available in agricultural farmlands. Continuous decline of key ecological functions, such as loss of biodiversity, can eventually lead to system collapse (Koohafkan et al., 2012).

To support plant- and animal-life's natural habitats, corridors should be placed in the cultural landscape so animals and plants find refuge (Fylkesmannen Vestfold, 2012). Non-crop habitats are also alternatives to pesticides as they provides biological pest control through diversity of natural enemies such as predators and insectivorous birds (Power, 2010). Natural habitats provide a space for pollinators, which are important for 75% of global crop species. Many studies show that plants, pollinators, arthropods and birds are more abundant in organic farm-systems, where chemical pesticides are not used (Kremen and Miles, 2012, Bengtsson et al. 2005). Crop rotations provide ecosystem services such as pest control, but also better soil fertility and access to nutrients, through cycling, structure, and soil retention (Power, 2010).

Biodiversity can also be supported through conservation of veritable genetic races of both crops and livestock. The transition to modern animal breeds and modern varieties of cultivated crops has resulted in a genetic erosion were many locally adapted breeds disappeared (McKinnon, 2015, Norsk genressurssenter, 2008). In the future a wide variety of genes can allow us to develop breeds and varieties that are plant-disease resistant, of better nutritional composition and more robust to climate changes.

Animal welfare

The force upon farmers to get larger and industrialized has resulted in poorer animal welfare (Lassen et al., 2006). Farms now keep more animals per unit area leaving them more vulnerable to outbreak of diseases. Animals have also been bred to produce meat, milk and eggs faster and with lower feed inputs, which has negatively affected their health. Possibilities to exercise natural behavior have also diminished since housing is designed to control the behavior of the animals and thus make the management easier.

After the emergence of organic agriculture, conventional agriculture has adopted solutions that let animals exercise a more natural behavior, as is shown for example in; grazing requirements, space requirements and animal breeding (Solemdal & Serikstad, 2015). More products from sustainable productions which emphasize animal welfare are requested, as there is an increased awareness of sustainability issues and food production among consumers.

Social sustainability

The current food system is embedded in global supply chains, with long distances between consumers and farmers (Donkers, 2014). Industrial production has made it easier for most people to fill their daily needs for food, but the downsides are loss of agri- and food culture. Fresh local produce is exchanged with more preserved travelled foods, leaving negative effects on people's health.

Even though ensuring enough food for an increasing human population is an urgent need, the trend is decreasing number of farms which leads to food insecurity (Wheeler and von Braun, 2013). When agricultural societies deteriorate, this can affect remaining farmers' motivation to continue, which can result in emptied districts without agriculture and overgrowth of cultural landscapes (Storstad and Rønning, 2014, Universitetet for miljø og biovitenskap, 2004). In theory, a sustainable agriculture aims to improve rural livelihood, social equity and enhance resilience of people and communities (FAO, n.d.).

Farmer-consumer interaction

Farming is often characterized as a lonely occupation, as most hours are spent working alone on the farm. About 29 % of Norwegian farmers reported that they often felt lonely on the farm (Storstad and Rønning, 2014). This can partly be explained by fewer positions on the farms, but also a decreasing number of neighboring farms.

The desire for social contact, together with the low profitability in commercial distribution chains, often drives resurgence innovation, such as alternative distribution chains and social services (Veidal, 2011, Suess-Reyes and Fuetsch, 2016). Direct sales give farmers better prices, but also social contact with customers. Farmers are just as dependent on listening to customers' demands, as the costumers are that farmers produce food. Norwegian food is highly requested, and the demand for locally and organic produced food is also an increasing trend (Veidal, 2011). For example, sales of organic food through grocery stores increased by 22% in 2016 (Landbruksdirektoratet, 2016). In addition, a lot is sold through distribution channels like; organic food stores, farmers marked and subscription schemes, like cooperatives and community supported agriculture, which all promote organic and local food.

Promoting public awareness

The distance to production, ample access and plummeted food prices, have led to little valuation of food. Within the social dimension of sustainability, the most important thing is to teach consumers to appreciate food (Donkers, 2014). Since the real cost of food production is not reflected in food prices, it is essential for consumers to understand where food comes from and how to avoid wasting it, as ood production is a time consuming and resource demanding process.

Services like direct sales, education and tourism can create social connections and strengthen farms' positions within the local community (Horlings and Marsden, 2011). By welcoming the public to observe and participate in farm-related tasks, they might gain a greater understanding of what food production entails.

Protecting and promoting human health

In addition to extended interactions and services, social sustainability ensures that farmers and farmworkers achieve a balanced workload (Suess-Reyes and Fuetsch, 2016). Social sustainability also refer to finding an acceptable work-life balance as a farming family. Lower payments mean that each farmer must increase production and work-hours to achieve profitability. Farming is considered a special lifestyle that includes both work and hobby, meaning that unwinding can be difficult.

Working with large machinery, animals and chemicals also pose risks for farmers. Due to extensive use, pesticides are related to risks for both ecosystem and human health because of air and water contamination (Damalas and Eleftherohorinos, 2011). Glyphosate is one of the

most contentious agents where several studies suggest links between use and cancer incidences in agricultural areas (Schinasi and Leon, 2014, Vazquez et al., 2017). Whether pesticide use pose a risk for farmers and the general population living in cropped areas in Norway, that have stricter regulations than other countries, remains unsure. However, environmentally hazardous pesticide residues were found in water samples from drinking water sources in agricultural areas (Ludvigsen and Lode, 2010).

The intention behind organic agricultures intention is to create better livelihoods for farmers through higher prices and diverse sources of income that spread risks. If farms give work to several employees, this creates a social environment, variety of tasks and less weariness. There is no consensus about whether organic agriculture, as it is currently practiced, is more socially sustainable for farmworkers than conventional agriculture (Shreck et al., 2006).

Rural settlement

As the role of agriculture in local communities has been marginalized and fragmented, many farmers have been forced out of business (Horlings and Marsden, 2011). However, as the larger farmers in more central areas receive the lion's share of agricultural support, fewer and fewer farmers remain on the outskirts of Norway to secure agricultural production (Shucksmith and Rønningen, 2011). Since 1949, the number of farms has decreased by 80 %, from 213 000 to 41 800 today (SSB, 2016). This means that an average of seven farms were closed each day in that period. Similarly, over 20 % of the population was employed in agriculture in 1950, while the proportion is down to under 2 % today.

The worlds increasing urbanization has caused a declining population in rural areas where agriculture and extraction of natural resources occurs (Ikerd, n.d.). The role of small-scale and part-time farming is central to maintain public goods, including cultural landscapes, cultural heritage and biodiversity (Shucksmith and Rønningen, 2011). Mountain and upland farmed areas are fundamental to tourism, which also provide income opportunities for the local population. Policy steered towards an ideal of full-time agricultural holdings considers smallholdings as obstacles to productivity in agriculture, rather than recognizing their potential role in terms of rural sustainability.

METHODS

Research strategy

To research newly established farmers' relationship to sustainable agriculture, ten different cases were studied. I chose to use a case study approach as it is suitable to exploratory, descriptive and explanatory purposes, as it seeks to explore mechanisms around the action, and to understand "how" and "why" (Yin, 2009). This method allowed me to look at a contemporary phenomenon in real-life events, where the boundaries between phenomenon and context are unclear. As multiple cases form the basis for my analysis, the goal was to explore similarities and differences between them.

The cases

Purposive sampling gave me the possibility to strategically select cases relevant to the research questions posed (Bryman, 2016). This sampling ensured a spectrum of cases with different key characteristics. I got in contact with ten chosen farmers through informants in the institution Norwegian Agricultural Extensions service (NLR) and partly through my own network. The cases I worked with have different organizational structures, such as variation in terms of number of fulltime positions on the farm: some work alone, others with family members and external employees. These chosen farmers are either successors of family farms or they had purchased the farm on the open market. Farming methods and production varies between: organic and conventional, mixed farm systems, livestock husbandry and plant production. Some of the farms also offer services of social character such as: activities for children, education and direct sales from the farm.

The ten farmers I spoke with are newly established farmers, that are expected to continue farming for the next 20-40 years. In nine of the ten cases, farmers had farmed for less than 10 years. In one case I included a farmer that has farmed since 1998, because he demonstrated valuable experiences of farm development that unfolds over time. The farms are located in central parts of Eastern Norway – in the counties of Akershus, Buskerud and Vestfold. I had chosen to exclude hobby farmers – therefore all participants have or planned to have the farm as their main source of income. Since succession of family farms often is a gradual process, I included tenant farmers on family farms as they are registered in the producers' register. In some cases, parents are still involved in the management, but I only talked to the newcomers.

In cases where couples farmed together, questions were answered by only one of them, the one available at the time of interview. All participants received information about the study's purpose and consented to let me use their name in my thesis (Appendix 1).

Data collection

The fact that I was able to do a test case with a local farmer, gave me the opportunity to test and adjust many of my questions before I started conducting the interviews. I collected information through semi-structured interviews and observations on the farm. A semi-structured interview-guide allowed me to have a set framework of the qualitative themes to be explored (Thagaard, 2003). The semi-structured interview is designed to give information that helps to answer the research questions, but allows one to divert if needed. This way the participants were able to reveal their experiences and explain complex situations. The aim was to expand knowledge about individual thoughts, attitudes and experiences related to sustainable farm practices. Questions explored farmers' views, practices and priorities related to plans within economic, environmental and social aspects of the farm management. I gained some insight into what shapes each farmer's view. In addition to that, I gained a better understanding of the farm's role in the society.

All interviews were conducted face-to-face when I visited the farms during February 2017. A benefit of this was that farmers were in their normal surroundings, and we talked at the kitchen or in their offices with minimal disturbances. The interviews lasted approximately 2 hours, and were based on the interview-guide (Appendix 2). I asked my questions in a non-leading way. Instead of asking directly if participants followed specific practices I let them reveal what they were concerned about and aware of. All interviews were recorded, transcribed and translated by me.

During the farm visit I also got a guided tour that often confirmed some of the information revealed in the interviews. In addition, this was an opportunity to make new discoveries. On the farms, I generally looked at buildings such as operational buildings, such as barns, grain dryers and housing for seasonal workers. At those farms which have livestock, I had the opportunity to observe and greet the animals. Some of the farmers showed me machines and tools that are of particular importance to the operation. It was especially interesting to observe how farmers use local redundant resources, such as food waste from local suppliers and spent grain. Pictures from farm visits can be found in Appendix 3.

Analysis

To analysis the transcripts of my interviews systematically, I identified and placed all meaning units addressing the interview questions in grids under themes. The meaning unit was condensed and the underlying meaning interpreted. Further, the intent was to preserve the core meaning in the sub-theme or codes I had made. Coding is a review of transcripts where parts that seem theoretically significant are given labels (Bryman, 2016). Codes made the data more structured and easier to handle as well as interpret in the results.

The process of analysis involved a movement back and forth between the whole text and the parts (Robson, 2002, Yin, 2009). First, codes were reviewed for compatibility with the findings, and then, to see how this matched data from existing literature. The findings from this study are presented in the Results and Discussion. I am quoting the farmers on several occasions, as transcribed in the original interview text, which is translated from Norwegian to English by me.

RESULTS

In this chapter I will present my findings from the cases studied. First, an overview of the cases will be presented. The findings in this chapter are based on the interviews and observations on the farms, and provide a glimpse into how the newly established farmers perceive sustainability and how they plan to pursue it in their practice. Examples of this are given within the economic, environmental and social aspects of sustainability.

The cases

Table 1: Demographic information about cases.

Farmers name	Age	Farm administration	Production	Social services	Farm size. Incl. lease land (acres)	Farm location
Knut (M)	29	He makes decisions, father is involved	Organic Beef cattle, sheep and grain	Tuition of middle school children	610 + 600 forest	Akershus, Ås
Bjørge (M)	45	Operates together with wife. 30 seasonal workers	Conventional Spring onion, onion and herbs + vegetables		250	Vestfold, Horten
Jakob (M)	26	Run the farm alone	Conventional Sheep, beef cattle and grain		800	Buskerud, Hurum
Mari (F)	31	Has one employee in 40% position	Conventional Grain, potato, unsprayed vegetables		560, 120 pastures + forest	Akershus, Nes
Magne (M)	44	Runs together with partner, which is currently working on the outside	Organic Pigs, sheep, hens, ducks, strawberries, raspberries and vegetables	Farm shop	64	Akershus, Eidsvoll
Marthe (F)	26	Has no employees, but receive help from parents and boyfriend	Conventional Dairy cows and meat	Farm visits for kids	450 + 330 forest	Akershus, Ullensaker
Steffen (M)	33	Operates with his father. Has 2-3 fulltime employee and 80-100 seasonal workers	Conventional Strawberries and grains		1935	Buskerud, Modum
Nils (M)	26	Run the farm alone	Conventional Cereals, clover-seeds, oil seeds, peas		400	Buskerud, Hokksund
Hans (M)	26	Operates with his father. Has one 70-80 % employee position	Conventional Dairy cows, beef cattle and grains		1700	Buskerud, Modum
Kristin (F)	38	Runs with her partner. Have one fulltime employee, woofers and working guests	Organic Sheep, beef cattle + pigs and hens	Direct sales	700 + forest	Akershus, Oppegård

M = male, F = female

Economical sustainability

Most of the farmers had or planned to make huge investments in new outbuildings and infrastructure on the farms. This is not the case for Magne and his partner, who ended up being debt free when they bought the farm after a house sale in Oslo. Their investments on the smallholding have been minimal, which put them in a different situation than other farmers. They are mainly depending on revenues for a living, rather than to maintain and repay debt.

Five of the farmers in my cases are engaged in both on- and off- farm jobs, as they have had to invest in the farm, buildings, machinery and livestock. Knut, who took over the farm from his parents a couple of years ago, talks about the current situation where he has a 50 % position at Felleskjøpet and is employed as a teacher at the farm two days a week: *“I work a lot. I have two jobs in addition to being a farmer”*. He tells me how the weekends are filled with farm-related tasks, as a lot of his time is spent on other responsibilities during the week.

For most of the farmers, a fulltime on-farm job is desirable. The future as a farmer is unpredictable and depends on several factors, also political, but Knut remains hopeful, saying: *“I do not know if I would say that I believe, but it is my greatest wish that I can be a fulltime farmer...”*. Some of the other farmers, e.g. Mari, sees an off-farm job as an opportunity to maintain social contact, and would prefer to keep it that way rather than just working alone on the farm. She says: *“Not because I depend on it, but because it is comfortable to have an employee in a 40% position on the farm. I can get help with some farm related tasks, and get a little money outside. I also get the chance to meet people and be social this way.”*

To be able to live from farming, the farmers expressed the necessity to make huge investments to create an operational basis. These investments are often related to new farm buildings or remediation of existing buildings. Marthe, who recently built a new barn for her dairy cows, had to invest to make a full-time job for herself: *“If I were to be a farmer, I had to do something. The barn on the farm was old... so we had to build a new. The cost of the barn was 10.5 millions, and I bought the farm as well...”*

Even if the farmers make large investments, a full-time job at the farm is not always possible. Nils, who currently works 50 % at NLR, says that investing in a pig house will not guarantee a fulltime job on the farm, but that he will need less revenues from outside: *“I have thought about starting with pigs. A new pig house will be a huge investment... between 7.5 to 13 millions.”* Bjørge, who already has farmed for almost 20 years, expresses the need for expansion because of constantly decreasing prices: *“We have been able to use the infrastructure on the farm so far, but volume has increased over the years... So now we are on the threshold*

and have to figure out what we should do next". They feel pressured to invest in a new outbuilding in order to increase sales and remain as producers.

Those farmers that deliver their produce to the national cooperatives like Tine, Nortura and Felleskjøpet have agreements that ensure delivery and income. In the production of milk, meat and grain, volume production through efficiency and optimization is a way to achieve increased earnings. For Marthe, the new barn with milking robot was crucial to enter the profession as a farmer: *"There have been increased earnings because of the new barn. It has doubled our number of cows... and given way for an entirely different efficiency."* New technology in the use of fertilizers and pesticides is another aspect that leads to better economy through saved costs. Steffen, which grows grains on 1700 acres, says that use of GPS has made the work easier, in addition to saving both money and the environment: *"When the spreader comes to an area one already has spread, it closes down sections. It is done the same way for pesticides too..."*.

For farmers with alternative production forms, such as organic, most of their produce are sold through alternative distribution channels to achieve higher prices. Direct sales, are performed by Magne and Kristin, and to some extent also by Mari and Knut. This type of sales includes a marketing part, where the story around the production is part of the marketing. Bjørges and his partners aspiration is to build preference on behalf of how they produce herbs and vegetables, and have created their own brand "Skjæregaarden gartneri": *"We have had a lot of focus on living topsoil and recycling. I think there is a raised awareness among consumers. And even among the chains... Last year we received an award from Meny, because of emphasis on compost and recycling."*

All the farmers I talked to have several productions, which often function as a safety net to reduce risks. Magne as an organic producer communicated how their diverse system is robust to withstand unexpected events: *"If a disease wipe out all our strawberries, we cannot use pesticides to fix the problem. That is the reason we have many different productions... In that case, we could sell raspberries and survive."* This strategy is chosen as the farmers wish to withstand uncontrollable environmental surprises and to provide a secure economy.

Environmental sustainability

All the farmers I spoke to are interested in environmentally friendly management, but differences in the practical approaches reveal that are various perceptions about how this is best achieved. Bjørge looks at the concept of sustainability as defensive and not enough action-

oriented: *“The soil was depleted after long, hard management... We had to do something. We like to think that we manage regenerative¹, more than sustainable. We wish to make the topsoil better... and hand over the farm to the next generation in a better condition than we got it.”* Those who run organic farms referred to several aspects that they intend to execute in their farming practices. Magne, who has the most diverse system among the cases, follows holistic management¹ principles: *“We have a grazing-system that ensures a very high grass production. Grass binds a lot of carbon. And that is very environmentally friendly ... If farmers with cows did this, the whole equation would have been reversed.”* On an ideological level, conventional producers in my study talk about ecologization of conventional production. One example of how to move in this direction is adopting new technologies that reduce both chemical fertilizers and pesticides. Another is connected to integrated productions and use of available resources. Marthe says: *“I want us to constantly ecologize the conventional... chemical fertilizers should not be misused, animal manure should rather be used to a larger extent.”*

Most of the farmers I interviewed are concerned about customizing both size and type of husbandry to the farm's resources. Creating a balance between areas, feed, number of animals and manure is something Marthe had planned for: *“I built the new barn for 45 milking cows because I have 450 acres of cultivated land, which I own. I'm not dependent on renting land and self-sufficient in grass... That is why I don't want to have a larger number of animals either”*. Both those who have animals and those who do not are conscious of the benefits with integrated systems, with combined plant- and animal production. Jakob, who has both grain and meat production, sees the integration as a possibility to import and export less: *“I try to coordinate a little between the productions... instead of having a one-sided production. I produce all the feed myself. The only inputs I buy are minerals. They get grains from the farm.”* This integration also saves a small sum of money, as he does not need to buy and transport concentrated feed to the farm. All the farmers who do not have livestock in their systems express desire to have manure available. Steffen reflects on the lack of manure in grain production in Eastern Norway: *“I could have used it on the grain, it is really desirable. But there is also an economic aspect again about transport of manure... In the long-term, there is no doubt that it is beneficial to bring in some manure to improve the soil organic matter”*. As

¹ Holistic management is a value-based decision making framework that integrates social, economic and environmental aspects of planning (Savory, 2016). The practice seeks to reverse climate change through emphasizing infiltration of water, increased organic matter and carbon sequestration, use of renewable sun energy and improved wild life habitats. Within this lays regenerative solutions to agriculture that seeks to mimic nature and over years regenerates the topsoil and enhances biodiversity.

he is specialized in the production of strawberry and grain, getting his own animals is not a desirable solution.

A general aspiration for farmers with animals is to take proper care of them and ensure they have good quality of life. This is visible through loose housing, access to outdoor areas and the opportunity for natural living. Some farmers pay special interest in choosing healthier animal breeds. Kristin, who is a veterinarian and ethologist, mentioned that they are concerned about choosing lighter breeds, who give birth easily and don't have hereditary ailments or diseases: *"The usual pink production pig is a crossing ... It is not suitable outdoor where it gets a lot of back- and joint problems. And they get to many kids... I think Hampshire is better, but we still get some co-inherited problems derived from standard productions."* On their farm, they have also chosen other breeds like the traditional Norwegian sheep breed, Spælsau, the Irish cow breed, Dexter, and the Hungarian wool pig, Mangalitsa. This is an example of how farmers help avoid genetic erosion by preserving a diversity of breeds.

None of the farmers I interviewed, except from Bjørge, had invested in renewable energy solutions yet, but all of them are positive to this development and plan to introduce it within a few years, or at least during their time as farmers. Biomass heating for wood was frequently mentioned as a possible solution for many of the farmers, as most of them own forest. They envision using this type of energy to heat up buildings and grain driers. To Nils, this is considered very relevant, as he plans a new farm building: *"I've been thinking about investing in a biomass heating plant, to warm both houses, outbuildings, garage and grain drier. In addition, the plan is to use it in the pig house to warm it, instead of using electricity."*

Solar panels on barn roofs, is a frequently mentioned alternative to produce energy. Magne says that new legislation regarding sales of electricity allows him to produce power, without paying tariffs: *"It will of course be a small investment ... but it may be possible to make profits by producing energy."* He said this as he has a small farm, and productions that are not very energy demanding. The farms with milking cows require much more energy, but solar energy is mentioned as a solution to produce a part of the required energy to technology and automatization of machinery. Mari has dreamed about solar energy on the roof for years: *"I have estimated the costs... but unfortunately it is still too expensive, and Hafslund is still not willing to buy my energy. That is what stops it. The roof at the barn needs to be replaced anyway, and adding 500 000 and get an own power station would be okay."* Often farmers initiate transitions to more sustainable solutions when buildings and equipment need improvements.

Magne is one of the few that find electric tractors relevant: *“I have to buy a newer more environmentally friendly tractor... If an electric tractor existed, I would have bought it. I never use it more than 2-3 hours at a time anyway.”* Other farmers depend on tractors they can use for several hours at a time, especially if their production is larger. Hans, who needs tractors in production of grass and grains, as well as for snow ploughing, is interested in the possibility of using biodiesel: *“Follum in Hønefoss tries to start up production of bio fuel now, which will be relatively short travelled fuel.”* Some of the other farmers would also use biodiesel if it existed, but there also exists skepticism as it this production has been connected to negative consequences if fertile soil and food crops are used for that purpose.

The conventional farm systems have larger quantities of import, but many have started to look for alternative inputs from local resources and cooperate with local companies to utilize them. Hans, who has both beef cattle and milking cows, has made an agreement with a brewery to pick up waste for the cows: *“We have a possibility to replace a portion of the concentrates we would have used with spent grain. It is picked up in Drammen, which makes it a local resource. In addition, it is a very good feed for cows, which gives a good intestinal culture.”* Two other farmers that makes efforts to utilize local resources are Kristin and her wife. They pick up food waste like vegetables and bread from local distributors daily, as a manner act upon the food waste situation. This is excellent pig food, which minimize concentrate use to the time around when pigs give birth.

Some farmers, like Marthe, has gotten manure and compost resources from the immediate area: *“I have accepted some digestate created from food waste in Nes. It is to help with a social problem...but now I have enough manure myself.”* Bjørge, who has had great success with his compost, helps to get rid of horse manure which was considered a problem in the area: *“We need to learn how to better use local resources. There are lots of resources that are astray. We mapped local resources... it was horse manure and vegetable waste. If all resources are set in the system, I'm sure that a lot more could be used ... instead of transporting the waste and resources long distances”.* Not only are local resources utilized in the compost at Bjørge’s farm, - horse manure and wood chips are also used to make biochar. Heat from the production is used to heat the greenhouse during early phases of plant production: *“We're going to make compost, but it is not a full manure ... so we can add digestate. We blend digestate and biochar and then mix it with compost. We hope to make it stable by adding biochar, and then spread it on the fields and grassland. A lot of fertilizer can hopefully be replaced this way”.* By these measures they hope to continue to improve the soil quality significantly.

The farmers seem to deliberately work to avoid soil compaction, and therefore apply measures like smaller machines, double wheels and low air pressure to decrease ground pressure. Jakob, among others, has found it important to adjust the tractor according to driving circumstances: *“I use extra wheels on the tractor. In many of the fields around here I also use the small tractor, instead of the big. It depends... the important thing is to think about how much moisture there is in the soil”*. Another aspect is how well-drained the soil is. Many farmers, like Jacob, mention the need for trenching to improve the production.

Heavy tanks behind the tractor give greater risk of soil compactions during spreading of manure. Hans tells me that they currently plan to improve practices related to dispatching of manure: *“We are thinking about going over to a hose system. That way we can use a smaller tractor, instead of big tractors and the heavy muck truck in the field. The challenge is that we have a portion of leased land with a long distance from the farm. Therefore, we look at the possibilities of a temporary storage tank”*. Marthe, who recently upgraded the farm, already has such a system: *“I pump manure under the ground into a large basin. Two tubes go behind the tractor to a boom... it is not the big heavy tank like the previous one. Now it is only the tractor in top of the field”*.

Crop rotations appear as an essential part of everyone's practices, and almost all the farms have perennial crops such as grass and clover in the rotation. Nils tells me about the benefits of sowing clover and allowing the soil to rest: *“After a year with clover you notice the difference. You can see that the soil just crumbles, it gets the aggregate formation... Unlike a shift where there has been grain for three years. That soil will be hard and tightly packed.”* Perennial crops are essential to get greater yields in the following years, according to Knut: *“We had not been able to produce that amount of organic grain if we had not had the grass first.”* Also, other farmers see the value of reduced tillage and interruption of the soil.

Reduced tillage is not a widespread practice among Norwegian farmers, but Bjørge is aware of the negative effects of ploughing and milling, and therefore looks for methods to reduce tillage: *“It really is the worst thing for those engaged in agriculture... the less we touch the soil, the better... we have made a lot of mistakes so far. The idea is that after harvesting, we sow with green manure and reap it, it prevents weeds to come up.”* Bjørge found out that their soil was depleted after many years of intensive vegetable production, which resulted in their interest for regenerative practices: *“We use all the waste and make compost out of it. This results in stronger plants and less spraying. We also focus on how the soil should be green all the time. As long as photosynthesis is ongoing the topsoil is protected”*. In addition to this they have started a trial with biochar to raise the level of carbon in the soil: *“When the topsoil lack carbon,*

one could remove most of the energy from wood, and be left with a stable carbon.” Reduced tillage is considered important to minimize loss of nutrients and avoid pollution of waterways and harm of aquatic life, but are not always feasible to the farmers. Several of the farmers, like Nils, get larger yields if they plough in the autumn: *“It provides the best economy for me to plough in the autumn, because then I get larger yields... It is more profitable than to operate with reduced tillage. I can get some grants, but earn more by ploughing.”* Organic farmers depend on ploughing and harrowing to combat weeds, but do not plough in the autumn unless they sow. Because of current regulations and subsidies many choose to establish buffer zones and ponds to accumulate runoff. Mari, that has a 2-year education as agricultural technician, has a lot of focus on designs to prevent run-off from the fields: *“There are streams in the bottom on all gullies, so it is clover buffer zones everywhere. And then there are also buried grassy waterways in all gullies.”*

Animal’s roles in the system, beyond available manure, was mentioned by a few farmers. Magne uses his animals actively to improve the soil quality by making it lighter and airier: *“The pigs are our soil workers and ploughers. Some land was absolutely plagued with quackgrass and could not be used for anything. Pigs use their heads in the soil and plough. The quackgrass roots dry and die”.* Magne found inspiration in farmers abroad when he planned for his farm system. He uses a rotational grazing system for the sheep, and move them after 1-3 days to avoid over-grazing: *“The grass should never be less than 8 cm. When we remove them, the sun can nourish the grass, instead of only the roots. That way it grows a lot faster.”*

When it comes to protecting biodiversity, many farmers are concerned about keeping the cultural landscape maintained, but a lot more could be considered. Conventional producers, like Marthe, are attentive to the time pesticides are sprayed: *“I only spray in the evening. Not in the middle of the day when the bees and the flowers bloom... this way insects are taken care of”.* Some farmers put up more flowers and plants to attract pollinators if their productions benefits from this. In order to improve the seed production of clover Nils plants a pollinator attracting plant to attract bumblebees: *“I try to plant Tansies next to the clover field, for them to have food a bit earlier than the clover blossoms. I’m concerned about it because of the clover production that is totally dependent on bumblebees”.* Magne tries to create natural habitats to attract insects and birds: *“We plant flowers, have lots of different fruit trees which contributes long before the flowering time, set up birdhouses... birds are naturally insecticidal killers ... And we let some stripes on the meadow in blossom for bees”.* Bjørge wish to acquire natural habitats by using green manure that keep nutrients in the soil and attract natural enemies: *“If*

we sow with that seed mixture it attracts insects. The seed mixtures attract natural enemies to the insects we don't want... We are going to try it this year".

Only a few of the farmers mentioned how the amount of microorganisms in the soil is important. Knut believes the organic practices has helped to increase the micro-life in the soil: *"We plough up less straw now. If there is little oxygen and poor life in the soil, you plough up unconverted straws again ... and straws from 20 cm under come up again. All the straws are decomposed during a season, meaning that the micro life is really good..."*. He thinks this, together with grass in the crop rotation and import of chicken manure has been crucial to get the large yields of organic grain. This proves that organic practices over time improve soil quality and therefore secure farmers' livelihood on the long term.

Social sustainability

To create a long-term livelihood for farmers, society's appreciation of food production is important. Among the farmers in this study there is a large consensus about how they from an overarching policy perspective don't feel appreciated. Policies that suggest increased profitability for larger farms, is not well received, even by these farmers that are established in central areas. Mari chooses not to care too much about the politic situation: *"From a social perspective with the political situation we have now, one does not feel appreciated at all... You get the feeling that you are not wanted and an unnecessary part of the society..."*. Her belief is that those who think farmers are unnecessary have not reflected very carefully about it: *"Some people don't understand what you are doing because you are just at home... almost like, "get yourself a job"*. Knut agrees that being a food producer should be associated with a higher status: *"I truly wish it was more like ... "Look, there is the farmer", in a way... because we produce the food people eat. If we did not produce food, people would have died, or they would have to produce all their food themselves. People do not quite understand that"*. Marthe despairs statements from people who do not understand the many personal risks farmers put themselves in: *"We have bad payments... Some people think we earn a lot of money because we have large machines and a new barn. But they do not realize how many farmers that have full-time jobs outside of the farm, plus the farm at home. It is mostly milk producers that are full time farmers."* To be in this situation she has had to take many risks, not only economical, with a large loan, but feels she has put her entire family and the farm at risk.

Even though the support for farmers is low, the farmers in my study are convinced that contribution to food production is of obvious importance - which make them continue. People

within the industry, on the other hand, are very supportive of youth who enters the farming. Marthe has received positive feedback and great deals in the start-up phase, because she as a young woman chose to enter the industry. Some of the producers are recognized by Agricultural public bodies. Kristin, who produces free-range pigs and grass fed meat, feels supported by several actors: *“Fylkesmannen are concerned about the conservation and utilization of the area here. Innovation Norway is the super happy... we are noticed. We've got to go to the Grüne Woche now... were only a few producers were picked out”*. She thinks they get the extra attention because they choose to do things a little differently, which distinguishes them from other producers.

Most of the farmers thought that the amount of work on the farm was overwhelming, and to part of the extreme during the season. Mari reflected about how very few are aware about this aspect of farming: *“The hours get insanely many, to the extreme sometimes. If you work 20 hours a day and sleep for 4... I think this is a critical side of agriculture that is put too little emphasis on, which in turn affects both physical and mental health... is it really feasible?”* During the few years she has farmed, she has experienced body strains because of too much and wrong work: *“Last fall, I was not able to drive the tractor because I could not lift my arms... it was simply because I had been doing too much.”* According to how full time equivalent (FTE) is calculated within agriculture it shows that many farmers work many hours. Jakob reflected about the huge workload in the establishment phase: *“...perhaps what makes the farm least sustainable right now is the social aspect... If I work the equivalent of 3 weeks' worth of work in one week, it might not be sustainable in the long run.”* He just bought the farm this year and the farm development depends on major investments in the start-up phase. Jacob plans to work two FTE's on the farm in addition to one FTE outside, but realize that it sounds extreme: *“As the agricultural counsellor commented when we made the project plan; I have to reduce the workload, as it is the biggest risk with my project. What happens if I cannot work as much?”*

There are major risks associated with the workload, but also in relation to some of the tasks of handling grain, pesticides and heavy lifting. The emergence of technology has helped avoid weariness. Marthe thinks the physical parts are manageable as technologies help her: *“What is so great about the new technology, it is not damaging my health. It's not that heavy physical lifting as it was earlier.”* Bjørge believes that pesticides might be damaging for health and hopes to reduce the amount of pesticides over the coming years: *“When I'm going out to spray I must wear protective clothing. It says on the bottle that it is dangerous... that you should stay away from it. I think pesticides are used without much consideration. It is much more pleasant to manage the other way (without pesticides), even if it is more difficult.”* Harvesting

of grains is associated with a lot of dust and noise, something Nils has experienced: *“I wear a dust mask all day, and I wear hearing protection... In the grain dryer, there is a lot of noise and dust. You become unwell by working up there without protection...”*.

Some of the farmers consider their workload as acceptable, as they have the possibility to do things outside of the farm. Hans operates together with his father, in addition to having a high degree of automation, that makes the work less demanding: *“I get to do things outside, because I’m cooperating with my father. We both get the opportunity to do things outside the farm.”* For the plant producers, the winter season is considered as quieter, while farmers who had animals had several obligations during the winter. A few of the other farmers, Nils and Marthe, said that they have time for hobbies and physical activities outside the farm, but need to make it a prioritization. Hobbies outside the farm are not considered as possible to all the farmers. The amount of work often negatively affects farmers’ social life, where they cannot prioritize themselves and family life. Steffen loses a lot of time with the family during the season: *“The fact that you work a lot during the growth season means you cannot always prioritize a birthday, because you have to spray that day. Problems are more related to the social, than with physical health... that’s what I see as the challenge, in terms of spending time with the children.”*

Several of the other farmers also mention how dismissal of social contact, economical risks and uncertainties in relation to the succession phase, negatively affected the mental health. A part of it is also expressed as frustration about the political situation, and the pressure for expansion to be profitable. Steffen reflects on how the market price has stood still and almost stepped back, while the cost of everything else has increased: *“You already feel that you work quite a lot, and the question is... do you have the capacity to do much more? Where will it stop? And what if it never stops ...”*. Also Mari feels pressured by the situation and finds it worrying that farms are growing: *“For my own part, I think it would be difficult to stay focused on quality. And with the productions I have, there is already not enough hours in a day. If a single farmer is supposed to operate more than what I do now, I do not know how it is feasible.”* This shows that there is an awareness about how the farm life could be lived more balanced, still do many of the farmers do feel that it is impossible to do anything about the situation because of reigning outside circumstances.

Social services can be implemented of therapeutic considerations, but also to raise public awareness of food production, through e.g. on-farm activities and direct sales. Of the farms I visited, only two had provisional social services. Knut welcomes schoolchildren that struggles to his farm, and let them assist in various farm related tasks. The goal is to help them

on the right path in life and prepare them to one day get a job: *“If we now have four youths here, and all four end up getting a job when they are done, I feel we have succeeded”*. Marthe runs another type of service; farm activities for children, where she hosts 2-3 birthdays a week: *“I have a barn with hens, pigs, rabbits, guinea pigs, ducks and two horses... it is for the birthdays, so that we have some animals to show them.”* She looks at this as a possibility to teach children and their parents about agriculture and sees it as a social responsibility as a farmer: *“It's just as much for the parents that participate in the birthday, as for the kids. They learn the value of food, where it comes from and that it is not prepared on the store shelf. The kids get to try milking and taste fresh milk, jump in the hay, hold rabbits and pet the pigs. I think it gives them quite an impression.”*

The farmers that had animals generally saw welcoming people, especially children, to their farm as an important contribution to represent agriculture. Jacob's farm is located next to a primary school that pays yearly visits: *“I have almost all the pupils from the local school here during the lambing. I think it is important for them. I had 10th grade here... it was a recruitment day for Agricultural Education. It is fun to have people on the farm...”*. Hans and his father cooperates with the local agricultural school, and contributes to the society by welcoming students for practice and lectures on their farm. Kristin found that many are excited about the farm because of the history, and people attracted to the area because of hiking possibilities and the animals: *“Everyone is happy about the activity here... and that they are allowed to see the animals. We try to be inclusive and open for children to come and visit.”* They do not currently offer provisional social services, but hopes to one day be able to do it: *“We know some farmers who offer evening activities... instead of playing sports, children come and care for animals. We think the animals can be an important resource for many groups of people”*.

On Mange's small farm produce is exclusively sold through the farm shop, which means that many people visit the farm. This is an important factor to increase sales, says Magne. He has also noticed an increased interest by people to come and see how he operates the smallholding: *“Many people come to see how we do things. Suddenly, I know much more than many others, and many have started to ask me... I gladly share the little knowledge I have if people are interested.”* Also, some of the other farmers sold parts of the produce directly to customers and enjoyed the benefits of direct sales and customer contact. Mari found a niche selling unsprayed vegetables direct to restaurants: *“In vegetable sales I deliberately choose to have a direct contact. It's partly in order to maintain a social network, talk to people, travel around and supply... and hear what they want. And, I get a totally different price.”*

In addition to being food producers, some of the farmers said that the only public good they contribute is being a part of the cultural landscape. This means they attract hikers and people who wish to see grazing animals. Others also mentioned how the farms offer jobs and income for people. Steffen, who currently cooperate with his father and has 80-100 seasonal workers, mentioned that facilitating good working conditions for them is a part of the social aspect of sustainability. In addition, he finds this aspect relevant for his own sake as he wishes to continue for years.

Long-term perspective

Another perspective I found was strongly connected to sustainability, among the participants, were the ability to carry the farm on to the next generation. Knut shared his valuable thoughts about the succession of family farms: *“I think the most important thing is that farming can be continued. Everyone's wish is that one of the children will continue running the farm, it should be arranged so that the next generation can get by as good as possible...”*. All the three aspects of sustainability – economic, environmental and social, are together necessary to make the farms operative in a long-term basis. If one of them are down prioritized over time it can eventually make the farm less attractive for successors.

Farmers think that keeping the farm updated by upgrading farm buildings and machinery is essential to this aspect. Some of the farms that were taken over had been closed or had low production, which meant a lot had to be done in the succession phase to make them economically viable. Down-prioritizing of the social aspect, seen through heavy workload and uncertainties related to the future, can make farms less attractive to successors. This was something that farmers tried to cope with by choosing different strategies like, technology, expansion or value-adding. Environmental degradation should also be carefully considered as this can limit and make future production challenging.

DISCUSSION

In this section I discuss my findings from the case studies based on the research questions. I evaluate different approaches to sustainability and trade-offs in the practical approach for each of the three aspects – economic, environmental and social. Further, I discuss the causations and relations between my findings and identify what influences farmers to change their farm in sustainable directions. As several of the farmers pointed at reasons outside themselves/in the

society as hinders for sustainability, I add a section where I discuss these forces. The validity of the methodological approach is discussed in the final section.

The first research question I aimed to answer in this research was: *How do newly established farmers perceive and plan for a sustainable agricultural practice?* The findings in my case study indicate that newly established farmers chose to develop the farm in a more sustainable direction by choosing the following strategies (figure 2): value-adding and/or higher productivity to generate sufficient income, increased utilization of local resources and/or adoption of technological aids to increase resource preservation, and working to improve societal impact and/or hire employees to get a better quality of life.

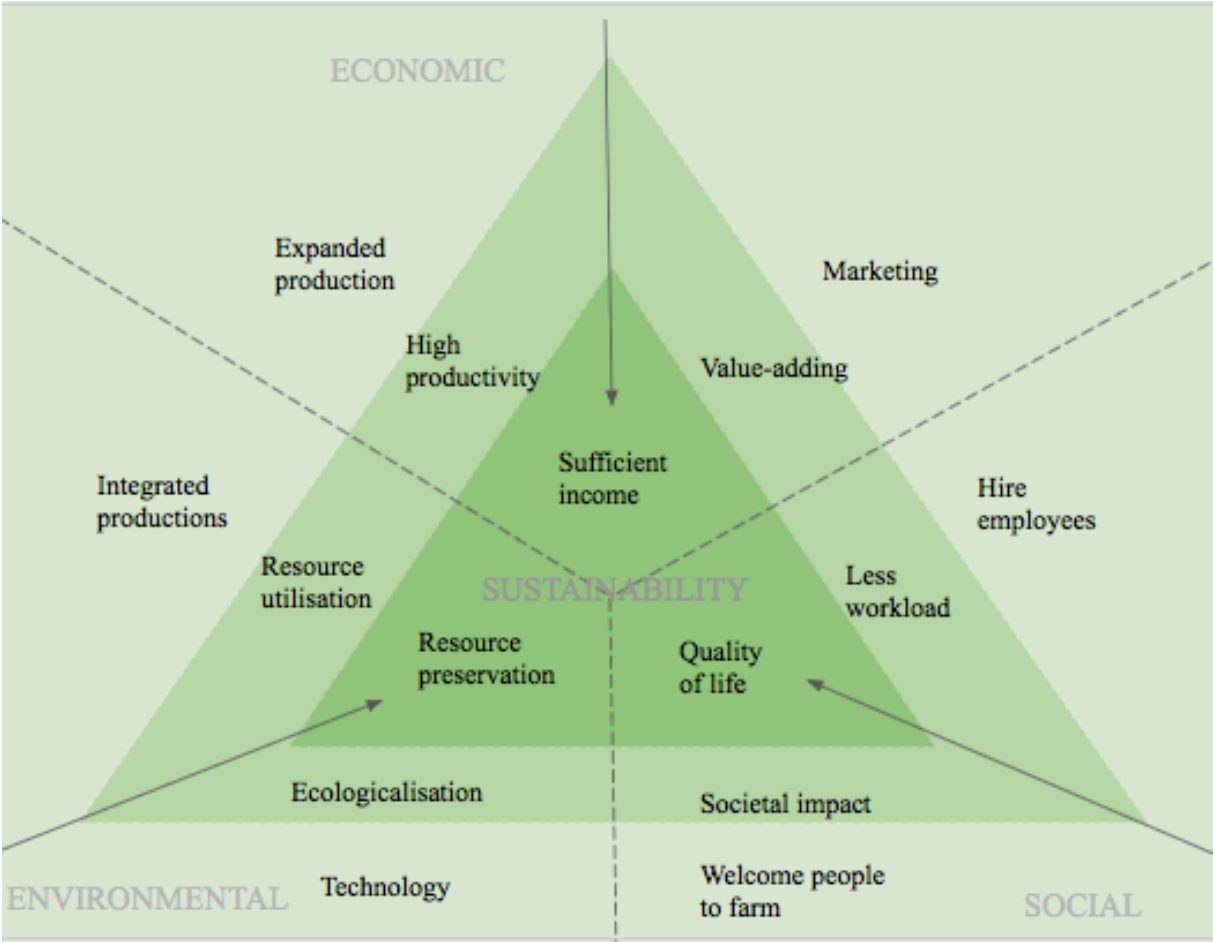


Figure 2: Strategies at farm level to achieve sustainability within the economic, environmental and social aspects.

Economic sustainability

Sufficient income

To most of the farmers' in my case study the farms' prospects as sufficient sources of income are unknown. As these farmers are in the establishment phase with high investments, their future economic security depends on several factors, such as market access and politics. Several farmers have recently bought the farm and made huge investments in buildings, machines etc., others are about to do it. Investments are in many cases seen as necessary to make the farms a fulltime position and economically viable. However, there are differences in how large investments the farmers imagine. Nils currently wonders if he dares to invest in a new pig house to the cost of 7-10 million, while other farmers with pigs have chosen simpler production approaches. Both Magne and Kristin have free range pigs, sheltered in small cottages on the field. This solution demands smaller investments, and, as Magne mentions, the risks are much lower if the market for pigs one day change: *"If it suddenly becomes a surplus of organic free-range pig, I put these cabins behind the barn ..."*. Magne thinks this production is more environmentally friendly as the housing are not made of concrete blocks and the cabins do not require electricity. The market price for free range pigs are much higher, in addition to the economic benefits with smaller investment. It can be discussed how sustainable huge investments and specialization are if the market change, as those who make minimal investments will have several options to customize production to market demands.

A few of the farmers mentioned how revenues should be generated from the farm, for it to be considered economically sustainable. This attitude indicates that there is an awareness about how dependency of off- farm jobs are not a beneficial long-term solution. Despite this view, Jakob currently depends on an off-farm job himself. Generally, off-farm jobs are seen as temporary solutions as both he and other farmers wish to reduce the workload outside the farm and increase the on- farm production. By working less outside the farm, there will be more time for farming, which in turn will allow for increased farm income. Hans mentioned how the income preferably should derive from the agricultural production itself, as it currently does at his farm, and not from activities outside the main production, like additional services. Knut and Marthe, continued social services their parents previously started. These services were based on farm resources and of importance to create on-farm jobs. Even though these services have economic significance, they are not only derived in economic revenues, as they intend to contribute to important social tasks.

At start-up, all the farmers adjusted their productions to ensure sufficient farm income. The farmers choose different strategies to achieve a sufficient income (figure 2). To some -

Steffen, Marthe and Knut, this was mostly related to expansion of the existing production, like increasing the number of livestock or renting more land. Others, like Mari, Jakob and Nils, brought in additional productions, with the intention of reducing risks. In addition to expanded productions were also strategies like value-adding beneficial to improve the farms' economic viability.

Value-adding

Value-adding of produce were another strategy chosen by half of the farmers to increase market price and income. The farmers that chose this strategy had a strong conviction that they wanted to do things differently, which allowed them to find alternative markets. Extra emphasis on animal welfare, feeding routines, soil quality and recycling were used as a part of the marketing. Because alternative productions demand more human labor, a more expensive resource than resources derived from fossil fuels, this strategy can be considered as the green shift in practice (Frison et al., 2016). Farming can be done in more efficient ways, but these strategies depends on a larger amount of import to the system and use of resources derived from fossil fuels.

High productivity

The other strategy includes practices that give higher productivity and produce more per unit. Adopting mechanical and technological aids give farmers the possibility to produce more, without a significantly increased workload. The farmers who follow this strategy have delivery contracts with Tine, Nortura and Felleskjøpet to deliver milk, meat and grain, which provided an economic certainty. Expanded productions allows farmers to produce larger amounts of food, and thus make the farm more profitable. If farmers adopt technological solutions, as for instance GPS to spread fertilizers and pesticides, it reduces the amount of resources derived from fossil fuels. This solution is therefore considered as ecologization of the conventional practice, as it is beneficial in terms of less environmental impact.

Environmental sustainability

Resource preservation

Stately grant programs reward farmers for undertaking measures related to soil preservation and health (Fylkesmannen Vestfold, 2012). Some measures perceived as environmental friendly, farmers consider as hard to implement due to time constrains or loss of economic benefits. One example that demonstrates a trade-off between environmental benefits and

economic profitability is recognized in Nils' case. In productions of crops like grains, farmers can choose whether they plough the fields in the autumn, or leave them covered until the spring. Ploughed land is unprotected throughout the winter and increases run-off of nutrients, affects soil organisms negatively and reduces carbon sequestration (Agropub, n.d., Miljødirektoratet, 2016). Nils' experience is that ploughing in the autumn gives him higher yields and improved income. Stately subsidies are given to support reduced tillage, but are not considered high enough to compensate for the lower yields. When farmers are forced to choose between economic revenue and environmental protection, most farmers choose the profitable alternative. Also, at the organic farmer Knut recognizes the conflict between ploughing and sustainability. Tillage interrupts the diversity of life in the soil and should preferably be avoided. Organic practices require more ploughing to diminish weeds as chemicals not are applicable. But, then again can pesticides have negative effects on micro life and biodiversity (Kremen and Miles, 2012).

The female farmer Mari wishes her farm could be organic, but does not find the production of seed potato compatible with the management method. Organic crops are more vulnerable to diseases, like blight, and the seed potato material must be kept clean, which is why she needs to access chemical pesticides. She also wants to introduce more measures she considers as environmentally friendly, such as: weed harrowing of grains and stone laying of streams, but finds that her own capacity of time and money inhibits it. When human labor is the most expensive resource, farmers are often forced to choose cheaper options, which often are derived in use of fossil fuels. Many farmers see the introduction of technological aids as a possibility to save human labor, fossil fuel and therefore ecologize the system.

Ecologization

Technology is way to execute environmental concern and increase profit. Solutions that leads to less use of fossil fuel derived resources, like fuel, fertilizers and pesticides is the core of ecologization. Conventional agriculture has slowly adopted many of the methods that have long been standards in organic production (Solemdal & Serikstad, 2015). The farmers I interviewed were especially concerned about practices in relation to: use of crop rotations, prevention of soil compaction and energy reduction. Several farmers saw mechanical weed harrowing of grain as a possible step. Steps of ecologization are often introduced one by one, to help solve complex problems within the production, while organic production includes a number of measures. Technological solutions simplify tasks like milking and feeding of animals, provide more efficient management and increased profits.

Finding new solutions that bridge the transition from non-renewable sources to renewable sources are not considered easy, especially as fossil fuel based energy is the cheapest option. The farmers were enthusiastic about implementing measures such as bioenergy, but saw large investments as the greatest obstacle to this, which made them postpone. This transition require State schemes that offer favorable support to transit to bioenergy. Innovation Norway has a bioenergy program where they offer grants and loans for farmers who wish to implement renewable energy on their farm (Innovation Norway, 2016). These schemes apply to the implementation of e.g. plants for biomass heating, biogas and biochar. Solar panels and heat recovery plants, can be supported where this is included as part of the combustion plant. Only one of the cases I talked to have been provident and invested in a biochar plant. Bjørge uses this to heat up the green house in addition to produce biochar to raise the carbon content in the soil. This is an example on how agricultural practices actively can contribute to carbon binding and storage in the soil (Miljødirektoratet, 2016). Such a solution prevents extended release of carbon through burning of fossil fuels, and increases utilization of local resources, such as wood.

Utilization of local resources

A production customized to fit the available on-farm resources or local resources is an essential part of sustainability, as it makes the farms less dependent on import. Several of the farmers expressed a clear wish to be minimally dependent on external resources, as they were not guaranteed in the future. This meant highest possible self-sufficiency of feed resources and transition to more use of local and renewable resources. As Marthe expressed, the number of animals should be customized to what the farm could bear, to be less dependent on resources from outside. Her reference went to parts of the West coast of Norway (Jæren), where the standard is large number of animals, imported feed and exported manure. As this solution requires lots of transport over far distances it conflicts with sustainability goals.

The utilization of resources was generally better in the cases with integrated productions. Animal manure as fertilizer improve soil quality, while production waste is fed to animals. Conversely, farmers with plant productions faces difficulties in relation to import of animal manure and to get rid of waste. Mari, the potato producer, have large quantities of damaged potatoes she struggles to get rid of, as neither she nor any of her neighbor farms have animals. Several farmers have found innovative solutions to utilize local resources as feedstuff and fertilizers, as it is essential for sustainability. Organic farms, which goal is to be more sustainable, cannot utilize resources that not are certified, which make a conflict. Kristin's farm

is certified organic and so is the meat from both the sheep and cattle she produces. The pigs, however, are fed on non-certified food waste and can therefore not be certificated as organic. They are, however, able to get better prices because they sell directly to private customers and restaurants that are familiar with their way of producing.

Social sustainability

Quality of life

Overall, I found that considerations of the social aspect were what most of the farmers from my cases struggled to implement in their farm practice. This can be perceived as a type of self-sacrifice, to ensure that economic and environmental aspects are prioritized. Time constraints are the most common explanation for down-prioritizing this aspect. Many of the farmers feel that there is a lack between what they consider as customizable workload and the amount of work linked to the production. Steffen, who has an expanded production, shared his concerns about being pressured by the continuous growth: *"You already feel that you work a lot, and the question is... do you have the capacity for much more? Where will it stop? And what if it never stops..."*. This is a concern that farmers feel they have little control over, which occurs partly due to the agricultural development abroad and political situation. Current regulations demand fulfilment of production-related tasks to ensure environmental quality and food safety. Subsidies stimulate choices that e.g. diminish contamination, preserves soil quality and biodiversity (Fylkesmannen Vestfold, 2012). This way, the economic and environmental aspects appear to be connected, which also is suggested by some of the farmers. Since there is no maximum limit for how many hours you can work on your farm, farmers occasionally work a lot. Farming is a special lifestyle where the farm often is considered both a job and hobby, and unwinding might be hard to prioritize. I got the understanding that many farmers work incredible amounts of hours on their farm. In addition, on-farm investments push farmers to take on additional jobs outside, resulting in an unsustainable workload and reduced quality of life.

In the long run, extended workloads negatively affect farmers' quality of life. Down-prioritizing of physical or mental needs, such as sleep, recreation and social contact cannot be considered as sustainable long-term solutions. Some of the farmers have felt the negative sides of physical strains, others sometimes feel isolated on the farms as they miss out on social events. Farmers also reported to miss out on valuable time with their children, as they had to down-prioritize parenthood during large parts of the season. Several of the farmers have taken big

personal risks by huge investments of money and time to get the farm operative. These findings from my case studies imply that farmers are willing to sacrifice a lot to be food producers. Being committed to producing food for other people, is a way to contribute in the society, rather than fulfilling own egoistical needs. As Mari said: *“I don’t feel that producing food is about me, but what I can contribute from a social perspective. If I were doing it for myself, I would have had 500 m². You sacrifice quite a lot of time and resources to produce food for others.”* A lot of the issue related to this is that farmers don’t feel appreciated by the society based on the job they do. Farmers often feel that the general population don’t understand how much work it takes to produce food, as they expect the food to be cheap.

Societal impact

Lack of understanding of value of food among the general population in Norway is considered a problem. The farmers with alternative distributions were clearly motivated by several social aspects. An important goal seems to be to communicate qualities of the product, which can be done through direct market channels as the producer meets the consumer directly (Veidal, 2011). Direct sales open the possibility for dialogue with customers, which could increase consumer’s knowledge and awareness about sustainable food production. Magne and his partner sell all the produce through the farm shop and are therefore dependent on using social media for marketing. To them, demand from customers has been crucial as they adjust their production to fit the market.

Kristin has clear intentions about farming the way they do and welcomes people to the area: *“We clearly have an intention to spread the message and raise awareness about what food is, where food comes from and how production takes place”*. This intention is reflected in the way they sell their produce. Vik and McElwee (2011) found that motives for deriving the farm business into social services, such as green care and social farming was more motivated by the wish to work with/meet people, than the need for additional income. Also in Marthe’s case, the on-farm activities are clearly societal goal to accomplish, beyond the economic revenue. In addition, she finds this side business necessary to provide her with the extra income she needs, instead of getting an off-farm job. As Knut welcome students on the farm every day, the service has been a way to create an extra position on the farm.

Hire employees

This aspect intertwines with the economic as the farmers depended on a sufficient income to be able to hire employees. Steffen and Bjørge with labor-intensive plant production depends on

external workers throughout the season. As many of the farmers with smaller farms barely generated enough to provide for themselves, hiring employees are not a feasible solution. Kristin and her wife has a labor-intensive farm strategy, as they pick up bread, fruits and vegetables from local suppliers daily and feed the pigs manually. Because of their alternative production practices, they are lucky to attract woofers and working guests to their farm, which is cheap labor. This goes well along with Kristin's intention to spread the message about food production and alternative practices. This is far from mainstream within Norwegian farming, but holds a great inspirational value as an example.

Even though the work situation was described as extreme by some of the farmers, they also felt privileged to be in this situation. This makes me wonder, is it really that bad? Because, if it was, then they would probably not chose to sacrifice all this to be farmers.

In order to achieve a sustainable agriculture all strategies mentioned in this discussion should be included (figure 2). Even though sustainability seems achievable in a theoretical sense, challenges in the practical sense often lead to trade-offs between the three aspects. According to the definition of strong and weak sustainability, can a farm that emphasize a balance with social and economic sides never be entirely sustainable (Bell and Morse, 2008). The farmers often faced trade-off that made an ideal prioritization of all the aspects challenging. Achieving a sustainable agriculture is not only up to farmers, as outside circumstances in the society, like politics, also are important in this development.

Reasons for change

The second research question I seeked to answer in this study was: *What makes newly established farmers change their farm in a sustainable direction?* Tentative suggestions are made to answer question is provided based on previous research.

Suess-Reyes and Fuetsch (2016) found that generational shifts often bring new ideas and resources into the farm business, which might result in innovative and sustainable behavior. The cases I explored suggest that newcomers at family farms do not switch productions, but rather expand upon them, start additional production and bring in new management methods. Bjørkhaug (2006) suggest that farmers with a typical farmers' habitus adjust production by increasing livestock, buying or renting more land and working harder when income decreases. A typical farming habitus is often found in farmers born into agriculture that have taken over family farms, who were not likely to have higher education or experience from other careers

and have a productivistic ideal. Another strategy is to diversify the farm businesses by starting new productions or services. Diversification can be a way to reduce economic risks by providing several productions and better utilize resources, and will in those terms be a movement towards a more sustainable practice (McElwee and Bosworth, 2010).

Farmers skills are essential in diversification of farm systems, and these skills often differ from those associated with conventional agriculture (McElwee and Bosworth, 2010). Farmers with higher education and/or experience from different work, were found to perceive sustainable agricultural practices as more important and therefore choose non-traditional farm practices and diversified farm systems (Bjørkhaug, 2006, Füsün Tatlıdil et al., 2009, McElwee and Bosworth, 2010). Independence from a family farm tradition can do the same. Several of the farmers had experience from other fields of studies, jobs and living situations, something that often was demonstrated through their practice. E.g. Kristin's wife had experience from book trade/publishing before they started farming almost ten years ago. This experience has been valuable to market produce and keep contact with customers, as all produce is sold through alternative distribution channels.

Whatever strategy they chose, all farmers wish to make their farm economically viable. Differences in how frequently economic factors and gains related to decision-making which were mentioned, revealed that the economic concern might be more dominant in some cases. Bjørkhaug (2006) found that explicit engagement in the economic sustainability revealed itself to be mostly a male concern. On the other side, deselection of farming has become easier over the last decades, leaving those who become farmers today conscious of their choice. In the conversation with Mari we talked about how the economic profitability today is better in any other profession, suggesting that people become farmers for other reasons. Findings from Bjørkhaug confirm that there is much more than economic rationality that keeps people in farming, and those who become farmers today have a great desire for this independent lifestyle. The farmers in my cases were motivated by the freedom of being their own boss and the important social task of producing food. Farming has become more demanding, which makes an extra drive necessary to succeed. This can have implications for who enters the industry and for future development in a sustainable direction. Regardless of this, extended concern about economic profit, leaves me wondering which consequences this has for sustainability if the environmental and social aspects are compromised.

All farmers claimed to be interested in implementing environmentally friendly managements, but differences in the practical approach revealed that there might be different perceptions of sustainability. As Bell and Morse (2008) mention in their book *Measuring the*

immeasurable, there are two contradictory visions of sustainability; those who appear to see no problem in equating sustainability with 'high-input', 'high-yield' conventional farming, and those who do not appear to equate sustainability with this view. In the cases studied, I identified a variety of these views, as all farmers were concerned about various aspects to various degrees, which influenced how they envisioned to develop their farm in the future. Bjørkhaug (2006) found that farmers with a typical farming habitus often experience their own production to be almost organic and organic farming to be something close to nonsense, as environmental sustainability has not been perceived as problematic by Norwegian farmers. Likewise, some of the farmers I interviewed referred to an exaggerated concern regarding the environmental aspect. Conventional farmers prompted ecologization of the conventional agriculture as a positive step toward sustainability, but also valued the emergence of organic methods, which could be applicable to their own farm practices with time.

Whether younger farmers were more cautious about sustainability issues, and how this was shown through their practice, is something I got to reflect about. The younger generation have had other impulses during their upbringing, which can have influenced their desire for change in a sustainable direction. An increased media focus can also play an important role in spreading information and push farmers in new directions. Schoon and Grotenhuis (2000) suggests that farmers' perception and plans probably are affected by various factors such as social relations and signals from society, e.g. about accepted or not accepted farming methods. The newly established farmers were all more willing to adopt new technologies, and this can increase the sustainability of their farm activities within several aspects. The farmers with alternative distribution channels were generally more concerned about environmentally friendly managements to improve soil quality, circulation of resources and animal welfare as this was as a part of their marketing strategy. In these cases animals are often seen as an essential part of such practices and consciously used to improve the soil, as they are free-range and spend all year outside. These farmers are also more likely to choose animal breeds that were not typically bred for meat production. They choose older traditional breeds, that are more likely to stay healthy. Consumers' willingness to support their produces with better price are the reason they could execute production that way, instead of adopting more efficient conventional practices.

These cases, that I found to have practices that reflected concern about sustainability issues, were the oldest of the farmers I interviewed. This finding can imply that change happens throughout life and is affected by a collection of personal experiences. This finding corresponds to what McElwee and Bosworth (2010) found about life experiences being crucial in

innovation, as these skills can be brought into agriculture. Likewise, did Østergaard (1998) find that conversion to organic practices was a gradual process of different phases. This process is triggered by a collection of life events and knowledge that influenced farmers values and attitudes. How long time this process takes depends on farmers' personality, support from outside, and ability to break with the conventionally accepted. Bjørge and his wife's case, who have farmed for almost twenty years, demonstrates a similar process. After years with intensive vegetable production and focus on pursuit of new and better pesticides, they realized that their soil was degraded. This motivated them to find new farming methods and to implement composting. By use of compost they have managed to raise the soil organic matter by 100 % in five years. They have noticed that plants immunity has improved because of the high content of onion in the compost. They are still in a continuous process of change, introducing biochar and seed mixtures for biological pest control this year. Bjørge believes that it may be applicable to produce organically on parts of the land that experience little disease problems. This implies that change happens in a gradual way, as farmers make new experiences over years. Moreover, the cases I have studied can change both their perception of sustainability practices and plans for the farms over the coming years.

Hindering forces

Even though farmers have the freedom to develop their farm in multiple ways, several of them referred to hindering forces beyond their control that prevents this development. All the farmers agreed that the present agricultural politics do not steer the Norwegian agriculture in a sustainable direction. This was mainly connected to the reward of large-scale farming and volume production, which weakens resource utilization and agricultural extension in remote areas. In the conversation with Steffen, we talked about how this can be explained as a consequence of the development outside of Norway, where everything becomes larger. Because Norwegian agriculture is not competitive on price, we are dependent on a policy that regulates import and promotes the qualities of Norwegian food. Agriculture is controlled through grant programs that supports environmental friendly choices, but lacks regulations to ensure utilization of local resources and decreased imports. In relation to the shift to bioenergy solutions, farmers do not consider the state as supportive enough. The factor that holds most farmers back from investing, is that bioenergy solutions are still not competitive in price. Although many farmers desire better solutions, economic profitability often decides.

Whether the political situation is a hinder for sustainable development can of course be discussed. It is possible to maneuver and find new solutions within the political framework as a farmer. This requires a great understanding, innovative thinking and a strong personal drive when the surrounding structure is missing. If political structures encouraged more sustainable practices like utilization of local resources, such as rangelands, and transition from fossil fuels to other solutions, it would be easier for farmers to adopt these solutions. Therefore, political regulations lacking ability to contribute to sustainability must take some part of the blame.

The organized cooperatives that have reception duty for meat, milk and grain have been strong in Norway, while this system is underdeveloped in vegetables, fruits and berries. These producers encounter problems delivering their produce because of deficient supply contracts and strict requirements of superficial standards. Mari, as a potato producer, faces considerable challenges delivering her potatoes. While the seed potato is sold via contract, she herself must make agreements on consume potatoes. One big portion of perfectly eatable potatoes worth 120 000 NOK was returned because it did not meet aesthetic standards. A low dry matter content in these types of potatoes, makes selling to the industry that makes potato flour or spirits unprofitable. This is a pervasive problem in the industry that provides huge challenges in terms of sustainability, as it results in increased food waste and poor resource utilization.

As the political regulations are steered to increase profits, rather than providing sustainable solutions farmers are forced to expand on productions. There has been a regularly decrease in the value of the products, and farmers, like Bjørge, need to increase production to continue to earn money. Since they only own a small area themselves, they depend on leased land from their neighbors. Some neighbors resist to give access to land because of their economic interest in land sales. So far has policy provisions prevented the rezoning of the area because of its value in agricultural production. Downsizing of fertile soil is considered one of the biggest threats against continued food production.

Challenges and limitations

Reliability and validity

The case study can be replicated based on the description of interviews and observations in the methods chapter. However, since this is a qualitative research the results depend on personal experiences of the individuals involved, which means that an exact replication is not possible. Because this was an exploratory study, the objective was partly to establish a causal relationship in an exploratory way (Yin, 2014). Possible explanations for findings were provided to the

extent it was possible. Alternative interpretation to this topic and findings are likely to exist. My findings depends on my own perception as I see everything through own experiences and awareness.

The fact that I spent little time on each case and used few sources of information can be limitations for the information/data I collected. As I decided to have 10 cases and only had one month to finish the fieldwork, data collection was limited to only one visit that lasted 2-3 hours per farm. It would have been interesting to follow these farmers over a longer period, to see how they went about implementing their plans for sustainable management. If this study were continued I could have revisited the farms over the coming years.

Yin (2014) argues that one should use multiple types of sources during data collection to achieve a triangulation effect and obtain validity. Even though the interviews were considered the main source of information in this case study, other sources of information could have been used to broaden my perception of the farm operations. This could have been participative observation in farm work or activities. I could also have included written information from project plans, accounting papers, blog posts and newspaper articles to get more insight and accurate information.

Theoretical generalization

As all my cases were located in the southern central part of Norway, it is likely that participants from other areas of Norway could have brought other perspectives and plans into this study. The farmers around Oslo are likely to have benefits that farmers in more remote areas of Norway might not have, such as being larger and closer to markets and consumers (Veidal and Flaten, 2014). This case study provides theoretical propositions based on “how” and “why” mechanisms, and can therefore be used to generalize and expand upon theories (Yin, 2009). Even though cases were picked out based on their differences, analytical generalizations for the topic, not population, can be made.

Selections of participants

Originally, I had clearer criteria for selection of participants, but soon realized that I had to adjust them. Fixed number of years as a farmer became a challenging criterion because in several cases as succession of farms is a gradual process over many years. In addition, one of my cases included had farmed for almost 20 years. This can be considered a weakness, as all the other farmers had farmed for less than 10 years. Despite this, I found great reasons to include it in my study because it illustrated how change happens along the way. First, this case changed

focus after having run the farm for 10 years. Secondly, they are still adapting to the situation and considering expansion and investments. Thirdly, this is an inspiring example to look at as they have had to be innovative and inspire others with its foundations.

SUMMARY

This research has set focus on newly established farmers perceptions of and plans for sustainable agricultural practice. Perception and awareness of sustainability issues and plans towards a sustainable management varied among the cases. The strategies I recognized that newly established farmers chose to develop the farm in a more sustainable direction was: value-adding and/or higher productivity to generate sufficient income, increased utilization of local resources and/or adoption of technological aids to increase resource preservation, and working to improve societal impact and/or hire employees to get a better quality of life. This has been demonstrated through the range of practices and solutions identified in the different cases.

Farmers often are forced to make trade-offs between the economic, environmental and social aspects, they reckon as important. Time constraints or economic benefits were found as limitations to prioritize environmental friendly practices. The social aspect, in terms of workload, was generally compromised to reach environmental and economic goals. A balance between these aspects is essential to the long-term aim of sustainability, as it makes a farm more attractive for successors.

External forces like political legislations and societal focus stimulate some change, but personal experience are likely the most important reason for farmers to achieve more sustainable management practices. This implies that change happens in a gradual way, as farmers make new experiences over years. Moreover, the cases I have studied can change both their perception of sustainability practices and plans for the farms over the coming years.

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Appendix 1: Information letter

Forespørsel om deltakelse i forskningsprosjekt

*“Future farmers and sustainability:
a case study of newly established farmers in Southern Norway.”*

Bakgrunn og formål

I forbindelse med min masteroppgave i Agroøkologi ved Norges miljø- og biovitenskapelige universitet (NMBU), ønsker jeg å undersøke bærekrafts utsiktene for norsk landbruk. Jeg ønsker å fremme fremtidens bønders syn på bærekraft, valg i den praktiske tilnærmingen og det som ligger bak valgene.

Casene i studien er valgt ut med ønske om å et spekter av gårder der driftsform, produksjon, tjenester og organisasjonsstruktur varierer. Alle deltakere er plukket ut på følgende kriterier; er registrerte i følge produksjonsregister, holder til i sentrale strøk av Østlandet, er nyetablerte bønder og skal drive gården i årene fremover og har/eller ønsker å ha gårdsdriften som sin hovedinntektskilde.

Hva innebærer deltakelse i studien?

Studien vil ta utgangspunkt i intervjuer og observasjoner gjort under gårdsbesøk. Spørsmålene omhandler tanker og holdninger rundt miljømessige, sosiale og økonomiske aspekter av driften. Under intervjuer vil lydopptak bli benyttet og notater tas. Bilder fra gårdsbesøket er ønskelig dersom det tillates.

Hva skjer med informasjonen om deg?

Kun jeg og eventuelt veileder vil ha tilgang til lydopptak. Deltakere vil kunne gjenkjennes i oppgaven dersom det samtykkes til det. Prosjektet skal etter planen avsluttes 15.mai. Personopplysninger og opptak vil anonymiseres eller slettes ved prosjektslutt.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle innhentede data bli anonymisert.

Dersom du senere har spørsmål til studien, eller ønsker å trekke deg kan Ellen Heggelund kontaktes på ellen.karoline.heggelund@nmbu.no eller telefon 94 37 02 03.

Mine veiledere kan eventuelt kontaktes – Geir Hofgaard Lieblein på telefon +47 67 23 27 51 eller geir.lieblein@nmbu.no, eller Anna Marie Nicolaysen på telefon +47 67 23 27 87 eller anna.marie.nicolaysen@nmbu.no.

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykkeerklæring

- Jeg har mottatt informasjon om studien og er villig til å delta.
- Jeg samtykker til at fullt navn kan brukes i oppgaven.
- Jeg samtykker til at gårdsnavn kan brukes i oppgaven.
- Jeg ønsker ikke å identifiseres med navn (Etc. Kornbonde, 32, Akershus).
- Jeg tillater at bilder kan tas på gården og eventuelt brukes i oppgave.
- Jeg ønsker å få tilsendt transkribert versjon for å lese igjennom og rette opp i eventuelle opplysninger.

(navn/gårdsnavn)

(Signert av deltaker, dato)

Appendix 2: Interview guide

Interview Guide

Information before interview start:

Thank you for participating in my study. If it's OK for you there will be made an audio recording of the interview. The material is for my use during analysis of data and will be deleted when the thesis project ends.

You have the right to remain anonymous if you wish. You also have the right to withdraw from the study any time in the process.

This is not a test where there are right or wrong answers. It is important that you answer what you mean, so it provides an accurate picture of how things are for you.

Interview time: 1-2 hours

Personal information about the farmer:

Age:

Sex:

Education:

Who runs the farm:

Start-up:

Production:

Farm size:

Area:

Interview questions

Introduction

How did you end up taking over / lease / buy the farm?

What are your main motivations for being a farmer and operate the farm?

What is sustainability to you?

How do you see your farm in relation to each of the aspects (refer to model with environmental, social and economic aspects)?

Economy

How many jobs (% positions) do your farm offer? To what extent does the farm contribute to work in the local community?

Do you have income outside the farm? How much of your income (in %) comes from the farm?

What do you think about revenue from outside? Is it necessary to survive? How does it relate with sustainability?

How do you imagine the workload on/off the farm to evolve?

Has or will increased production /new productions be introduced to create better economic balance?

Has there been/ will financial investments to maintenance or expansion of the farm? How are investments / acquisitions financed?

In what ways have you already performed/have future investments conjunction with the desire for a more sustainable farm?

Is there anything that prevents you from investments /expansion?

Has the way you operate lead to financial savings and / or increased earnings (better resource utilization, less imports, efficiency etc)?

How is access to the market for your productions? What are the three most important economic productions / revenue sources?

What are the prospects for having sufficient finances for you as a farmer and support a family?

Environment

What is your ideology around the management?

Do you have livestock production? What measures are introduced to achieve an environmentally friendly production? What role does the animals have in the farm system?

What measures are taken to ensure the best possible soil quality? Has soil quality changed over the years?

What measures are undertaken to safeguard biodiversity on the farm? Do you notice any benefits from it being taken care of (ecosystem services)?

Which renewable and local resources are used on the farm?

What measures practiced in relation to energy use, and how do you see that this can be solved on your farm in the future?

Does it happen that you have a need for irrigation during the season? Do you have any measures to save/accumulate water?

Are there other measures that are practiced today you think benefits the environment?

Do you envision implementing environmental friendly measures in the near future? Are there measures you think would be beneficial in relation to climate change?

What are your thoughts on organic certification? Do you operate more or less sustainable than the eco-standard? In what ways?

Is there anything that prevents you from practicing more environmental measures? (Time, profitability, power etc)

Socially

What role do your farm have in the surrounding area (for neighboring farmers, local community) today? In what ways have the farming affected your social network?

What significance does the farm have for people involved (in the work, activities, etc.)?

Do you have / plan to start any kind of additional social services?

Are there any obstacles to starting up social services as side business?

What would you like to achieve by offering social services (influence in society etc)?

How do you feel that you as a farmer and your farm is valued in the society?

Are you concerned about addressed traditional knowledge and farming culture through your farm?

How is your / employees work-life balance on the farm?

Do you have any thoughts about the operations positive and negative effects on health? (Alternatively, employees' health?)

Influences

How do you think your background (childhood, education, job, etc.) have affected how you want to operate the farm?

Compared with 10 years ago, has your view of what sustainable production is changed? If so, how has it changed, and what do you think has influenced this?

Where do you get ideas and inspiration for change? Where do you find information about sustainable / environmentally-friendly operation?

To what extent do you think the state has helped to add to a more sustainable operation?

What signals do you pick up from research and how does this affect how you want to produce?

What signals are picked up by consumers and how do they affect what you produce and offer of social services?

In what ways do you perceive that other farmers are committed to practicing sustainable? What aspects of sustainability is emphasized by them?

Do you notice differences between newcomers and the older farmers in the way they want to practice?

Is there anything you feel you had to forgo to operate the farm as it is done? If you are going to think about aspects of sustainability, is any of them compromised?

Have you experienced pressure or expectations from previous generations? How easy do you think it has been to choose your own path in life (choice of profession) and selection (innovation) on the farm? How are previous generations values matching your own values?

To summarize: How has your farm evolved in a sustainable direction after you took over the farm - ecologically, socially and economically?

End interview: Is there anything you want to say in addition to what has been talked about?

Appendix 3: Pictures from farm-visits



Picture 1: At the potato farmer Mari's farm, big amounts of potatoes are unusable due to damage during harvest, but also because the market demands a lot in terms of aesthetic requirements. She showed me large quantities of potatoes she struggles to sell. This made it very visible to me how huge the problem with food waste is.



Picture 2: On Hans' farm they have found a way to replace a portion of concentrates with waste from brewery production. Because this is picked up in Drammen, it's a way to utilize local resources and help reduce waste and imported concentrate.



Picture 3: Kristin's Hungarian wool pigs are fed on large amount of food waste from local distributors instead of concentrated feed. The intention to help cope with the large amounts of waste that is a huge social problem.



Picture 4: At Bjørges farm, they have found ways to make use of waste through composting both their own and other farmers residues. These ranks consist of waste from vegetable production and horse manure which is composted two years before added in the soil.



Picture 5: Strawberries is a labor-intensive production, and Steffen has chosen to furnish the old barn to accommodate all 80 seasonal workers over the season.



Picture 6: Magne showed me the old storehouse which today is used as a farm shop, through which he sells all his produce.



Picture 7: To make her operation less labor demanding, Marthe has built a new barn with space for 45 dairy cows. Technological aids, like the milking robots, are adopted to suit her needs.



Picture 8: This is the slot where Jakob's new barn will be raised within the year. With the new building in place it will be possible to increase the number of cows.



Picture 9: Knut wishes to preserve the traditional, local cow breed "Østlandsk Rødkolle" and have plans to increase the number of animals.



Picture 10: Nils showed me some of the equipment he uses in the production of field crops. Including this small, light tractor to avoid soil compaction.



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