

Alana Lennon

Natural Regional Resilience

Determining the Sustainable Value of a Local Wool Industry through Actor-Network Theory



Naturally Pigmented Norwegian Sheep

Photo - Alana Lennon

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Supervisor: Nina Irene Gunnerud Berg

Norwegian University of Science and Technology

Faculty of Social and Educational Sciences

Department of Geography



Norwegian University of
Science and Technology



Grey Trønder Sheep

Photo - Arild Espelien

“The whole landscape here is a complex web of relationships between farms, flocks and families”

- James Rebanks, *The Shepherd's Life*



Old Spæl Sheep

Photo - Arild Espelien

ABSTRACT

Sustainable development has become accepted by many as the only sensible option for future development at global, national, county and municipal levels. On a national level, Norwegian authorities have made strategic policies aiming to reach the goal of a low-emission society by 2050. Green innovation, efficient use of natural resources as well as a stronger focus on local processing and production, are all regarded as offering sustainable options for future local and regional development. This thesis studies a small-scale local wool industry in Trøndelag (a spinning mill and associated actors) which focuses on utilising wool from the older, rare breeds of native Norwegian sheep. Wool from these breeds is often pigmented and regarded by many as under-valued in relation to the potential value it has as a natural resource from the bio- or eco-economy. At the same time as having this potential, it is also the bi-product of meat production from animals that release emissions. This aspect makes calculating the sustainable values of the local wool industry more complex.

Actor-Network Theory is used as a theoretical framework and methodology, offering a holistic approach to researching the complex relational activity between animate and inanimate elements of the wool industry. Assembling the actor-network of the local wool industry, which the researcher is also a part of, made it possible to see all the connections between the actors and understand the collaboration and relationships stretching across space and time. Although the different elements and relationships showed that aspects of ecological, social and economic sustainability are interwoven, this study argues that the local wool industry in Trøndelag has a deeper focus on ecological sustainability. This suggests that it operates outside a capitalistic system, which is driven primarily by economic interests. The study further suggests that the industry is perhaps not so much working towards sustainable regional ‘development’ as sustainable regional ‘resilience’. Collaboration is central to the industry’s sustainability through helping to build up environmental, social and technological resources for providing local clothing and food. From an ecological perspective and in the light of an uncertain or unpredictable future connected to today’s environmental crises, this perhaps offers greater regional and local value.

SAMMENDRAG

Bærekraftig utvikling blir av mange akseptert som det eneste fornuftige alternativet med tanke på fremtidig utvikling både på globalt, nasjonalt, fylkes- og kommunalt nivå. På nasjonalt nivå har norske myndigheter utformet strategiske tiltak med sikte på å oppnå målet med et lavutslippssamfunn innen 2050. Grønn innovasjon, effektiv bruk av naturlige ressurser og en sterkere fokusering på kortreist foredling og produksjon, ansees å gi bærekraftige muligheter for fremtidig lokal og regional utvikling. Denne oppgaven studerer småskala, lokal, ullvirksomhet (et spinneri med tilhørende aktører) i Trøndelag som fokuserer på bruk av ull fra tradisjonelle, bevaringsverdige norske saueraser. Ullen fra disse sauene er ofte pigmentert og blir av mange betraktet som undervurdert i forhold til potensielle verdier som den kan ha i bio- eller øko-økonomien. Samtidig som ullen har dette potensialet for lokal, bærekraftig verdiskapning, er den også et biprodukt av klimagassproduserende kjøttproduksjon. Dette aspektet bidrar til å gjøre bærekraftberegninger mer komplekse.

«Actor-Network Theory» brukes her som et teoretisk rammeverk og metodologi for å gi en helhetlig innfallsvinkel til kompleksiteten mellom de levende og ikke-levende elementene i aktørnettverket til ullvirksomheten. Ved å sette sammen «aktør-nettverket» til den lokale ullvirksomheten, som forskeren også er en del av, ble det mulig å oppdage forbindelser mellom aktørene og deretter forstå samarbeidet og forhold som strekker seg over rom og tid. Selv om de ulike elementene og relasjonene viste at de miljømessige, sosiale og økonomiske aspektene ved bærekraft er vevd sammen, viste studien at ullvirksomheten har mest fokus på den miljømessige siden. Det kan derfor synes som om virksomheten i denne studien opererer utenfor det kapitalistiske systemet, som hovedsakelig drives av økonomiske interesser. Videre antydes det at de ikke sikter så mye mot bærekraftig regional 'utvikling', men mer mot en bærekraftig regional 'motstandsdyktighet' (resilience). Samarbeid er sentralt for virksomhetens bærekraftighet ved at det bidrar til oppbygging av miljømessige, sosiale og tekniske ressurser for lokal forsyning av klær og mat. Sett fra et økologisk ståsted, og i lyset av en usikker og uforutsigbar fremtid knyttet til miljøkrisene som vi har i dag, kan nettopp dette fokuset tilby større regionale og lokale verdier.

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GLOSSARY

SHEEP BREEDS & RELEVANT ABBREVIATIONS

DS - Dala Sheep - *Dalasaau*

GRC - Norwegian Genetic Resource Centre - *Genressurscenter (Skog & Landskap/NIBIO)*

GTS - Grey Trønder Sheep - *Grå Trøndersau*

GTBS - Grey Trønder Breed Society - *Grå Trønder raselag*

NWS - Norwegian White Sheep - *Norsk Kvitsau*

ONS - Old Norse Sheep (Wild sheep) - *Gammelnorsk sau (Villsau)*

OSS - Old Spæl Sheep - *Gammel Norsk Spælsau*

TERMINOLOGY

Commission spinning - Spinning service for others to hire - *Leiespinning*

Crimp - Bends in wool fibre giving resilience and strength - *Krus*

Kemp - Weak and brittle fibres - *Dødhår eller marghår*

ORGANISATIONS & OTHER ABBREVIATIONS

Animalia - Professional support for Norwegian meat and poultry production

ANT - Actor-Network Theory

County Governor - *Fylkesmann*

GRC - Norwegian Genetic Resource Centre - *Norsk Genressurscenter*

IN - Innovation Norway - *Innovasjon Norge*

KRUS - Research Programme: “Enhancing local wool value chains in Norway”

Ministry of Agriculture and Food - *Landbruks- og Matdepartementet*

NFACA - Norwegian Folk Art and Craft Association - *Husflidslag*

Norwegian Agriculture Agency - *Landbruksdirektoratet*

Norwegian Association of Local and Regional Authorities - *Kommunesektorens Organisasjon*

Norwegian Farmers Union - *Bondelaget*

Norwegian Food Safety Authority - *Mattilsynet*

Norwegian Cooperative for Skins, Casings & Wool - *Norilia*

NSG - Norwegian Association for Sheep and Goat Farmers - *Norsk Sau og Geit*

Sheep Control System - *Sauekontrollen*

Smallholders Union - *Småbrukarlag*

South Trøndelag’s County Authority - *Sør-Trøndelag Fylkeskommune*

Woolen Factories - *Ullvarefabrikkene*

1 INTRODUCTION

Wool has held a vital role in the livelihoods of people, from providing prehistoric warm clothing to creating industry, trade and economy for many countries (Buer, 2011). Sheep and wool have been connected to substantial changes in the economy, technology and even the exploration and development of culture, such as the Vikings (Klepp et al., 2016a). The welfare and well-being of people throughout the world has also been affected by woollen clothing that, in Norway, enabled survival in otherwise cold and remote valley's (Sundbø, 2016). Innovation in the textile industry even resulted in clothing that reflected a person's status (Becker et al., 2016). Sheep are also responsible for significant changes to the landscape. The biodiversity of the Norwegian cultural landscape has been affected both positively and negatively through over-grazing and under-grazing (Austrheim et al., 2016). These examples show the long-standing connection and interwoven relationships between wool and people.

Wool has many properties that made the fibre unique in comparison to other fibres such as flax; it is water-repellent, soft, easier to harvest and it can be grown on poorer land (Becker et al., 2016). These properties in addition to wool's natural flame resistance, biodegradability, resilience and elasticity are what continues to make wool a valuable resource today (IWTO, undated). However, the production of cheaper and far less sustainable textiles has created serious changes to the clothing industry, with increasingly poor environmental impacts (Klepp et al., 2016a). In 2016, wool was calculated as making up slightly over one percent of the consumption of global fibre whereas synthetic fibres accounted for over 62 percent (Lenzing, 2016). The revival of the wool industry as an ecological resource in contrast to textiles created from the petro-chemical industry was key to establishing the high-profile project, The Campaign for Wool, with HRH The Prince of Wales as the patron (Campaign for Wool, 2017).

Norwegian wool has not been immune to the changes in the textile industry. As a fibre, sheep's wool was, "by far the most important here in the country" (Hoffmann, 1991, p.16 - my translation). The use of Norwegian wool has also fluctuated and a marked increase in the use of synthetic fibres began from the 1960s (Tviland, 2017). However, the percentage of Norwegian wool being used within the country has increased again in the last few years and currently 20 percent of the volume of Norwegian wool is used within the land (Tviland, 2017). Norway has a unique system in place for collection of wool and delivery to wool stations run by the farmer's cooperatives; *Norilia* (The Norwegian Cooperative for Skins, Casings and Wool) and *Nortura* (The Farmer's Company) (more information in Chapter 2.2) as well as the

family-owned slaughterhouse; Fatland. Arrangements between *Norsk Sau og Geit* (Norwegian Association for Sheep and Goat Farmers (NSG¹)) and the wool stations were made in 2008 to ensure that local collection of wool is organised and farmers have an outlet for this product (NSG, undated). Norilia also organise the sales of Norwegian wool after it has been washed in their wool scouring plant in Great Britain (Norilia, 2015). Although wool scouring was once done by the wool factories themselves, it is now only Sandnes wool factory and the smaller spinning mills that wash or scour their own wool; the majority is sent to England (Hebrok et al., 2012). The washed wool of higher qualities (predominantly white, extra fine fibres or lamb wool) are then transported back to Norway for use by *Ullvarefabrikkene* (the woollen factories); mainly Rauma, Hillesvåg and more recently Gudbrandsdalen (Tviland, 2017). Other wool is sold on the world market by Curtis Wool Direct, an international wool dealer based in Great Britain which is 85% owned by Nortura (Nortura, 2016). Due to this system for collection and sales, there should be no reason for wool to be thrown away but this is unfortunately believed to be the case for some Norwegian wool (Klepp & Tobiasson, 2016a). It is the wool that is not greatly sought after within Norway that is in danger of being discarded; especially coarser and naturally pigmented wool mixed with white (Tviland, 2017). Lack of market demand for this wool results in a lower payment for the farmer and little incentive to spend money on shearing and transportation (Klepp & Tobiasson, 2016b). Although Norwegian wool is subsidised by *Landbruksdirektoratet* (The Norwegian Agriculture Agency) the payments for naturally pigmented wool have been recently reduced (see Chapter 2.2.1).

The plight of Norwegian wool has received much attention in the last few years, helped through projects such as “Valuing Norwegian Wool” (Hebrok et al., 2012), “*Ullialt*” (Wool in Everything) a four-year project of *Husflidslaget* (The Norwegian Folk Art and Craft Association (NFACA)) (Norges Husflidslag, undated) and the KRUS-project; “Enhancing local wool value chains in Norway” (Nordic Fashion Association, 2017). More recently, calculations regarding the environmental footprint of wool clothing have stirred up debate as to the effects wool has on the environment (Hermstad, 2016; Veløy, 2016; Klepp & Tobiasson, 2016b). Although this debate is not strictly focused on Norwegian wool, it highlights the issue that much of Norway’s woollen clothing is not made from Norwegian wool (Hermstad, 2016; Hansrud, 2017). Local production and market improvements for Norwegian wool are central to the

¹ Many abbreviations are used in this thesis; explanations can be found in the Glossary on page xii.

KRUS-project with a view to creating a more sustainable clothing industry (Nordic Fashion Association, 2017).

Sustainability, climate and the environment are key issues for all future development. Building a future based on creating a sustainable and resilient society is a central goal on a global scale (UNEP, 2015; UN General Assembly, 2015; Steffen et al., 2015). Norway's prioritisation of sustainable development is reflected in national and regional plans looking to establish green restructuring of society and industry; or *Det Grønne skifte* (the Green Shift) (Norway, Fylkestingene i Sør- og Nord-Trøndelag, 2016). Restructuring for a greener society is aimed at reducing emissions and encouraging green innovation and the effective use of the bio-economy (Nordisk Ministerråd, 2016). Focusing on local production and local quality are regarded as areas for increased opportunity for sustainable development nationally and regionally within Trøndelag (Kommunesektorens Organisasjon, 2016; Norway, Landbruks- og Matdepartement, 2015; Nord-Trøndelag Fylkeskommune, 2010; Oi!, undated).

Norwegian wool is situated in-between these issues as it is a bi-product from meat production of animals that release emissions, and yet also an underused resource in Norway's bio-economy (Hebrok et al., 2012; Hansrud, 2017) and therefore potentially an opportunity for developing local quality. These issues, in addition to a personal interest in local wool as a handicraft artist (see Chapter 1.2) with some prior knowledge of the small-scale wool industry in Trøndelag, led to my focusing on this area of research.

The initial research design developed from a report of an EU project that was carried out in Jämtland, a county in central Sweden, from 2008 to 2010. The project aimed to discover if a small-scale woollen mill could provide regional development and especially economic growth to rural areas (Lundström & Skoglund, 2010). This aspect is also one of the goals under this study in relation to economic sustainability (see Chapters 1.3 & 3.1). Geographically, Trøndelag and Jämtland have some similarities and the two regional cities, Trondheim and Östersund, collaborate in projects in mid-Scandinavia (Trondheim Kommune, 2015). On discovering that the woollen mill was still in operation in Jämtland, a dual case study, where the Swedish mill and Selbu spinning mill could reflect each other's experiences was considered. Contact was made with the spinning mill in Sweden and interest was expressed but initially they were unable to allocate time to discuss a follow-up study to the 2010 report. Two, in-depth case studies would also have been demanding within the time-frame of a master's thesis. It was then decided to focus in greater detail on a single case in Trøndelag.

1.1 Selbu spinning mill

Selbu spinning mill was established in 2010 by Ingvild Espelien and Frida Tove Meland in Selbu municipality in the county of South Trøndelag, about 70km south-east of Trondheim city, by road. The mill uses Belfast mini-mill equipment, which is designed to process between nine and fourteen kilos of wool per day with approximately two employees (Belfast Mini Mills, 2009). In the beginning this was Frida Tove Meland from North Trøndelag and the daughter of Ingvild Espelien who was living in Klæbu municipality, South Trøndelag. Ingvild Espelien was employed elsewhere but was Chairman of the Board, a position she still holds today as well as being Managing Director (Selbu spinneri, 2016). In the summer of 2016, after Frida Tove Meland retired, the mill relocated to Klæbu, only 20km south of Trondheim and with a much shorter travelling distance for the current employees. Selbu spinning mill now has one full-time permanent employee, two part-time employees and Ingvild Espelien who is employed with a 60% position at the mill but is paid through various project work, such as KRUS (more in Chapter 1.2). These projects are an important part of the network for Selbu spinning mill (see Chapter 5.3.3).

The establishment of Selbu spinning mill came about due to close collaboration with sheep farmers in North and South Trøndelag working with threatened breeds of Norwegian sheep (see Chapter 2.1). The business spins yarns for sheep farmers (commission spinning) and sells yarns through the internet- and mill shop. Establishment of the mill shop and commission spinning services was done with the aim of improving the value of the older, pigmented breeds and providing additional income for the farmers (Selbu spinneri, undated). Selbu spinning mill is one of two craft-based mini-mills in Norway, the other is Telespinn based in Telemark and specialising in spinning yarns from mohair or Angora goats (Telspinn, undated). Selbu spinning mill is the only mill in Norway with a main focus on the older breeds of pigmented wool (Klepp & Tobiasson, 2013).

The catchment area and network for the spinning mill naturally goes beyond the borders of Trøndelag, but the region offered an interesting and realistic boundary for an in-depth study. In addition, the region has local government, NGOs and farming cooperatives that have some knowledge of and collaboration with Selbu spinning mill. In 2018, North and South Trøndelag will be merged into one county, creating an important region for sheep farming and agriculture in general (see Chapter 2.3). There is no fixed or organised business between the various farmers who commission spin or sell their wool to Selbu spinning mill, other than the connection they all have to the older sheep breeds and the mill itself. This connection creates a

network of relationships between farmers, landscape, animals, spinning mill, machinery, local government, agricultural authorities and policies, as well as other wool and agricultural related organisations. Actor-Network Theory (ANT) recognises interactions between all actors in a network, regardless of their human or non-human status (Law, 1992) and was therefore seen as an ideal theoretical framework for this study (see Chapters 1.2 & 3.3). I have chosen the expression ‘Trøndelag’s local wool industry’, to describe the active interest of all involved in creating and utilising the value of pigmented and older breeds of sheep and wool; wool that generally gives poorer economic returns. The sheep breeds are discussed in more detail in Chapter 2. However, to roughly explain the economic situation; the Norwegian White sheep (NWS) generally give a better income, both in terms of meat (due to the size of the animal and amount of lambs produced) and the wool (due to it being white and not pigmented) (Jensen, 2013).

1.2 Personal Relationship to Wool

In 2008, I registered a small handicraft business in Norway, “Alanafelt”, which exhibited and sold handmade felted products from Norwegian wool and offered courses in various wool-related handicrafts for adults and children. In 2013, I worked in conjunction with *Bioforsk* (Norwegian Institute for Agricultural and Environmental Research), *Bondelaget* (Norwegian Farmer’s Union) and NSG to create a wool seminar in Tingvoll, Møre and Romsdal county. Ingvild Espelien, the managing director of Selbu spinning mill was also involved in the seminar as both workshop leader and guest speaker. Collaboration has continued with Ingvild Espelien, including study tours to Italy and Great Britain in 2014. Ingvild Espelien is also project leader on one of the work packages for the KRUS-project which will also include this thesis as part of their publications. The KRUS-project is a four-year research project with funding until 2018. It is an interdisciplinary project, looking at the entire value chain of Norwegian wool from the challenges of working with older breeds of sheep, to opportunities for local production of sustainable clothing (Nordic Fashion Association, 2017). The aims of the KRUS-project helped to inspire the topic of research for this master thesis. However, the actual study objective and research is my own work and not funded by KRUS or Selbu spinning mill.

1.3 Research Questions

The aim of this study is to investigate the network associated with Trøndelag’s local wool industry to assess if and in what ways it affects sustainable regional development. ANT is used as methodology and theoretical framework for the study. As methodology, this recognises my role as an interested party in the research also having a connection to the network (Ruming,

2009; Jóhannesson & Bærenholdt, 2009). As a theoretical framework, ANT was chosen due to its acknowledgement of the heterogeneous aspects of the actor-network (Law, 1992), thereby allowing a more holistic or open approach towards relationships between human and non-human actors (Dankart, 2012). The research may help to increase understanding of the values of a local wool industry from the perspectives of all involved; be they people, animals, policy or landscape. In this way, it is hoped a deeper understanding of the effects of a local wool industry on sustainable regional development can be uncovered.

Aim

To investigate Trøndelag's small-scale wool industry through Actor-Network Theory to discover how it affects sustainable regional development.

Research Questions

1. What is the actor-network that helped create and maintain the small-scale wool industry in Trøndelag?
2. How does the actor-network function in relation to economic, social and environmental sustainability?
3. How can the actor-network help a small-scale woollen industry affect sustainable regional development in Trøndelag?

1.4 Structure of Thesis

The next chapter, Chapter 2, gives the background detail to the case study, explaining Norwegian sheep breeds and the importance of the agricultural cooperatives and creation of the Norwegian Wool Standard. Information is also given about the region of Trøndelag in relation to agriculture and specialisation in local food. Connections are made between the sustainability, marketing and specialisation of local food to the same potential in local wool and yarns.

Chapter 3 covers the theoretical concepts used in the research and focuses on three main areas; sustainable development; regional development (focusing on sustainability and the importance of 'place'); and ANT.

Research methods are the focus for Chapter 4, describing approaches used within this qualitative case study. An overview is given of the interviews and participant observation used for generating data along with a brief description of the analysis process. Ethics and my positionality as researcher are also covered in this chapter.

Chapter 5 divides the analysis into three main sections, following the direct comments made by interviewees. ‘Tracing the Origins’ focuses on the creation of the actor-network and reasons why farmers choose the older breeds of sheep, why the mill was established and the importance of the location. ‘Maintaining the Network’ covers ways the network functions through various relationships; economy, marketing and the controversies that can alter those relationships. ‘Moving Forward’ discusses potential future development and change for the network; from the perspective of the farms, wool sorting and further collaboration for the spinning mill.

The reflective discussion in Chapter 6 assembles the overall actor-network and discusses the connections to sustainable regional development and resilience. Arguments are put forward to suggest the network stretches over time and place; into the past and future. It also describes how some farmers expressed the feelings that they are outside the system and how this can make the industry seem less important in regard to its value in sustainable regional development. It hopefully sheds light on where the strengths and challenges are within the network. This leads into concluding remarks as to how the small-scale wool industry is already affecting sustainable regional resilience and suggestions where further research may be useful.

A Glossary of abbreviations for the different sheep breeds and Norwegian organisations which have been translated into English is included on page xii.

2 SHEEP, AGRICULTURE & TRØNDELAG

In this chapter, the background to the case study of Trøndelag's local wool industry is discussed. The case study looks into the entire value chain, from wool production through all processing to the end products. The products are predominantly yarn, although Selbu spinning mill also produces carded wool for felting, thick rug yarns and some hand-knitted products. The farmers also sell some hand-knitted products but mostly yarns, spun from the older breeds of Norwegian sheep especially with naturally pigmented wool. The network of farmers, spinning mill, wool station, handicraft organisation and local government, who have an immediate connection to the wool industry are all situated in the counties of North and South Trøndelag.

A brief introduction to Norwegian agricultural history as it relates to the traditional and pigmented sheep breeds is given first. The Norwegian agricultural cooperatives are discussed to provide an overall picture of the ways farmers have been utilising networks for hundreds of years, and have also developed a classification system for Norwegian wool. A brief description of cooperatives that focus on collection and sales of wool in Norway helps to illuminate the situation which the pigmented breeds currently hold in the system. Finally, some basic statistics on Trøndelag are included, to explain the importance of agriculture and local production within the region.

2.1 Sheep Breeds in Norway

Archaeological discoveries and pollen analysis suggest that agricultural activity began in Norway as early as the period between 3800 and 3000 BC (Myhre, 2004). Although it is difficult to be certain of the exact time when the first sheep came to Norway, archaeological discoveries point to the animals having been used as livestock 6000 years ago (Drabløs, 1997; Buer, 2011). As agriculture developed through the years, domestication of the sheep would have helped to prevent starvation and provide a better economy. Wool became an important resource as the animal did not require slaughtering for this product (Myhre, 2004). Wool was, for hundreds of years the main reason for farmers to keep sheep, and was valued higher than meat or milk (Drabløs, 1997; Lunden, 2004; Buer, 2011). Sheepskins would have been used for clothing, perhaps even earlier when sheep were still undomesticated (Buer, 2011). Wool's natural insulating, elasticity and moisture absorption properties are still seen as valuable today, as well as having a strong place in history. Wool could provide not only warm clothing against harsh weather but also woven sails for the Vikings (Klepp et al., 2016a).

According to Buer (2011) the first sheep to arrive in Norway were the breed known today as the Old Norse Sheep (ONS) or ‘Wild sheep’, and are directly related to those that were prevalent across Europe. They have distinct characteristics of short tails, horns and a double layer of wool; soft under wool and strong, coarser guard hairs (Buer, 2011; Norwegian Genetic Resource Centre, 2011; Sundbø, 2016). Lunden (2004) states that this breed was, “[t]he traditional and usual Norwegian sheep until the middle of the 19th century” (p.184). Other sources comment that larger sheep breeds from Great Britain and Spain with longer tails, were already being imported from the 1700s (Drabløs, 1997; Buer, 2011; Sundbø, 2016).

According to Drabløs (1997) the initial imports of other sheep breeds proved problematic to farmers. This he explains, was because the newer breeds with their finer wool absorbed more water, felted and shrank under use and were therefore not suitable for traditional uses, such as fishermen’s mittens. Drabløs (1997) also suggests that it was only when meat began to gain a greater market focus in the late 1800s, that the larger imported breeds were accepted by farmers. Crossbreeding Norwegian sheep with imported, long-tailed breeds, then became more popular (Drabløs, 1997). The crossbred breeds soon dominated the sheep populations in Norway, almost resulting in the extinction of the ONS by early 1900 (Gjerdåker, 2004).

The industrialisation and modernisation of spinning machines created a demand for imported breeds of sheep with fine, white wool (Sundbø, 2016). The properties of this wool could compete with the fashionable fabrics being worn in other countries and could be dyed evenly, without the discolouration often caused by pigmented fibres (Hebrok et al., 2012; Sundbø, 2016). The demand for fine, white fibre by the wool industry has continued to affect the population of different sheep breeds in Norway today. In 2011, the sheep population in Norway was 85% long-tailed crossbred and 15% short-tailed sheep (Norwegian Genetic Resource Centre, 2011). The distribution of naturally pigmented sheep is also much lower than the white breeds and often correlates to the threatened status of the breed. Table 1 below shows the number of sheep in relation to the breed and wool colouring. Norwegian Genetic Resource Centre (GRC) categorise the status of breeds of sheep as follows (Skog og landskap, 2013):

Critical	-	Less than 300 breeding females
	-	Less than five breeding males
Threatened	-	Between 300 and 3000 breeding females
	-	Between five and twenty breeding males
Vulnerable	-	Between 3000 and 6000 breeding females
	-	Between 25 and 35 breeding males

Table 1- Distribution of Ewes by Breed (Adapted from Norway, Animalia, 2016b, p.21)

DISTRIBUTION OF EWES (Breeding females) BY BREED					
WHITE BREEDS	*	AMOUNT	PIGMENTED BREEDS	*	AMOUNT
Norwegian White Sheep	C	248 530	Old Spæl Sheep	S	9 966
White Modern Spæl	S	34 636	Pigmented Modern Spæl	S	7 354
Dala Sheep	C	5 374	Norwegian Pelt Sheep	S	5 410
Norwegian Cheviot	C	3 424	Old Norse Sheep	S	4 127
Texel	D	3 342	Blæset Sheep	C	2 292
Suffolk	E	2 658	Grey Trønder Sheep	C	1 015
Rygja Sheep	C	2 625	<p style="text-align: center;">* KEY C = Crossbred S = Spæl breed E = English breed (long-tail) D = Dutch breed (long tail)</p>		
Nor-X Sheep	C	2 415			
Steigar Sheep	C	2 193			
Black Face	E	1 294			
Charolais Sheep	C	803			
Fuglestadbrogete Sheep	C	652			
TOTAL WHITE 91.1%		307 946	TOTAL PIGMENTED		30 164 8.9%

Table 1 shows that white wool dominates Norwegian production today with over 90% of the wool produced. It also shows that only five of the eighteen breeds mentioned above are of the older, short-tailed or spæl breeds. The pigmented wools are predominantly from the spæl breeds, with only the Modern White Spæl sheep producing purely white wool. Four out of the six pigmented breeds are categorised as threatened or vulnerable. Of the white Norwegian breeds, Rygja, Fuglestadbrogete and Dala sheep (DS) are threatened breeds and an updated list of threatened breeds shows Steigar to be critical (Skog og landskap, 2017) which questions the figures for this breed given in Table 1.

Table 1 is adapted from the 2015 Annual Report of Animalia's *Saukontrollen* (Sheep Control System); just one of the many systems in place regarding organisation for wool production in Norway. These systems will be explained in more detail in Chapter 2.2. However, not all sheep in Norway are registered with the Sheep Control System. Statistics from 2015 state that only 45,5% of the ewes in Norway were registered (Norway, Animalia, 2015 & 2016b). Animalia maintain that over four million kilos of wool is produced each year from over two million sheep and lambs (Norway, Animalia, 2015 & 2016b); and that 10,8% of the registered wool in 2014 was pigmented (Norway, Animalia, 2014).

2.2 Agricultural Cooperatives & Norwegian Wool

Innovation in the agricultural sector has constantly brought improvements and changes to production. In the 19th century, farmers responded to these changes by establishing the first official processing cooperatives (Gjerdåker, 2004; Norsk Landbruks-samvirke, undated). This began in the 1840s with the distilleries derived from arable farming. Later, cooperatives for milk, meat and wool, to name but a few, became even more important with regards to regional economy (Gjerdåker, 2004; Norsk Landbruks-samvirke, undated). It has been suggested that similar forms of organising within farming communities began much earlier, around 1600 (Norsk Landbrukssamvirke, undated). These forms of community cooperation created a supportive network to assist farmers in reduced circumstances, through accidents or other hard times and later led to the establishment of insurance and credit organisations (Norsk Landbrukssamvirke, undated). As cooperatives were formed for processing raw materials, this improved market access, added value and improved the economy for farmers throughout Norway (Gjerdåker, 2004).

Nortura was established in 2006, with the purpose of developing a value chain and brand for Norwegian farm products, but its history began in 1911 as a slaughterhouse in Oslo (Nortura, undated). While Nortura is based on meat production they also established subsidiary companies to ensure that the entire animal is utilised and nothing is wasted. Norilia is a subsidiary of Nortura which is responsible for developing and selling the additional products that come from the slaughterhouse; skins, casings and wool.

Norilia's website (Norilia, undated) shows that their wool department is responsible for selling wool from Nortura's eight wool stations that are situated to cover the whole of Norway. They maintain that 78% of Norwegian wool is collected and classified at these wool stations, before being sold to Norwegian wool processor's (30 - 40%), or exported abroad. Around a quarter of Norwegian wool is processed through Fatland; a family owned business and Norilia's competitor (Norway, Animalia, 2014). Norilia and Fatland have systems in place for local collection of wool which is shorn on the farms and delivered in sacks by the farmers. The rest of the wool comes directly from the slaughterhouses (Tviland, 2017), shorn from the sheep and lambs before slaughtering. Any waste wool from Norwegian spinning mills can also be delivered for classification at the wool stations (Norway, Animalia, 2014). Both Norilia and Fatland have approved wool classifiers who consider each fleece in accordance with the *Norsk ullstandard* (Norwegian Wool Standard) and allocate the relevant payment.

2.2.1 Norwegian Wool Standard

Several systems with the aim of improving the quality of Norwegian wool were attempted during the 1900s (Hebrok et al., 2012). Pigmented wool has had distinctly different prioritisation through the years. Sundbø (2016) describes a Norwegian standard from 1935 with five classes of quality in the following order:

“Old Norwegian sheep (ONS) [spæl breed]; Good clean, white wool; Less good, not completely clean white wool; Grey, brown or black wool; Less good, less clean, grey, brown or black wool” (p.63 - my translation).

The 1950, the Norwegian Wool Standard had nine overall classes which included 40 sub-categories (Hebrok et al., 2012).

The Norwegian Wool Standard today rates quality in relation to the wool's properties, for example; fibre length, crimp, shine, colour and how clean it is. There are currently 16 classes defining various qualities (see Table 2 below). Farmers receive a payment which is made up of the sale price of the wool plus the subsidy given by the Norwegian Agriculture Agency, minus the labour and sales costs (Norway, Landbruksdirektoratet, 2015; Norway, Animalia, 2014). In 2015, the Norwegian Agricultural Agency suggested a change to the payments, where the five poorest qualities would stop receiving subsidies and be paid only in accordance to the market price. The money previously designated to these five qualities was allocated to, and divided between the highest qualities. The intention behind this was to hopefully stimulate increased quality in Norwegian wool (Norway, Landbruksdirektoratet, 2015; Norway, Animalia, 2016a). By creating extra incentives for farmers to deliver first class quality wool, it may well be a valid case for the top qualities of wool which are predominantly white wool. However, it can lead to reduced quality for pigmented wool and increased difficulty for accessing wool from different pigmented breeds, which, depending on their quality, can all end up in the same poorly paid class (Klepp & Tobiasson, 2016b). Table 2 below, shows the 16 classes of the Norwegian Wool Standard; gives a brief description of the criteria for that class, and the payments from Norilia that are valid from 7th November 2016 up until printing of this paper.

Table 2- Norwegian Wool Standard (Adapted from Norway, Animalia, 2007 & 2016a)

Yearly Wool - Crossbred		Brief Criteria for Class	Price p/kg
Classification	A1	White, soft, good elasticity, longer than 100mm	52,00
Spring Wool - Crossbred			
Classification	B1	White, soft, crimp, good elasticity, longer than 40mm.	49,00
	B2	White, crossbred/spæl cross, longer than 40mm, some kemp, plant material & light felting allowed.	20,00
Autumn Wool - Crossbred			
Classification	C1	White, soft, crimp, good elasticity, longer than 70mm.	55,00
	C1fin	As C1 but even finer wool.	60,00
	C1L	As C1 but with even longer fibres.	55,00
	C2	White, longer than 70mm, some kemp, plant material & light felting allowed.	20,00
	C1S	Pigmented, soft, crimp, good elasticity, longer than 40mm.	30,00
	C2S	Pigmented, crossbred/spæl/pelt sheep cross, belly, thigh and tail wool (pre-sorted or not), felted wool, urine-burnt wool, plant material and kemp.	1,00
Autumn Wool - Spæl Breed			
Classification	F1	White, long, soft and lustrous guard hair - 120mm, soft, fine under-wool - 40mm.	52,00
	F2	White, spæl/cross, 120mm guard hair, 40mm under-wool, some kemp, plant material & light felting allowed.	20,00
	F1S	Pigmented, long, soft and lustrous guard hair - 120mm, soft, fine under-wool - 40mm.	30,00
	F1P	Pelt sheep (Pigmented), soft, lustrous, good curl, guard hair 80mm.	32,00
Wool - Felted, Coarse or with Plant Material			
Classification	G	White, hard-felted but can put thumb through wool.	1,00
	V	White, lots of plant material but only light felting.	1,00
Pre-sorted Wool - Belly, Thigh & Tail			
Classification	H1	White, autumn or yearly wool, 70mm, kemp allowed.	20,00
	H2	White, spring wool, shorter than 40mm, some kemp, plant material & light felting allowed.	1,00
	H3	Originally white, urine-burnt, very dirty, kemp allowed, some plant material & light felting allowed.	1,00

Table 2 highlights the fact that only four classifications are designated for pigmented wool, one of which, C2S, lost the state subsidy in 2016. The classification system perhaps reflects the

domination of white wool in Norway and the fact that there is a greater demand for this wool within the woollen industry in Norway and on the world market (Hebrok et al., 2012).

However, it does appear that there is a growing interest and market within Norway for pigmented wool. Norwegian spinning mills are utilising both white and pigmented wool, there are also several projects in place for spinning and utilising wool from the ‘wild sheep’ or ONS (Klepp & Tobiasson, 2016b). Selbu spinning mill, based in Trøndelag (see Chapter 1.1), has its main purpose to utilise the wool from the pigmented and older Norwegian breeds of sheep.

2.3 Trøndelag

At present, North and South Trøndelag are two separate counties. In 2018, they will be merged to create Norway’s second largest county covering over 41,000 square kilometres, stretching from Oppdal and Røros municipalities in the south, to Namskogen and Røyrvik in the north (Norway, Trøndelag fylkeskommune, undated). Figure 1 below, shows the position of both counties in relation to the whole country, which as a region is often referred to as mid-Norway. The population in 2016 was 450,000, with 73,4% living in densely populated areas (Norway, Sør-Trøndelag fylkeskommune, 2016).



Figure 1 - Position of Trøndelag on Norway Map (Adapted from Wikimedia Commons, 2015)

2.3.1 Agriculture

The region has great geographical variation, including mountainous and cultural landscapes, diverse woodlands, wetlands, rivers, lakes and a long coastline of the Norwegian Sea (Norway, Sør-Trøndelag fylkeskommune, 2016). Agriculture is regarded as North-Trøndelag’s most

important industry, providing 11% of Norway’s total food production in 2013, whilst housing only 3,2% of the population (Norges Bondelag, 2013). According to South Trøndelag’s County Authority, merging the two counties will result in Trøndelag becoming Norway’s largest agricultural county (Norway, Sør-Trøndelag fylkeskommune, 2016). They also state that in 2015, North-Trøndelag was the second largest producer of meat and the fourth largest in grain production, amongst all the municipalities in Norway.

Oppdal in South-Trøndelag has the largest number of sheep of any municipality in Norway, with over 40,000 summer-grazing animals (Norges Bondelag - Oppdal, 2016). Once the counties are merged, Trøndelag will be the third largest sheep county in Norway with over 85,000 adult animals, as shown in Figure 2 (Norway, Landbruksdirektoratet, 2016). Statistics for the division of sheep breeds by county is still being assessed, in a collaborative process between the GRC, Animalia (who manage the Sheep Control System) and the breed societies (Anna Rehnberg, senior advisor at GRC, 2016 - interview).

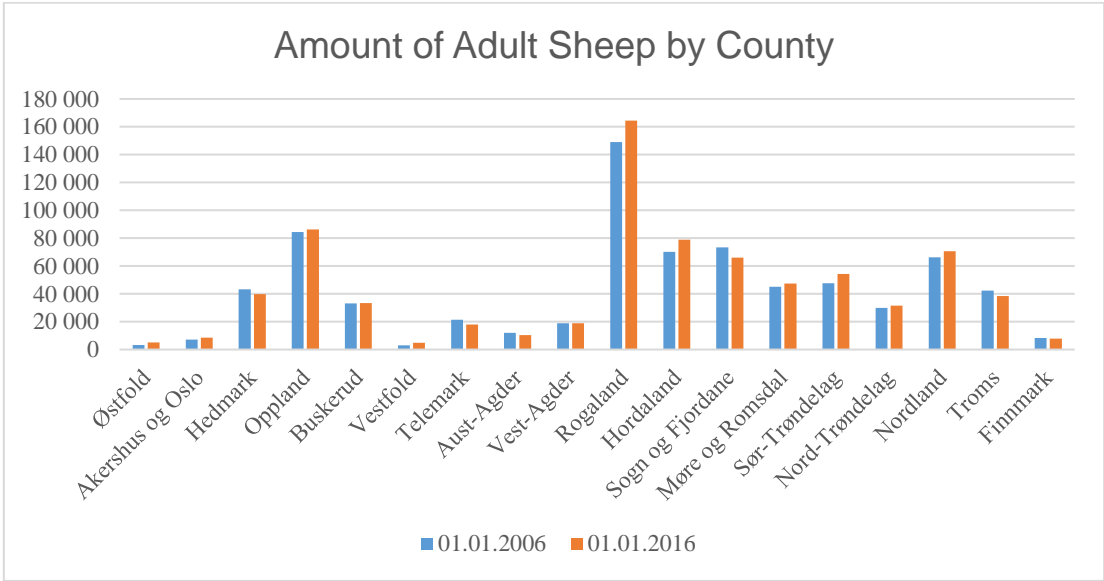


Figure 2 - Amount of Adult Sheep by County (Adapted from Landbruksdirektoratet, 2016)

Figure 2 shows that the total number of adult sheep in South- and North-Trøndelag has increased slightly since 2006. The combined number of sheep in 2016 from both counties comes to 85 893, making Trøndelag the third largest sheep county in Norway once they have merged.

2.3.2 Local Quality

Although this study mainly focuses on the production and processes of wool, sheep farming naturally has a joint production of meat and wool. As explained in Chapter 2.1, sheep farming today is predominantly focused on the production of meat. Norwegian agriculture has been undergoing structural changes resulting in larger farms run by fewer farmers (Norway,

Fylkestingene i Sør- og Nord-Trøndelag, 2012; Knutsen, 2016). There has also been a reduction in land-use for agricultural purposes (Norges Bondelag, 2016). South-Trøndelag is regarded as the worst county in Norway for reducing the amount of land available for food production (Norges Bondelag, undated). This happens even though it is widely recognised that food production is even more essential worldwide, due to an increasing population (FN-Sambandet, 2016). *Norges Bondelag* (Norwegian Farmer's Union) and *Småbrukarlag* (The Smallholders Union) are now prioritising small and medium sized farms for investments to help maintain widespread Norwegian production, providing food and employment to regional and urban Norway (Knutsen, 2016; Norges Bondelag, 2016).

Local food development is of national interest. *Landbruks- og Matdepartementet* (Ministry of Agriculture and Food), sees a potential for economic growth in that sector which can in turn have positive effects on the local society and regional development (Norway, Landbruks- og Matdepartement, 2015). Trøndelag focuses on developing businesses which specialise in local food production, and has over 130 small and large firms selling a large variety of speciality products. Farmers are already working within networks to help increase sales and distribution, as well as marketing collaboration through organisations such as *Bondens Marked* (The Farmers Market) (Nord-Trøndelag Fylkeskommune, 2010). The Farmers Market was established in Trøndelag in 2003 and offers customers local food from the farm, produced on a small scale and usually sold directly by the producer. The focus is on quality food not easily found in other places, as opposed to marketing for price. The *Trøndersk Matfestival* (Trønders Food Festival), began in 2005 with sales and marketing of local food from the traditional to new specialities; today the festival attracts between 150 - 200,000 visitors (Oi!, undated).

Local food is seen as environmentally responsible as it uses less fossil fuels through minimum transportation, (food miles) and is known in Norwegian as *Kortreist* or short-travelled (Bondensmarked Trøndelag, undated). A report from *Kommunesektorens Organisasjon* (The Norwegian Association of Local and Regional Authorities), points to food and transportation as key factors for helping to find solutions to reducing greenhouse gas emissions, in accordance with the Paris Agreement (see Chapter 3.1). The report, *Kortreist kvalitet* (Short-Travelled Quality) emphasises the concept of “local quality” as a strategy for becoming a low-emission society with sustainable use of local resources:

“The concept “Local quality" reflects a unifying strategy for the transition process. The efforts to reduce greenhouse gas emissions can thus be linked to the focus on local resources, and how environmental, social and cultural qualities can form a sustainable basis for a totally far more efficient and locally based circulation economy” (Kommunsektorens Organisasjon, 2016, p.7).

2.4 Summary

This chapter briefly discussed the historical development of Norwegian agriculture, in relation to sheep and the reduced economic values the traditional, naturally pigmented breeds have within the current system. Some basic statistics on Trøndelag show that agriculture and food production is an important source of employment in the region. Trøndelag’s established tradition for local food networks was mentioned, alongside the belief that local production can increase regional identity and economy, as well as assisting a transition towards a low-emission society. A White paper from the Ministry of Agriculture and Food and a report from the Norwegian Association of Local and Regional Authorities, both suggest that a focus on local quality production can offer sustainable solutions, and is to be encouraged on both local and national scales. These are issues central to the theoretical frameworks of this study.

3 THEORY

This chapter gives an overview of the main theoretical concepts that have particular relevance to this research. Beginning with a review of sustainable development; how it relates to the role of enterprises, to regional development and to the research in this study. Local food is discussed as a better known example of a local movement comparable to this study's case of the local wool industry. Examples of these movements within the bio- or eco-economy are working towards sustainable regional development often on a small-scale. The concept of 'slow' food and fashion is mentioned in connection to the value placed on traceability of products and their potential as 'micro-clusters'. This is also shown to have similarities to and potential for the local wool industry in Trøndelag. Networking is introduced as an important method for achieving sustainable goals on personal, organisational and regional levels. Finally, Actor-Network Theory (ANT) is presented as a relational approach used in human geography and as a theoretical framework and methodology for this research. The holistic aspects of ANT are shown to work together with ecological thinking, offering potential for a better understanding of sustainable regional development in connection to Trøndelag's local wool industry.

3.1 Sustainable Development

Sustainability is a word that is used very often in the media, academia and in daily conversations. However, as a concept, it needs some explanation to define which aspects of sustainability are being referred to in the research. Ehrenfeld's definition of sustainability, "as the *possibility* that all forms of life will flourish forever", reflects a belief in the potential for humans to create a more egalitarian world (Ehrenfeld, 2005, p.24 - original emphasis). This definition could well be described as coming from an ecological perspective; taking into account all forms of life, not just humans. Ecology, as the study of innumerable complex relations between "organisms and their environment" (Smith & Smith, 2015, p.18) is dependent on these complex relationships functioning in order to 'flourish'.

From a mainly economic perspective, the term 'sustainable development' is commonly used. The best known definition comes from the World Commission on Environment and Development (WCED) in the document 'Our Common Future' also known as The Brundtland report:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs” (WCED, 1987, p.41).

This definition is also the basis for the United Nations Environmental Programme’s (UNEP) description of sustainable development resting equally on three pillars; society, economy and the environment (UNEP, 2002). This is perhaps better known as the “triple bottom line” of sustainable development, first conceived by John Elkington in 1997 (Elkington, 2006, p.523).



Figure 3 - The Triple Bottom Line of Sustainable Development (Office of Environmental Sustainability, 2017)

Research emphasising the importance of sustainable development is a response to the environmental, social and economic crises bringing increasingly negative effects to all our planet’s inhabitants. The current situation of rapidly growing population combined with a culture of consumerism and drive for economic growth, is seen as increasingly unsustainable (UNEP, 2012). It is widely believed that it is the pressure of humans on the Earth system, that has resulted in local, regional and global thresholds exceeding safe levels (UNEP, 2012; Steffen et al., 2015). Griggs et al. (2013) suggested a new definition of sustainable development that could reflect the changes required:

“Sustainable development [is] development that meets the needs of the present while safeguarding Earth’s life-support system, on which the welfare of current and future generations depends” (p.306).

This definition acknowledges the necessity to work with the triple bottom line of sustainable development but places more emphasis on the environmental aspects, recognising that the social and therefore economic aspects are fully dependant on a healthy, functioning planet.

Figure 4 below is adapted from Griggs et al. (2013) and shows the diagram they use for defining sustainable development:

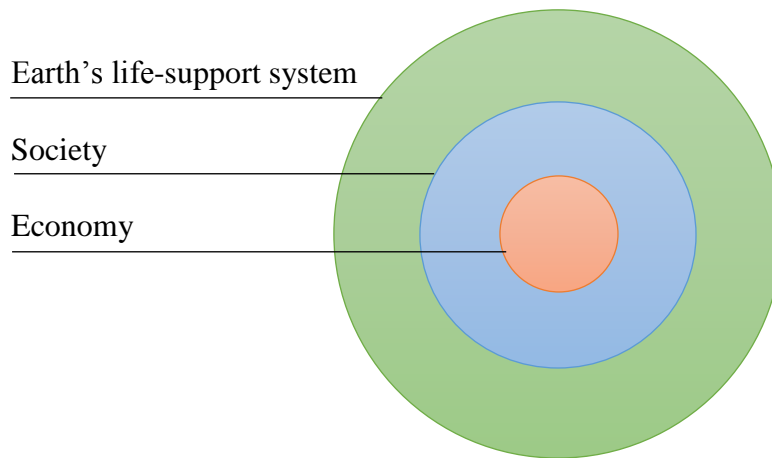


Figure 4 - "Nested Concept" of Sustainable Development (Griggs et al., 2013, p.306)

In 2015, several ground-breaking reports were published reaffirming sustainable development as a necessary step for preserving the planet as well as peace and prosperity. Steffen et al. (2015) published an updated report of the Rockström et al. (2009) research, stressing the threat to the planet's resilience from human activities. A "safe operating space" is illustrated as a place where humanity needs to remain in order to thrive (Steffen et al., 2015, p.736). In relation to the nitrogen and phosphorous flows, biodiversity and changes to climate and land-use it is suggested humanity needs to make drastic changes if it can come back within a safe threshold (Steffen et al., 2015). The revised development goals were also published by the UN General Assembly. The 2030 Agenda for Sustainable Development, established a global action plan of 17 Sustainable Development Goals (SDGs) designed for people, planet, prosperity, peace and partnership (UN General Assembly, 2015). The Agenda recognises the need for a global shift towards a more sustainable, resilient and equitable future for all. The goals are made up of 169 targets, designed to help balance the triple bottom line of sustainable development within all countries through stakeholder collaboration. The United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties, twenty-first session (COP21) also produced a draft climate agreement, known as The Paris Agreement, for unifying the world's nations in moving towards becoming low-emission societies (UNFCCC, 2015). COP22, which coincided with the Agreement's "entry into force" in November 2016 (UNFCCC, 2017) and saw world leaders declare a global commitment to climate action as an "irreversible momentum" (COP22, 2016, p.1). These reports highlight that change is needed and contributions from all levels of society is the only way to achieve 'the future we want' (UNEP, 2012).

3.1.1 The role of small enterprises

Small and medium-sized enterprises (SMEs) are regarded as incorporating the major part of a nation's economy, and therefore potentially contributing largely to environmental impacts (Hillary, 2000). Achieving sustainable development on a global scale to ensure the welfare of future generations will require drastic changes also at the local level. As Dicken (2015) states, it is at the local level where the difference is made to everyday lives, even where issues at hand are regarded as global. The radical changes that are needed to reverse the unsustainable system means that 'business as usual' is not an option (Senge et al., 2007). Textiles and the clothing industry have a poor track record when it comes to sustainability, especially with environmental and social issues (Gardetti, 2017 in Muthu, 2017). Agriculture is also regarded as an area that needs to move towards more sustainable production methods (Cooper, 2011). Small-scale farming has an important role to play in the move towards global (and local) security regarding food, employment and the environment (UNEP, 2015). Sustainability is thus an important topic for research into Trøndelag's local wool industry of sheep farmers and small-scale yarn processing for textiles.

The market for consumerism that has grown out of economic development has created unsustainable patterns for the environment and therefore, humans (Ehrenfeld, 2005). The realisation that sustainability needs to incorporate the social, environmental and economic aspects at global, national and local levels is becoming more widespread in society. The SDGs can offer guidelines for how society can achieve a mutual sustainable development vision through collaboration (Hajer et al., 2015). Government enforced regulations alone cannot solve all the problems; business and industry, farmers and people everywhere have a part to play (Hajer et al., 2015). The local wool industry of Trøndelag is already working towards targets under four of the SDGs. Currently the following goals are included, taken from the UN General Assembly report (2015, p.14):

“Goal 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable.

Goal 12 - Ensure sustainable consumption and production patterns.

Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.”

Aspects of sustainability from the SDGs targets covered by the local wool industry are resource efficiency, protection and promotion of cultural and natural heritage, conservation and biodiversity. These will be discussed in the Analysis (see Chapter 5).

The need for collaboration to create change and more sustainable ways of thinking has also resulted in environmentally-focused bottom-up movements such as local food, local clothing manufacture and ‘Transition Towns’ (Hopkins, 2008). Local movements and their connection to Trøndelag’s local wool industry will be outlined in Chapter 3.2.1. However, a brief explanation of Transition Towns is given here. The Transition Initiative began in Ireland in 2000, based on permaculture teachings and works towards creating local resilience through low energy consumption, independence from oil and collective action (Hopkins, 2008). These environmentally-focused movements are working towards a deep level of sustainability that harmonises with the Griggs et al. (2013) definition mentioned above (see Figure 4). In turn, the Griggs et al. definition of sustainable development corresponds with Ehrenfeld’s (2005) definition of sustainability (Chapter 3.1), in that they both have a deeper focus on environmental perspectives. It is these definitions that guide the research into the sustainable aspects of Trøndelag’s local wool industry, by considering all values that are given by the research subjects. Sustainability in this study regards the environmental aspects first, without ignoring or specifically focusing on the need for economic sustainability in small-scale regional development.

3.2 Sustainable Regional Development

Regions are growing in importance in relation to sustainable development (Pike et al., 2006; Marsden, 2016). Pike et al. explain how the concept of sustainability has increasingly influenced local and regional development, to the point of challenging the methods that are traditionally focused on economic growth. As environmental awareness becomes more widespread, the need for development to reduce environmental damage and provide longer-lasting solutions has become more apparent. This has led to finding ways to incorporate environmental, social and economic aspects simultaneously, in accordance with varying levels of prioritisation (Pike et al., 2006). The Regional Plan Strategy for Trøndelag (2016-2020) cites sustainability as one of three main goals for the region, recognising that global issues, like climate change, will also have local impacts. The planned strategy of “balanced development” focuses on collaboration between cities, towns and rural areas as well as development that balance social, environmental and economic sustainability (Norway, Fylkestingene i Sør- og

Nord-Trøndelag, 2016, pp.3-5 - my translation). This study seeks to illustrate the effects the local wool industry in Trøndelag have on regional sustainability issues.

Sustainable development can differ from “weaker forms” to “stronger forms”. Weaker forms refer to economic growth pursued through more efficient use of resources, renewable energy and implementing environmental practices as a way to create economic growth. Pike et al. (2006) call this “Ecological modernisation” and suggest that on a policy level, this method has most influenced local and regional development (p.115). Stronger forms of sustainable development relate to locally organised, often small-scale approaches toward self-sufficiency, such as “local trading networks and ecological taxes” (Pike et al., 2006, p.117) or the “Transition Towns” movement (Kommunesektorens Organisasjon, 2016, p.47). There has been criticism regarding both forms, including doubt over whether weaker sustainable development can achieve the necessary goals of economic, social and environmental sustainability. Stronger forms are criticised for being overly idealistic or limited to small-scale solutions only (Pike et al., 2006). However, small-scale operations are often seen as favourable regional initiatives in connection to farming and local food production (Murdoch, 2000; Pike, 2006; Marsden, 2016) which operate in similar ways to local wool processing. There has been a great deal of research on local food production and effects on regional or rural communities. Many farmers that are producing wool for the local wool industry in Trøndelag are also involved in food production as in that way all resources are utilised from the sheep. Theory related to local food production or clothing production covers similar issues for the farmers involved with the wool industry and is therefore relevant to this research.

3.2.1 The ‘Local’ Movement

As mentioned in Chapter 2.3.2, local food production is regarded as an important area for regional development both nationally and with a particular focus in Trøndelag. The strategic plan for Trøndelag prioritises food, linking it to tourism, culture and the experience industry (Norway, Fylkestingene i Sør- og Nord-Trøndelag, 2016). The plan also states that local food, as an already established renewable agricultural resource, has potential for further development. Interestingly, wool is not mentioned, although it can also be described as a renewable agricultural resource with potential for further development in the region. Generally, wool is classed as one of the four “most important livestock products in Norwegian agriculture” (Knutsen, 2016, p.22 - my translation).

Production and processing of food and wool come under the definition of 'bio-economy'. The bio-economy has been described as, "all industries and economic sectors that produce, manage, and exploit biological resources" (Swinnen & Riera, 2012, p.1). A further definition states; "It is much more than just biomass-based production or biotechnology. Bio-economy is a societal strategy to combat climate change and the increasing scarcity of natural resources" (Luoma et al., 2011, p.4). Bio-economy development is documented in Trøndelag's strategic regional plan as being significant for achieving sustainability in the region through labour, knowledge and information networks (Norway, Fylkestingene i Sør- og Nord-Trøndelag, 2016). Kitchen & Marsden (2009) use the term 'eco-economy' as an alternative for bio-economy which they see as operating at the corporate, international level:

"[U]sing the term eco-economy places an emphasis upon the recalibration of micro-economic behaviour and practices that, added together, can potentially realign production consumption chains and capture local and regional value between rural and urban spaces" (p.275).

Countryside, landscape, biodiversity, agriculture and tourism are aspects that they categorise as 'eco-economy' which can be associated with the local wool industry. Recognition of the local wool industry's utilisation of natural resources can potentially be beneficial to development of the local industry and to the region's sustainable development. Marsden (2016) argues that rural-regional eco-economies relying mainly on transforming resources from nature can become, "key potential driver[s] for real sustainability transitions" (p.598).

As consumption of biological resources rises along with population, increased demands on the bio-economy can cause conflict, resource restraints and poverty (Swinnen & Riera, 2012). This can also apply to fibre, which has always held importance as a natural, agricultural resource (Swinnen & Riera, 2012). A bio-based economy with a strong focus on local production of housing, food, energy and clothing is considered a possible solution to avoid conflict situations (Luoma et al., 2011). Local resilience to climatic and environmental change can be developed from the physical and social resources found in the region (Marsden, 2016). Development of local enterprises based on local resources may initially result in higher material and labour costs. However, reduced transportation costs, increased manufacturing skills and better visibility of the supply chain and processes can offer economic, environmental and social benefits for the region and beyond (Luoma et al., 2011; Ashby, 2016). Wool is a resource that is being grown in Norway and the knitting trend is booming (Klepp et al., 2016b). Historically and currently, knitting has been responsible for clothing the Norwegian and indeed many other populations (Klepp & Tobiasson, 2013).

Traceability, Slow Trends & the Importance of 'Place'

Environmental and ethical awareness has resulted in consumers demanding more information as to where products originate; from sourcing of raw materials to processing the finished products (Luoma et al., 2011; Bradu et al., 2013; Ashby, 2016). Traceability can have a stronger impact on the consumer than organic labelling, where the ethical information is effectively expressed (Bradu et al., 2013). Communicating the ethical nature of local food production is also shown to increase consumer preference for local food over organic food (Hempel & Hamm, 2015). The local food movement adheres to the consumer's preference for traceability and transparency through selling the local story of their products directly to customers (see Chapter 2.3.2) a practice often used by farmers selling local yarns. A recent report has also brought attention to the need for labelling Norwegian wool (as is already being done with Norwegian food), in order to increase the traceability which links the product to good animal welfare, environmental practice and ethics (Vittersø et al., 2017).

Utilising local farm produce is one of the main characteristics of the 'slow food' movement, which gained popularity through providing customers with traceable food connected to the community where it was produced. 'Slow fashion' has taken inspiration from the 'slow food' movement, focusing on locally sourced materials, production traceability and longer-lasting, better quality products (Pookulangara & Shephard, 2013). The local raw material available for clothing in the Trøndelag region is currently wool, being made into yarns, which can be (and has been) used for local fashion (Bårdsgård, 2016). The 'slow' movement, like the 'local' movement, is a means of supporting the local or regional economy as well as reducing negative impacts on the environment (Pookulangara & Shephard, 2013; Ashby, 2016). Connections between the 'slow' food and fibre or fashion movements deepen as we look to the necessity of building a network of relations to help create a more sustainable future:

“The slow culture vocabulary of small-scale production, traditional craft techniques, local materials and markets, that has proved so successful in food [...] It challenges growth fashion's obsession with mass-production [...] It offers a changed set of power relations between fashion creators and consumers compared with growth fashion, based on the forging of relationships and trust that is possible at smaller scales” (Fletcher, 2010, p.264).

The local yarns being spun and sold directly from farmers or through Selbu spinning mill, are directly traceable to the location and actual sheep. Some farmers use this traceability to help sell their products as will be shown in the Analysis (under *Marketing & Collaboration in* Chapter 5.2.2).

Use of traceability and connecting a location to a product for marketing purposes brings attention to the importance of 'place' from a relational geographic perspective. Cresswell (2013) explains how geographers have always been interested in researching places but that humanistic geographers in the 1970s helped bring attention to the more emotional connection people have with 'place'. Massey (1995) talks about the need for "reconceptualising places" and recognising the relational activity that helps create the experience of place (p.72). Later, Massey refers to places as being relational meeting places and a product of the connections made in that time and place (Berg & Dale, 2015). In this way, the yarns created from particular sheep that have been grazing in areas known to potential customers can connect the knitted products to the physical nature of that place. This creates meaning through the experience of relating to the place (Cresswell, 2013). Pine & Gilmore (1998) also link experience into important aspects for adding economic value to a product or service. This topic is referred to again in the Analysis (see Chapter 5.2.2).

3.2.2 Networking

Networks are an important part of our daily lives on personal and organisational levels; boosting employment opportunities or support mechanisms (Hanson, 2000); motivating regional growth through complex social relations (Murdoch, 2000) or innovative entrepreneurship (Huggins & Thompson, 2015) and assisting in sustainable regional development through stakeholder collaboration (Sarkis et al., 2010; Ingulfsvann et al., 2014; Marsden, 2016). In connection with local food or clothing networks, it is noted that the existence of already established personal relationships in rural regions can assist innovation and growth in these fields (Murdoch, 2000; Ashby, 2016). These relationships, whether between small farms or through an organisation's supply chain, are often based on trust, information exchange and shared purpose (Murdoch, 2000; Ashby, 2016). This study enquires into this aspect in relation to the local wool network.

When regarding issues of sustainability or sustainable development, research points to the need for more collaboration and network-building between all stakeholders in local and regional settings (Sarkis et al., 2010; Ingulfsvann et al., 2014). This includes local enterprises, communities, local government agencies and academic institutions working together in support of endogenous development or 'bottom-up' approaches (Murdoch, 2000; Sarkis et al., 2010). Rural innovative networks are often based on the use of local, natural resources and develop from previously established networks within the agricultural sector (Murdoch, 2000). The local food sector is such an example where farms, processors and retail outlets work together in close networks creating shared value in the region, from natural resources and human capital

(Murdoch, 2000; Michael, 2006). Similarities between local food and local wool networks, based on farming natural resources would suggest that this theory is relevant to Trøndelag's wool industry.

Local food or textile networks can also be potentially described as 'micro-clusters', where unique products are sold from small firms located in a relatively close area:

“[T]he term “*micro-cluster*” was coined to refer to the geographic concentration of a small number of firms in a cohesive local environment (Michael, 2003), where the complementary interaction between those firms contributed to an enhanced level of local specialisation. A micro-cluster, then, is defined by its local context, and the unique identification of its product.” (Michael, 2006, p.2-3).

Micro-clusters are also dependant on a network of people sharing a vision for the community, or region in order for the cluster to succeed and be sustainable on economic, social and environmental levels. Local government agencies can assist in supportive roles, especially where tourism is also a consequence of the micro-cluster (Michael, 2006). Supportive roles can range from financial assistance to facilitating opportunities or new members into the cluster (Michael, 2006). Support for network-building needs to be linked to the particular cultural, social, environmental and economic circumstances that affect that region (Murdoch, 2000; Michael, 2006). The concept of micro-clusters will be looked at in relation to Trøndelag's local wool industry to establish if this is an appropriate term for what is happening, or if there is potential to incorporate the concept in future development.

It is perhaps undeniable that all stakeholders consider networking intrinsic to the sustainable development of regions. However, Murdoch (2000) states an interesting point in that, “it is not the networks themselves that are so important but the objects and relations that flow through them” (p.417). ANT offers a framework and methodology for looking further into the relations, between both humans and non-humans that lead to the construction and reconstruction of actor-networks, and “the social in general” (Bosco, 2006, p.2).

3.3 Actor-Network Theory

3.3.1 Origins and Basics of ANT

ANT originated in the 1980s through the work of Bruno Latour, John Law and Michel Callon, although other authors are also associated with this approach (Bosco, 2006). Rooted in sociology, the approach came about in order to understand and describe the connections between science, technology and society (Bosco, 2006; Ponti, 2012; Hassard; 2013). Callon used the term “sociology of translation” to define how ANT can be used to comprehend

complex socio-technical situations, by looking at the ‘translations’ or transformations of all involved in an actor-network (Ponti, 2012; Hassard, 2013). These translations refer to the connections or communication made between actors, through constant relational activity, that bring order to their lives and simultaneously create new dynamics, or transformations (Jóhannesson & Bærenholdt, 2009; Dankert, 2012).

One of the fundamental concepts of ANT is the heterogeneity of the actor-network, wherein human and non-human entities are recognised as being in relation (Law, 1992) without making “privileged distinctions” between them (Bosco, 2006, p.5). Actors can be as diverse as an individual human or animal, an object or tool, a concept or a policy (Dankart, 2012; Ponti, 2012). To incorporate the diversity of actors in ANT, the term ‘actant’ is more readily used; describing something that takes part in action; experiencing or causing an action (Latour, 2005; Dankart, 2012). According to Latour (2005) the way to discover if something is an actant is to ask the following question: “Does it make a difference in the course of some other agent’s action or not?” (p.71). The ability to affect or change ‘other agents’, or actants, is called ‘agency’ (Dankart, 2012). In accepting that objects, animals or equipment can also have agency, the human subject becomes ‘decentred’ (Law, 1992; Bosco, 2006; Jones, 2009). Traditional ideas of hierarchy should be dropped, to allow power relations to be revealed through relational activity in actor-networks that constantly change (Latour, 2005; Bosco, 2006).

To follow the example of Bosco (2006) as inspired by John Law, I can describe how this master thesis could not be written without the computer and keyboard; the books and articles found and ordered through the library system; the internet; help from friends, family and supervisor; even the black tea that keeps me alert is a part of the actor-network for completing my master thesis. This is in addition to the research subjects, telephone, recording equipment and transport that enabled generating empirical data through the interviews. In relation to the actor-network being studied in this research, there are of course people involved but there are also sheep, wool, landscapes, machinery, agricultural policies and systems to name but a few non-human actants.

Through ANT, the relations or connections between actants are ‘traced’ to discover how the networks were established, what keeps them together (or why they fail), and what the effects of the relations are (Latour, 2005; Bosco, 2012; Dankart, 2012). Tracing the network connections requires listening to the research subjects, following their words from the empirical data and trusting the narratives given (Latour, 2005; Jóhannesson & Bærenholdt, 2009; Ponti, 2012). As Ponti (2012) succinctly summarises Latour:

“In ANT, the "explanatory" must be something that is included in the data. This position does not recognise that data speaks for itself or that a larger context exists. It only suggests that analysts should follow the actions of the "actors" and avoid imposing general and abstract principles on what they study” (p.2).

Qualitative research within human geography is defined as incorporating investigative methods that allow for analysis of human experiences (Winchester & Rofe, 2010). In this research, reflection and analysis of the informants own descriptive narratives were carried out to trace the connections of a small-scale wool industry to sustainable regional values. Illumination of environmental, social and economic issues could highlight the viability or impracticality of such a venture, as well as suggest potential improvements through collaboration or networking. As Murdoch (2000) states:

“[A] concern with networks does not provide “the answer” to the problem of rural development; it simply shows how we might create new opportunities by rethinking some of our traditional approaches” (p.417).

Networks are always seen as actor-networks where relations change and new dynamics are created (Jóhannesson & Bærenholdt, 2009). To understand what is happening in a given situation, the relational activity between human and non-human actants must be traced; discovering the organisation and power relations of the actor-network (Latour, 2005; Jóhannesson & Bærenholdt, 2009; Bosco, 2012; Dankart, 2012). This can sometimes lead to surprising or unexpected results (Ponti, 2012; Dankart, 2012).

3.3.2 ANT in Geography

ANT has been used with various social sciences (Hassard, 2013), becoming visible in geography in the mid to late 1990s (Jóhannesson & Bærenholdt, 2009; Cresswell, 2013). From a geographical perspective, ANT has been said to be useful in working through problems with dualistic thinking, such as structure/agency, local/global, culture/nature or realism/social constructionism (Murdoch, 1998; Jóhannesson & Bærenholdt, 2009; Cresswell, 2013). Issues such as global warming or the increased use of information technology were seen to blur the boundary between identifying nature, culture or the social (Jóhannesson & Bærenholdt, 2009). However, ANT’s approach to follow the world of the actants requires the researcher to avoid using preconceived ideas of what social, cultural or natural are. As Latour (2005) states:

“[W]e want to leave the actors free to deploy the full incommensurability of their own worldmaking activities. Be prepared to cast off agency, structure, psyche, time, and space along with every other philosophical and anthropological category, no matter how deeply rooted in common sense they may appear to be” (p.24).

Allowing non-human actants equal agency to human subjects has also been seen as an important aspect of ANT for geography (Cresswell, 2013). This has led to insightful studies of wildlife and biodiversity (Whatmore, 2002); deeper thinking on the relationship between culture and nature (Jones, 2009) and social-ecological analysis (Dwiartama & Rosin, 2014); to name but a few. This also connects in to issues of 'place' from an ANT perspective. Our relationship to the world is not only established through connections to other people but to all elements; human, biological, technical or conceptual that connect into the network, or do not (Berg & Dale, 2015). Relating to non-human actants has led to the concept of hybrid geographies (Whatmore, 2002; Cresswell; 2013) as well as hybrid places (Massey, 2005; Berg & Dale, 2015). The idea of hybrid networks is based on an understanding that places are made through the interactions between people and other elements (Berg & Dale, 2015). The relational activity between heterogeneous elements including those that are non-human or non-organic creates similarities between ANT and 'assemblage theory' (Berg & Dale, 2015). The term 'assemblage' has also been used to describe the connections of actants through space and time in what Latour (2005) calls "local interaction" (p.194). Jóhannesson & Bærenholdt (2009) also describe the creation of assemblages as part of ANT's "productive force" (p.18). The relational activity between diversely different actants; creating openness for how places are formed and kept together, is central to 'assemblage theory' (Anderson et al., 2012). Relational thinking of assemblage is looking at the internal and external interactions or tensions between stability and change that occur in the process of assemblage (Berg & Dale, 2015). Assemblage theory is not necessarily seen as a substitute network theory to ANT (MacFarlane, 2011 In: Berg & Dale, 2015).

It is the openness to alternative relational activity between animate and inanimate actants; leading potentially to changes in power relations between things (Bennet, 2010), that makes ANT particularly relevant to this research. Allowing the sheep equal agency to the farmers, the mountains or some as yet unknown inanimate element, can result in recognising their necessity in the creation of the network or transforming other elements within it. Agency is produced through the act of relating in networks and therefore changes the focus, leaving no room for dualistic thinking (Cresswell, 2013). He explains that looking at the connections between things instead of the physical or 'topographical' differences can also be described as a 'topological' focus, often associated with relational geography. The act of relating is not necessarily constrained by scale or place (Cresswell, 2013). This aspect of ANT has given rise to new considerations on space, time and place (Murdoch, 1998) including how the researcher sees their own fieldwork (Jóhannesson & Bærenholdt, 2009). There is more on this in Chapter 3.3.3.

ANT's topological standpoint implies a constructivist theory (Mol & Law, 1994; Dankart, 2012; Cresswell, 2013) although it has been described as providing a middle ground between social constructionism and realism (Jóhannesson & Bærenholdt, 2009). Cresswell (2013) comments on ANT's insistence on non-humans being so much more than simply constructed by humans and therefore moving away from social constructionism. Yet he also acknowledges ANT as constructivist in that the social, or reality is generated through relational networks (Jóhannesson & Bærenholdt, 2009; Cresswell, 2013).

Although ANT is said to offer an in-depth view of networks and relational activity, it is also criticised for being apolitical, not engaging questions such as why different relations matter (Bosco, 2006), or the “ethical or unethical means” behind the relations (Hassard, 2013, p.5). However, in connection to ecological studies, ANT appears to address politics and ethics. It is argued that Whatmore's “Topologies of Wildlife” (2002, pp.12-34) develops both ethical and political thinking in connection to environmental and conservation issues (Bosco, 2006). Political agency has also been said to require actor-networks and relational activity in order to enable resilience within social-ecological systems (Dwiartama & Rosin, 2014). Consequences of dualistic thinking around the topic of the nature/culture divide also uncovers new approaches to understanding the politics, ethics and balance of power associated with current environmental challenges (Jones, 2009). Cresswell also notes that the question of power in agency between different actants is open to criticism, when considering who or what can intentionally change or replace parts of the network (Cresswell, 2013). Latour states that ‘power’ is exactly one such category that potentially carries fixed presumptions and should be examined on a relational basis (Latour, 2005). Other researchers have stated that ANT is particularly interested in power, precisely through looking at the relational activity bringing networks together (Bosco, 2006) or examining complex power relations (Murdoch, 2000; Jóhannesson & Bærenholdt, 2009).

3.3.3 ANT as a Methodology

Human geography is described as having experienced a “cultural turn”, including a move towards more qualitative research methods such as interviewing (Ruming, 2009, p.451). This has also shed light on subjectivity in research, or the impossibility of objectivity as the researcher's own experiences, interests or position have an impact on all aspects of research (Ruming, 2009; Dowling, 2010). ANT takes this concept further through recognising the research field as an actor-network and therefore the researcher as an actant, having a role in the network's creation (Ruming, 2009; Jóhannesson & Bærenholdt, 2009). This aspect is of relevance to this research as my interest and experience in wool has influenced the choice of

research topic and places me firmly in the role of actant. Ruming (2009) explains that positionality not only helps construct the research but that interpretations of the actor-network are also positioned in relation to the researcher. This may of course affect the analysis of the research but also positionality is used, “for the purpose of gaining access to a diverse set of actors” (Ruming, 2009, p.465). My own positionality is described in more detail in Chapter 4.3.1. However, to help clarify this point here; introducing myself to the farmers as a feltmaker (having worked creatively with wool for many years) may have given me access to different ‘inside’ information.

ANT has been described as a methodology that tries to “capture the complexity of our world today” (Bosco, 2006, p.2). This is done by focusing on the empirical data collected during fieldwork and tracing the human and non-human connections (Dankart, 2012). This holistic approach to ANT (Dankart, 2012); namely the heterogeneity of relations and equality of traceable actants, suggests a possible affinity between ecological thinking and social theory (Dwiartama & Rosin, 2014). Dankart (2012) states that ANT research is useful to investigate complex issues. Sustainability is generally seen as an increasingly complex issue (Elkington, 2006; Senge et al., 2007) as well as central to regional development policy (Norway, Fylkestingene i Sør- og Nord-Trøndelag, 2016) and can therefore, potentially be better understood through an ANT approach. Assembling the actor-networks involved in establishing, developing and maintaining the local wool industry in Trøndelag may help discover the potential for further development in relation to sustainable regional development. It can also help understand potential areas of vulnerability:

“[U]ncovering the heterogeneous ‘actor networks’ of associations allows us to explain the mechanics of power and organization in society, and to understand how different things [...] come to be, how they endure over time, or how they fail” (Bosco, 2006, p.3).

3.4 Summary

In this chapter, the concept of sustainable development was discussed to present the need for a deeper focus on the environmental aspects, accepting that social and economic aspects are dependent on this. Collaboration on all levels of society was seen as essential for creating the sustainable changes needed on global, regional and local levels. Local governmental policy recognises the need for incorporating sustainability into regional development, as defined in Trøndelag’s strategic plans. Research also shows that endogenous development can motivate sustainable movements, especially where local resources are used from within the agricultural sector. Networking is an essential element to build on this as well as to stimulate collaboration

within all stakeholders. It is perhaps important to look at the relational content of networks in new ways when considering sustainable development from a deeper ecological perspective.

ANT's relational approach accepts both human and non-human relations as having agency and therefore able to bring about change. As a holistic methodology, ANT may be beneficial to ecologically-focused research, potentially uncovering vulnerability or the need for development. ANT is known for showing unexpected results as well as positioning the researcher in the actor-network being researched. This aspect of ANT will be covered in more detail in the next chapter.

4 RESEARCH METHODS

This chapter describes the qualitative research process used to study how Trøndelag's small-scale wool industry was established, maintained and developed and any effects this can have on sustainable regional development. It begins with a description of the case study design, including semi-structured interviews, and a short period of participant observation at Selbu spinning mill. The research process is described further in order to clarify the choice of interviewees, the interview questions and analysis of the data. Finally, ethics, my positionality and trustworthiness are also examined to help validate the research.

4.1 Case Study

Case study research is described as being of particular relevance when investigating contemporary social phenomena in detail; looking into how or why something is occurring (Yin, 2014). A qualitative case study design was used here to enquire as to why and how a regional wool network in Trøndelag was established, maintained and developed by the individuals, both directly and indirectly involved. Recent media attention on Norwegian wool perhaps reflects an increasing interest in the development of the wool industry throughout Norway (Lillekvelland, 2017; Hoffengh & Rusdal, 2017; Grann, 2017). Trøndelag's wool industry, which is based around the establishment of Selbu spinning mill in 2010, offers a contemporary case of regional and national interest.

To gain an in-depth understanding of the network involved in wool production and processing from different perspectives, I wanted to design a "holistic case study" (Yin, 2014, p.55). This research focuses on the network as a whole, and the value of the connections or interactions between each actant. This corresponds with the way Baxter (2010), describes case study research below:

“[T]he qualitative case study researcher [...] prefers to study one carefully selected community intensively and holistically to understand how the various things studied interact with one another in, for example, one place” (p.85).

The initial focal point for studying the network of Trøndelag's wool industry was Selbu spinning mill, suggesting a single case design. The spinning mill produces its own yarns for sale but has a direct network of farmers, who commission-spin their own wool, many of whom sell their own yarns. The spinning mill has a wider network of collaboration with Norilia and their regional wool station at Malvik, South-Trøndelag. Local government, the NFACA, other Norwegian spinning mills and various research organisations, are all linked to the network for establishing and maintaining the spinning mill. The farmers in turn have their own networks

that interlink with some of the same organisations. As already mentioned in Chapter 3.3.3, the theoretical framework of ANT advocates recognition of all actants equally, be they human, animal or inanimate, which could be seen as a holistic approach (Dankart, 2012). The case study was thereby designed as a single, holistic case. Yin (2014) suggests that multiple case studies tend to offer stronger designs than single cases, being able to use replication as a form of “external validity” to help define the quality of the research (Yin, 2014, p.45). Initially a multiple case study was considered with a view to investigating an additional small-scale, regional wool industry in Sweden (see Chapter 1). However, time constraints from the Swedish mill and for achieving the thesis within the time-frame meant this was not feasible. Bui (2009) emphasises the importance of being realistic as to what is feasible within the available timeframe.

To ensure validity in the single holistic case study, Yin (2014) advises using theory to help with external validation of the case findings. The use of “multiple sources of evidence” can also help corroborate findings and “construct validity” or help prevent the collection of data that substantiates the researcher’s viewpoint (Yin, 2014, pp.45-47). Validity was aimed for using theory as well as gathering narratives from many different sources connected to the network.

4.2 Data Construction and Analysis

4.2.1 Semi-Structured Interviews

King & Horrocks (2010), state that interviewing is regarded as the most common method for generating data in a qualitative research design. Open-ended questions should be focused on the interviewees personal experiences, and the confidentiality of informants should be respected, often by assuring anonymity (King & Horrocks, 2010). Interviewing offers the opportunity for ‘collecting’ a diverse range of insights and opinions, but is very time-consuming, from planning the questions to transcribing the recordings (Dunn, 2010). For this study interviews were the obvious choice of method, in order to acquire the appropriate empirical data in the form of narratives needed for tracing relations through ANT methodology (Latour, 2005; Jóhannesson & Bærenholdt, 2009; Ponti, 2012).

Semi-structured interviews were used to allow room for flexibility and further development of the issues during the interview (Dunn, 2010). During the course of the interviews it became apparent that some questions worked better than others at eliciting answers from interviewees. Occasionally, additional topics were brought up by the early interviewees, which resulted in some slight changes to the later interview guides. Several media debates regarding the

sustainability of sheep and wool, and the over-production of lamb meat, also became relevant under later interviews (Bakken, 2016; Veløy, 2016). Changing the interview guide for later interviews is seen as appropriate, as “any insights you gain in the process of carrying out your first few interviews should inform subsequent ones” (King & Horrock, 2010, p.37-38).

Sample participants

“Criterion sampling” describes a method for selecting participants in research that are involved with the same issues, or meet the criterion needed for the study (Bradshaw & Stratford, 2010, p.75). It would be impossible to interview everyone who met the criterion of having had experience with Selbu spinning mill, so selection was made to aim for a broad range of opinions across the network. The initial key informants in this study were Ingvild Espelien, the managing director and co-founder of Selbu spinning mill, and a broad selection of the farmers who commission-spin their wool. The opening interview was conducted with Ingvild Espelien, and during this interview the immediate network for the spinning mill was stated. The commission spinners were cited as the most important part of the network for Selbu spinning mill.

In total, 32 farmers were contacted that had some connection to Selbu spinning mill. The essential criteria were; that they were based in South or North Trøndelag; had kept, or continued to keep the older sheep breeds; had spun or sold wool to the spinning mill, or were interested in doing so. Eleven of these potential interviewees came through Ingvild Espelien and Selbu spinning mill’s mailing list, two contacts were traced through the Old spæl and Grey Trønder sheep breed societies, fourteen were contacted from the member’s register of the Grey Trønder breed society (GTBS), and the last five were contacts previously obtained through a wool seminar held in Tingvoll in 2012. Of the 32 original contacts, 16 interviews were conducted with farmers. Seven of these came through Selbu spinning mill’s mailing list, six through the GTBS, two from the previously held contacts and the leader of the GTBS. The sample list is larger than originally intended, but seemed necessary in order to acquire a broad spectrum of informants in relation to sheep breeds, flock size, how often the contact had collaborated with Selbu spinning mill, as well as ensuring the contacts came through various sources. Ages also ranged from farmers in their early twenties through to pensioners.

All potential informants were sent a preliminary e-mail introducing myself, my course programme at NTNU and giving a brief description of the intended research outline. The interviewees were advised that the interview would take around 45 minutes to an hour. For the majority of the interviews this was the case, however a couple of interviews were finished after

half an hour and several interviews extended to over an hour but only where it was acceptable to the interviewee to continue. One interview was over two hours long! Interviewees were also informed of the wish to record the interview for personal use in the research, and permission was requested again before the actual interview began. Anonymity was assured and therefore the farmers are just given a number, both in the list in Table 3 below and in the Analysis chapter. One farmer was contacted regarding a quote that linked them to their workplace; Fosen *Folkehøgskole* (Folk High School) and they not only approved the quote but suggested using the title of the school.

Table 3 lists the core interviews of the immediate network. Details included are; the position held (part or full-time farmer); whether they or their partner grew up on a farm; their gender; the types of animals farmed; and if they spun or sold wool to the spinning mill. The date of the interviews shows that a second, shorter interview with Ingvild Espelien was held after all other interviews had been completed. This helped clarify questions that came up under the interviews with the farmers. The different sheep breeds and other animals or production on the farm are coded in the table; these codes are explained in the key below the figure.

Table 3 - Core Interviews - The Immediate Network

Subject	Position	*Farming Background	Gender	**Animals	Spun/Sold	Date
Ingvild Espelien	Managing Director, Selbu spinning mill	No	F	-	-	14.09.16 & 30.01.17
Farmer 1	Part-time	Partner - Yes	F	GTS, NWS, NPS +	Spun	4.10.16
Farmer 2	Part-time	Partner - Yes	F	OSS +	-	5.10.16
Farmer 3	Full-time	Partner - Yes	F	GTS +	Spun	6.10.16
Farmer 4	Part-time	Yes	F	GTS	Spun	7.10.16
Farmer 5	Full-time	No	F	GTS, OSS, NWS	Spun	10.10.16
Farmer 6	Full-time	No	F	GTS, OSS, MSB	Spun	11.10.16
Farmer 7	Full-time	Yes	M	OSS	Spun	11.11.16
Farmer 8	Full-time	Yes	M	GTS +	Both	14.11.16
Farmer 9	Part-time	Yes	M	GTS, NWS, NPS	Both	17.11.16
Farmer 10	Full-time	Yes	F	GTS +	Sold	22.11.16
Farmer 11	Part-time	No	F	ONS	Spun	23.11.16
Farmer 12	Pensioner	Yes	M	GTS +	Spun	23.11.16
Farmer 13	Pensioner	Yes	M	GTS, MSB	Spun	23.11.16
Farmer 14	Part-time	Yes	M	GTS +	-	25.11.16
Farmer 15	Part-time	No	F	GTS	Spun	30.11.16
Farmer 16	Full-time	Yes	M	GTS +	Sold	14.12.16

KEY TO TABLE 3

* Farming Background - The interviewee or partner grew up on a farm.

**** Coding for animals:**

GTS - Grey Trønder Sheep

OSS - Old Spæl Breed - *Gammel Norsk Spæl*

NPS - Norwegian Pelt Sheep - *Pelssau*

NWS - Norwegian White Sheep - *Norsk Kvit Sau*

MSB - Modern Spæl Breed

ONS - Old Norse Sheep - *Gammel Norsk Sau* or *Villsau*

+ - Indicates the farm had additional production such as beef or dairy cattle, hens, sledge dogs or grains.

Table 3 shows there is a domination of GTS farmers amongst the core interviewees; a result of recruiting members from the GTBS. It was discovered during the interviews that many of the members are also owners of a few shares in Selbu spinning mill. Other breed societies were contacted but no reply was received. There may have been a different perspective from farmers with predominantly other breeds, independent from ownership relations with the spinning mill. However, a broad selection of responses was gathered, expressing both positive and negative personal views in relation to the network and the spinning mill, so I do not feel the findings were compromised.

Additional interviews were conducted to include a wider network of those with connections to Trøndelag's local wool industry. These were carried out in order to gain insight on the local and regional responses to Selbu spinning mill, sheep farming and the potential of a local wool industry network to affect sustainable regional development. These included members of the local and regional government, Norilia and Malvik wool station, Innovation Norway, a local handicraft consultant plus two researchers. The same procedure of descriptive e-mail and requesting permission for recording the interview was also carried out in respect to these participants. Permission was also requested to use the names of these participants, with the proviso that any quotes would be checked by them prior to publication, which was subsequently done. Interviews with farming organisations such as The Norwegian Farmer's Union or The Smallholders Union, would have added a more political perspective. Once again, the limited time-frame of a master's thesis did not allow for these interviews, but up-to-date information from these associations has been included from recent publications.

Table 4 below lists the eleven additional interviewees and the purposes for contacting them for the interview.

Table 4 - Additional Interviews - The Wider Network

Interviewee	Position	Purpose of interview	Date
Jarle Martin Gundersen	Deputy Mayor, Klæbu Municipality Local Council	To ascertain the political view of local development, and the move of Selbu spinning mill to Klæbu municipality.	27.09.16
Marion Tviland	Director of Wool Department at Norilia	To gain a better understanding of the system for collection and the market for sales of Norwegian wool. Plus, any potential changes to the market from the establishment of Selbu spinning mill.	18.10.16
Anna Caroline Rehnberg	Senior Advisor, Norwegian Genetic Resource Centre (GRC)	To gain more information on the collaboration between the GRC, Selbu spinning mill and farmers with threatened sheep breeds.	19.10.16
Aud Kvalvik	Senior Advisor, Innovation Norway (IN)	To gain insight into the areas within small-scale agriculture where IN, as a funding organisation, values innovation.	10.11.16
Gunnar Austrheim	Professor, NTNU, Department of Natural History	To increase personal understanding of the positive & negative effects of sheep grazing on the environment.	14.11.16
Roar Uglem	Business Advisor, Selbu Municipality Local Council.	To ascertain the impact of Selbu spinning mill on the local development from a political view of Selbu municipality.	15.11.16
Reidar Almås	Senior Researcher, Centre of Rural Research	To increase personal understanding of Norwegian Agriculture and political aspects of sheep farming today.	17.11.16
Magnhild Melandsø & Eva Dybwad Alstad	Deputy Director of Agriculture & Senior Agricultural Advisor, County Governor	To gain insight into the regional political view on the importance of agriculture, sheep farming and regional development in Trøndelag.	21.11.16
Olaf Berset	Contact Person, Malvik Wool Station, Norilia	To increase personal understanding of the local system for wool collection and sorting. To gain insight into the collaboration between the wool station and Selbu spinning mill.	25.11.16
Evy-Ann Ulfnes & a Local Sheep Farmer	Agricultural leader, Rennebu Municipality & Grazing Cooperative sheep farmer	To understand how farmers are already organised in different networks. Values and problems with Grazing Cooperatives and collaboration between farmers and municipality.	30.11.16
Sidsel Skjelford	The Norwegian Folk Art and Craft Association (NFACA) consultant for South-Trøndelag	To gain a better understanding of the collaboration between NFACA and Selbu spinning mill and the work they do to promote Norwegian wool.	15.12.16

Only three interviews were conducted in English; Ingvild Espelien, Gunnar Austrheim and Reidar Almås. Quotes from these sources are therefore exactly as they were given. However, quotes from all other interview subjects were translated to English and were done to try and keep the full sense of meaning that was given in the Norwegian.

Interview setting

Different physical settings for conducting interviews can affect how the interview develops (King & Horrocks, 2010). They suggest that “comfort, privacy and quiet” are essential aspects when carrying out interviews (p.42). Crang & Cook (2007) discuss how different settings can also provide additional information about the interviewees. Both King & Horrocks (2010) and Crang & Cook (2007) comment on ways that the researcher should approach the topic of where the interview should be conducted. However, the majority of the interviewees in this study suggested the location for the interview. Regarding the farmers, 13 out of the 16 interviewed suggested that I come to their home for the interview. Out of the other three farming interviews, one was carried out at their place of work and another was conducted over skype at the request of the informant. The third interviewee was carried out in my home following a suggestion from the interviewee. They live a long way from Trondheim but were visiting the city so it was convenient for us both. Out of the eleven additional interviews, ten were conducted at their work places and one was undertaken in their private home, as they were not currently at work.

Interview Guides or Schedules

An interview guide is described by Dunn (2010), as providing a flexible guideline for the themes to be covered in the interview. He explains that this is of particular use in semi-structured interviews, to enable a more natural flow of conversation between the interviewee and interviewer. Schedules are said to follow a fixed set of questions which are more usual in structured interviews (Dunn, 2010).

The prepared interview themes and questions for the informants in this study were a mix of interview guide and schedule. Main questions were written down, with other themes, like sub-headings added as key reminders below. The questions were not absolutely strictly adhered to or asked in exactly the same way they were written. Different questions within a loose structure of the following four overall themes were covered; background, network, sustainability and the future. These themes varied slightly depending on the role of the interviewee. The farmers were asked about their farming background, sheep, their relationship to Selbu spinning mill, and sales

of yarn including marketing and networking. The sustainability questions were often brought up naturally by the interview subject during the interview, and covered grazing, biodiversity, organic farming and economic aspects of sheep farming. Opinions were sought as to the future of sheep farming with the older sheep breeds and sales of yarn on personal and regional levels.

The additional interviews covered the same four themes, but with questions related to the professional position of the interviewee. In addition, opinions and experience were sought connected to Norwegian agriculture, regional or local development, sheep farming and the older sheep breeds. Also, opinions regarding the availability of funding and development opportunities for those involved with a local wool industry were gained in relation to the economic, environmental and social sustainability of such a venture. A selection of the full interview guides are included in the Appendices.

All interviewees were offered the opportunity to see an overview of the general themes the questions covered, prior to the interview; a few farmers and some of the additional interview subjects requested and received this. It was explained that other areas of interest may arise under the interview in addition to the given themes.

4.2.2 Participant Observation

Fangen (2011) explains how using interviews and participant observation together can help to get a broader perspective on the research. Interviews provide information which is principally generated between the researcher's questions and the interviewee's particular answers (King & Horrocks, 2010). However, observations allow the researcher to use their own reflections from the experience in the analysis, which can help in seeing beyond a selective perspective (Fangen, 2011, p.40). This 'selective perspective' applies to the interviewees answers and the positionality of the researcher, which will be explained further later (see Chapter 4.3.1). Crang & Cook (2007) comment that traditionally, participant observation has been used to gain an understanding of everyday experiences in the direct context of how people are living their lives. In this way, it is possible, as a researcher, to be immersed in the studied community, and at the same time keep awareness of the connections to society 'outside' (Crang & Cook, 2007). Kearns (2010) suggests that, "participant observation for a geographer involves placing oneself in situations in which systematic understandings of place are most likely to arise" (p.246). The advantage of participant observation is the possibility to gain personal experience on the situation you are studying, which can lead to better understanding and interpretation of the research field (Fangen, 2011, p.39).

I undertook nine days of participant observation at Selbu spinning mill, to gain a better understanding of the day to day activities of the organisation and the nuances of creating, not only yarn but a hub for the local wool industry in Trøndelag. Observations were predominantly focused on the physical and mechanical procedures required for processing the wool, to obtain a better understanding of the challenges and intricacies of these processes. This included the initial deliveries in sacks; through all the processes at the spinning mill (from sorting wool to twisting the finished hanks - see Figure 5); to the finished products being sold from the shop or sent to the farmers who had commissioned the yarn from their own wool. Even though the initial intentions for the period of observation were to observe the mechanical and inanimate processes, observations of human or social interaction were also possible. During the nine-day period, there were several deliveries of wool from farmers, and the working relations between the employees, voluntary helpers and farmers could be observed to some extent. It was intended to begin the research process with participant observation. However, due to the spinning mill relocating to new premises only weeks before the study began, this aspect was delayed until after completion of the interviews.

The period of participant observation was discussed with Ingvild Espelien (Managing Director), and arranged to be undertaken over a two-week period in the beginning of December 2016. This was also a particularly busy work period for the spinning mill as it was the run up to Christmas, with increased sales and the need to complete orders before the holiday. In addition to Ingvild, there is one full-time employee, Ingvild's eldest daughter, who runs all the machinery (usually single-handed), and has full responsibility for the spinning machines. The mill also has one part-time employee who is responsible for most of the sorting, washing and labelling of the wool. Ingvild's youngest daughter has also begun to work at the spinning mill part-time; she will be working to get a qualified apprenticeship in industrial textiles and yarn production. This offers great potential for the spinning mill to become a company that is recognised for offering apprenticeships in the future. There are also several volunteers who come and help with the wool sorting when they can. The spinning mill has also provided a place for work experience and language training for local immigrants. The main work for helpers at the spinning mill is sorting the wool into different colour shades and quality, ready for washing or storage.

A recent experiment with the mill's schedule was incorporating late shifts on two days a week; thereby extending the running time and efficiency of the machines. This meant that in addition to sorting wool I could have the opportunity to learn and experience running some of the

machinery; which would have been difficult during the normal day shift. However, some of the machines, especially the machines for spinning require experience and training to use, as a careful balance is required to adjust the machinery to the various qualities of wool being spun. My jobs included sorting, classifying, labelling and washing wool during the day shift. On the late shifts, I sorted wool first and then was able to work some of the machines. The machines I used most were the picker (or ‘wolf’), fibre separator, and the yarn skein winder. I also had opportunities to experience running the carding machine and rug-yarn maker. Figure 5 shows all the wool processes in the mill. I began and ended my working day at the same time as the other workers and we mostly ate lunch together, except during the late shift. I was introduced as a “hospitality worker”, although I was open about writing a master thesis on Norwegian wool and regional development in Trøndelag. Hospitality is given occasionally to people interested in learning how to run a small-scale spinning mill.

Fangen (2011) notes that the researcher can appear artificial, if trying to do the same activities as others in the situation where you are undertaking participant observation; the ideal situation is where you fit in naturally. Although it was the first time I have used the machines at the spinning mill, it didn’t feel unnatural to be working with wool processing, due to my having a deal of prior experience working with wool on an even smaller scale (see Chapter 1.2). Crang & Cook (2007) comment that it can be difficult to take part in participant observation where there is a skilled trade involved:

“Unless researchers have spent some years qualifying and working as plumbers, nurses, accountants or pilots, for instance, although they may be able to observe such work, it is extremely unlikely that they will be able to *participate* in it” (p.38 - original emphasis).

I was able to use my previous experience with wool to help me both ‘fit in naturally’, and acquire a full understanding of the processes of the spinning mill in a relatively short time period. In addition, I could actually feel like I was being useful at the same time as learning and observing.

“For participant observers, the core data that they generate is that which fills their *field diary* or *notebook*” (Crang & Cook, 2007, p.50 - original emphasis). A notebook or ‘field diary’ was in daily use under the short period of participant observation. Notes were taken occasionally during the work but mostly written up each evening on coming home. Conversation was not the objective of this data generation and would be difficult to get when working with the machines. There was a relatively high level of background noise in the machine room and the

tasks were being mostly completed alone. Sorting wool was done sometimes alone and sometimes in the company of another worker. Descriptions of the systems in place at the spinning mill the handiwork involved for processing the wool; along with my daily personal feelings and reflections were recorded in the diary and re-written in detail.

In order to help the reader picture how the wool is processed at Selbu spinning mill, Figure 5 below is designed to give an overview. Without having visited a spinning mill it may otherwise be difficult to understand the processes involved.

It starts in the top left hand corner with the wool entering the mill; either directly from farmer's deliveries or via collection at Malvik wool station; run by Norilia. The blue arrows show the progress of the wool processing through various different machines. The green arrows show where wool is recycled and either delivered back to the wool station or re-processed through machines to reduce loss and utilise as much fibre as possible or create new products. The yellow arrows depict the products being made. There are only two substances added to the processing; soap during washing and felting and oil after 'picking' the wool to reduce static electricity during carding and spinning.

The information given in Figure 5 will hopefully give the reader both a better understanding of the work conducted under participant observation as well as insight into the core of Trøndelag's local wool industry.

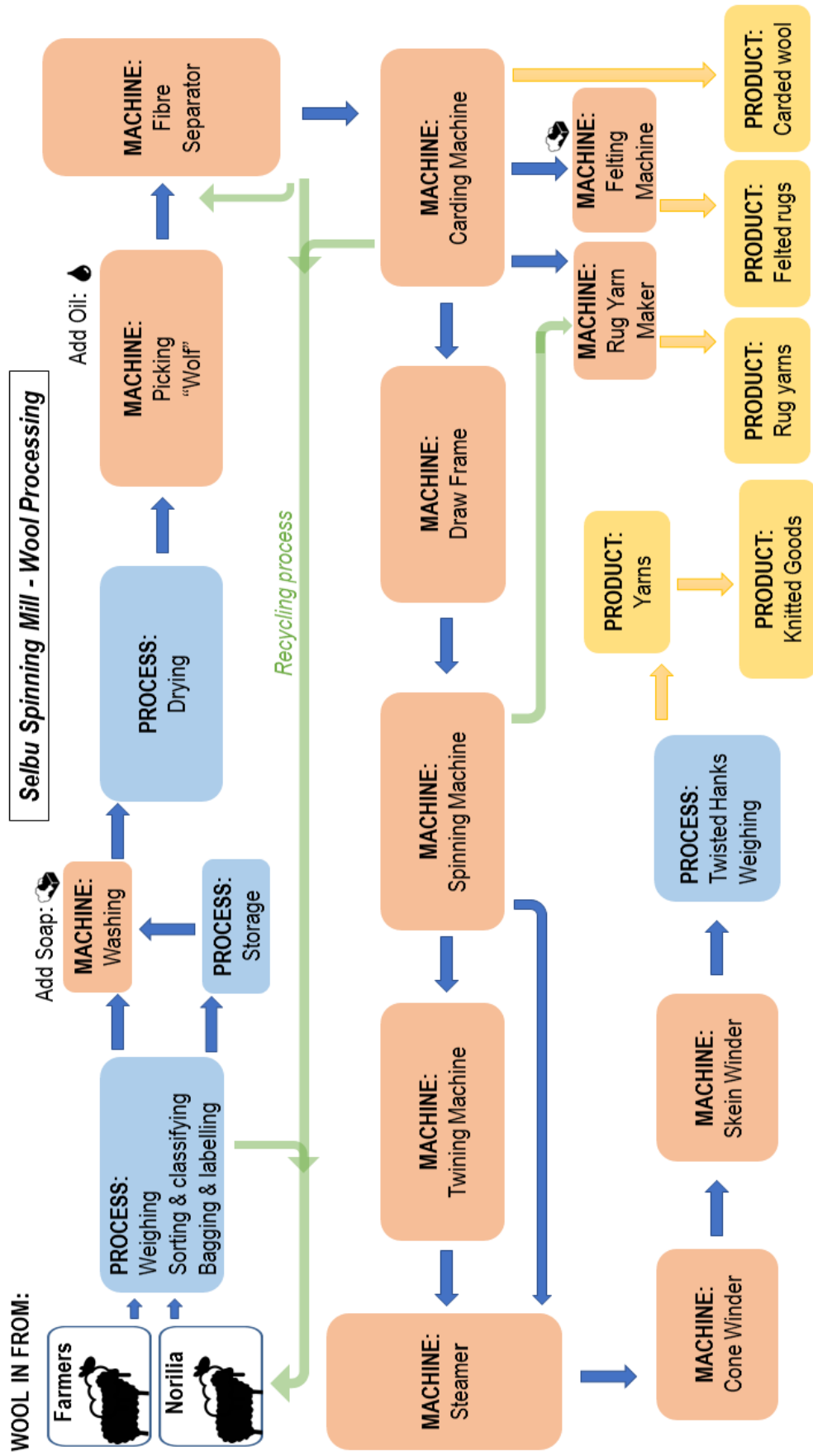


Figure 5- Wool Processing at Selbu Spinning Mill

4.2.3 Data Analysis

The interviews were transcribed and coded according to the themes that came both from the interview questions and through the narratives of the interviewees. Descriptive and theoretical codes were located and traced in conjunction with ANT; following the narratives given by interviewees. Descriptive codes are described as the obvious themes that are given by the informants (Cope, 2010) in this study they included the reasons that led to a decision or behaviour that affected the network. Analytic codes became apparent from the descriptive coding in relation to establishing the spinning mill and network. Often the analytic coding for the sustainability of the local wool industry was 'embedded' in the research questions (Cope, 2010). The additional interviews were coded in accordance to the themes that became apparent from coding the core interviews. Relevant quotes or sentences from the interview subjects were highlighted and translated into English, where applicable.

The field diary notes from participant observation were initially written up as a daily diary. The notes were then organised into a shortened version of the descriptive categories from Cloke et al. (2004) (in Crang & Cook, 2007, pp.51-52). These included; physical descriptions of place, machine or system; interactive descriptions between others or including myself; participation in activities, self-reflections, impressions and consideration of the research process and my position as observer.

4.3 Ethics and Positionality

Research ethics is concerned with the appropriate behaviour, requirements and duties of the researcher in relation to all involved in the research process (Dowling, 2010). A professional approach and a polite and friendly manner is appropriate in all communications and research situations. Case study research also has the additional challenge of avoiding preconceived bias in relation to the study topic, as a degree of understanding of the research issues is necessary prior to research (Yin, 2014). It is important to remain open to the information given by research subjects as well as being informed of current research in the field of study.

4.3.1 Positionality

Crang & Cook (2007) highlight the importance of independent research and the need to declare any partiality towards the research topic. It has been said that it is impossible to remain fully objective to the research Dowling (2010) and ANT requires the researcher to see their role as part of the actor-network being studied (Ruming, 2009; Jóhannesson & Bærenholdt, 2009). Jóhannesson & Bærenholdt (2009) describe how the openness of an actor-network in relation

to time and space helps place the focus on constructing the field, and makes it easier for the researcher to see their own role in its construction (see Chapter 3.3.3). In this way, it is important to mention the ‘positionality’ of the researcher, defining how their own knowledge, beliefs or situation may influence the study.

Having a strong interest in wool and the environment has inspired me to study this field, and has directed the research questions to consider the sustainable aspects of the wool industry. Sustainability is also of significant importance in today’s society, as shown through Norway’s focus on the Green Shift, and dedication towards becoming a low-emissions society (Nordisk Ministerråd, 2016). Previous collaboration with members of the KRUS research group and Ingvild Espelien (see Chapter 1.2) on wool related projects, has given me an understanding of the issues at hand regarding pigmented wool in the Norwegian market. This naturally helped me to hold a position of ‘interested work colleague’ rather than researcher during the participant observation. In this way, the daily activities and behaviour of other workers was hopefully not greatly affected by my presence at the spinning mill.

This project was my first experience directly related to hearing the issues from the farmer’s viewpoint, and this has highlighted various topics and situations that were new for me. It was particularly interesting to discover how different the farmer’s histories were. Another reason for having interviewed so many farmers was the feeling that ‘saturation point’ had not been found. The glossary in Hay (2010), describes saturation as:

“The point in the data-gathering process when no new information or insights are being generated. This is one method used by researchers to determine when to stop gathering data” (p.387).

My position as interviewer or researcher changed many times in the course of interviewing the farmers, depending on their personal interests or background history. These positions became more apparent when reflecting on the interview situation; they included ‘fellow student’, ‘political associate’, ‘guest’, ‘conspirator’ or ‘potential informer’, and often affected the flow or direction the interview had. Sometimes the role changed as the interviewee became more engaged with the topic and less reserved, especially where I could show an informed knowledge of the subject matter through questioning. The differing positions were due in some part to my encouragement of topics broached by the interviewees. Here my own interests and selective viewpoint helped guide the subject matter being discussed. I began each interview with a brief description of myself, as an English feltmaker, not grown up on a farm but with some experience working on a sheep farm in Ireland and my hands-on creative experience with

Norwegian wool. This also helped to build up a rapport with the interviewees, which Dunn (2010), describes as being central for conducting a successful interview. Although occasionally I was unable to understand what was said in an interview, this was relatively seldom and I asked the interviewee to clarify what was said. I did not feel that my being English changed the rapport of an interview, except perhaps sometimes interviewees spoke slower in the beginning and some interviewees explained that they tried to use less dialect with me.

As a well-travelled, mature student, I have had experience of communicating with people from different backgrounds and in various professional roles as well as with language differences. This experience helped me to feel relaxed during the interviews and try to create an informal atmosphere for the interviewee. This is more in line with “creative interviewing” techniques than “professional interviewing” which Dunn (2010), describes as being detached and demanding respect from the interviewee (pp.114-115). To demand respect from the interviewees is not conducive to my personality or, in my view, to creating an atmosphere for a semi-structured narrative to flow easily. My age was perhaps an added advantage, especially when interviewing the additional interviewees, many who held leadership positions in private or governmental organisations. In relation to interviewing the researchers my position was more naturally that of a student, but this only assisted the role of fact-finder in those situations.

4.3.2 Trustworthiness

Dowling (2010) suggests it is not possible to be objective in collecting qualitative data as the researcher always brings their own personal background with them. This can be taken further to state that the data, or findings, are constructed, which was suggested through using ANT as a methodology (see Chapter 3.3.3). From the perspective of social constructionism, the ‘truth’ is not simply collected from interviews or observation. As King & Horrocks (2010) express; “Meaning is not out there waiting to be discovered; rather it is brought into being in the process of social exchange” (p.22). Bradshaw & Stratford (2010) bring attention to the responsibility of the researcher in representing the experiences of the research subjects and creating trustworthiness through research methods, design and checking. The design of the research has been checked and discussed with my supervisor and colleagues. I have striven to conduct the research responsively and report the results accurately with regards to all opinions and experiences. Sources of evidence have been gathered from theory as well as following news articles related to Norwegian wool and sheep farming. This method of ‘data triangulation’ can help to corroborate findings through a process of “convergence of evidence” (Yin, 2014, pp.120-121). In addition, this broadened my knowledge and understanding of the relevant,

contemporary issues affecting the farmers and members of the network. Conducting participant observation, semi-structured interviews, using theory and being up-to-date with contemporary farming news is seen as bringing information together in triangulation, where different perspectives can support the findings.

In addition, the quotes given by the additional interview subjects have been sent, in context, to the relevant participants and checked for accuracy by them. Details connected to KRUS have been reviewed by the relevant members of the research programme. Ingvild Espelien has verified factual details related to the processes of Selbu spinning mill.

4.4 Summary

This chapter has presented the qualitative methods used to prepare, design, generate and analyse data from a broad selection of informants involved directly and indirectly with this case study of a regional wool network in Trøndelag. The semi-structured interviews are introduced, from the questions asked to the reasons for and methods of choosing the informants. The short period of participant observation is also described as helping to broaden the perspective of the research when used in conjunction with interviews. The use of ANT as a holistic approach to the research field, not only fits with the design of a single case study, but also helps guide the researcher to their own influence on the research. This accentuates the importance of recognising the positionality of the researcher. Positionality can alter during the research process, and this was discussed and reflected upon in relation to any affect it may have on the research findings. Validation of the research through the use of several sources of evidence was also mentioned. Triangulation of data through the use of theory and being up-to-date with contemporary newspaper articles is also useful to corroborate findings. The analysis of these findings is covered in the next chapter.

5 ANALYSIS

In this chapter, the findings from the interviews are presented to cover the three main areas that were apparent from the narratives given; the background or reasons for starting a local wool industry; how the network functions and is maintained today; and the potential for its future development. Latour (2005) describes how the researcher should “follow the actors themselves” (p.12) and in this way their words are used to organise and illustrate the networks being uncovered (Latour, 2005; Jóhannesson & Bærenholdt, 2009; Ponti, 2012). Insight from the participant observation carried out at Selbu spinning mill helps to corroborate the farmers’ narratives as does the information given under the additional interviews.

5.1 Tracing the Origins

When using ANT as a research method it is suggested to begin with the actant that appears to represent the starting point for the research, as this is usually related to the central theme or aim (Dankart, 2012). The overall aim of this research is: *To investigate how Trøndelag’s small-scale wool industry affects sustainable regional development* (see Chapter 1.3). In this way, the natural starting point for the research was Selbu spinning mill which is central to the local wool industry in Trøndelag. This position was also supported by the farmers; “We feel that they [Selbu spinning mill] are the mid-point and we are all the threads leading out” (Farmer 6). During the initial interview with Ingvild Espelien from Selbu spinning mill she explained her personal background history in relation to sheep and Trøndelag:

“I was born in Trondheim but when I was two we moved down south to the Oslo area. I grew up in Drammen, but during the summer holidays I was always in Orkdal on a farm. So, I was kind of a farm girl during the summer. I learnt to spin when I was 18 and I have been a handspinner since. I went to Agricultural school and later at university I studied Biology, so that’s part of why I wanted to start a spinning mill because I have worked a little bit with biodiversity and conservation of rare breeds” (Ingvild Espelien - interview 1).

Trøndelag was a place of ‘meaning’ for her (see Chapter 5.1.4), however one of the main reasons for establishing Selbu spinning mill is connected to her educational background:

“To start the spinning mill was actually the result of a meeting we had [...] I think quite a lot of the people that attended that meeting were concerned about the situation of the rare breeds. Because we saw that these old breeds with pigmented wool were decreasing and actually one of the breeds disappeared just about that time [...] we were worried that it might happen with several of the other breeds. The reason for this is of course because the price of the pigmented wool is very low” (Ingvild Espelien - interview 1).

Following this statement then it is possible to say that the low payment for pigmented wool was one of the reasons for starting the mill (more on this in Chapter 5.1.3). However, it shows that the actor-network for establishing the spinning mill in Trøndelag starts prior to that event. It is then necessary to trace the origins further back before looking at the establishment of Selbu spinning mill.

5.1.1 A Curious Choice of Sheep?

The negativity around the payments for the wool led to the question of why farmers kept pigmented sheep. In general, these sheep also produce smaller lambs and are therefore poorly paid for meat and for wool. Although three farmers did mention that the GTS produced lambs of good weight, especially in comparison to the ONS. Many farmers gave an opinion similar to this farmer's regarding GTS: "People who want to live off the weight of the meat choose another breed" (Farmer 8). In relation to ANT, Latour (2005) states there is, "no group, only group formation" (Latour, 2005, p.27). Looking at the original source of wool and sheep that helped bring together the wool producers and processors is essential to understanding the origins of the actor-network. That it is not a fixed group but ever-changing is explained in detail in Chapter 5.2. Looking at the choice of sheep also helps answer part of the first research question: *What is the actor-network that helped create and maintain the small-scale wool industry in Trøndelag?*

From the 16 farmers interviewed, four had no immediate farming background and for three others, only their partners had grown up on farms. The four farmers without farming backgrounds consisted of one not living on a farm but working with sheep as part of a school farm. Two others bought small farms in order to fulfil dreams of a smallholding: "I always had a wish to buy a smallholding; it was a dream for many years" (Farmer 5). Out of the 12 that had a farming background, only one had inherited the farm with a pigmented breed of sheep, in this case the GTS. Four others had grown up with or inherited sheep with the farm but these were all white breeds, either the DS or the NWS. However, all 16 farmers currently have pigmented breeds making up the whole, or part of their flock. The reasons given for keeping sheep in general included; being able to combine sheep farming with other work; a tradition of sheep farming on the farm; the physical structures or farm buildings already designed for sheep; the landscape being too steep for cows to graze and the inspiration of a teenager's interest in farming sheep:

“Actually, I didn’t want to begin with sheep but we had a 15-year-old boy who said he was interested in taking over the farm, but he wanted to farm sheep not cows. He used part of his confirmation money to buy three sheep, and that’s how it began” (Farmer 1).

The reasons for choosing the older, pigmented breeds of sheep were even more diverse. Some farmers explained how they had made an informed decision in choosing these breeds, although it wasn’t always easy to find the right information: “There is a jungle of information everywhere but to find what was needed was difficult” (Farmer 5). The main reasons for keeping pigmented breeds are separated into different sections below.

Ecological Reasons & Behavioural Characteristics

Reasons for keeping ONS were focused around their ability to live out of doors throughout the year as well as the sheep being a traditional coastal breed (Norwegian Genetic Resource Centre, 2011). This suited the teaching arena of Fosen Folk High School on Trøndelag’s coastline which was included in the interviews. Here the ONS are utilised for wool, meat, skin, horns and bone according to traditional farming methods, as part of a holistic teaching programme:

“It is a very important role to convey the history and tradition. At the same time express the need to look after the animals, the responsibility we have for managing the landscape of the island and use the whole animal afterwards. We try at least to convey that you take what you need and nothing more and that which you take, you should use properly. That is the main idea, but then there are all these handicraft traditions like tanning the skins and processing the wool so I think the sheep are important from so many angles” (Farmer 11).

The reasons farmers gave for choosing OSS or GTS were similar. Both breeds are described as being ‘easier to farm’; many of the farmers mentioned easier lambing due to the ewes producing fewer lambs than the NWS. A strong flock instinct was said to make it easier to gather the animals from the grazing areas. It was also suggested that the flock instinct, camouflaging colours and the lighter weight of the old breeds were advantageous against predator attack. Research on the behaviour of several different sheep breeds also showed that the lighter breeds (such as OSS) had stronger ‘anti-predator’ behavioural traits (Hansen et al., 1998). GTS were not studied in the report but one farmer commented on the predator issue in relation to GTS:

“GTS is a breed that covers much of the terrain and you have the flock instinct which helps in relation to predators. The sheep are more alert and have a bit better defensive instinct than NWS. There is no contrast between their wool and the surrounding terrain; they aren’t a focal point for a predator from afar” (Farmer 9).

The GTS and older breeds of sheep were also mentioned as having a particular good grazing pattern:

“Like all the old breeds, they graze differently to the white sheep which is more like a lawn mower. So here they tidied up really well in the outfields and took more than just grass” (Farmer 15).

One farmer suggested grazing was the reason that people were buying these breeds:

“Many of those who bought [GTS] from here they want to have some sheep to graze the pastures around the small-holding [...] To care for the cultural landscape” (Farmer 8).

Under the additional interview with the professor from the Department of Natural History at Norwegian University of Science and Technology (NTNU), the different grazing habits were confirmed:

“The ancient breed would eat more woody species, they would produce a more open landscape, while the other species [...] have a lower proportion of woody species in their diets, and that will have a different impact on the whole ecosystem. If you would like to keep and maintain semi-natural habitats, I think it would be a better solution to go for an ancient breed, if that is your main aim because they better prevent forest succession” (Gunnar Austrheim).

The question of whether this is more ecologically sustainable or not was more difficult to answer. Gunnar Austrheim continued to explain that the older breeds are more browser than grazer which can lead to these breeds having a more positive effect on preserving the biodiversity of the landscape in relation to plants, insects and fungi. However, the open, cultural landscapes were also a product of historical over-grazing, which will have caused restrictions for many plants and animal species at that time. In relation to sustainability, it is essential to find a balance. Removing the sheep completely from an area was also potentially problematic:

“We would like to prevent over-grazing so we should be very careful about having high densities [of sheep] and we should set specific limits for the densities in specific regions. Also, if we have a management aim of maintaining a semi-natural landscape, which I think we should have; it’s also a part of the natural variation. We have a lot of plants and animals as well as semi-natural habitats that are red listed because of forest succession, so we should also aim for preventing under-grazing” (Gunnar Austrheim).

There are many aspects regarding the grazing and sustainability of different breeds. The older breeds tend to choose alternative vegetation later in the grazing season, whereas the NWS tend to remain grazing the same material even when of poorer quality (Jensen, 2013). The heavier weight of NWS compared to the older breeds also means that NWS require more energy or food input, especially where they give more lambs (Jensen, 2013). This can result in the older breeds requiring less imported grains than the NWS:

“We have had this breeding policy for larger, more productive animals. [The extra weight] means also that NWS are dependent on more nutrient rich fodder to fulfil their optimum, they need more food in general, but they also need food with more proteins, which often implies eating more cereals, more imported grains” (Gunnar Austrheim).

In relation to grazing in the Norwegian landscape with a management plan for preserving the open, or semi-natural cultural landscape; this would suggest that the older breeds are ecologically more sustainable when not grazed at high densities. In addition, they require less nutrient supplements (see also Chapter 5.3.1). Many supplements are imported (Adler & Løes, 2014) and sometimes farmed unsustainably using resources needed by other countries (Lindahl, 2014). Food and wool production from the older breeds can be regarded as more ecologically, socially and perhaps economically sustainable through reducing the costs of feeding.

Although both the GTS and OSS breeds are not currently on the critical list for requiring conservation, OSS are classified as vulnerable and GTS as threatened (see Chapter 2.1). The conservation status was given as a reason for farming these breeds:

“We really wanted a conservation breed on the farm and didn’t know much about GTS before we started with animals” (Farmer 9).

“I wanted to have the old breeds; I wanted to take part in the conservation work because if no one does that then they’ll disappear” (Farmer 5).

“This is my small contribution to the gene bank. I believe it is important to have the spice shelf full even if you don’t use everything, there can come a time when it’s good to have something to choose from. That’s my motivation” (Farmer 8).

This shows that protection of ecological biodiversity already has a strong place in the actor-network, as a main reason for farming the pigmented sheep.

Creative & Aesthetic Reasons

The coloured wool was also given as a reason for keeping these breeds, despite the poor payments (in comparison to white breeds), when delivering the wool through the conventional system to Nortura (see Table 2, Chapter 2.2.1). From an aesthetic perspective, the sheep were seen as more attractive. Several farmers also stated that it was fun to have a breed which was something different to the usual white sheep. In addition, they were described as “less industrialised than NWS” (Farmer 10), as well as being curiosities and hobby animals. The latter reason applied especially where only a few animals were kept or the main farm production was dairy cows: “When you only want a few [sheep] then they can just as well be curiosities,

nice animals” (Farmer 8). “My work is in the cow barn and my hobby is in the sheep-shed” (Farmer 16).

From a more creative and economic perspective, the wool of both ONS and GTS was described as very good quality or even “fantastic” (Farmer 7). “GTS is an exciting sheep when you consider the wool quality” (Farmer 9). The quality and different colours of the wool made the sheep especially attractive to farmers wanting to utilise the wool in handicraft or textiles:

“I work mostly with things that engage me and wool engages me. I think it is important to take care of it. The same as with so many other old handicraft traditions and now I’ve managed to make myself a livelihood based on the farm and handicrafts and the animals” (Farmer 2).

Seven farmers already used the wool in handicrafts that supplemented their income, two others were hoping to develop a handicraft enterprise from the farm, and an additional two used the wool in handicrafts for their school or for their own creative projects. This topic will be discussed further in Chapter 5.2. Its relevance here is to show that creative interests influenced decisions to use pigmented sheep breeds and also to breed for wool quality and colours. The GTBS states that one of their goals is to work towards producing the fine-fibred wool that the breed was originally known for (Grå Trøndersau, undated). “We [GTBS] value the wool quality high but reckon there is a big variation in wool on the GTS today” (Farmer 9). Not everyone is in agreement that breeding for wool is the right direction to take: “When they [GTBS] claim that GTS should be long and slim and have good wool then there’s too little meat value on them [...] there is a different focus” (Farmer 10). The same farmer also commented shortly after that; “the wool or the skins are what save me though” (Farmer 10). Here they meant that there was some financial compensation through selling the sheepskins. Other farmers were aware from the beginning that they would breed for better wool:

“We say that we have walked an untraditional path in relation to other sheep farmers. We focus on the wool whereas the others focus on meat [...] we were always conscious of the wool; the genes with the colours that breed [OSS] has and the quality” (Farmer7).

Historically sheep were bred for their wool in Norway (Drabløs, 1997), so whether Farmer 7’s path is untraditional or ‘un-modern’ is perhaps a matter of semantics and the meaning of the word ‘traditional’. The economic sustainability of the small-scale wool industry will be discussed in further detail in Chapters 5.2.3 and 5.3.3. However, this shows that the intended aim of creating an extra income from the pigmented sheep is in the actor-network from the outset for many farmers.

Reasons associated with place

Four farmers also stated how the connections to Trøndelag made the GTS an interesting breed to have. All four farmers were born and raised in Trøndelag, although two had lived abroad before returning to their home county. Two farmers stressed the historical connections to the now extinct Tautra sheep being the reason as to why they kept the GTS, making the sheep more “fascinating” (Farmer 13). The other two farmers were interested in breeds that came from Trøndelag: “It’s fun to look after something that’s local to Trøndelag” (Farmer 14). This suggests a connection between the GTS and a “sense of place”, where meaning is attached to the location (Cresswell, 2013, p.112). ‘Place’ is described by Berg & Dale (2015) as a product of the connections formed through space and time. It has therefore an essential part in the actor-network of the small-scale wool industry in Trøndelag. The concept of ‘place’ is also connected to the aspects of the physical location of the spinning mill which will be discussed further in Chapter 5.1.4. However, several different actants bring attention to the issue of ‘place’ in connection to establishing the spinning mill and the physical access they had in acquiring or buying pigmented breeds of sheep.

5.1.2 Establishing or Developing a Network?

Not all the farmers had originally chosen the pigmented breeds themselves. One farmer had inherited a few GTS from a family relation who had died, another had loaned a ram from friends which led to buying a small flock of GTS:

“My good friend came with a ram for me and it was GTS [...] So after two days I got a phone call from Ås, they had heard about the ram (he was reported as leaving my friend’s farm) ‘I hear that you have GTS’. They were registering the breed, trying to track down where the animals were. They wondered if I had my ram registered, told me a bit about the breed and gave me tips on a flock not very far from here who were going for slaughter, from a pensioner with GTS who was giving up farming [...] I bought 7 sheep then, so that was the start” (Farmer 8).

In this farmer’s case, if his friend had not registered the movement of the ram in the sheep control data base, then he would not have got the phone call that led to the start of his breeding GTS. This shows that not only the reasons *why* farmers chose the pigmented breeds but also the physical connections as to *how* the sheep came to be on the farms can shed light on the origins of the actor-network.

It is important to note that in order to prevent the spread of infectious diseases; it is generally forbidden to move sheep over county borders in Norway, unless they are being transported to the slaughterhouse (Norway, Mattilsynet, 2013). It is possible to apply for permission from

Mattilsynet (The Norwegian Food Safety Authority) in special circumstances, such as to prevent in-breeding on a farm where there is a lack of breeding stock (Norway, *Mattilsynet*, 2013, p.4). In this way, it is natural that the physical location plays an important part as to where farmers get access to buying sheep.

However, it is interesting that eight farmers began farming pigmented breeds due to direct connections through friends, family or neighbouring farms. This even included being persuaded to use a different breed to the one originally considered:

“GTS came in through a friend that my partner works with. I really wanted to have NWS but he wanted to sell us GTS and then I decided that it was perhaps fun to try them” (Farmer 4).

To buy sheep from neighbouring farms and through the advice of friends suggests a deal of trust in these relationships. Investing in sheep may not be as expensive as cows; “one cow is the same as about 20 sheep” (Farmer 8). However, buying live animals of registered, threatened breeds is not a cheaper alternative to the NWS:

“There were many who called me up, especially two years ago, they wanted to have male lambs [GTS], and when I took the price and added on the extra charge for the breed, then no, they’re not interested, because then they’re too expensive” (Farmer 12).

As recommendations for these breeds often came through communication in personal relationships, knowledge about the potential of the breeds was also shared. Ingvild Espelien was often cited as a sharer of knowledge concerning GTS especially. Her involvement with grazing associations, dog breeding clubs, local handicraft organisations, educational programmes and ecological activity centres helped her establish a wide network covering Trøndelag and beyond.

“I didn’t know what they were, they were fine sheep. Ingvild said they were GTS. I hadn’t heard the name before. I just thought they were nice, black with white dots over the eyes. But no one else had them so there was no ram. It wasn’t until 2005 when Øya secondary school began working with GTS that I got a ram and began to focus on GTS then. So, it's Ingvild's fault!” (Farmer 16).

Many farmers noted the connection to Øya secondary school as it was here that the conservation work and GTBS began:

“Øya agricultural school have a conservation herd of GTS, they get support to preserve and keep the breed [...] That's where it started, [Ingvild] worked at Øya and Skjetlein [secondary schools] and it was there that an initiative was put in place to start a breed society” (Farmer 8).

The farm manager at Øya secondary school was also the leader of the GTBS at the outset. The farm manager was contacted in relation to this study but I was unfortunately unable to interview him. Ingvild Espelien worked at Øya secondary school with dogs, rabbits and GTS.

“So, we started in 2008 or 2007, we came in contact with Øya secondary school, we were actually there to look at buying the Trønder Rabbit, which is also endangered [...] However, when we were there we met Ingvild, she was employed there and had responsibility for the rabbits then. And then we were introduced to the GTS” (Farmer 15).

The existence of other animals, such as rabbits in this farmer’s case, resulted in a new flock of GTS. The knowledge of the existence of the rabbits and where they could be found also needed to have been accessible for this situation to come about. According to Murdoch (2000) established agricultural networks are said to be effective for enabling horizontal innovation networks due to relationships already based on trust and collaboration. He discusses how shared knowledge, “spatial proximity” and an established network of small, agriculturally-based enterprises can instigate sustainable forms of rural development:

“[C]losely networked relations between local farms, processors, distributors and retailers make for a degree of flexibility in adapting to market changes, while also allowing the value-added to remain within the regional economy (Murdoch, 2000, p.413).

The shared knowledge between the sheep farmers and Ingvild Espelien helped provide the innovation needed for establishing the local spinning mill. However, this could not have happened without the connections to a lot of other actants. Many aspects of the network were already established through personal and work relationships as well as physical proximity of farms with the same breeds of sheep. Other aspects of the network were established many years ago regarding the arrival of sheep in Norway and the changes this created to the landscape through grazing (Austrheim et al., 2016). This is an example of how an actor-network can stretch over space and time (Murdoch, 1998) as the farming methods and imports of sheep from the past are interwoven with the local wool industry of today. Some of the most important actants are the old pigmented breeds of sheep, as will also be shown in the next section, Chapter 5.1.3.

Figure 6 below illustrates the start of the actor-network, with the main reasons why farmers chose or ended up farming the pigmented breeds. The main actants are placed with connections in towards the old pigmented sheep breeds. However, the connections also run between actants connecting them through personal relationships, knowledge-sharing, proximity, handicraft skills and institutions such as the GRC. The colours are used to represent the strongest aspects

of these connections: Green - Ecological; Purple - Aesthetics; Blue - Relationships; Orange - Idea, Emotion or Concept; Yellow - Technology. (The symbols hopefully speak for themselves.) One of the strongest connections is biodiversity and the conservation of the threatened breeds, such as the GTS. As Anna Rehnberg from the GRC said of how she met Ingvild: “It was the Grey Trønder sheep that was the gateway really” (Anna Rehnberg).

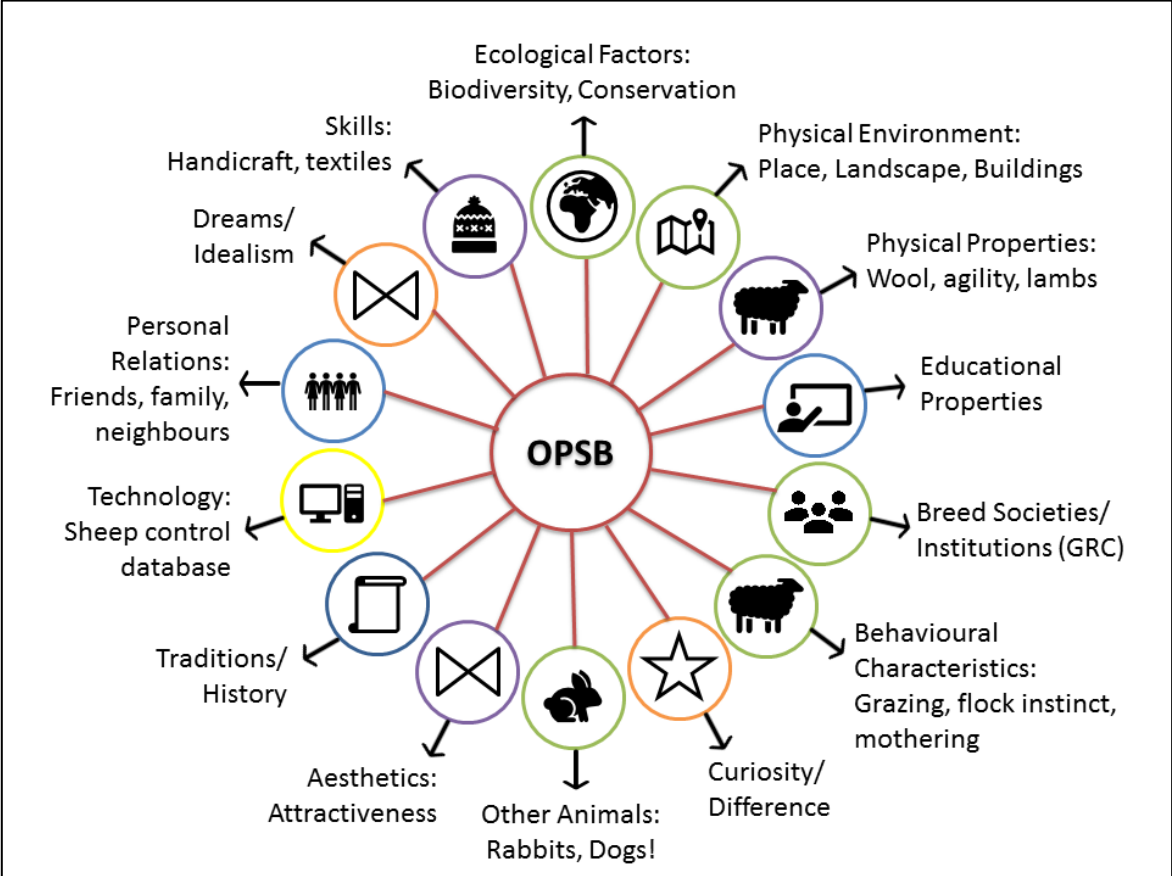


Figure 6 - Actants Involved in Farming Old Pigmented Sheep Breeds (OPSB)

5.1.3 Green & Social Entrepreneurship

The origins of establishing Selbu spinning mill as a small business enterprise take the actor-network into the realms of entrepreneurship. As the most important reason for keeping pigmented breeds was seen to be ecological reasons this chapter starts with green entrepreneurship. To define the concept of ‘green entrepreneurship’, Allen & Malin (2008) advise combining the image of the innovative and energetic risk-taker, usually associated with the entrepreneur, to the contemporary movement towards environmental sustainability. They suggest that the vision or motivation for green entrepreneurs includes creating economic and environmental change through new opportunities based on, “responsible resource use, sustainability, or social responsibility” (Allen & Malin, 2008, p.829). These aspects are shown to cover both green entrepreneurship and social entrepreneurship in connection with

establishing Selbu spinning mill. They are highlighted by following direct comments from the interviewees.

Green Entrepreneur

A green entrepreneur can also be expressed in a shortened version as ‘ecopreneur’, (Schaper, 2002). Looking at the motivation Ingvild Espelien states for starting Selbu spinning mill, much of what she says can classify her as an ecopreneur; even though it is perhaps not a word she would use herself:

“For some years, we had sheep on our own farm [in Trondheim] and I realised that I would never manage to hand spin all the wool from our own sheep and I started to think about how to do something with this pigmented wool. Because we had wild sheep with grey wool and nobody wanted that wool” (Ingvild Espelien - interview 1).

From an entrepreneurial side, this was recognising an opportunity for a new enterprise to do something with the grey wool. The identification of opportunities is said to be central to innovation and entrepreneurship (Mitra, 2012). From an environmental perspective, it was investigating the possibility for better utilisation of natural resources. Ingvild organised a meeting for other farmers and wool enthusiasts (mentioned at the beginning of this chapter), to determine the extent of the need within the region. The meeting concluded with a concrete decision which became a call for action for Ingvild:

“The conclusion of that meeting was that we needed a new spinning mill. And then I said, “So - who’s going to start that?” And nobody said “Me” so I said “Ok, I’ll do it!” (Ingvild Espelien - interview 1).

The actions of the ecopreneur have been compared to Schumpeterian entrepreneurial qualities of ‘creative destruction’ through the transformation of usual business methods (Allen & Malin, 2008). These researchers continue to explain that the ecopreneurs they investigated deviate from usual concepts of capitalism and often had the importance of community or location embedded into the business model (Allen & Malin, 2008). On asking Ingvild about the main goal for starting the spinning mill she said:

“It was primarily to contribute to saving the rare breeds. We tried to do that through helping the farmers with spinning yarn for them so the farmers can sell their own yarn from their farm. That was the main goal. We also wanted to campaign for the wool from the rare breeds by selling the yarn from our own shop and also by giving lessons and talking about this in different arenas” (Ingvild Espelien - interview 1).

The initial goals were aimed towards ecological biodiversity through ‘saving the rare breeds’ and can therefore be classed as green entrepreneurship. I would argue that by placing the goal

for 'helping the farmers' above that of selling products from their own shop that this can also be classed as social entrepreneurship.

Social Entrepreneur

In many ways, green entrepreneurship and social entrepreneurship are comparable. Although there is some discussion around whether for-profit enterprises can be classed as social entrepreneurship (Bacq & Janssen, 2011). The definition of a social entrepreneur that Bacq & Janssen came to includes; "find[ing] innovative solutions to social problems of his/her community that are not properly met by the local system" (Bacq & Janssen, 2011, p.388). As the system for the pigmented wool was not meeting the needs of the local farmers (or the sheep if it resulted in their extinction), an innovative solution needed to be found. The topic concerning pigmented wool being classed as 'social problems' is discussed further in Chapter 5.2.

Continuing with the connections of social entrepreneurship and establishing Selbu spinning mill, Alsos (2010) describes how the entrepreneurial process in smaller communities is often started by enthusiastic individuals or groups. As well as identifying opportunities, emphasis is put on getting the community involved in the process (Alsos, 2010, pp.28-29). Although it is perhaps not possible to call Trøndelag a 'small' community, the group of farmers breeding GTS is still relatively small and was very small before the creation of the GTBS: "We were only a few so we knew everyone" (Farmer 8).

Community involvement in establishing Selbu spinning mill is also emphasised through the connections of the GTBS and the spinning mill. Both were established as a result of the initial meeting for farmers and wool enthusiasts. The comment below shows how the small community of GTS farmers were involved in the establishment of the spinning mill through creating the Breed Society:

"An interest group was established to look into the possibility of a spinning mill with the idea of GTS, and this was actually the start of the GTBS. Then Ingvild Espelien and Frida Tove Meland [first general manager] and Marit Lianes [GTS farmer] got to work to look at the possibilities for developing wool from the GTS. It ended up in 2011 that Ingvild and Frida Tove started up a private spinning mill on the basis of lessons learned from the pilot project in the GTBS" (Farmer 9).

Many of the farmers involved in the local wool industry in Trøndelag hold shares in the spinning mill and in that way, have involved themselves in some of the 'risk' in starting a new enterprise:

"I was with them from the start; I bought shares right from the start" (Farmer 16).

“I knew Ingvild from before; I think the innovation is exciting. That she grabbed the opportunity with wool and created her own workplace, I think that in itself is interesting. So, I decided to become a shareholder” (Farmer 2).

One comment from a farmer holding shares suggests that even though they were involved in establishing the spinning mill, the enthusiasm has changed over time. Although this will be discussed further in connection to maintaining the actor-network (see Chapter 5.2.3), it also has relevance here in connection to community involvement:

“I was an idealist and bought some shares; don’t know if I’ll see the money again any time, [laughter]! So, that was like risk capital” (Farmer 13).

The final aspect related to the origins of the network and establishing the spinning mill is connected to the physical location of the mill.

5.1.4 A ‘Sense of Place’

Cresswell (2013) describes how new regional geography see regions as socially constructed; emerging from a variety of natural, cultural, political and economic processes. Regions are not static geographical locations but (as with actor-networks) constantly changing through the relational activity that happens both within and passes through a region (Cresswell, 2013). This relational approach also applies to the individual connections people have with ‘place’ and the consequences of these connections. Situating Selbu spinning mill in Trøndelag was partly due to Ingvild Espelien living in Trøndelag and therefore her having a network established in the area:

“I think Trøndelag was a very good starting point. Because I knew a lot of farmers here and I knew they were very enthusiastic about their work with the sheep, so I was thinking that this might be the best place to start it” (Ingvild Espelien - interview 1).

However, other reasons are relevant regarding perceptions of the region’s ability to understand the ecological focus that the spinning mill is working with:

“I think Trøndelag is a very good place for a spinning mill like this because there is a lot of focus on ecology and sustainability in this region. I also think, Trondheim is a university town and that means that there are a lot of people here that are very conscious on what they buy and how they live, they are like trend-setters” (Ingvild Espelien - interview 1).

Trøndelag, as described here can define the region as an assemblage of different elements that make up the whole. Anderson & McFarlane (2011) refer to assemblage as a verb rather than a noun to explain the process by which all elements work together to create the whole. In Trøndelag’s case the concepts of ecology and sustainability working together with a variety of

people connected to the university, creates a meaningful region for an ecologically focused spinning mill. The university town suggests a greater movement of people and ideas through the region. This relates to theories of mobility intertwined with place, which can also be seen as reinforcing relational aspects and making a sense of place even more important (Berg & Dale, 2015).

The spinning mill was originally established in Selbu as the name suggests, and therefore the reasons for the original choice of location and the subsequent move to Klæbu in 2016 are important in uncovering the actor-network. As this study also looks into the effects of the local wool industry in connection to sustainable regional development, comments from the interviews with Selbu and Klæbu municipality representatives are also relevant here.

Why Selbu?

Ingvild Espelien explained that there were two reasons for choosing Selbu as the location for establishing the spinning mill:

“One was that I live in Trondheim and my colleague lived in Skatval and Selbu is in the middle between those. But the other reason was that Selbu has a very strong knitting tradition and it was based on the natural sheep colours, and we liked that connection. So, we were thinking that this is something that we can utilise in cooperation with the community there” (Ingvild Espelien - interview 1).

This explanation for establishing the spinning mill in Selbu covers issues of the benefits of physical location as well as an association to historical meaning connected to a place. Selbu is much more than a location in Trøndelag; it shares its name with the largest lake in South-Trøndelag and has a history that gave enough meaning for a new business to be established there. It is the combination of physical and meaningful aspects of a location that create a ‘sense of place’ for individuals and shared associations (Cresswell, 2013). Interestingly, both the physical location and the historical knitting traditions of Selbu later led to the spinning mill moving to Klæbu (see below).

However, first it is important to explain a little bit about the knitting tradition mentioned here in connection to Selbu. The Business Advisor of Selbu Municipality’s Local Council also stated that; “They [the spinning mill] were very conscious that they wanted to be in Selbu as Selbu’s knitting history has some value in it” (Roar Uglem).

According to the municipality’s website, the story of the knitting tradition dates back to 1852 and the creative knitting experimentation of an 11-year-old farm girl (Selbu kommune, 2011). Instead of using only white wool to knit, she decided to try incorporating the naturally

pigmented wool into her knitting and created the first Selbu, or eight-leafed rose (Selbu kommune, 2011). The popularity of the rose spread throughout the land and has become a recognised brand for the municipality (Selbu kommune, 2011) including its use on the municipality's coat of arms, as seen in Figure 7 below:

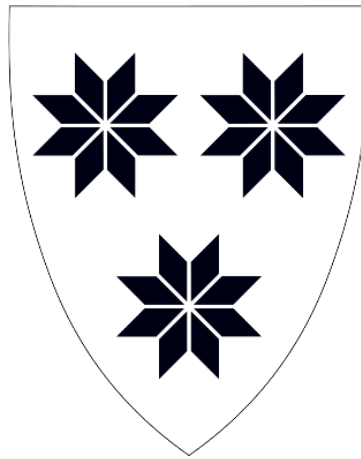


Figure 7 - Selbu Rose on the Municipality's Coat of Arms (Wikipedia, 2017)

The historical connections of the Selbu rose to the naturally pigmented wool being promoted by the spinning mill, offered potential for a branding alliance which could be mutually beneficial for both (Cassia et al., 2015). In fact, the connections to the knitting traditions in Selbu facilitated the eventual move to Klæbu:

“The one person we started a permanent cooperation with was working on the Selbu knitting tradition but she was actually living in Klæbu. So, she was travelling to Selbu and we were travelling to Selbu. That’s actually why we moved to Klæbu. Because she was here and she tipped us about this house [premises for the mill] that we could buy” (Ingvild Espelien - interview 1).

Here, the knitting traditions, brand and original connections to ‘place’ that instigated the original location in Selbu caused a subsequent move to Klæbu through collaboration with another actant associated with the same traditions.

Why Klæbu?

Several reasons were given for the move to Klæbu including ecological reasons in relation having to drive a greater distance each day. Selbu municipality is approximately 70km south-east of Trondheim city by the main road. Klæbu municipality is only 20km south of Trondheim (see Figure 8). The distance from Selbu to Trondheim caused difficulties on many levels:

“It was quite long to travel every day and the only option was to go by car. I have an electric car but I couldn’t use it all the year because the roads are very bad. So, we spent a lot of time travelling and that is not very good for the environment. Also,

I think there was a problem with customers, the only persons that came to our shop to buy - they were travelling from Trondheim. So, there was actually no local sale. We should have been closer to the market and now that we have moved here [Klæbu] we are closer to the market” (Ingvild Espelien - interview 1).

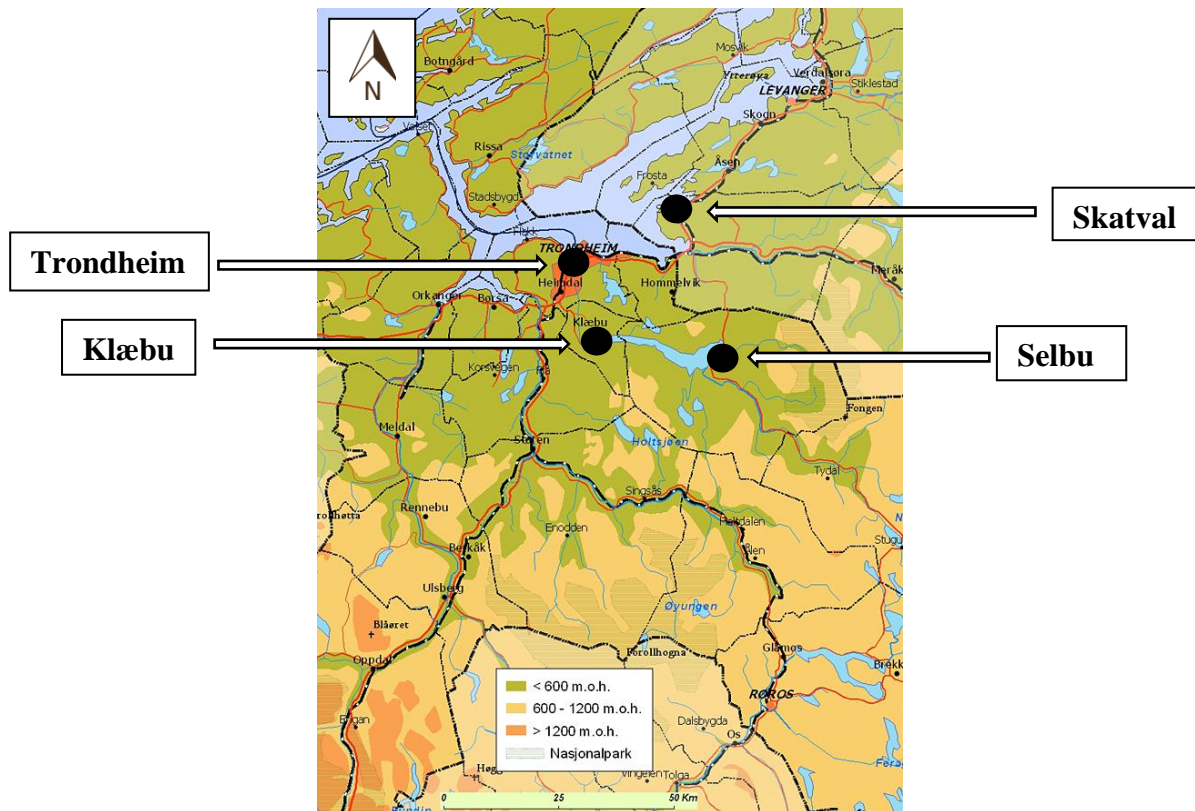


Figure 8 - Geographical Locations Regarding Location of Selbu Spinning Mill in Trøndelag (Adapted from - Wikipedia, 2016)

The geographical move was made easier when the co-founder of the spinning mill retired. This meant the main workforce was then based closer to Trondheim and Klæbu. The fact that the workforce was not from Selbu, or living there, may also have had an effect on the lack of connection to the physical location. As the business advisor of Selbu Municipality’s Local Council commented regarding the effect Selbu spinning mill had on the local community:

“They weren’t a big employer in Selbu [...] They were not very visible in the community. They were there the same as other companies and that in itself is positive [...] But they didn’t have any other role other than running their own business [...] I think the network they had was outside Selbu with related businesses [...] It wasn’t here they had their market, they couldn’t have survived long with only Selbu as their market” (Roar Uglem).

In Selbu the spinning mill was a few kilometres outside the town centre whereas in Klæbu it is very central. Although the business advisor didn’t think this will have made much difference to

the number of customers the spinning mill received, an increase in custom has been noted since the move to Klæbu:

“We just started to have a long opening day on Thursdays and it seems to be popular; it seems that people come here. They know that we have moved. I’ve used Facebook a lot to inform about it” (Ingvild Espelien - interview 1).

It is unknown how much the social network of Facebook was used to inform potential customers of the spinning mill when it was based in Selbu or how the increased network has made a difference over the years. However, the position of the spinning mill in Klæbu town centre will inevitably make the business more visible to the local population, which can have a mutually beneficial effect for the community and the business. This is part of the municipality’s strategic plan to keep the town centre alive, as Klæbu’s deputy mayor says:

“We have a municipal plan that says in Klæbu centre, all new buildings need to make the first floor a commercial property, although there may be three or four floors with accommodation above. It’s a tough but clear requirement. Real estate builders would like to build houses because that’s what sells now. We politicians and our strategies must think 40 years ahead. If we want a vibrant town centre, then we must have commercial businesses in Klæbu” (Jarle Martin Gundersen).

This shows that regional development policy is also an essential actant in Selbu spinning mill’s move to Klæbu. Figure 9 below shows the relevant actants involved in the establishment of Selbu spinning mill in Trøndelag, including the location move to Klæbu. Connections also run between these actants emphasising relational activity through personal contacts, knowledge-sharing, proximity, policy and economy. These elements will be discussed further as they are relevant to the future development of the local wool industry and the maintenance required for keeping the actor-network in existence. The colours are used to represent the strongest aspects of these connections: Green - Ecological; Red - ‘Place’; Purple - Aesthetics; Blue - Relationships; Black - Economy & Policy; Yellow - Technology.

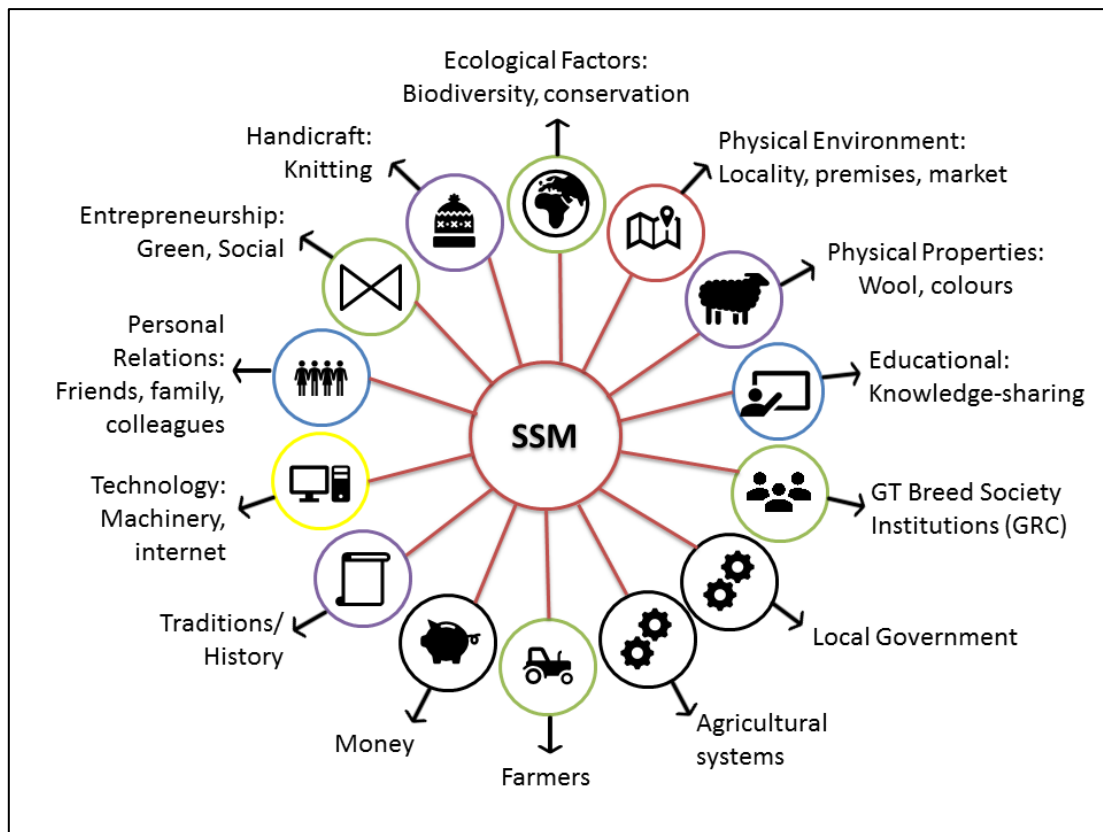


Figure 9 - Actor-Network Involved in Establishing Selbu Spinning Mill (SSM)

5.2 Maintaining the Network

This section of the analysis chapter is looking more closely at the network involved currently within Trøndelag’s local wool industry. This includes how the network functions, the values created through spinning local pigmented wool and the challenges of maintaining this small-scale industry. Latour (2005) has stressed that it is through the need “to maintain the groups existence” that change or disturbances occur and the elements affecting the network can be traced (p.35). Actor-networks are not regarded as fixed or static but rather ever-changing through the interaction of different actants (Latour, 2005; Bosco, 2006). This section looks into ways actants are recruited into the local wool industry of Trøndelag, the marketing and selling strategies of products and how the network changes in relation to disturbances or controversies in the network. In this way, this section hopes to answer elements of all three research questions: *What is the actor-network that helped create and maintain the small-scale wool industry in Trøndelag?*

How does the actor-network function in relation to economic, social and environmental sustainability?

How can the actor-network help a small-scale woollen industry affect sustainable regional development in Trøndelag?

5.2.1 Recruiting Actants

A network or group is never still but changing and growing through “recruiting ever more actants” (Jóhannesson & Bærenholdt, 2009, p.16). Actants have been recruited into the network from the very beginning in relation to; choice of sheep, location and the original establishment of the spinning mill. In this section, the recruitment is focused on the attracting commission spinners and the growth of the actor-network. Growth and development within the actor-network connected to the local wool industry in Trøndelag can also potentially have direct effects on regional development. Regional growth can help improve the economic situation for its inhabitants but also needs to take account of issues regarding ecological and social sustainability; as shown in Chapter 3.2. In this section, the ‘recruiting’ activities of the network are considered in the light of sustainable regional development.

New Premises

The move from Selbu to Klæbu created many changes for the spinning mill both physically and relationally. A new location offers new possibilities and new relationships. ‘Place’ has been described as a ‘meeting place’ or coming together of people, structures, concepts and relations (Massey, 2015, in Nyseth & Pløger, 2015). ‘Place’ as part of the actor-network is also in a state of change and regarded as always moving towards becoming something else (Nyseth & Pløger, 2015). It has already been shown in Chapter 5.1.4 that the spinning mill moved closer to the market for local customers, thereby potentially increasing its economic sustainability. The move to Klæbu is also an aspect that the municipality regards as an exciting development:

“Three [new] businesses have come now to Klæbu centre that are unique [...] the third, Selbu spinning mill, has a view to not only process but also sell wool. So now we have three things which people must come from the region to Klæbu to buy directly from the manufacturer. It's a bit special for Klæbu because we don't have any through-traffic. So, there are many of those 180,000 who live in Trondheim that have never been to Klæbu and that has been our challenge” (Jarle Martin Gundersen).

Selbu spinning mill's move to Klæbu is seen as potentially bringing customers to the town that would not ordinarily have visited, this can affect the sustainability of the town on economic and social levels. From a social aspect, it was also mentioned that this may help develop a more positive image of Klæbu, which in turn reflects on the town's residents:

“The synergy effect is big I think. It's my dream that when people hear the name Klæbu they connect it with the simpler things. So, I hope and believe that such a type of business [as Selbu spinning mill] can help turn the image of Klæbu and connect it with something positive” (Jarle Martin Gundersen).

Selbu spinning mill is recognised as having a sustainable image as a business, especially due to the conservation work connected with the GTS. When asked whether Selbu spinning mill was working towards sustainable development, the business advisor of Selbu municipality's local council answered:

“Yes, I had that feeling. They are very aware of it. They are also very happy with their own products and really had their heart in what they were doing. They were also very keen to safeguard the GTS. So, they were very strong on it [sustainable development]” (Roar Uglem).

This sustainable image of Selbu spinning mill can have a positive effect on Klæbu in many ways, especially if used as part of a process for re-imagining the town. According to Rehan (2013) promotion of sustainability through branding can bring advantages by making the place regionally attractive. He explains that social, cultural, economic and environmental sustainability issues are important factors to making this image attractive for visitors. Although this theory is related to city-branding, connecting sustainable businesses to the image of Klæbu can also have some value for the town.

The deputy mayor has personal connections to wool having been a sheep farmer in Klæbu for many years and he also has professional motivation to help bring positive development to the town. He helped instigate the spinning mill's move to Klæbu through enquiring after several options for premises once the news of their need to move came to his attention. This collaboration, between local government, local businesses and the local artist who made it known that the mill was looking to move, could be seen as a positive example of local governance. Pike et al. (2010) describe the change from government to governance as a move away from a classical authoritative position and towards a focus on networking and trust. This requires methods of governing to focus on “the interaction of multiple actors” (Pike et al., 2010, p.128). In this case, the deputy mayor's position was to bring actors together using his knowledge of the town. His openness to the positive effects of small-scale enterprises such as Selbu spinning mill can prove beneficial in many ways including, “filling a hole” in the town centre (Jarle Martin Gundersen).

Comments from the farmers were also positive about the move, even though for some of them it meant a slightly longer journey to deliver the wool. There were, in general more benefits than disadvantages with the move:

“It's very exciting that Selbu spinning mill has moved to a new site in Klæbu, getting more security in relation to the lease on the building and maybe more time for the mill” (Farmer 9).

For the spinning mill, it meant not only the potential of more customers buying finished products but also more custom from farmers. It was mentioned by the Business Advisor in Selbu municipality that although agriculture is still a main source of employment in Selbu, he didn't think that any sheep farmers had sold wool or spun yarns at the spinning mill during the six years it was based there. I discovered and interviewed one part-time sheep farmer in Selbu who was interested in spinning yarns in the future. Ingvild Espelien later confirmed that one Selbu farmer had commission spun yarns from DS and a few others sold wool to the spinning mill. If the spinning mill had not moved to Klæbu I would have used more time to enquire after Selbu farmers' interest in using the spinning mill. During the participant observation, I observed several local Klæbu farmers bringing their wool to the spinning mill, both to sell wool and to commission spin yarns; these were not only farmers with the pigmented rare breeds of sheep.

Spinning of Yarns

Commission spinners are obviously essential for the actor-network of Trøndelag's local wool industry as they constitute the majority of the work being undertaken at the spinning mill:

“They [farmers] are the most important group of customers that we have. We are very happy with that kind of customer because they buy our service and they are like big customers compared to the knitters who are small customers [...] I would say maybe 80% of the wool is farmer's wool that goes back to the farmers” (Ingvild Espelien - interview 1).

As will be shown in Chapter 5.2.3, the interest in commission spinning is increasing. Reasons why farmers choose to spin yarn from their own wool are interesting to discover the actants involved in making this choice. Reasons why farmers did not continue with commission spinning are also of interest and covered in Chapter 5.2.3.

Twelve of the sixteen farmers interviewed had sent their own wool for commission spinning at least once. In general, the reasons given for spinning the wool into yarns were similar to the reasons for keeping the pigmented breeds of sheep (see Figure 6). These included handicraft interests, ecological reasons, personal connections to Ingvild Espelien or other spinners, having time in addition to employment and farming and a wish to share the traditional uses of the older breeds of sheep. Reasons connected to handicraft, ecology and personal connections were the strongest and are discussed here. Time and employment are also connected to controversies within the network and are therefore covered in Chapter 5.2.3. Sharing traditional uses of the sheep breeds was discussed in Chapter 5.1.1.

The farmer's handicraft interests or skills had the strongest connection for those interested in continuing to commission spin yarns. Eight farmers expressed interest in commission spinning their wool again in future and seven of these mentioned having handicraft skills themselves or in their immediate family. One farmer's own knitting skills resulted in commission spinning via first learning to hand spin:

“I thought it was a bit crazy when I like knitting so much, maybe I wanted to learn to spin. So, I registered for a spinning course. My interest in wool began to wake up after the spinning course [...] Once or twice I sent wool [for spinning, in order] to sell yarn. I want to start a web shop” (Farmer 1).

The spinning course mentioned here was conducted by Ingvild Espelien at Selbu spinning mill. The establishment of the spinning mill had a direct effect on ‘waking up’ wool interests in this sheep farmer. In addition, it may eventually lead to the establishment of a new enterprise or web shop in the region. Another farmer commented on how their handicraft skills were rediscovered with the establishment of the spinning mill:

“I've always had an interest in wool. But it lay dormant, I might not have gone further with it until Ingvild started working with spinning and the spinning mill” (Farmer 2).

This farmer now uses wool and handicraft skills “as a resource for teaching others” (Farmer 2). The establishment of Selbu spinning mill was also fundamental in connection to a larger handicraft project with OSS that would otherwise not have been possible:

“We wanted to recreate a 'bolstervev' [traditional, striped, very hard-wearing mattress cover] like we found on the farm. It was woven of the same wool [we had] and it fitted very well as the backing for the sheepskins we sew. So, we had our wool both front and back so to speak. But we saw no chance before Selbu spinning mill started. For there was no spinning mill in Norway that could process [our wool]. So, it was actually that factor which got us going because then we realised that there was a possibility” (Farmer 7).

These examples show that handicraft interests and skills are an actant that can result in farmers choosing to use the services of Selbu spinning mill. Similarly, the establishment of the spinning mill has awoken or revived handicrafts skills leading to regional projects or opportunities for some farmers. This has potential for economic sustainability for the spinning mill as it can lead to further demand for their services. In relation to one project it also led to initiating knowledge-sharing between the weaving industry and the spinning mill, recruiting new actants to the network:

“We created the partnership; we were looking for a weaver who would take our [wool]. We came across Selbu spinning mill and we rang around until we found

Krivi [small weaving factory] and they were the first who said ‘Yes! That's fine’. One day later he [managing director] was sitting at our kitchen table. Then we agreed on what we should do and he went up to Selbu to teach them how to spin a yarn that could go in his machines. Selbu was just starting up and they had no experience with spæl wool because they had started due to the GTS” (Farmer 7).

In this way, the GTS recruited not only the farmers and their traditional project into the network but also the possibility for other spæl wool farmers to spin their wool.

Other reasons for commission spinning include having previous contact with other commission spinners or especially a connection to Ingvild Espelien and Selbu spinning mill. When asked why they decided to commission spin this farmer answered:

“I knew Ingvild from before in connection with Samoyed [dogs]. Also, the farmers we bought the GTS from tipped us about Selbu spinning mill. I also have a mutual friend with Ingvild who has ONS that I shear [and she commission spins]. So, I knew a bit because of that as well” (Farmer 4).

The association of the spinning mill with the GTBS also resulted in members wanting to support the spinning mill:

“So, we who are in the breed society felt that we were in some way a bit of the reason why they started the spinning mill since they knew we were interested in getting yarns spun” (Farmer 3).

So, personal relationships and connections have a part to play for some farmers in making the decision to get their wool spun at Selbu spinning mill and be directly recruited into the actor-network.

Ecological reasons, such as resource efficiency, are also important actants leading to farmers commission spinning their wool. One farmer described commission spinning as part of the whole reason for keeping GTS:

“[We] utilize the entire animal in production, we can use local processing of wool in relation to our own yarn and you have sheepskins as a separate product and we use the GTS lambs in the autumn” (Farmer 9).

Using resources efficiently is also linked to the fact that farmers receive poor payments for pigmented wool and therefore feel the need to do something different with it:

“You have this great wool and breed of sheep and you must try to make something more out of it than just send it from you and know that it is dumped into the system at a very low price. The price is so low that we actually lose money when we pay the shearer. So, that was really what started it all when I met Ingvild, for she is incredibly inspiring to hear. It's the whole fundamental idea that the breed deserves that we use the wool, it does not deserve that we throw it away” (Farmer 5).

This quote also shows how a meeting connecting with Ingvild Espelien helped to inspire the choice of commission spinning. The quote below supports the issues of badly paid wool:

“Eventually we discovered that pigmented wool was not paid, so it cost more to hire a shearer than what we were paid for the wool; we’re talking about autumn wool which is first class quality. It was such a problem that we talked about that maybe we should do something ourselves with the wool” (Farmer 7).

When there is so little to gain through the usual system that manages sales of wool then it is worth making the effort to take a chance on doing something extra with it. This also links in to entrepreneurial behaviour and will be discussed further in the next section (Chapter 5.2.2). The reasons for the low payment of pigmented wool is explained by Norilia’s director of the wool department:

“I set [the prices] because I know what the State subsidy is for the different classes and in addition to the subsidy I calculate on my earnings and my costs and make a consideration on the basis of how much profit I have and how I will distribute the money to the various [wool] qualities. Some I really want to give a good price for because I want to get it in because there is a high demand and we can obtain good prices when selling the wool, while others, for example the poorer qualities, I am unable to obtain a good price for in the market, so I can’t spend a lot of money paying for this wool. Norilia prioritises wool that is most sought after and therefore in total brings the most value back to the wool providers” (Marion Tviland).

In this way market forces are an actant in the network that help to recruit some farmers into the actor-network to find alternative ways to value the natural resources produced through farming pigmented breeds of sheep. This also suggests that farmers who are utilising their natural resources in new ways are working with elements of green entrepreneurship (Allen & Malin 2008).

Figure 10 below shows the actants involved in helping farmers choose to commission their wool and therefore, recruiting them into the actor-network. The connections are related through their colours which represent the following aspects: Green - Ecological; Black - Economy & Policy; Purple - Aesthetics; Blue - Relationships & Communication; Orange - Idea, Emotion or Concept; Yellow - Technology.

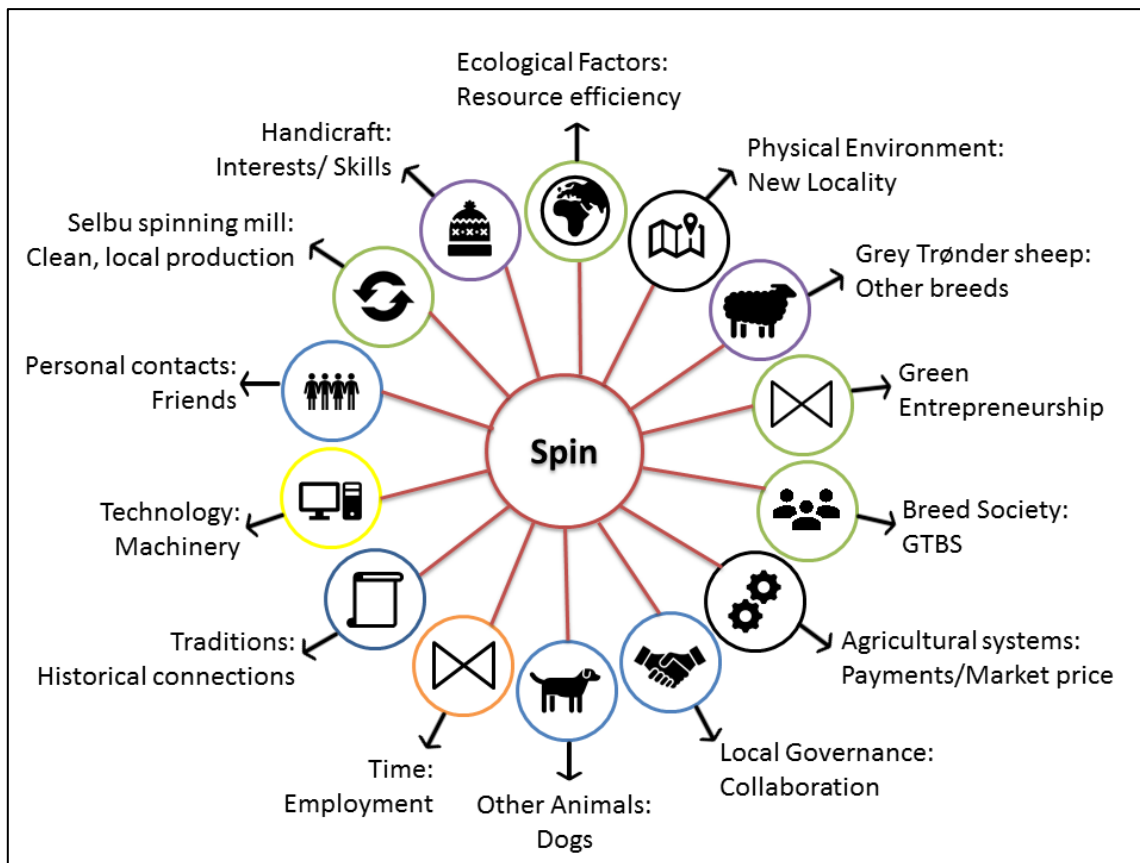


Figure 10 - Actants Involved in Recruiting Farmers to Commission Spin Yarns

5.2.2 Economics & Marketing

Encouraging innovation and entrepreneurship to initiate economic growth is still regarded as an important aspect of regional development (Huggins & Thompson, 2015) even though economic growth is recognised as having led to environmental damage and the unsustainable system we currently live in (UNEP, 2012). The Organisation for Economic Cooperation and Development (OECD) state in a chapter describing green growth for regional development that, “environmental policies that do not support economic growth and wealth creation are not sustainable in the long term” (2011, pp.132-133). They continue to say that green growth must foster economic growth whilst still providing the natural resources needed for future well-being. However, it has also been said that to create a sustainable society, it is necessary to combine entrepreneurship with ecological and social aspects in order to aim for ‘value capture’ (Marsden & Smith, 2005). Through using a long-term perspective in relation to capturing value instead of focusing on making money in the short-term, it may be possible to avoid what Jackson (2009) describes as the “dilemma of growth” (pp.49-65). The unsustainability of growth in relation to the ever-increasing cost it has on the environment is on one side whilst on the opposite side; “De-growth” creates instability by leading to unemployment and recession (Jackson, 2009, p.65). Bugge et al. (2010) suggest that a balance is needed to bridge the gap between, “the

noble, but often abstract, principles of sustainability and the day-to-day practice of local and regional development” (p.78). Innovation for sustainability that is based on collaboration are central to creating a balanced system for the future (Bugge et al., 2010; Kommunesektorens Organisasjon, 2016). As part of a strategy towards creating a low-emission society, The Norwegian Association of Local and Regional Authorities describe how replacing fixed ideas of economic growth and consumption with more qualitative concepts of collaboration or sharing can lead to new types of sustainable industry (Kommunesektorens Organisasjon, 2016, p.26).

This section focuses on the ways in which farmers who commission spin their yarn, sell their products and therefore connects in to the aspects of deeper sustainability and the dilemma mentioned above. It includes their attitudes towards making money; methods used to sell products and ways in which they use networking and collaboration. All aspects help to build up the actor-network that establishes the value of the local wool industry for farmers, customers and the region.

Entrepreneurship, Breeding & Money

Entrepreneurship and innovation in sheep farming is not a new phenomenon. Bleie & Lillevoll (2010) discuss the innovative aspects of arctic sheep farmers in relation to creating new and localised breeding regimes as well entrepreneurial activities such as turning their knowledge into new enterprises. Breeding has played a very big part of the actor-network of sheep farmers interviewed in this study and was given as one of the reasons farmers were interested in the pigmented breeds (see Chapter 5.1.1). The GTBS carries out breeding both to preserve and conserve the GTS and to improve the wool quality which is a part of the ‘breed standard’ (see below). The GRC works a great deal with the Breed Societies in relation to breeding to help build up populations of breeds that are at risk:

“[The] breed societies are a very important group. We see that a well-functioning breed society is absolutely essential for a breed to exist [...] We come with professional advice on breeding and the breed society takes the information to its members [...] It is more general breeding advice on small populations and how to build up sustainable work. To have a sustainable breeding work it is important to use enough breeding males in the populations. Using rams in natural mating is by far the most efficient way to achieve that. Due to the restrictions of moving live animals of sheep across country boundaries, artificial insemination (AI) is an important method for moving genetic material across borders” (Anna Rehnberg).

Although the actual breeding is the personal choice of the farmer; collaboration between breed society, GRC, farmers and farming associations can influence breeding decisions. The breed

societies work with a breed standard or characteristics that are considered the best for that breed. Ram lambs are judged in relation to the breed standard given out by the NSG (NSG, 2016). Judged animals have the potential of being more valuable if they are classed highly within this standard. Twelve farmers mentioned breeding was an area that was of particular interest to them or their partners. Two of these were interested in breeding to create lambs that would get high classification in the breed standard, partly because these lambs could potentially bring in better income:

“I think it's fun with breeding and find it really fun with that breed [GTS] that you should try to preserve it and you should work to a breed standard; I think that's very interesting. To try to get the best possible animal so you can sell it for the most money because it's better to sell livestock instead of the meat [...] My goal is to try to get a ram which is so good that they come into the AI directory sometime in the future” (Farmer 4).

One farmer bred in genes from Finn sheep to produce more lambs and only one farmer mentioned breeding to produce better meat instead of wool. This farmer had sold wool to the spinning mill before but didn't have the time or interest in commission spinning yarns.

Eight farmers stressed that breeding for wool quality was a priority for them. This was the case even when the work this entails does not seem appreciated:

“I'm probably more interested in wool compared to many others, but when you're farming the old breeds it is in some way a part of it. It's part of the breed standard and that is what is important to breed in. But it is also a paradox when you are very focused on breeding good wool but you get told that your wool is not wanted because it doesn't fit in to the Norwegian wool standard” (Farmer 5).

It can also take time and extra expense to breed when thinking about the products you want to breed towards:

“We breed for wool, so the whole process takes us a year to get the best possible wool. So, when I buy rams I look to see ‘how good were you on wool when you were judged’ but they must be good on other qualities too because it hangs together [...] So it's a process through a whole year before we get to a product” (Farmer 6).

Another farmer described how they used years to get the qualities they were happy with:

“We worked with breeding for many years and achieved good breeding stock, the wool and everything. We got the male lambs judged and worked for good wool each year” (Farmer 15).

One farmer stressed how they breed for wool quality, not only in relation to the products this can create but also with a view to the welfare of their flock of ONS:

“I think it is very exciting being able to look at individuals and manage to retain variety and genetic diversity, while at the same time it is only those with the best wool which we keep because they need survive outside an entire winter” (Farmer 11).

These examples are used to show that the majority of the farmers involved with the local wool industry are focused on more than just making money. They seek out other values from the sheep and their wool, including seeing the importance of the wool for the sheep itself. One farmer had no intentions of making the yarn production and sales into a large enterprise as she felt it was better to stay within a niche of quality:

“For me it’ll never be the main thing on the farm, that would be the sheep, it is a bi-product because I like it. But I am so happy with the yarns [...] I think it's unique and it should remain that way, you needn’t go out [of Trøndelag] and try to be so big. I’m glad that I can sell what I have and that they [the customers] see the quality of it” (Farmer 6).

The dilemma of growth is perhaps not a problem for the small-scale yarn industry in that the environment would suffer if the industry should develop. The question is perhaps if the farmer’s sales would lose their niche market if the industry grew too much. The market for local yarns is seen to be increasing; this was the opinion of the NFACA consultant for South-Trøndelag:

“I think there is a good market for it [local yarns], especially when the labelling for Norwegian wool is improved. People are becoming more aware of this. It's just like local food; people appreciate buying locally sourced food. I think that eventually people will appreciate more and more buying yarns of local wool. So, I think it is absolutely the time for the local and the experience also gives added value. This is also important from an environmental perspective; that it’s important to use the resources we have” (Sidsel Skjelford).

The NFACA published their membership’s magazine in the spring of 2017 which had the sole theme of wool (Norway, Norsk Husflid, 2017). The front cover pictured pigmented lambs of the Old Norse breed. The increasing demand and niche markets will be discussed further in Chapter 5.3.

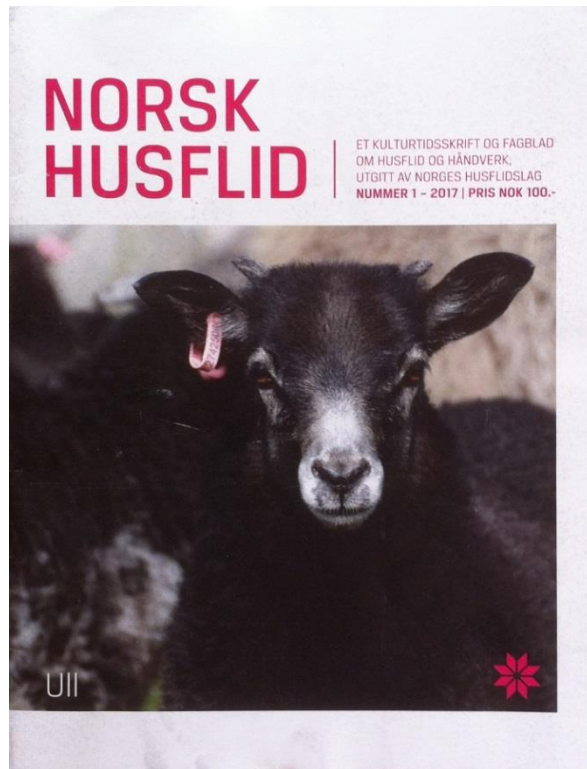


Figure 11 - Front Cover of The Norwegian Folk Art and Craft Association's membership

According to Marsden & Smith (2005) an important aspect of ecological entrepreneurship is the potential for “carving out new value-creating niches” through finding innovative ways of working with natural, economic and social resources (p.450). Allen & Malin (2008) describe how enterprises created by green entrepreneurs tend to land within four motivational concepts: Strengthening community ties; Passion for the environment or craft; Long-term values (as opposed to short-term money-making) and Sustainability for future generations (pp. 838-839). Much of what the farmers have said about keeping the old breeds of pigmented sheep fit very well into working with a passion for their handicraft or the environment. One farmer’s comment regarding commission spinning can be understood in relation to long-term values as well:

“I don’t want to become rich on it, and I don’t think I will anyway, so it’s not my goal. But I have a goal of what I can do; I can increase the earnings of the farm because maybe that helps a little bit so people can see that they can have such a breed and actually earn the same as with a NWS. So, that's what my goal is, to get an OSS or GTS to provide as much income as a NWS. I think I’m quite near also but it’s a lot more work” (Farmer 5).

The same farmer also mentions how important it is to create something positive for the next generation in her family:

“That's why I’m creating the farm shop because it is not enough to just run the farm, but if you manage to create something around it that makes it that she [daughter] may feel that it might be okay to take over some time, that it is interesting to take

over, so I think that's great fun. But it's not that she must take over, because this here [the wool and sheep] is my interest" (Farmer 5).

Research regarding an Italian wool supply chain was also recognised that opportunity is not dependent on economy alone; "[...] whenever there is a combination of resources, will and talent, despite possible low revenues, there is still an opportunity" (Vagnoni et al., 2016, p.85). Entrepreneurship and entrepreneurial behaviour are also relevant in connection with farmers who continue to commission spin their wool and will be discussed further in Chapter 5.2.3.

Marketing & Collaboration

It is important that the local wool industry is not only seen in the light of social and environmental sustainability but that it can also provide economic sustainability, otherwise it will not be able to continue indefinitely. Pricing of yarns has proven difficult for many farmers and is one of the 'controversies' that arise in the next section (Chapter 5.2.3). However, the ways in which the farmers market and sell their products is relevant to the maintenance of the network and valuing the yarns.

A concept that many farmers mentioned using in the sales and marketing of their products was using aspects of their farm and sheep as a way of selling an experience to the customers. Pine & Gilmore (1998) described the 'experience economy' as a method for increasing economic value through designing and selling an experience linked to a product. Bille (2012) also describes how Scandinavian countries have integrated this concept into aspects of local and regional development; promoting cultural activities to attract visitors or residents to a region. Regarding local food networks, the Farmers Market (see Chapter 2.3.2) provides a cultural experience for customers as well as the history and tradition connected to the food and farm (Sidali et al., 2013). It often works in similar ways for the sales of local wool and yarns too:

"I cannot bring all my clients on the mountain but I can give them the experience with a story behind products. I name the yarns after the sheep and I have only some sheep of that colour so it's easier for me to remember the colour. I have a grey yarn which is very thin and it's called after our favourite sheep Magda. I was questioned whether Magda was a problem. 'No, she was really nice' I say, 'but the yarn was so hard to wind into a ball, it ended up twice as big'. So, we talked a bit about Magda and she thought it was great fun to make Magda mittens. If you are selling an experience as well, then the raw material is worth so much more" (Farmer 5).

Many farmers use images and names connected to their farms to help boost the connection of the products being locally sourced. This included using; the name of the farm; pictures of a nearby known lake; pictures of the sheep; writing labels in local dialect and advertising that the

production was carried out by Selbu spinning mill. (Quotes related to these topics referred to names that would not protect the anonymity of farmers, so were therefore not used). In connection to ANT, the use of local nature, landscape or sheep gives these actants agency (Dankart, 2012); suggesting they have power in relation to marketing and selling the products. This power is also perhaps established through creating deeper meaning to the sense of 'place'. Cresswell (2013) describes how humanists influenced geographic thought by looking at how people experience places from a relational and emotional perspective. This again ties in to aspects of the experience economy mentioned above.

Using the 'local' connection to sell products helps promote the environmental aspects through more than simply reduced transportation needs. Other ecological aspects include; the conservation of the pigmented breeds; good animal welfare (guaranteed by the farmer) and the clean, gentle and local production:

“Selbu spinning mill is also a bit sustainable, the wool is untreated, there are no chemicals and that's very important for us” (Farmer 7).

“We justify the quality of the entire value chain from our farm with close contact to the animals and not least in relation to the gentle treatment [of wool] which is an advantage with Selbu spinning mill. We promote it as locally produced wool and locally produced yarn” (Farmer 9).

The farmer below used electronic-bells on her sheep that send a digital signal so she can follow where they were grazing. The technology actually led to the sale of local yarns. It also helped that the customer could relate to the grazing location:

“There was a customer who wondered if they were my sheep or whether they were from Selbu. I said no, they are my sheep and the black one here, I knew it was [grazing] in Rindal because I had seen it on the web in the morning. ‘Oh, that's not so far from my cabin’ and then came ‘Mm, maybe I've seen that sheep actually’ and then there were two skeins [of yarn] sold straight away! I think if you can tell where they come from it has a lot to say as well, we're back to the local. Many buy food from local farmers, they will know where it comes from” (Farmer 6).

Building up a relationship with the customer is important for communicating the value of the products:

“When the customer feels that they know you in some way, so you build up a relationship and they feel that it's you personally who guarantees the quality [...] It is a conscious choice that I am my products, it's my value-promise” (Farmer 5).

Some commission spinners also process their own meat products for sale and sell this in addition to sheep skins and yarns. This offers the personal connection to the products in a

similar way to farmers involved with The Farmers Market. However often many of the sales are conducted from the farm itself:

“We sell in smaller markets around here, not all that many but most of the yarn we sell directly from home, on the farm” (Farmer 9).

“We have prioritised Rørosmartnan, that's where we sell most of our sheepskins and we make contacts and then people come here [to the farm] over the years, there are many people that know about us” (Farmer 7).

Of the twelve farmers interviewed that had commission spun their wool, ten had sold their yarns. One farmer-teacher sells yarns directly to their students who also work with the sheep; they were sold so that they covered the costs of spinning and transport. Five of the other nine farmers mentioned they actively use the social network Facebook as their main source of marketing:

“[We] prioritise a few markets during the year, it's very good advertising and we use Facebook active in marketing. We don't have a website today [...] We have not spent anything on marketing other than what we pay to be on the various markets. But it becomes more like an exhibition combined with sales at the markets we are involved in” (Farmer 9).

When asked about networks in connection to sales of products most collaboration occurred on a very local basis. Neighbouring farms that also had locally processed products often worked together to advertise, promote or sell each other's products. This included selling products through local yarn shops; other farmer's home-farm shops and working with or establishing tourist routes where several neighbours opened up their farms to visitors on an established day:

“We are ten farms that are all doing different things [...] It sort of happened by itself [...] we are many women and we could drink coffee in the morning since we worked from home, so it was a bit of a social at first. Then came the idea that maybe we should put a name to the collaboration and arrange some open days and use each other a little” (Farmer 3).

This collaboration seemed to work particularly well where farmers sold different products or services to each other although there was also room for joint production:

“We cooperate with a neighbour who is also doing a bit of small-scale farm production so we have rented a place in a farm shop that our neighbour runs. We have both exhibition and sale of our products [...] It is only local products from meat and various other things. My neighbour is farming free-range pigs and has a number of products related to them and we run a joint venture with inland-fishing and sell products from that: process products of fish in addition to yarn and sheepskins and sheep meat” (Farmer 9).

Collaboration within the network of farmers who commission spin and sell yarns was limited mostly due to the physical distance between them. However sometimes this was an advantage:

“I know someone who farms GTS; I met her through various courses. We did not meet until we both began as sheep farmers. I have bought livestock off her. So, we’re selling the same products and we have found out that we are so far apart that we can cooperate without competing with each other. We cover two different markets really. So, we intend to run some courses together” (Farmer 5).

Collaboration for the spinning mill with additional projects such as KRUS often takes the network beyond the region of Trøndelag. This ‘outside’ project work is necessary for keeping the network maintained as these projects pay for Ingvild Espelien’s wage. From a sustainable perspective, collaboration or cooperation as opposed to competition is the way forward to creating a sustainable and equitable economy (Ims & Jakobsen, 2010). The issue of competition and collaboration will be discussed further as it appears as one of the ‘controversies’ in the next chapter. Before looking at these aspects, Figure 12 below shows the actants involved with marketing or selling yarns; from the farmers’ perspectives. The colour-coded relational aspects of the actants below are as follows: Green - Ecological; Blue - Relationships & Communication; Black - Economy & Policy; Orange - Idea, Emotion or Concept; Red - ‘Place’; Yellow - Technology and Purple - Aesthetics.

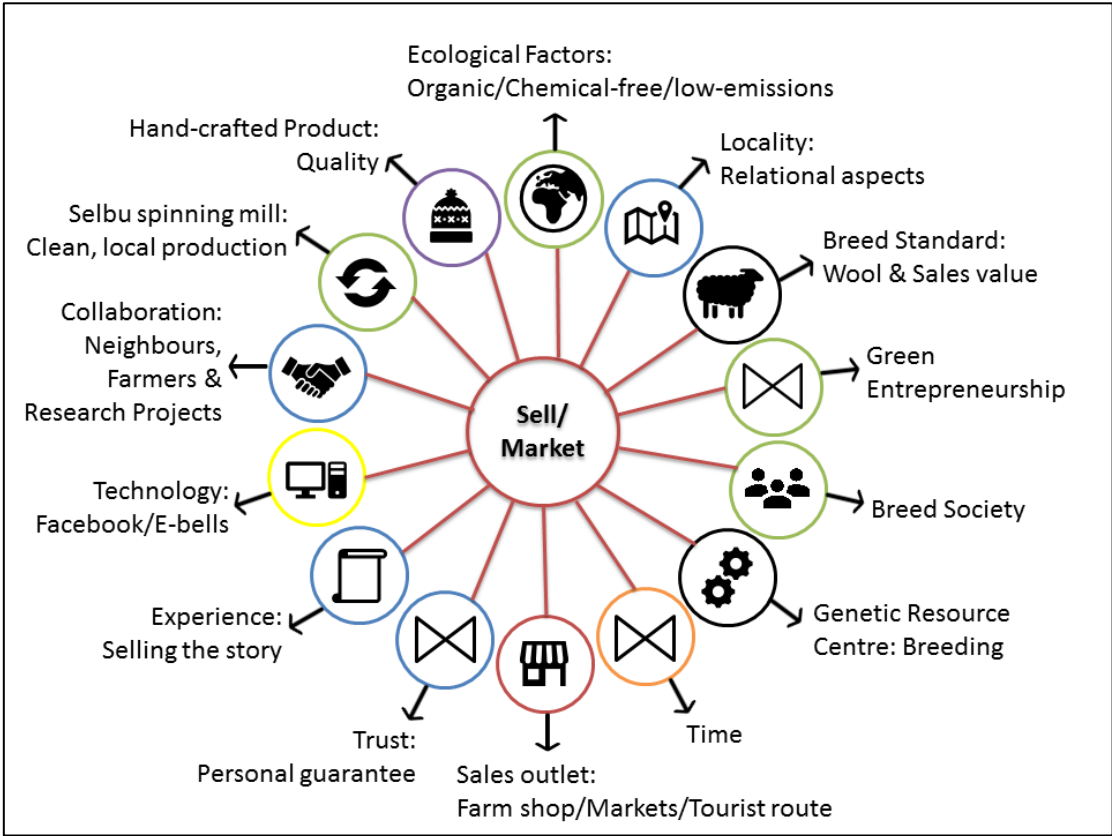


Figure 12 - Actants involved in Sales and Marketing of Local Wool Industry

5.2.3 Controversies and the Changing Network

Latour (2005) begins ‘reassembling the social’ by looking at the controversies defining what he calls, “five major uncertainties” that make up the world we know (p.22). These uncertainties cover the identity actants have within groups; actions that result in changing goals; the interaction of objects; disputes between society and the natural sciences and social science studies (Latour, 2005). The first three uncertainties are of particular relevance to this study and have, to some point, been discussed in various sections without actually naming them as uncertainties. I have chosen to keep this section; the final chapter discussing maintenance of the network, to discuss the issues where there is disagreement within the network. It looks into how those involved in the local wool industry have reacted in different ways to the ‘controversies’ that shake the network and can potentially alter it. These include economic issues over pricing the products; competitive issues between the farmers and the spinning mill and the issue of capacity and time taken to commission spin yarns.

As this section looks very closely at what is happening currently in the network it is, in some ways, already outdated as I write this. The nature of the actor-network is that it never stands still and the network of the local wool industry in Trøndelag is constantly changing. New commission spinners join and old ones leave which can also have a direct effect upon the customers, the sheep and the farms. New ideas for wool processing or marketing products occur on a regular basis and policy is changed in the agricultural system; all can affect the dynamics within the actor-network. These changes in turn have consequences for environmental, social and economic aspects within the network and therefore, potentially within the region.

Sales Pricing and Competition

Referring mainly to local food, Almås (2016) states how local production has made a great difference to Norwegian agriculture through increased demand for niche products. He also mentions that it is only after 15 years that results in the variety as well as economy are really being seen (Almås, 2016). Economic results for the commission spinners interviewed in this study vary greatly, depending on their own entrepreneurial or commercial focus as well as the amount of work invested in the wool before sending it to the spinning mill.

Before discussing the controversies that surfaced around price it is important to describe how the spinning mill charges for the commission spinning service. Although the mini-mill can spin fibres from different animals (from dog hair to musk ox wool) sheep wool is the predominant fibre. The mini-mill can take in a minimum of ten kilos of sheep wool from one commission

spinner although 30 kilos is the recommended minimum weight (Selbu spinneri, undated). The price is charged on the kilo weight delivered in to the mill as opposed to the weight of the finished yarn. The information given out to prospective commission spinners explains that weight is lost at different stages in the processing; the amount depends on the breed and the quality of the wool brought in (see Table 5 below).

Table 5 - Loss of Wool through Processing (Selbu Spinneri, undated - my translation)

FIBRE	LOSS - Sorting	LOSS - Washing	LOSS - Processing
Spæl wool	0 -10%	25%	20%
‘Wild Sheep’ wool	0-15%	30%	20%
Crossbred wool	0-5%	30%	0-30%

The following information is also sent out to commission spinners:

“[T]he less you deliver, the more loss there is, so the final price will be more expensive! If you deliver 10kg, the price can be almost double per kg compared to if you deliver 30kg. If you deliver 30kg or more, we have a guaranteed maximum price on the finished yarn. Badly sorted wool needs to be sorted and that costs [extra]” (Selbu spinneri, undated, p.1 - my translation).

The loss of fibre does not necessarily mean that it is wasted as it can be made into other products or returned to Nortura (see Figure 5, p.45). The recommended minimum delivery however, has affected the actor-network, resulting in one interviewee deciding to send their small amount of wool to Telespinn in Telemark instead:

“When Selbu spinning mill started up I was in contact with them and I could just send the wool there, but I wouldn’t get back my own yarn before I sent over 30 kg of wool and then we decided to send to Telemark instead [...] with only 25 sheep and one shearing a year it would take a bit to get to 30 kg which is of so high quality that you want to spin it” (Farmer 11).

However, the minimum weight did not dissuade everyone who had only a small flock. One farmer interviewed with less than 20 sheep is in the process of collecting and saving up his wool so he can spin it in the future. I asked Ingvild Espelien about this issue of minimum quantity during the follow-up interview:

“I don’t know how Telespinn does it but if you take five kilos you get maybe two kilos of yarn, actually less [...] and the yarn would be extremely expensive for the farmer and that’s why we wish to have 30 kilos because then we can guarantee what they must pay. Also, I think that it is part of our plan that we like to be a little bit professional together with the farmer, so if the farmer only wants to spin five kilos and make it for themselves, it’s ok that they use Telespinn. We want to work with the farmers that want to sell yarn or sell products” (Ingvild Espelien - interview 2).

This more 'professional' attitude can help to secure farmers that want to continue spinning and become regular customers with the spinning mill. Out of the 12 interviewees who had commission spun their wool; four commented that they were unlikely to spin more yarns. One had issues with the time it took to spin the yarn and that will be discussed later. The three others had spun yarns for their own personal use. One of these didn't have sheep any longer and the other two were pensioners and explained that they weren't good 'salesmen' and felt the price of the yarn was too high to sell:

"If we would sell it [the yarn] it would have to have been so high a price so that perhaps we could have covered costs but not have made anything on it. So, then we could keep it and knit for the children and grandchildren and so that's what we did. We have a pretty active art and handicraft association in the district here but basically it comes down to price and then the idealism is swallowed up really" (Farmer 12).

Where farmers prioritised selling the yarns and had a more entrepreneurial focus on using the yarns as part of the farm business, then the price did not seem to matter too much. It also made a difference where farmers worked to sort their own wool first, reducing the work needed by the spinning mill as well as the loss of fibres during processing:

"It has very much to say in relation to the price that we take the greatest possible part of the job ourselves to sort the wool before sending it from us [...] It's a very well paid job to take the sorting of wool yourself [...] You have to be set on making money from own yarn. So, you must see it a little commercially; what you need to make it work economically [...] it's exciting to set a good enough price but it goes well. We just need to decide which customers we want to sell to and we have a market that is willing to pay a higher price for yarn. The group is large enough to cover the demand we have on the amount we have today" (Farmer 9).

Relying on a market that is willing to pay higher prices can potentially cause problems when finances are low. During the interview with Innovation Norway (IN) the possibilities for local yarn sales in relation to IN's experiences of supporting local food producers were discussed:

"There are opportunities but it always boils down to how willing people are to pay for external sustainable products [...] It [an income] is coming but it does take a long time. But in periods like 2008/2009 they experienced a drop. It doesn't have to have any effects in reality but they [customers] are more careful with money. So, it is vulnerable" (Aud Kvalvik).

Given the need to choose between food or clothing, the consumer who is being careful with money is more likely to buy food. However, in order to work towards local resilience, developing social resources (Marsden, 2016) or utilising natural resources from the bio- or eco-economy have an important role in sustainable regional development (Marsden, 2016; Luoma

et al., 2011). Wool is a naturally renewable resource as well as a bi-product of food production and has therefore the potential for further utilisation whilst serving the food and fibre demand (Marsden & Farioli, 2015).

One of the two organic farmers interviewed commented that their customer group is willing to pay a higher price, but that does not necessarily mean that the customers have to be wealthy, only that they too need to be conscious consumers:

“We sell mostly to people [...] who are very concerned that things should be organic. It should be original and it must be quality. I would say that when you consider our consumer group, they don’t need to have so much money, some have it, but what characterises them is that they are conscious of what they want; quality and that it should be organic” (Farmer 7).

Guercini & Ranfagni (2013) studied the relationship between sustainability and luxury products through focusing on projects using native wool in Italy. They suggest that although the products are seen as unique and are at a higher price level and therefore a luxury, the products were accessible to, “consumers who identify with the underlying sustainability project” (p.86). This would suggest that an increase in understanding of the need for sustainable products within consumers may also increase the market for sustainable products.

Some farmers mentioned that it was not easy to make money through commission spinning but that other values could be gained from having the yarn available for sale:

“The way it is now we don’t earn any money from spinning yarn at Selbu spinning mill, I do it mostly because it’s fun [...] But I actually lose money to sell yarn [...] I feel that I take a high enough price so I cannot charge a higher price than I have [...] So, we sell meat and I think that the yarn is part of the whole [picture] which is good for our image. I think that we earn from it that way, in some ways everything is connected together” (Farmer 3).

“I don’t earn so much selling yarn but I think it’s fun anyway. Also, that people come and greet the sheep and know where it came from” (Farmer 4).

Pricing the yarn was one of the controversies that was mentioned several times under the interviews with farmers. Not only that it was difficult to ask the consumer to pay a high enough price but also because of the price that Selbu spinning mill sold their own yarns:

“Selbu spinning mill compete with us farmers because they sell yarn so cheap, I cannot sell yarn as cheap [as them] because then I’m giving it away. I had so much wanted to support them, wanted them to survive. While now it becomes more that they can ruin it for me. So, I lost a bit of the glow I had” (Farmer 1).

This suggests that the issue of pricing led to a loss of admiration and trust in the working relationship with Selbu spinning mill and therefore within the actor-network. Michael (2007) describes trust as essential for developing a business network: “[F]or *trust* is an essential ingredient in relationships to the level where cooperation for business purposes can occur” (p.50 - author’s emphasis). The differentiation in pricing became even more of an issue if farmers and Selbu spinning mill were selling products at the same market:

“The problem is that they [Selbu spinning mill] sell yarns cheaper and they are often out on markets. The customer does not understand the difference and it is the customer who buys. We realise that they can sell [cheaper] and still earn on it but we can’t do that [...] But at [a recent market] they were really kind and not there, otherwise they would have destroyed the market for us in some ways because they can sell cheaper. It is them who create the price-line because it is them who are known first. Most people associate our products with Selbu spinning mill” (Farmer 6).

The price difference is creating competition and therefore affecting power-relations within the actor-network; in this case, price has the power to secure the customers and Selbu spinning mill has power over the farmers to set the price. An imbalance in feelings of power can then lead to negative feelings within the actor-network. Ims & Jakobsen (2010) describe how; “jealousy, envy, cheating and disintegration are symptoms of a mismatch between worldview and principles for organising the economy” (p.34). They continue by saying that cooperation and participation need to be valued above competition and are sustainable aspects that need to be, and can be learned in a more sustainable system. Selbu spinning mill may be seen by some farmers as competition but they also offer to promote farmers’ yarns for sale within their own network of customers. It may be that not all farmers are aware of this as I only discovered it through one of the commission spinners. When asked how she had sold her yarns she replied:

“Facebook and through Ingvild. For Ingvild announced that we had taken home some yarns on her website and there were some who were interested there. [So, I] got help from the mill too and it was good because there were some who bought through them” (Farmer 4).

This would suggest that there is an attitude of cooperation between the mill and the farmers. Another farmer corroborates the idea that the whole actor-network needs to be and is actually working for each other in some ways:

“I don’t look at Selbu spinning mill and the other commission spinners as competitors I look at us as representing the same industry, the same interest. So, if they buy yarn from me or yarn from another farm, that does not have much to say because next time maybe they buy from me, if they first find out that [the yarn] is pleasant and good to work with. So, it's the same as with local food you can’t have

local food if there is only one provider in all of Norway, it is no longer local food. That's what happens at the Farmer's Market, they buy a bit from everyone. If there were only three farms that were there, no one will have bothered to go there. We must promote each other” (Farmer 5).

It was unclear if the issues of pricing had been brought to the attention of Ingvild Espelien and Selbu spinning mill. One farmer mentioned that at a recent meeting for judging the ram lambs the issue of price came up between some of them:

“We talked a bit about the price and there was someone who suggested at the meeting that we try to put about the same price on our yarn. It was said at that meeting that some reacted to the price Selbu spinning sold for and they [Selbu spinning mill] need to be told because it isn't good” (Farmer 1).

This would suggest that the information had not been communicated back to the spinning mill, whereas another farmer was open about discussing the issue directly with Ingvild Espelien:

“What I tend to say to Ingvild is that she must think; it is us who are the commission spinners, so if they want us to be at a price level then they need to be there too. They can't be lower. For if not, then we need to go down in price and earn even less and that means we most likely lose money [...] So then you have to make a choice to either stop spinning yarns or you need to find another spinning mill and then we all lose out. You don't want to use another spinning mill because you want to use Selbu” (Farmer 5).

For this farmer, the trust is not yet broken which could suggest that the direct communication and discussion of the issue with Ingvild, who represents Selbu spinning mill, has helped to keep the network and connection between them intact. The need for better communication within the network also surfaces later in this chapter. For now, we continue with the issue of pricing. The yarns are generally sold in 100g hanks or skeins both by the farmers and through the spinning mill's shop. One farmer stated that it was not Selbu spinning mill's price that was the problem but the low price offered by other commission spinners for their skeins:

“I sell with a bigger profit compared to the others that sell yarn, I'm 70 kroner more expensive [per 100g skein]. But I sell. I sell for profit but those who sell for the same price as Selbu spinning mill they make a loss. ‘For us small businesses selling so that we get something sold’ they think, so they price themselves after Selbu spinning mill's prices. I cannot be satisfied by that. I cannot afford to buy new yarns either. So, I put myself 70 kroner more expensive and yes, many think it was expensive but I sold” (Farmer 6).

Many in the network are aware of the discussion around price and it is an issue with several different angles to it, including not scaring the market away before it has really got interested:

“It is a bit of my philosophy that the interest in Norwegian yarn is rising but it isn’t on top. I know that it is difficult to increase prices of products later, but if you are so high that no one will buy it so you don’t get the interest up either. So, there is a balancing act there, we can’t price ourselves out before we’ve started” (Farmer 5).

Valuing the yarn is not simply down to the price tag and an economic calculation. Creating and selling the story of the value chain from sheep to product brings in a connection to the experience economy again:

“I know that many are very aware or concerned about having the same price for selling the yarn of GTS. I am not so sure whether it’s the right path because the whole package (if I can call it that) means just as much in relation to whether you align the price. I think it’s your own story that sells as much yarn” (Farmer 9).

It must now be said that Ingvild Espelien is also aware of the pricing debate. The spinning mill began recommending a price range for the commission spinners about a year after the mill was established. Each farmer is sent a recommended price list with their finished yarns, although Ingvild commented that she wasn’t sure if everyone read these lists. In December 2016, Selbu spinning mill increased their own prices for selling yarns without increasing the commission spinning prices:

“We increased the prices because I think we have too small a margin in selling the yarn, now the margin is bigger and it’s easier for people who want to sell our yarn in a shop somewhere. They will be able to earn a little bit more money; they can get a lower price from us compared with our web shop price. Also, it’s because the farmers should charge about 200 kroner for 100g and then we should be in the same price area” (Ingvild Espelien - interview 2).

This may have helped to diffuse the issue and realign power relations, bringing more balance to the actor-network and hopefully removing the feeling that farmers were being out-competed. However, all farmers were interviewed before the price increase had been initiated. The issue did bring to light the need for some form of communication platform where spinners and mill could discuss these issues together:

“I think it’s good to discuss when it has something with the price anyway, so that we are a little bit similar. Now the price starts to have 30, 50, 70 kroner difference so it’s a big price difference. But it’s okay to have a price that you are not ashamed of every time you say it. That you don’t get a knot in your stomach every time you say [how much it] costs” (Farmer 6).

The potential for developing discussion through a networking platform to encourage easier communication between the farmers and the spinning mill will be discussed further in Chapter 5.3.3.

Capacity & Time

The second and perhaps more serious issue has resulted in at least one farmer being reluctant to continue spinning and was commented on by almost all who had spun yarns. This is the issue of the capacity of the spinning mill and the time it takes between delivering wool to the spinning mill and receiving the finished yarns:

“First I delivered wool just in sacks and it must have gone in storage or something because it took a long time before I got it back, way too long [...] It took so long last time that I lost the courage [to spin again]. How do I know that it won’t take two years next time?” (Farmer 1).

“There has been mixed interest [in spinning] over the years but I think the interest is growing. A small challenge with Selbu spinning mill is that it takes a long time from when they have supplied [the mill] with wool to when they have got the yarn back. It has been a start-up challenge for the spinning mill and it has affected the interest a little in relation to delivering wool from GTS among others” (Farmer 9).

There were also some farmers who mentioned that it was difficult to hear about the other projects that Selbu spinning mill is involved in while they are waiting such a long time to get their yarns back. When asked what would be acceptable in terms of a time-frame for receiving yarns back from the spinning mill, one farmer said:

“Just a date would be acceptable. It goes two years or something and no-one knows when they’re going to get it back. They [the mill] have many good intentions but the organising has not been completely there. It’s a bit different now I think, but still, we hear about dog hair and alpukka spinning but we, as shareholders, we don’t know what’s going on” (Farmer 8).

This aspect also links in to the need for a communication platform (see Chapter 5.3.3), where such issues can be broached and explained; giving clarity to all parties. The necessity of other projects for paying the wages of Ingvild Espelien and maintaining the network are perhaps not fully understood by all the farmers/shareholders.

The capacity of the spinning mill is something that Ingvild Espelien is constantly trying to do something about. It is an issue that came up several times during the participant observation where I first learned about one of the changes put in place to help increase the amount of wool processed each week. The move to Klæbu instigated the introduction of late-shifts which was also made possible due to the reduced travel distance to the spinning mill and the employment of Ingvild’s youngest daughter. Late-shifts were introduced to improve the efficiency of the spinning mill by keeping the machines running longer, with a shift from 12pm to 8pm on two

evenings a week. The increased interest from farmers wanting to commission spin their wool has led to there being approximately a two-year waiting list:

“The problem today is that there are a lot of farmers that want to have spun wool from their own sheep and the mill is too small. So ideally, I would like to have a bigger mill” (Ingvild Espelien - interview 1).

To increase the size of the mill requires a large investment into the business to buy more machinery and bigger premises in which to house the machinery. When the mill was first established the issue of the present capacity was not foreseen as a potential problem:

“When we started, we thought that there was going to be a problem with marketing, we would need to work a lot to get farmers to come to us and make their yarn. We also thought that we had to work a lot with marketing the sale of the yarn from our own shop. But actually, the problem is/was the capacity of the mill. That is good news to us but it was a drawback because it was a problem to make the mill economically sustainable because it is too small compared with the salary for one person that is working here. So, it would be much better to have a bigger mill, we could still run the mill with only maybe one or two persons and that person could do twice or maybe three or four times the job on a larger mill” (Ingvild Espelien - interview 1).

The economics of the spinning mill makes it difficult for the business itself to re-invest in larger or more machinery, as well as causing problems when seeking investment from other sources:

“The first year we had money for making the business plan and we also got investment money, 30% of the investment in the machines we got from IN. [Since then] we have had meetings with them and they told us that they were not interested in putting up any more money into the mill because we didn’t earn money. But we wanted more money because we realised that we couldn’t earn money because it was too small and they couldn’t give us money because we didn’t earn money. So, this is catch 22” (Ingvild Espelien - interview 2).

In relation to moving towards a sustainable future that also ensures economic, ecological and social sustainability, Jackson (2009) states that investment is key to meeting the challenge although the traditional paths for investment need to change:

“Innovation will still be vital, but it will need to be targeted more carefully towards sustainability goals. Specifically, investments will need to focus on resource productivity, renewable energy, clean technology, green business, climate adaption and ecosystem enhancement” (p.138).

As a ‘green business’ in Trøndelag with the potential for fulfilling some of the sustainability goals as well as working towards resource productivity; indirectly having potential effects on ‘ecosystem enhancement’ through effective grazing, it would seem that Selbu spinning mill should be a good candidate for receiving funding. A similar opinion was given in the interview

with Reidar Almås who established the Centre for Rural Research in Trondheim and has many years' experience working with Rural Sociology and Norwegian agriculture (Centre for Rural Research, undated). When asked if he had heard of Selbu spinning mill and if he thought there was a place for wool in sustainable regional development he replied:

“Yes, I’ve read about [Selbu spinning mill] in the newspaper, I think they should have had support for their work and I guess they’ve had some, but not too much I think [...] It is a part of Norwegian tradition, [wool] is a sustainable product, it won’t pollute, it can serve people for a long time and then it can go back to nature and it’s also an under-developed product, under-developed natural resource. And when we want to develop the natural bio-economy we must look for under-developed natural resources” (Reidar Almås).

Long-term, resilient solutions are needed in order to make the change from an unsustainable society to a sustainable system (UNEP, 2015). However, long-term solutions can conflict with the interests of short-term economic gains (Kommunesektorens Organisasjon, 2016). IN state that sustainability and economic profitability can work together towards creating new opportunities for Norwegian industry (Innovasjon Norge, 2016). However, from a deeper sustainability perspective it seems clear they are required to put economy first:

“We demand that people who seek funds from IN come up with an argument based on figures as much as on prose [...] The job we have is about economy, what we lose by not taking into account that it is worth conserving breeds, is a part of the culture and history. We can lose the whole breed if there is no economy in it [...] Although it is important to take care of old breeds, IN cannot put the requirement for profit aside. Applicants must show that the project has the potential to become financially sustainable” (Aud Kvalvik).

The Norwegian Association of Local and Regional Authorities, however, recognise that the creation of value should relate to the combined effects of business activities including financial, environmental, cultural and social; “Nature and culture are an integral part of economic activity and cannot be seen as external conditions” (Kommunesektorens Organisasjon, 2016, p.27).

Regional resilience is also seen as relying on attracting and keeping skilled labour and innovative firms (Bristow, 2009). Following the comments from one of the farmers interviewed, they use the skills of Selbu spinning mill as part of their approach to marketing their yarns:

“We justify [the price] that it is a local handicraft and it is a small-scale spinning mill and knowledge that there is very little of in Norway today, so it's very special” (Farmer 9).

During the participant observation, it became very clear to me that the wool processing in the mini-mill was handicraft; which was surprising as it is also machine work. However, even with my knowledge of wool and handicraft background, it was at times challenging to repeat the handwork done by others there. Some of the machines require a level of tacit knowledge and are therefore accessible only through experience or ‘learning by doing’.

The process for securing funds for increasing the capacity of the spinning mill is still on-going and will require the entrepreneurial skills of Ingvild Espelien as well as collaboration with the farmers and the local municipality to find a final solution. Some possible ideas around a bigger spinning mill will be discussed further in connection with future development of the network (see Chapter 5.3). Figure 13 below shows the actants involved in keeping a balance within the actor-network through changing power relations and adapting to the controversies that arise. The connections are related through their colours which represent the following aspects: Green - Ecological; Red - ‘Place’; Brown - Practical Applications; Black - Economy & Policy; Blue - Relationships & Communication; Yellow - Technology and Orange - Concept.

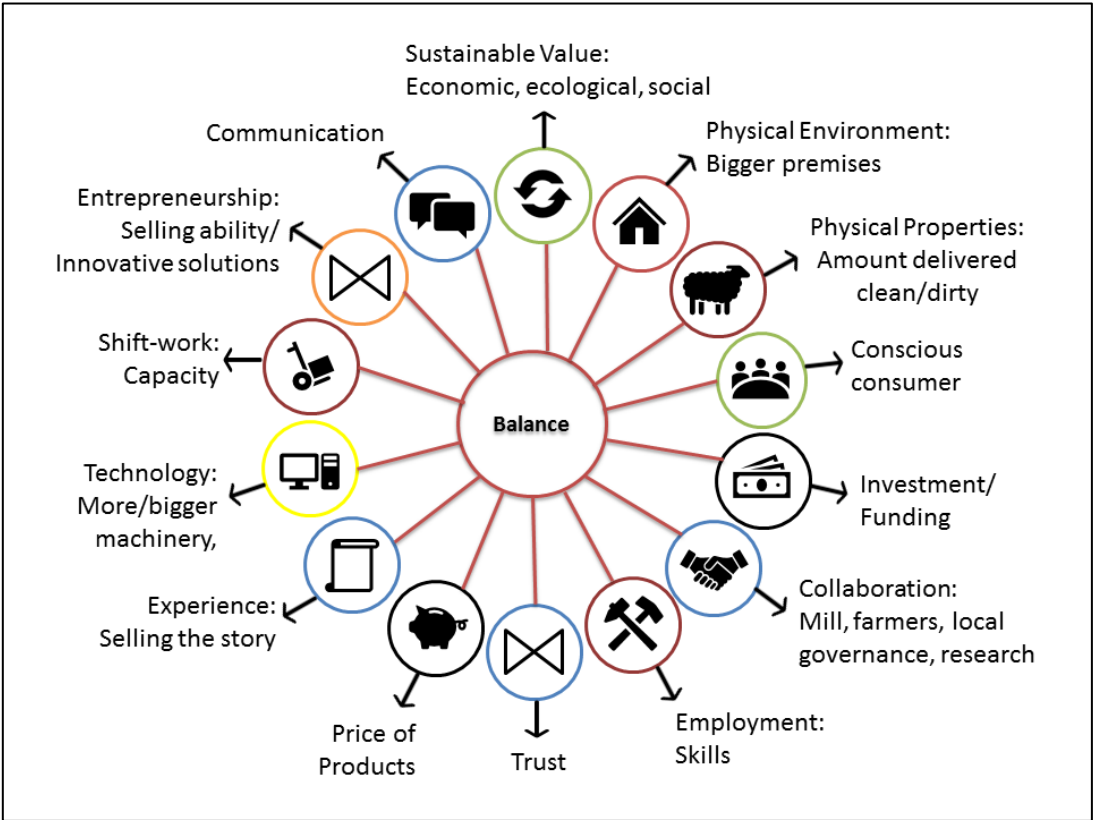


Figure 13 - Actants involved in Creating Controversies and Keeping Balance within the Actor-Network

5.3 Moving Forward

This section of the analysis looks at the comments given by interviewees regarding the future; for farming the older, pigmented sheep breeds; for spinning yarn and for developing the small-scale wool industry in Trøndelag and therefore the actor-network. This is an important aspect in answering research question three: *How can the actor-network help a small-scale woollen industry affect sustainable regional development in Trøndelag?*

Development of the actor-network is also necessary for its maintenance as the network ceases to function if the relational activity ends. However, the focus for this section is future change; covering ideas, dreams and plans the interviewees are considering and links these to theoretical possibilities. Issues of change include what happens to the farms and farmers; regarding flock size, breeds of sheep, attitudes towards organic farming and employment outside the farm. Network development covers possibilities for improvements in communication and developing new partnerships. System change looks at possible developments within the system for sorting wool through the agricultural collective Norilia and the potential for developing the system for spinning yarn, increasing the capacity of the spinning mill and stimulating sustainable regional development.

5.3.1 Changes on the farm

Agriculture is an industry that is familiar with constant change connected to new farming methods, technology and the drive for more effective productivity (Norway, Landbruks- og Matdepartement, 2016). Norwegian agriculture is also required to adapt and contribute to the move towards a more sustainable society (Norway, Landbruks- og Matdepartement, 2016) and agricultural policy can help towards providing resilience in the changing climate (Campbell & Almås, 2012). At the same time, Norwegian agriculture is also affected by international market prices and therefore expected to offer strong competition on an economic level (Norway, Landbruks- og Matdepartement, 2016). Market prices in turn affect the income of the individual farmer in relation to the meat and wool produced from their sheep and subsequently can affect their decision as to which sheep to farm.

Sheep, Income & Employment

The farmers were asked about the future developments on the farm in relation to their sheep flocks and the answers were varied. Five farmers had plans for increasing the number of sheep they farmed, although for two of them NWS were being considered, purely to help bring in income:

“We thought that maybe we should invest more in NWS and get a better return for the meat because we haven’t quite managed to get started with the wool processing and yarn” (Farmer 1).

To increase the NWS was seen as an unfortunate necessity by the other farmer as it would also mean reducing the number of older breeds:

“We are starting to get tired and therefore we have bought in NWS as well. It feels like a defeat actually; feels like I’ve lost the fight. But we must have something that pays the bills on the farm” (Farmer 5).

Selbu spinning mill does take in white wool for spinning too, so it would not be impossible for the farmers to use some of their white wool in the local wool industry. However, it was the three other farmers, interested in increasing the number of old breeds that were also considering increasing the development of yarns. The increase in flock size was also with an aim of improving the overall farm economy but depended on having enough money to extend the sheep barn or rent more land for grazing:

“It is possible we develop and get a new barn and then perhaps increase the flock; it depends whether we can lease the land. But it could easily happen that we increase to be larger sheep farmers with ONS and GTS and a little white spæl maybe. It is the play of colours; the product that I take back” (Farmer 6).

Increasing the flock is also directly related to creating an income from the farm with the older breeds of sheep too:

“Up until now we have concentrated on building up the farm with sheep, so all profits have gone back into the farm. Our goal is to reach 200 over-wintering sheep, then one of us can be full-time on the farm. This is both in terms of meat production and in relation to developing the wool and skins” (Farmer 9).

The local wool industry may not be enough to supply an additional income on its own but in conjunction with the other products and values that the pigmented sheep can offer, it can help create local employment that helps keep families resident in rural areas. The creation of small value chains in Norwegian agriculture were recognised as essential contributions to local development and the preservation of rural communities (Norway, Landbruks- og Matdepartement, 2011). The Farmer’s Union emphasise that small holdings as well as large farms are necessary for achieving climate-friendly and sustainable agriculture and that local ownership of farms creates the potential for more resilient communities (Norges Bondelag, 2016).

The issue of employment also connects into the likelihood of farmers continuing to spin yarns and develop products; mainly in relation to the time they could devote to develop the handicraft and sales side:

“When you work with sheep you have the opportunity to combine it with other things” (Farmer 7).

Seven of the twelve interviewees who had commission spun their wool at least once were part-time farmers with flocks varying from 20 to over 100 pigmented sheep. Six of these had full employment in various positions such as teacher, ambulance driver, nurse or agricultural director. Only two of them were considering continuing to commission spin their wool and one of those was hoping to soon work full-time with the sheep. Full-time employment away from the farm was seen as an obstacle towards developing products with wool, although other opportunities arose with keeping the sheep:

“I believe that we will continue with sheep. Also, if things do not change much we certainly intend to continue to do something with the wool. But it's a bit dependant on time. If I get a full-time job outside the farm it can happen that we don't do so much [...] But what we see is that there is a big interest in spinning and it's a lot less work for us to sell raw wool” (Farmer 3).

Sales of ‘raw’ wool (unwashed, straight from sheep) could provide as much as ten times the price the farmer got paid if they delivered the wool to Nortura, making this opportunity very economically viable. Selbu spinning mill offers several spinning courses, often together with wool sorting classes, so in a way the spinning mill is also contributing to increasing the interest in spinners on a regional basis.

From the five full-time farmers, four expressed interest in continuing to commission spin their wool, the fifth farmer had retired from sheep farming. This suggests that farmers are more likely to continue commission spinning yarns where they are working full-time with sheep production, or have only part-time employment in addition to the farm.

However, a potential drawback for part-time and small-scale farmers wanting to develop opportunities with the local wool industry can be the difficulty of sourcing funding to develop their ideas:

“Grants for development projects in agriculture are prioritised for those businesses in which the agricultural sector has or is expected to have real economic significance for the family. This applies to both traditional agriculture and the new cultural or additional industries. So, those whose main income is outside the farm would also be outside [IN's] target group as the farm is then a preferred residence and not a real financial commitment of the family” (Aud Kvalvik).

This can of course encourage farmers to work full-time with sheep and increase their flock size but for small-scale farmers it can be difficult. One farmer gave up sheep farming in 2014 due to the change of government and the poor signals for small-scale farmers:

“It was not something that we really earned a lot of money from, it was supposed to pay for itself and provide a little bit more. Plus, it was an important thing to do to take care of both the cultural landscape here and likewise the breed [GTS] that we found so interesting. But then we got a change of government and that was a direct reason why we stopped. The signals we see now have actually started to arrive; that they would favour larger farms. So, if you had under 50 or 60 overwintering animals you would get smaller grants. Likewise, some of the special subsidies would be taken away, such as for steep farmland” (Farmer 15).

In the interview with the employees from the County Governor’s office, it was suggested that sheep farmers were an important resource in other regional industries in addition to farming, due to the reason that they were part-time farmers. The senior agricultural advisor repeated what she had heard at a recent lecture describing:

“[H]ow important it was to have sheep farmers to carry the industry in Norway; the industry which is de-centralised. Those engaged in sheep farming may have the opportunity to take on extra shifts and work in industry as well as sheep production” (Eva Dybwad Alstad).

In addition, when considering whether larger farms can use resources most effectively, the assistant agricultural director stated that small-scale farmers had in general fewer external pressures on their time and therefore could be more efficient:

“We in south-Trøndelag are generally a small-scale agricultural county. We do not have many of those kinds of huge farms. The majority are in general [small-scale] and I think these farms effectively exploit the areas and resources we have, even though they may not be the largest farms. The sitting government want to support large farms, so they are working towards that. It's a goal that we have to follow and we will do it as well as we can. But in our county, it's pretty small-scale agricultural areas and mountainous. We have to adapt but the topography sets natural limitations” (Magnhild Melandsø).

Suggesting, it is not only financial issues that determine if a farmer works part-time or not but the landscape itself can be a determinate, perhaps even with some power against governmental policy. This is particularly interesting in relation to recent events in New Zealand where a river, and before that land, was given the same rights as a human being (Roy, 2017; Machado, 2016). Recognition of the heterogeneity of the actor-network (Law, 1992) and the equality of human and non-human actants to enable change (Cresswell, 2013) is fundamental to ANT. The New Zealand government acknowledged the power of the landscape in connection to the beliefs and

culture of the Maori people. This would suggest recognition of the sense of belonging people have with 'place', connected in various ways to relations, feelings, history or historical stories (Aure, Nyborg & Wiborg, 2015). The assistant agricultural director of Trøndelag's County Governor's office recognised the power of the physical landscape on agricultural practice and the need for policy to take this into consideration.

Returning to the future of farms in Trøndelag, several farmers mentioned that the 'younger generation' were interested in farming sheep, although not all farmers were sure they would recommend it:

"Our youngest boy is now at Agricultural school, he wants to take over here and has previously said he wants to farm sheep. So, in that way maybe there will be more sheep here but I haven't recommended it because there is little money to be made from it. I hope they learn more about it at school" (Farmer 2).

One farmer professed that if the sales of wool can be increased then this could have a direct influence on farming the older breeds of sheep:

"If you increase the interest in the purchase of wool of GTS this can contribute to growth in the breed. You can't expect that all sheep farmers are equally interested in relation to the selling yarn from their own sheep, I think you have to be realistic that it's a big job to sell it. But it may be a bit easier to deliver wool and to get a good payment only for wool would definitely mean more would farm GTS" (Farmer 9).

Another farmer described the success of the few farmers in their area that managed to produce and sell local products as being due to their ability to do all sorts of things and have always that bit extra to give. In Norwegian: "*Overskuddsmennesker*" (Farmer 12). This could also fit the definition of an entrepreneur, such as Allen & Malin's definition; "of an enthusiastic, industrious individual [...] ready to tackle challenges and innovations most would find daunting" (2008, p.828). It suggests that entrepreneurial behaviour can affect the future of combining sheep farming with niche production.

Organic Farming

One of the possibilities suggested by Selbu spinning mill as of interest for future sustainable development, was the obtaining of certification for organic production. The assumption of some farmers is that the spinning mill could almost be classed as organic already. The only additions to the wool during processing are soap under washing and spinning oil under production. The spinning mill estimate they have around 20% of farmers supplying wool from organic farms and it is these farmers that would potentially benefit from this change:

“In the future, I’d like to have ecological certification for the production. ‘GOTS’ [Global Organic Textile Standard] or ‘Oeko-Tex’ [Confidence in Textiles] there are a few labels. If we get this system, it’ll be for all the wool, but of course only the farmers with the ecological sheep can market using this quality sign for the whole value chain. Some farmers and some customers have already asked for it. The reason why we don’t have it is we need to take care to be economically sustainable first because it costs a lot of money to work through the whole system to get it acknowledged. Then afterwards we need to pay each year for it. I think the most important aspect is that we could say that it is ecological because I don’t think that we could increase the price of the yarn very much but maybe some of the farmers can do that” (Ingvild Espelien - interview 1).

Considering ecological certification which would predominantly help organic farmers at financial cost to the spinning mill connects the business again with green entrepreneurship as it suggests working with a sense of social responsibility (Allen & Malin, 2008).

Two of the sheep farmers interviewed ran organic production and mentioned that organic certification for the yarn processing would be an added benefit. Two other farmers had farmed organically before and the prospect of being able to label the yarns organic would make it interesting to convert back to organic production:

“We practiced organic sheep during the first years. We could well have thought to run an organic farm but as Selbu spinning mill does not have the certification for organic products so even if we had organic sheep, we could not market as organic wool. It would absolutely be worthwhile, it would be good for marketing products if you have a wholly organic product both with the idea of the animal and not least in relation to the spinning mill” (Farmer 9).

This suggests that organic certification of the spinning mill, could influence the organic status of at least some of the sheep farmers they work with. This would also work in conjunction with the plans for the county and agriculture in Norway in general. Increasing organic production in order to achieve 15% of land and 15% of animal production as organic by 2020 is part of the future goal for Norwegian agriculture (Knutsen, 2016). Trøndelag is seen to be leading nationally in attempting to reach this goal (Norway, Fylkestingene i Sør- og Nord-Trøndelag, 2012). Organic production is also seen as an area for increased possibilities in relation to developing new industry (Norway, Fylkestingene i Sør- og Nord-Trøndelag, 2012). IN also prioritise organic production where possible:

“[A]nyone who seeks to farm organically is a priority, where they can show potential for being profitable. Organic production is prioritised ahead of conventional production, on milk and meat and vegetables” (Aud Kvalvik).

However, nine farmers stated that organic production was either not interesting for them, as it meant too much work and not enough money or it was not possible due to having poor quality land, too few acres to farm or not enough experience. Eight farmers proclaimed that sheep farming in Norway is as good as organic already due to the lambs being fattened from grass or mountain grazing instead of imported grains:

“There are very many who are concerned about whether it is organic, and we are not organic so we try to explain that the sheep are completely organic. We give them almost no concentrated feed; only when we collect them and right after lambing. They eat grass that is not sprayed with pesticides and they go out throughout the year. The sheep farming is completely organic but we also grow grain and that's not organic. So, then we don't get the 'Debio' certification for the sheep” (Farmer 3).

Some farmers felt that because Norway has a good reputation for clean production, organic certification was not as important for customers:

“I don't know if Norway has the customers [for organic] because we have faith in the Norwegian clean production. So, organic has not so high a standard when compared to the conventional as it does in other places where organic for them gives the surety that it is a good product” (Farmer 8).

In addition, several farmers mentioned that media attention (Messel, 2016) questioning the value of organic products had caused doubt or scepticism around the theme:

“There was a television program just now on the difference between food that is conventional and organic. There is no difference. They found no evidence that there was anything dangerous with food, the only difference was the fertiliser and that in itself is not dangerous. It's completely harmless. Pesticides I watch out for, I don't spray anything, I realise that it is dangerous to spray a lot” (Farmer 16).

“Seems there has been a small problem in recent times, when we're trying to increase organic production and they're running big [television] programmes asking if there anything with organic or not” (Farmer 12).

This perhaps explains why many farmers mentioned using the term sustainable as an alternative:

“My lambs are almost strictly organic. But I think that the ecology concept has lost some charm and so sustainable is my new favourite phrase” (Farmer 10).

So, for many of the farmers interviewed in this study, organic certification was not as necessary as being recognised as sustainable. From a business perspective, ecological labelling can have benefits where recognition and trust in the label helps the consumer see a sustainable image of the business (Böstrom & Klintman, 2008). Ideally eco-labelling can provide consumers with the knowledge that the whole value-chain from raw material to processing and finishing of the

final product is carried out under environmentally and ethically sound methods (Böstrem & Klintman, 2008). However, labels with recognition on a global scale, such as GOTS, may not be so well known or understood by Norwegian consumers (Austgulen, 2013). This would suggest that if the majority of customers buying yarns from the local wool industry of Trøndelag are Norwegian, then some form of Norwegian sustainability labelling would perhaps be a preferred option. Norilia have been certified with a Nordic ecolabel which is well-recognised within Nordic countries (Nordic Ecolabelling, undated):

“Our washed wool received the Nordic Swan ecolabel in 2015, so it is in some way proof that we have wool that is very clean and that we take animal health, animal welfare and clean production into consideration” (Marion Tviland).

Although the Nordic Swan ecolabel is not working to organic principles, it may be a good starting place for presenting a sustainable profile that is easily recognisable by potential customers.

5.3.2 System Change

In terms of selling wool, Norway and Great Britain are seen as the two European countries which have succeeded best (Olofsson et al., 2010). Norway’s system for collection of wool from farms and delivery to the wool stations offers a unique possibility for all farmers to have an outlet for their wool:

“We have a very good system for collecting wool in which we cooperate with the local NSG organisation. Through this system all farmers do have the opportunity to hand in their wool. However, I hear stories that some farmers are not delivering the wool, saying it is because the price they get for it is so low that they do not think it is worthwhile” (Marion Tviland).

The collection system for Norwegian wool is described in Chapter 1; sorting wool into different classes is explained in detail in Chapter 2.2. This section focuses on changes that could be made to the system potentially benefitting all actants involved, as well as presenting an even more sustainable system.

Wool Sorting

It is possible to deliver all wool to the wool stations, even the wool that is not able to be processed at the spinning mill:

“The waste wool is going back to the wool station and it’s sold on the world market because there’s always use for dirty wool. So, also the wool from the mill that’s going out from the processing is also going back to the wool station. We never throw anything in the garbage” (Ingvild Espelien - interview 1).

Concerning sustainability; finding a market for all wool products shows effective use of natural resources, even if there is not always so much profit to be gained. When asked if they manage to sell all wool that comes into the Malvik wool station, the answer was:

“Yes, that is because Norilia own the wool scouring plant in England. There are several classes of wool here that we would certainly not get sold if it were not for that” (Olaf Berset).

Wool sorting is an important aspect of the processing system for Norilia and Selbu spinning mill. Wool that is well sorted prior to delivery can create more effective running of the wool stations (Tviland, 2017) and reduce preparation time before processing at Selbu spinning mill. It is also important economically for the farmers. The cleaner the wool delivered to the wool stations, the higher the price is likely to be (see Table 2, pp.13). Similarly, for the spinning mill; the less sorting that is needed results in more wool being able to be processed and a better price for the finished yarn (see Chapter 5.2.5 and Table 5 p.84).

Malvik wool station explained how they inform farmers that they should keep pigmented wool and white wool separate when they deliver wool, as the pigmented wool will decrease the value of the white wool. Selbu spinning mill regularly hold wool sorting classes in order to inform farmers about the requirements from the wool stations to be able to classify wool in higher classes, and also what is best for the spinning mill. This is another example of collaboration within the actor-network that can be beneficial to all actants in relation to economic sustainability. Currently many farmers deliver their wool directly to Selbu spinning mill which means bypassing the wool stations. Financially this could make a difference as subsidies can only be paid for wool that is professionally classified:

“A private farmer who delivers wool to Selbu spinning mill without going through the wool station will not receive the state subsidy. If this farmer has very fine wool, they might lose money on it, depending on how much Selbu Spinneri pays for it. But if you have wool where the price is not so good you might get paid better there” (Marion Tviland).

However, as Ingvild Espelien explains, in connection to the pigmented wool it is not the payments the farmer receives from the spinning mill that is the problem:

“It doesn’t matter very much for the farmer in the short-term because from us he gets the same price as if he delivers to Norilia, but the problem is that the wool will disappear from the statistics and that’s what worries me because if all the farmers deliver the wool directly to the spinning mills, nobody will get an overview of the wool in Norway. So, with GTS most of the wool goes to us and not the wool station and then nobody knows how much wool there really is from GTS. Also, if we take

wool directly and the subsidies disappear, then the government will say we don't need these subsidies anymore" (Ingvild Espelien - interview 2).

This would suggest that although the spinning mill is hoping to create extra income for farmers of threatened breeds and help increase the knowledge about these breeds the opposite may actually happen. Removal of the subsidies could have direct effects on the amount of sheep farmers that keep old breeds and therefore influence the environmental sustainability of the actor-network. As shown in Chapter 5.3.1 the reduction of subsidies contributed to Farmer 15 deciding to give up farming GTS. Another farmer stated that subsidies help influence farmers of GTS to register their sheep in The Sheep Control system (Chapter 2.1):

"I don't want the subsidies to be a big sum; they shouldn't be the reason why you have that breed. But they should be enough so you can pay for The Sheep Control because you have to be registered there to get the subsidies» (Farmer 8).

There is strong collaboration between Selbu spinning mill, Norilia wool department and Norilia's wool station in Malvik, South-Trøndelag so discussion around changing the system to suit all actants better may already have progressed beyond the issues presented under the interviews. Increased use of the wool station is a suggestion for how the current system of wool sorting could make processing more efficient for Selbu spinning mill:

"I've discussed this a little bit with Marion [Tviland] and asked her how we can do this better, I think we need to make a plan for this. The best thing would be if they take the wool in and we get the wool from them, then they can also do the classification and I don't need to spend that much time on sorting wool. It would save us a lot of money" (Ingvild Espelien - interview 2).

However, this could cause changes in relation to the traceability of the wool, which has been shown in Chapter 3.2.1 to be an important aspect for the consumer to relate to. Connecting products to a specific place acts both as a personal guarantee for the ecological sustainability in relation to animal welfare, cleaner production and less transportation (see Chapter 5.2.2, under *Marketing and Collaboration*). It also reinforces a meaningful connection to 'place' (Cresswell, 2013) which can increase the experience related to the product (Pine & Gilmore, 1998; Bille, 2012). The wool station can only keep track of the wool for part of the processing:

"When the wool enters the wool station, we know which farmer has delivered it and it is recorded on the individual producer so they can receive payment. But then the wool is placed into different containers and the wool from one producer can end up in more than one container. So, we have no traceability of which producers have wool in which containers other than who we have sorted that day [...] It then becomes Norwegian wool" (Marion Tviland).

According to Malvik wool station, it would be possible to narrow down the traceability to a smaller region or municipality in relation to where the wool is collected before being delivered:

“When we get a container [of wool] in, it comes from a region. We begin with one region and then when it is finished, we'll start a new one. We don't really have a storage area so when the container comes in it acts as our storage. So, it'd be really quite easy to organise if someone wanted to have the wool from a particular breed from one region, yes” (Olaf Berset).

This could be developed further to increase the effectivity of the wool stations if certain breeds are concentrated in different areas then the wool stations in those areas could take over the sorting for that type of wool. However, to increase the number of classes for the wool makes the system more complicated and therefore less effective or more expensive:

“Based on where the wool is located then that wool station could handle it. If they [wool stations] are to begin to sort out more than the 16 classes that they have today, it'll be a lot more work for each new type of wool they sort. If there is an interest in the market, we can consider product development and sorting wool for this. However, it increases the complexity very quickly so care is needed not to believe that we will sort out all sorts of things. It can cost a lot more than we are able to profit from it. Knowing how much wool is actually available and at which slaughterhouse the various wool producers deliver to would be good. So, it helps to have it concentrated in that area” (Marion Tviland).

In relation to keeping healthy populations of sheep breeds it is important to have the breed spread over a wider area, not concentrated and therefore vulnerable to disease. Although it is difficult to move sheep over borders (see Chapter 5.1.2):

“It has very much to say in terms of safety and saving the breed that we have it spread to other areas in case something unexpected happens in relation to disease; that we increase the variation in genetic material. In relation to the sheep it is relatively restrictive for the movement of animals between counties; you can almost regard them as populations within the county. It is only the use of insemination which can basically get your genetic material from other counties than those they live in” (Farmer 9).

“There are no defined, special areas where one breed fits better than another with the exception of the ONS, which is originally a coastal sheep and fits best to the coastal heathlands” (Anna Rehnberg).

So, it may end up that breeding to increase populations can produce concentrations of particular breeds in certain areas although the ideal will be to have increased concentrations in many different areas. This suggests a potential area of conflict between environmental and economic sustainability of the wool sorting system if such changes were to be implemented.

One suggestion came from Malvik wool station as to how time could be saved, from sorting the poorer classes of wool and used for creating more options for sorting the better qualities:

“In my opinion they could have merged the poorest wool classes and rather made more classes for the best wool. We have wool that is felted and full of kemp, it is one class, and then we have a class full of vegetable matter and debris, and then there is wool which is full of dirt and discoloured; this is in all three classes and you get the same [low] price for it. So why not take it all up in one class and rather take the fine wool and make more of them. Rather spend more time on wool that is something; it would have saved us space and time and energy” (Olaf Berset).

This suggestion could be a solution for effective use of time; creating better economic sustainability as well as more effective use of resources, which is a key to developing industry in Norwegian agriculture (Knutsen, 2016). Product development within these poorer wool qualities; such as recycling it into wool compost (Dalefoot Composts, 2017) could provide an environmental and economically sustainable industry. This is an area of sustainable development that Norilia would perhaps be willing to work with more:

“We try to see if we can be part of projects in relation to the recycling of wool, in some way a circular economy, if there are things there that we can involve ourselves in” (Marion Tviland).

Circular economy, based on more effective use of natural resources and re-cycling or re-using waste through a circular model instead of the linear “take, make, dispose” system (Ellen MacArthur Foundation, 2015, p.2). This is seen as part of the solution for creating a low-emission society (Kommunesektorens Organisasjon, 2016). In relation to social sustainability, having a more defined and collaborative purpose to the wool sorting would also make the work more enjoyable for the wool classifiers:

“That you sort the wool to be earmarked for a purpose; I have more faith in that. So, if the market is uninterested we create classes for creating classes. But if the market decides what it wants, so we create a class for the demand. It would be more enjoyable as well. We can’t just sort [wool] to sort it. There has to be some input for it” (Olaf Berset).

This suggests that market forces have the power to change the actor-network in relation to wool sorting. Actor-networks are constantly changing through relational activity (Latour, 2005). Any changes to the demand for the pigmented wool products or capacity of Trøndelag’s local wool industry, can therefore have agency in the wool sorting system for Norilia and Selbu spinning mill. Ingvild Espelien mentioned the system she works with is in a state of change:

“I think the whole system I work in, it’s not actually an established system, we’re trying things out and ideally I would like to have the wool in wool bails and have a

system for working with the wool bails in the spinning mill, then we'd have less need for a big storage" (Ingvild Espelien - interview 2).

The possibility for working with the compressed bales of wool that the wool stations already work with was also mentioned by Malvik as something that would make things easier for them; reducing the manual labour of packing wool into sacks which they currently do. This suggests that if Selbu spinning mill could increase its capacity it would benefit the wool station as well. However, increasing the capacity of Selbu spinning mill could benefit Norilia and farmers in ways other than simply economic:

"The value comes first; to create value for the wool producers but very closely linked to it is that we would like the wool to be used in Norway. I think this has a lot to say in relation to the credibility and in relation to the subsidies from the state; that the wool is actually used in Norway. The subsidies have great significance to the income of the producers. I also think that it is the pride and the emotional aspect in it; that it is much more fun to produce something when you see what is made and that it used here" (Marion Tviland).

Currently, Selbu spinning mill is not considered as a large customer for Norilia in comparison to the other woollen mills such as Rauma, Gudbrandsdalen, Hillesvåg and Sandnes yarns that are able to order larger quantities of wool (see Chapter 1). The next section looks at possibilities for increasing Selbu spinning mill's capacity as a way for creating sustainable development on environmental, economic and social levels for the region.

5.3.3 Capacity & Network Development

In connection to the actor-network, this section is focusing more on theory than on actual comments from interviewees. Many farmers commented on the need for some form of communication platform and this will be looked at in relation to increasing the capacity of the spinning mill. However, there are only a few comments relating to actual ideas for how the spinning mill can be developed.

Research & Development (R&D)

It was established in Chapter 5.2.2 that innovation is seen as a key component to regional growth. Innovation for sustainable regional growth is perhaps more complicated as, "sustainability is about equilibrium and permanence [whereas] innovation is about changing the way things are done" (Sarkis et al., 2010, p.2). Sarkis et al. (2010) continue to describe how innovation for sustainability is likely to require collaboration with many different actors, in order to have the resources to achieve the complexity of sustainable development. Small firms are often at a disadvantage in relation to funding R&D, although in relation to innovation they

are said to have advantages over large firms due to a less bureaucratic management structure (Mitra, 2012). Selbu spinning mill is a small firm with big intentions towards sustainable regional development, but as explained in Chapter 5.2.3, they are finding it difficult to raise the funds for developing the business. When asked about the importance of finding ways to utilise wool one of the researchers interviewed answered:

“I think that with the new bio-economies in general that you need to put up government money for R&D. The R&D on wool especially has lagged behind [...] Wool is one of these important bio-economies and resources that should be developed with rather patient government capital because Norway; one thing we have enough of is capital. So, it should be invested in the value chain of all products from the sheep and the most under-developed product is the wool” (Reidar Almås).

Selbu spinning mill collaborates with scientists in relation to the project work that is undertaken by Ingvild Espelien. KRUS involves an important group of scientists that the mill is in cooperation with. KRUS are also looking into the whole value chain of wool from sheep to end product (Nordic Fashion Association, 2017). This project work involves collaboration with other woollen factories, such as Hillesvåg and Telespinn. Other project work includes close cooperation with GRC in relation to the sheep threatened breeds. In addition, current projects are connecting the spinning mill to collaboration with a professional weaver and other sheep farmers in Troms in northern Norway:

“I think it’s very important to have a strong local network but still, Norway is too small to only focus on the local area. So, I think it’s also important to have a focus on a national network” (Ingvild Espelien - interview 1).

However, there may be potential for further collaboration within Trøndelag. The region has the advantage of the university; NTNU in the vicinity and therefore as Pike et al. (2006) mention; the potential for attracting human capital or connecting in to the knowledge economy through collaboration for R&D purposes. Knowledge sharing in a regional innovation system (RIS) or through localised cluster development, can help develop collaboration that is beneficial to local businesses, government and educational institutions (Runiewicz-Wardyn, 2013). Indeed, innovative projects working with wool are not new to NTNU. In 2012, two NTNU students in industrial design began working with ideas for felted wool tiles to dampen acoustics and eventually created the business Rom & Tonik (Rom & Tonik, undated). They are currently using wool and manufacturing skills in Mongolia, but there is perhaps room for collaboration with wool processing in Trøndelag. Wool was recognised by the two industrial designers as an underused resource with natural benefits, such as being flame retardant and being able to absorb moisture as well as sound (Rom & Tonik, undated). Instigating collaboration between the local

wool industry of Trøndelag and NTNU with support from local government and R&D organisations could encourage sustainable regional development on many levels. Pike et al. (2006) state that local and regional innovation approaches agree that such innovation needs industrial and university R&D, local skilled labour and know-how, as well as risk capital. When related to the local wool industry the only missing component is the capital (see Chapter 5.2.3).

Clustering, Alliances or Industrial Ecosystem

One of the future developments being considered by Selbu spinning mill is buying new equipment to extend the capacity that they have today. During participant observation, I realised that the mill has a definite routine for spinning wool from the different breeds, due to the different properties of spæl and crossbred wool (see Chapter 2.1). This led to the question under the follow-up interview whether spinning would be easier with different machines for spæl and crossbred wool:

“Yes, it would be much easier. Only the spinner is needed, not the other machines. Like we have it today we have to mechanically move some parts on the spinner to spin the spæl wool. So, it would be much easier to have a different spinner for the spæl wool. For now, we need to make a plan that makes this change a rare event, so we try to do that only once or twice a year” (Ingvild Espelien - interview 2).

Increasing the amount of machinery would depend not only on finances to fund the investment but also larger premises to house the machinery in. Whilst carrying out participant observation, I was made aware of premises that were being considered as a future possibility with enough room for new machines and potentially artists or other small, related businesses. Selbu spinning mill already has a widespread network of wool enthusiasts that includes local artists in Klæbu. The potential for creating an alliance with other small-scale firms, artists, local government and potentially students from the university links in well to cluster theory.

Cluster theory is influenced by the work of Porter and his analysis of how firms succeed through cooperation and competition in particular geographic locations (Hejj & Hejj, 2010). Although not always easy to establish, clusters are seen to stimulate economic growth through utilising shared resources, developing a base for local skills and knowledge, and creating relationships between firms (Mitra, 2012). Clustering can be defined as horizontal, vertical or diagonal (Hejj & Hejj, 2010; Michael, 2007). Horizontal refers to businesses located in the same area and working within a similar industry; vertical refers to the horizontal relationships as well as the supply chain (Hejj & Hejj, 2010). Diagonal clustering is the form that is relevant to the potential development around Selbu spinning mill, describing co-location of complementary businesses:

“Here, each firm adds value to the activities of others, even though their products and services may be quite distinct and clearly belong to other industry classifications. Diagonal clustering occurs where firms working together create a bundle of separate products and services that the consumer effectively purchases as a single item” (Michael, 2007, p.26).

In relation to Selbu spinning mill the term “micro-cluster” could be used, referring to the local context and specialisation of a number of small businesses producing a unique product (Michael, 2007). This is happening already in some ways as farmers create their unique products and services connected to the local wool industry, utilising the older breeds of pigmented sheep. (Chapter 5.1.1 gives details of products made from the skin, horn, bone and meat; Chapter 5.1.4 talks about knitted products and traditions; Chapter 5.2.1 gives details of farmers making woven cloth and Chapter 5.2.2 mentions individual mittens and farm tourism). Micro-cluster theory is often connected to the development of community-based tourism. This concept of tourism describes the synergy-effect of a variety of small, localised firms within niche areas interacting to provide complementary products and attract visitors (Michael, 2007). Further collaboration within the actor-network of Trøndelag’s local wool industry (as mentioned in Chapters 5.2.2 & 5.2.3) could work towards creating an attractive tourist network. This is perhaps a topic for the communication platform mentioned below.

Further possible development for Selbu spinning mill links in to the micro-cluster theory but with a more sustainable synergy-effect. Industrial Ecology as a concept for industrial manufacturing grew from a comparison to the function of the ecosystem and co-existence of biological organisms (Gallopoulos, 2006).

“The aim of industrial ecology is to reduce the generation of wastes and the use of materials and energy by closing system loops not only for each individual manufacturing process, but also for manufacturing complexes, and even entire industries and economies” (Gallopoulos, 2006, p.12).

Industrial ecosystems can also be described as a form of eco-industrial network which can improve environmental sustainability through collaboration to improve resource utilisation as well as reduce costs through improved efficiency or even create new products from waste (Patala et al., 2014). This also links into the circular economy (see Chapter 5.3.2). When discussing future sustainable development for Selbu spinning mill, one suggestion was given that links into improvements within their industrial ecosystem:

“When it comes to the environment, I would like to do a lot more than we do. Just now the washing water is going into the community system. Ideally, I would like

to have some other system for that where we could maybe utilise the other nutrients in the water” (Ingvild Espelien - interview 1).

Development of this idea could lead to working with or creating other small firms that not only provide a new system for water drainage but perhaps find new products or services connected to the nutrients from washing the wool. The local municipality was interested in improving the water drainage:

“Oh yes, we can do that because the drainage is costly for the municipality even though it is a cost for the individual business. Both in relation to water in and out; if you manage to reduce it as much as possible that is most positive for Klæbu in general. So, it is important for us to be involved in facilitating that the least amount of water and the least amount of bad water comes from the mill” (Jarle Martin Gundersen).

Such sustainable development would mean other actants recruited into the actor-network (see Chapter 5.2.1) and further steps taken towards a sustainable micro-cluster. The potential for attracting visitors and tourism through sustainable branding is also of potential, as discussed in Chapter 5.2.1. It is also recognised that achieving sustainable development on a wider scale requires businesses to act as good examples, showing other businesses that there are more environmental alternatives for industry (UNEP, 2015).

The role of local government in helping to establish micro-clusters is divided (Michael & Hall, 2007). Cluster formation is often regarded as a ‘bottom-up’ process (Hejj & Hejj, 2010). However, government assistance in relation to providing possibilities through infrastructure or assisting with networking and social capital are seen to give added benefit to the community the cluster is located in (Michael & Hall, 2007).

Obviously, there is also a need for financing to help develop some of these ideas. IN described how networking and cluster formation were concepts that are of interest to them:

“We finance business networks and we finance clusters. So, for those companies [we support] we can build up their skills, build up their equipment, help with investment and we can build networks” (Aud Kvalvik).

In this way, it could be possible to get help not only with physical developments of the spinning mill but also to provide a better system for the whole of the actor-network connected with Trøndelag’s local wool industry:

“We have lots of wool but we do not use it as much as we could have done. If someone wants to work with such a project and presents a good project on it so it then there is room for it under certain circumstances. Again, if we see that it provides added value and the innovation is good enough, it would have been

interesting for us to look at. But then again textile is not my industry” (Aud Kvalvik).

Creating a bigger centre of activity in Klæbu around the development of a local wool cluster may also help to develop a platform for better communication with the wool producers and farmers who are commission spinning their wool.

Communication Platform

Relating is essential to the formation, maintenance and development of actor-networks (Latour, 2005). Communication is therefore an important element in the development of the actor-network and the local wool industry. Marsden & Smith (2005) show how inter-relations on a community level have helped create sustainable development, especially in connection to local food networks. (See Chapter 3.2.1 for the similarities between local food and local wool). Marsden & Smith (2005) conclude that successful ecological entrepreneurship requires key actors to have a prominent role in the network that help to maintain and develop the network through innovation. With reference to the local wool industry in Trøndelag, Ingvild Espelien would be the obvious candidate for this role as co-founder of the spinning mill and with entrepreneurial behaviour as discussed in Chapter 5.1.3. The spinning mill offers a central point, whereas the farmers are spread over Trøndelag and mid Norway. One farmer mentioned some ideas of how Ingvild Espelien could help:

“We are spread out a bit and everyone is busy in their own area but maybe there should be a network [...] If we could find a venue, perhaps Selbu spinning mill, where we could perhaps gather once a month or every other month. At least some regular meeting and have a development conversation. Talk about what each farm sits and struggles with. I was going to talk with Ingvild about it but I have not come so far” (Farmer 2).

This suggestion would need Ingvild Espelien to have the time to both organise regular meetings and allocate time to the farmers. During participant observation, it was obvious that Ingvild Espelien’s job, made up of many different projects connected to research on Norwegian wool (see earlier in this Chapter) as well as the work with the spinning mill results in time being short. However, I believe the time would benefit the spinning mill and entire actor-network through stimulating creativity, ideas and competence throughout the network. Gausdal & Svare (2013) found that facilitating network-based input in relation to building competency also led to increased trust resulting in shared knowledge. Although this research favoured businesses with established R&D competence, communication and relating is essential to all groups. Actor-networks are built on relational activity (Jóhannesson & Bærenholdt, 2009; Dankert,

2012). To use the ecosystem metaphor; a well-functioning ecosystem is dependent on its interconnectedness and interactions between members of the community (Ehrenfeld, 2005). Comments from many farmers confirm that some form of closer network would be beneficial. Five farmers mentioned that a shared arena for advice or tips would be useful:

“You become more inspired; if we could have met and talked more. You don’t choose GTS because you want to have meat production” (Farmer 1).

One farmer mentioned how help to develop products on a larger scale than niche production would be useful:

“There isn’t a partnership here that can help, not yet and we miss that, there should have been something. Norilia sells the bulk but if you want to process the wool further in Norway there must be enthusiasts who are burning to make things happen. We have tried with our farm and IN and it works to develop a business base on the farm; we got funding for small niche production but we did not get any grants to organise things on a larger scale. We don’t have time to have a meeting and gather everyone in Norway that could be interested; we are doing so much. The time factor means we must limit ourselves all the way” (Farmer 7).

In this way, some form of micro-cluster could help put this farmer together with the right actors for collaborating and further developing their products without them having to take all the risk themselves. Taking risks is a quality often associated with the entrepreneur (Allen & Malin, 2008). The issue of the farmer being left with the risk was mentioned by three farmers during the interviews (see also Chapter 5.1.3). In connection to processing meat from their own farm one farmer mentioned how instead of taking risk they can also be left with it:

“I have the old beef cattle breeds [at a local slaughterhouse]. They went bankrupt now recently. So, I have some money tied up there; I am a bit fed up as it always the farmer who is left sitting with the entire risk” (Farmer 10).

Selbu spinning mill does offer advice and assistance to farmers in regard to selling products on a small-scale. The development of a micro-cluster and larger premises with increased production capacity could also allow further development of a sales arena for those farmers that don’t have time to sell their own products. The establishment of a communication platform or meeting place could also improve networking where several farmers can work together in relation to sales or further production. This could lead to a reduction in costs for the farmers and increased sustainable development for the region. Such networks for sustainable food have been successful in relation to The Farmers Market (see Chapter 2.3.2) and “Sustainable Food in Urban communities” (Kommunesektorens Organisasjon, 2016, p.44).

Norilia has registered an increased interest for Norwegian wool in Norway. Norwegian companies have increased their use of Norwegian wool from 15% to around 20% although this has mainly been for white wool. When asked what the future possibly held for Norwegian wool, communication was also a key element for its development:

“I am very optimistic; I think there are lots of opportunities both in Norway among Norwegian businesses and customers and internationally for telling the story of Norwegian wool. The method of using non-arable land for grazing and good animal welfare; those things can appeal internationally. Also, there is a potential in getting different Norwegian actors to collaborate more to create new opportunities. So, I think there is potential for continued growth and I'm optimistic about the increased use of Norwegian wool in Norway” (Marion Tviland).

Figure 14 below shows the potential for future sustainable development within the actor-network of Trøndelag’s local wool industry. The colours are used to represent the strongest aspects of these connections: Green - Ecological; Red - Physical ‘Place’; Black - Economy & Policy; Blue - Relationships; Yellow - Technology; Orange - Concept and Brown - Practical Applications.

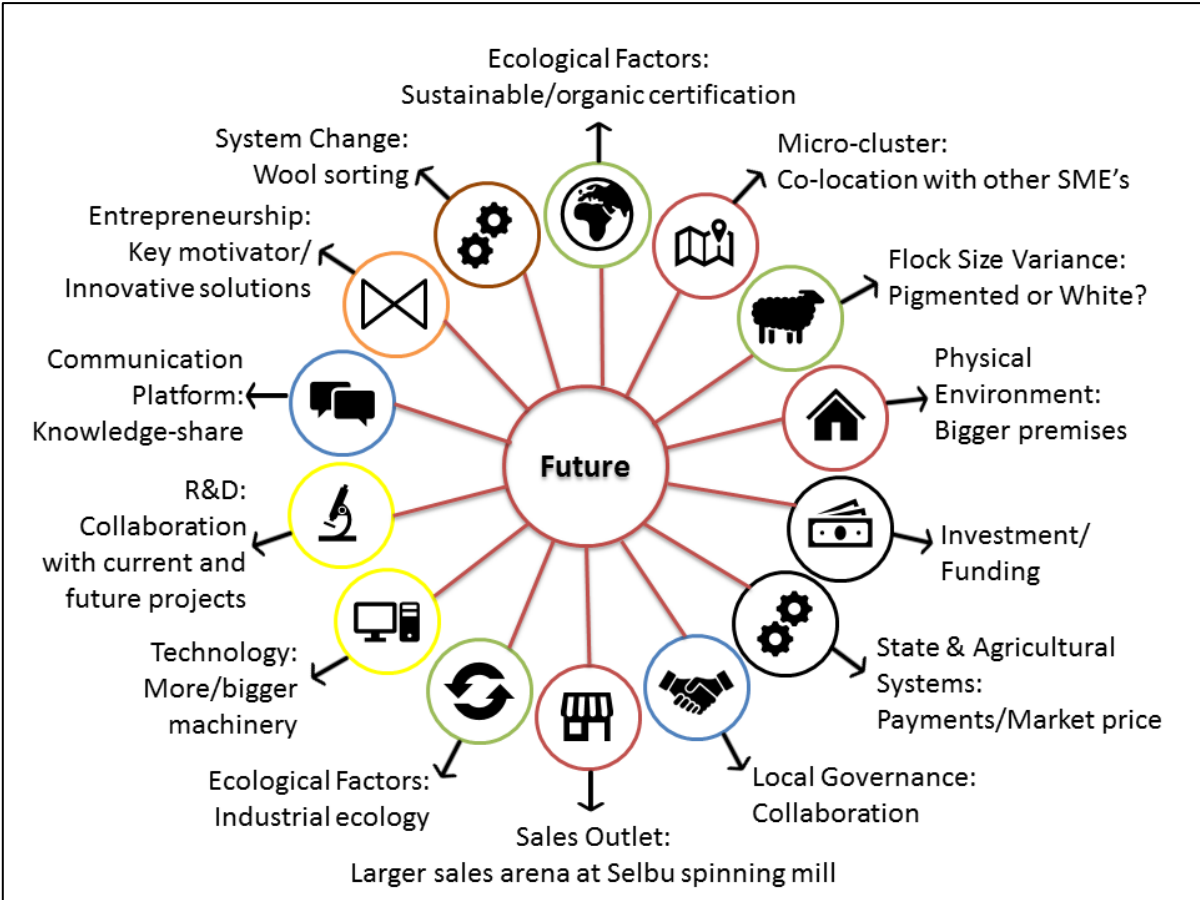


Figure 14 - Future Sustainable Development Possibilities

5.4 Summary

This chapter has followed the actants involved in the local wool industry of Trøndelag from the origins of the actor-network; discussing why farmers chose to farm the older, pigmented breeds of sheep and how the spinning mill and the local wool industry was established. Ecological reasons for keeping the breeds were prevalent in areas of conservation, grazing habits, resource efficiency and clean production. The presence of handicraft skills led to aesthetic and creative interest in the pigmented breeds instead of the more usual white breeds. In relation to the GTS, an association with place connected some farmers born in Trøndelag to the sheep that were associated with the region. Place also plays an important role in connecting products to individual farms, generating trust, traceability and experience economy. Green and social entrepreneurship were seen to be fundamental to the establishment of the spinning mill and the development of niche businesses started by some farmers.

It is important to keep the established actor-network maintained through recruiting actants in order to have sufficient farmers interested in continuing to commission spin yarns. This also requires that there is a market for their products to provide economic sustainability, even though it is shown that financial gain is not the driving force of the actor-network. Collaboration was generally favoured above competition which is recognised as a more sustainable and equitable business characteristic. Although some controversies surfaced during the interviews concerning price differences between the spinning mill and the farmers, many of these issues are perhaps already on their way to being resolved or offer suggestions towards how the actor-network can be further developed.

Increased capacity of the spinning mill through larger or extra machinery is perhaps a necessity to maintain and develop the network further. Collaboration with the university and research institutions as well as other small firms can offer future sustainable regional development. The ecological development ideas that come from Selbu spinning mill are seen as positive by the local municipality, which suggests possibilities for future collaboration there. As the signs are that there is an increased interest in Norwegian wool and the necessity for sustainable development becomes more prevalent, it is perhaps the right time to invest in the local wool industry of Trøndelag to further develop the resilience of the county.

6 REFLECTIVE DISCUSSION & CONCLUDING REMARKS

The aim of this research was to investigate the small-scale, local wool industry of Trøndelag using Actor-Network Theory (ANT) in order to discover how it affects sustainable regional development. The term local wool industry was used to describe the entire network involved with the vulnerable, older or pigmented Norwegian sheep breeds. Central to the network are the sheep farmers who commission spin their wool and the small-scale wool processing factory; Selbu spinning mill. However, there are many more essential elements connected to growing, collecting, categorising, subsidising, processing, marketing, selling, researching and buying the wool and related products. Determining the network of diverse actants and their connections to, and value for, sustainable regional development can perhaps help to focus more attention on a resource which is otherwise under-utilised and according to many of the farmers, undervalued. This chapter will highlight the key actants involved in the local wool industry, that are both already affecting sustainable regional development and have the potential for influencing further future development or resilience. It concludes with further reflections on where research could be of additional interest to the case.

6.1 The Actor-Network

The first research question looked to define the actor-network of the small-scale wool industry in Trøndelag. Latour (2005) states that once you have traced the origins and uncovered the actants that outline the actor-network it becomes, “unquestionable [...] and thus will no longer produce any trace, spark or information” (p.33). The actor-network for the local wool industry is vast; reaching back into history in connection to knitting traditions (Selbu kommune, 2011), agriculture (Myhre, 2004) and the sheep themselves (Buer, 2011). In Chapter 6.2, I argue that it also stretches forward into realms of the future by assisting with sustainable transition, as well as through breeding regimes for wool. The network also extends across space to different counties in Norway through connections to agricultural policy (Norway, Landbruksdirektoratet, 2015), The Norwegian Cooperative for Skins, Casings and Wool (Norilia, Undated) and research projects (see Chapter 1.2). Other countries are also connected, regarding the historical imports of sheep (Drabløs, 1997), the world market for wool (Norilia, Undated) and even knitting patterns used by farmers:

“I decided I needed to make a knitting-pack to sell the yarn. I searched online for a hat with a knitting pattern for 100g yarn. I found one that I liked but there is a very strict copyright. So, I contacted the designers in America and said, ‘I live on a small mountain farm in Norway and have a sheep breed called GTS and I would like to

make a knitting-pack, can I copy your pattern and put it together with my yarn?' I didn't believe it would work, but yes, I could" (Farmer 1).

From this farmer's quote alone, a great many actants are involved in creating one knitting-pack. From the original idea to the technology of the internet, copyright legalities and policy, the designers, the connection to 'place' through using the words "small mountain farm" and of course the sheep. To link in every connection that has been mentioned by the farmers and other interviewees encompassing their relational activity is perhaps an impossibility. It has also been stated that it is important to guard against making ANT research, "a functionalistic exercise in filling up a blank field with descriptions of networks" (Jóhannesson & Bærenholdt 2009, p.19).

In the Analysis chapter, actants were uncovered regarding various aspects of the wool industry. These included; farming the older, pigmented sheep breeds; establishing Selbu spinning mill; commission spinning of yarns; sales and marketing of products; balancing the network and its controversies; and future sustainable development possibilities (see Figures 6, 9, 10, 12, 13 and 14). Many of the actants were similar for several of the aspects being investigated. Comparing the six actor-networks already defined in this study, some actants presented themselves repeatedly. Perhaps unsurprisingly, the actor-networks regarding choice of pigmented breeds (Figure 6) and establishing the spinning mill (Figure 9) share nine out of fourteen actants. This is unsurprising as it was established that conservation of the Norwegian pigmented sheep breeds was the main reason for starting the mill (see Chapters 5.1.3 & 5.1.4). Reasons why farmers chose to spin or continued to commission spin their wool (Figure 10), shared eight actants with the actor-network for selling and marketing yarns (Figure 12). A natural connection between these two would perhaps be to suggest that the majority of farmers consider the sales of the yarn before deciding to spin. Economic sustainability is definitely necessary and for some farmers the lack of a market for the yarns had a direct effect on continuing to spin:

"I would absolutely commission spin yarns again if someone would buy the yarns from me, but it's very much [money] to pay out first [...] You rely on having customers; if you live in Trondheim so there are many people but out here there's fewer" (Farmer 12).

This quote is also another example of the important role 'place' has within the network (see Chapters 3.3.2, 5.1.4 & 5.2.1). However, in relation to economic sustainability, Chapter 5.2.2 presented the argument that most farmers valued their wool and sheep for many reasons, instead of purely focusing on economy.

Seven of the shared actants in Figures 10 and 12 were included in the 14 main actants for the overall actor-network for Trøndelag's local wool industry. These were; handicrafts, ecological

factors (such as preserving biodiversity and utilising natural resources), Selbu spinning mill's clean production, the sheep, green entrepreneurship, GTBS and traditions or historical factors. Figure 15 below shows the 14 main actants with the same symbols and colour scheme previously used. The outer boxes hold the main secondary connections, many of which are the same for several actants, suggesting Latour's (2005) "unquestionable" actor-network which was mentioned above.

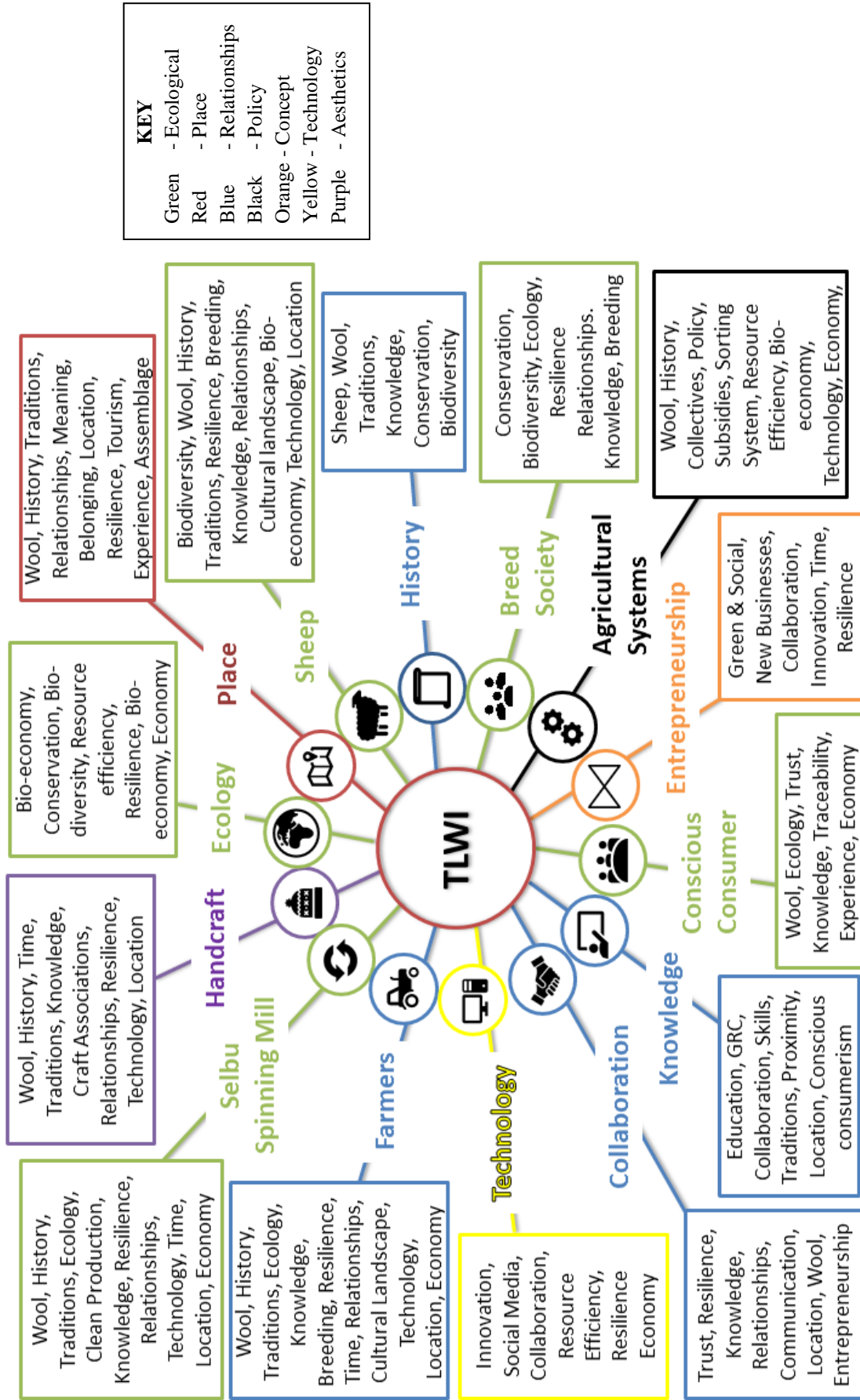


Figure 15 - Actor-Network for Trøndelag's Local Wool Industry (TLWI)

Relational activity between actants is essential to the maintenance and development of the network through the creation of new dynamics (Jóhannesson & Bærenholdt, 2009; Dankert, 2012). The interactions between the main actants and secondary connections are also highlighted by the amount of connections that are shared. Latour (2005) suggests discovery of an actant is defined by recognising that they make a difference to the action of another element of the network; meaning an actant has ‘agency’ (Dankart, 2012).

Looking at Figure 15, it is possible to see how the removal of any of the main actants will make a difference to the rest of the network, showing how each actant has agency. Some are more obvious, such as the removal of Selbu spinning mill, the sheep or the farmers would mean the network cannot exist any longer as it is today. The history and traditions cannot be removed perhaps but they could be forgotten without collaboration, use and the sharing of such knowledge. Regarding the history and traditions of sheep breeds, this requires interaction between the breed societies and the knowledge from associations such as GRC, as well as farmers interacting and sharing knowledge with each other and their customers. Once shared with the consumer, the connection this has to Trøndelag or the ‘small mountain farm’ can carry extra meaning in relation to the location (Cresswell, 2013) and result in sales of yarns, the maintenance of the network and potentially, future development. Vagnoni et al. (2016) emphasise the importance of strengthening and valuing the link between local wool products, ‘place’ and environmental sustainability as part of a products’s identity. The interconnections between actants create dynamics which will be discussed in the following section to better understand the relationship between the actor-network and sustainable regional development, thereby answering the main aim of this study.

6.2 Local Wool Industry & Sustainable Regional Development

Initially, this chapter was to be divided into three sections defining how Trøndelag’s local wool industry separately affects environmental, social and economic sustainable development in the region. Looking at Figure 15 in relation to the colour coding perhaps gives a first impression of a clear division between actants working towards environmental sustainability (in green), and those working towards social sustainability (in blue). The use of colour serves as an overview of my impressions for which aspects came over strongest from the interviews and participant observation. As described in Chapter 3.3.3, the ANT researcher is also an actant involved in the network’s creation (Ruming, 2009; Jóhannesson & Bærenholdt, 2009). By representing my impressions, the colour coding of all the figures is perhaps a visual illustration of my role as actant in the research; connecting into and helping create the actor-network. When examining

the figure in more detail, it is possible to see how the three aspects of sustainable development are interwoven and should therefore be discussed together to highlight the complexity involved.

6.2.1 Outside the System

“Social and ecological systems are sufficiently complex that our knowledge of them, and our ability to predict their future dynamics, will never be complete” (Berkes, 2007).

Sustainability, requiring “safeguarding Earth’s life-support system” and providing for the well-being of future and present generations (Griggs et al., 2013) is a complex task. The SDGs reflect the complexity of achieving sustainable development through the 169 interconnected targets aimed at assisting a global transition towards a sustainable, resilient and equitable future (UN General Assembly, 2015). Sedlacek (2013) states that, “sustainable development has to be understood as a process of change” (p.75). However, change is not always easy to make, as can perhaps be illustrated by recognising that a deep awareness for much needed ecological sustainability has been around since the 1960s (Næss, 1997), yet we have still not managed to implement it.

In the Analysis chapter, it was shown that from the origins of the actor-network (Chapter 5.1) to the potential future development (Chapter 5.3), actant’s intentions were focused on aspects of sustainability. Reasons behind the choice of the older, pigmented breeds (Figure 6) and establishing Selbu spinning mill (Figure 9) were primarily based on the desire to preserve the breeds, promote biodiversity, utilise an underused local resource, increase the awareness of the breeds and finally improve the economic situation for pigmented wool. I would suggest that even with the presence of other actants this shows a prioritisation of ecological aspects, which goes against a system of capitalisation (Moore, 2010). The actor-network of Trøndelag’s local wool industry is also associated with green and social entrepreneurship (see Chapter 5.1.3). Social entrepreneurship has been connected to problem solving on a community level that the ‘system’ doesn’t meet (Bacq & Janssen, 2011).

During the interviews, it became apparent that farmers often felt that the current system for sheep wool and meat prioritised NWS, leaving the pigmented wool and the smaller lambs from the older breeds of sheep, outside the system. Even with the attention Norwegian wool has received through various projects in the last years, some farmers felt misunderstood:

“There is no one who knows how big the problem is for the farmer who actually delivers the wool. We feel that we are fighting against the system all the time, we are constantly struggling and hear that we produce a poor product that they don’t want” (Farmer 5).

The same farmer later explained that in order to increase the farm's income they were going to breed NWS and reduce the number of pigmented breeds which felt like they had "lost the fight" (Farmer 5) (see Chapter 5.3.1). For other farmers, the fact that the pigmented wool was 'outside the system', resulted in them having nothing to lose by taking the chance at creating projects to try and make more out of the resources they were personally proud of (see Chapter 5.2.1). In this way, the aim of Selbu spinning mill to provide additional income to these farmers, as well as the farmers' taking the chance to utilise the wool, could be seen as trying to find a solution for where the system failed. However, as the local wool industry appears not to fit into a strictly capitalistic system, I suggest it is perhaps difficult to gain recognition for how they are working with sustainable regional development; where 'development' is still focused on economic growth (see Chapter 5.2.2).

6.2.2 Time & Place

It is widely felt that the only way forward for society in general is to evolve sustainably (Marsden, 2016). Sustainable regional development, is recognised as a necessity in Norway, both nationally (Kommunesektorens Organisasjon, 2016; Norway, Landbruks- og Matdepartement, 2015) and at the regional level in Trøndelag (Fylkestingene i Sør- og Nord-Trøndelag, 2016). However, when reading strategic regional plans, it is apparent that the goal for reaching a sustainable society is still 30 years in the future; "[...] the government has a long-term goal that Norway will be a low-emission society in 2050" (Fylkestingene i Sør- og Nord-Trøndelag, 2016, p.11 - my translation).

Marsden (2016) sees eco-economies as having the potential to drive transitions towards sustainability (see Chapter 3.2.1). This he explains in terms of developing the ecological and social resources to create more resilient communities that also generate new relations with urban society. I would suggest that although on a small or 'micro'-scale, Trøndelag's local wool industry has not only the potential for assisting in sustainable transition, but that it is already having an effect through utilising local wool and the local social resources of farmers and artists (see Chapters 5.2.1 & 5.2.3). In this way, they are already somewhat positioned in one of the future goals for the region.

It has already been put forward that both farmers and the spinning mill are working with elements of ecological or 'green' entrepreneurship (Chapters 5.1.3 & 6.2.1), which has been connected to, "a forward-thinking orientation about sustainability" (Allen & Malin, 2008, p.828). The predominantly ecological focus; utilising the wool as a natural resource as well as

conserving the older breeds of sheep with their more sustainable grazing patterns (see Chapter 5.1.1), is also information the network shares with their communities. When looking at the actants involved in all stages of the local wool industry, it becomes clear that personal contacts, collaboration and knowledge-sharing are important factors. Several farmers explained how they used the ecological aspects of Selbu spinning mill's clean and local production in conjunction with the unique attributes of the breeds of sheep and the special connection to their farm for marketing their products (see Chapter 5.2.2). This was, however, not just a sales pitch or 'greenwashing', where sustainability is not fully integrated into business (Baumgartner & Ebner 2010), but central to the purpose of working with local wool:

“I feel I must represent us [farmers], it is important that we inform people about what we really are doing. Also with the traditions and cultural landscape; that will disappear if we don't agree on preserving it and if we don't do a job there. It's only us who can do that as we have the animals to do it” (Farmer 5).

Information dissemination is an important role for many actants in the local wool industry. The NFACA have recently held a four-day conference on Norwegian wool in Stjørdal, North-Trøndelag (Norges Huslidslag, undated). Ingvild Espelien gave a lecture there on the use of wool from Norwegian breeds, which is also part of her role at Selbu spinning mill. Changing peoples' attitudes in order to instil positive sustainable behaviour is seen as a difficult challenge (White & Simpson, 2013). However, sharing environmental information can at least help increase some peoples' knowledge and awareness; environmental knowledge has also been recognised as being key to environmental action (Klökner, 2015). So, through the information-sharing, the local wool industry has the potential for recruiting conscious consumers into the actor-network; thus, potentially broadening environmental awareness on social levels. This is perhaps especially relevant through personal contact and the generation of trust that is associated with small-scale production (Fletcher, 2010).

Connecting to Nature

Marsden & Farioli (2015) discuss the sustainability of 'place-making' in relation to alternative eco-economies within the food industry with the potential to; “realign production-consumption chains and capture local and regional value” (p.337). In Chapter 3.2.1, I discuss the similarities between the local food movement and the local wool industry of Trøndelag. Both can be categorised as bio- or eco-economies working with issues of traceability, reduced transportation and generating personal connection to and guarantee of the value chain (including animal welfare). Marsden & Farioli (2013) explain how sustainable production-consumption patterns are constructed, resulting in the assemblage of processes, practices and 'place' that make up the

eco-economy. Regarding food, they stress that the eco-economy has to be place-based; using the agency of place innovatively and for sustainable purposes. To relate these statements to Trøndelag's local wool industry, 'place' has also been instrumental to the sales and marketing of unique products, using both the 'Trøndelag' name associated with the GTS, as well as individual sheep names relating to the natural colours of the wool and the grazing areas of the sheep (see Chapter 5.2.2). Connecting the local wool industry to the experience economy (Pine & Gilmore, 1998) has also given agency to nature, landscape and the sheep through generating a meaningful connection for consumers and sellers. It was also suggested that Trøndelag's focus on sustainability and ecology can be beneficial to the local wool industry, as there may be increased understanding for the ecological aspects of the industry and more willingness to pay for this (see Chapter 5.1.4).

Connecting the natural and the social is essential for 'sustainable place-making', in order to bring nature, society and production back in harmony and therefore create "pathways towards sustainable landscapes" (Marsden & Farioli, 2013, p.332). Bleie & Lillevoll (2010) studied sheep farmers in northern Norway and discovered they had a sense of responsibility towards using nature in a sustainable way. Sheep farming, although socially constructed over many hundreds of years through domestication and breeding practices (Drabløs, 1997), is deeply connected to and dependant on nature for the characteristics of sheep and wool today, as well as for grass and fodder for summer grazing and winter feeding. The grazing is itself the result of collaboration between nature and local farmers, often working together in a grazing cooperative. This dependency has caused challenges in connection to the changing climate:

"What's interesting with the climate, the longer summer we get the worse the lamb growth is with less meat. What is happening is that spring starts earlier and earlier and the grass starts earlier due to there being less snow and so the grass grows and it stays as rough grass all summer. Then the lamb weight goes down" (Sheep farmer, Rennebu grazing cooperative).

Expanding their knowledge and skills is a requirement for farmers in order to adapt to social and political changes as well as a changing climate (Norges Bondelag, 2016). The sheep are also expected to adapt to the nature around them as they have been doing for many years (Dýrmundsson, 2005). The farmers interviewed as part of Trøndelag's local wool industry are also working with nature and the characteristics of the different sheep breeds through careful breeding. This is a very important aspect for the actor-network regarding producing hardy breeds that can survive outdoors all winter (ONS), as well as improving the wool quality and producing good breeding animals that meet the breed standard (see Chapters 5.1.1 & 5.2.2).

Breeding again stretches the actor-network between the past and the future, as it takes years to see the results of the work being done today; “[...] breeding work takes more than one generation, it takes time and you have to be consistent with it” (Olaf Berset).

Breeding for wool is an example of the relationship between the sheep, the farmer and the environment, as well as the criteria that NSG decide for the breed standard. This relationship does not always work out the way farmers would like as one farmer described how if the fibres of white spæl wool are too fine they can easily felt together in extreme weather or if the sheep grazes in forested areas. Felted wool reduces the price (see Table 2) as well as making it difficult to shear. In this way, nature and the physical environment have agency over the wool quality, meaning the farmers and NSG are not the only ones that can change the characteristics of a breed, but the sheep’s own natural resilience and adaptation to weather plays a part.

Farmers also showed resourcefulness and adaptability in making developments on the farm, reusing and recycling materials to keep costs and resource use down. There were several farmers who demonstrated an attitude of not being people who, “use and throw away” (Farmer 6). Creativity and entrepreneurial behaviour among farmers who continued to commission spin yarns, as well as Ingvild Espelien (see Chapters 5.1.3 & 5.2.1), also suggests adaptive and innovative abilities; acquiring competence through ‘learning by doing’ (Mitra, 2012).

“[...] people and living nature are different entities. Yet they are combined in the practice of farming, which involves constructing a proper equilibrium that needs to meet several objectives. It has to provide sufficient production [...] But also needs to reproduce nature, preferably enriching, improving and diversifying it. Using and transforming nature also implies that people are able to cope with diversity, uncertainty and capriciousness” (Van der Pleog, 2013, in Marsden & Farioli, 2015, p.339).

This suggests the resilience of farmers and potentially Trøndelag’s local wool industry to adapt to and cope with change. This has also been shown to some extent already in Chapter 5.2.3, where controversies have shaken the network yet it still continues and develops, adapting and changing as needed.

6.2.3 Sustainable Regional Resilience

The definition of resilience varies slightly depending on the perspective. Dwiartama & Rosin (2014) argue that ANT can be a useful theory in connection to resilience thinking through the acknowledgement of agency beyond only human interactions. They offer three definitions of resilience; from a systems perspective, human agency perspective and the perspective of ANT.

The quote below is the one I am most familiar with and would be based on human agency as well as a systems perspective:

“Resilience refers to the ability of a system, from individual people to whole economies, to hold together and maintain their ability to function in the face of change and shocks from the outside” (Hopkins, 2008).

Resilience from an ANT perspective is described simply as; “an effect generated by a network of heterogeneous, interacting, materials” (Law 1992, In: Dwiartama & Rosin, 2014, p.4). From a human perspective, the local wool industry shows resilience, not only through their adaptive skills mentioned at the end of Chapter 6.2.2, but also through the collaboration that was described many times throughout the interviews. Collaboration held relevance in almost all the Analysis chapters. A collaborative enterprise is seen to have stronger sustainability than those based on competition, as a direct result of developing long-term and valued relationships with stakeholders (Tencati & Zsolnai, 2010). Collaborative innovation is also seen as essential for the transition to a low-emission society; potentially bringing together aspects such as, “cultural qualities, local business innovation and biodiversity” (Kommunesektorens Organisasjon, 2016, p.7). These aspects were especially selected as they could relate directly to Trøndelag’s local wool industry, both as it is now on a micro-scale and in relation to the continuing development with research programmes such as KRUS (see Chapter 5.3.3); the potential collaboration with NTNU or establishing a micro-cluster (also in Chapter 5.3.3). Although some farmers voiced concerns that Selbu spinning mill competed with their sales due to the differences in price (see Chapter 5.2.3), it was confirmed that the spinning mill had already made changes to address this issue. It also became clear that direct communication on these issues also helped to strengthen feelings of collaboration. Even with the price difference, some farmers acknowledged that all sales were beneficial to the collective goals of the concept of local wool (see Chapter 5.2.3).

From an ANT perspective, Trøndelag’s local wool industry is collaborating not only between human members of the network but with nature, sheep, plants, dogs, fencing, knowledge, technology, historical traditions and agricultural systems; simply through using summer grazing in the mountains (there may be more). On physical, biological and aesthetical levels, the sheep provide sustenance, warmth, and creativity to each other; with the human actants; and to other organisms they encounter (be that parasite, plant or bird). Pigmented wool, with its natural colouring has inspired projects (Chapter 5.2.1), established businesses (Chapters 5.1.3 & 5.2.2), possibly prevented predator attacks (Chapter 5.1.1), and exhibited at London Design Festival (Varp & Veft, undated) and yet has still been labelled as without value through the reduction

of state subsidies (Norway Landbruksdirektoratet, 2015). Even with the reduction of state subsidies, the local wool industry has shown the resilience to continue and the sheep breed populations have continued to increase:

“Today we see that there is a steady interest in only farming GTS and there are many who have GTS in addition to other breeds in their herds. I think that the growth of the breed is going to keep growing in the future” (Farmer 9).

Vagnoni et al. (2016) recognise that collaboration is central to achieving long-term sustainability in connection to local wool supply chains in Italy:

“The increase in cooperative initiatives among breeders and the intensification of networking activities among them, local government administrations and research centres still represents the key factor to achieve fully sustainability over the long term” (Vagnoni et al., 2016, p.89).

Trøndelag’s local wool industry is already creating small-scale cooperative initiatives (see Chapter 5.2.1) as well as networking with local government (see Chapters 5.1.4 & 5.2.1) and research activities (see Chapter 5.3.3). This can be seen as retaining and building up the environmental, social and technological resources needed to work towards a much needed resilient future in connection to food (Marsden, 2016) and clothing (Fletcher, 2010). In light of Jackson’s (2009) “dilemma of growth” (see Chapter 5.2.2), it is perhaps more appropriate to be working towards resilience instead of sustainable regional development. Figure 16 below shows how Trøndelag’s local wool industry is working with ecological, social and economic sustainability factors which I argue are assisting with a transition towards sustainable regional resilience. Figure 16 shows the interwoven connections of the main actants, although I am in no doubt that there are many hundreds more secondary connections, woven through from the past to the future and probably stretching across the globe.

Sustainable Regional Resilience

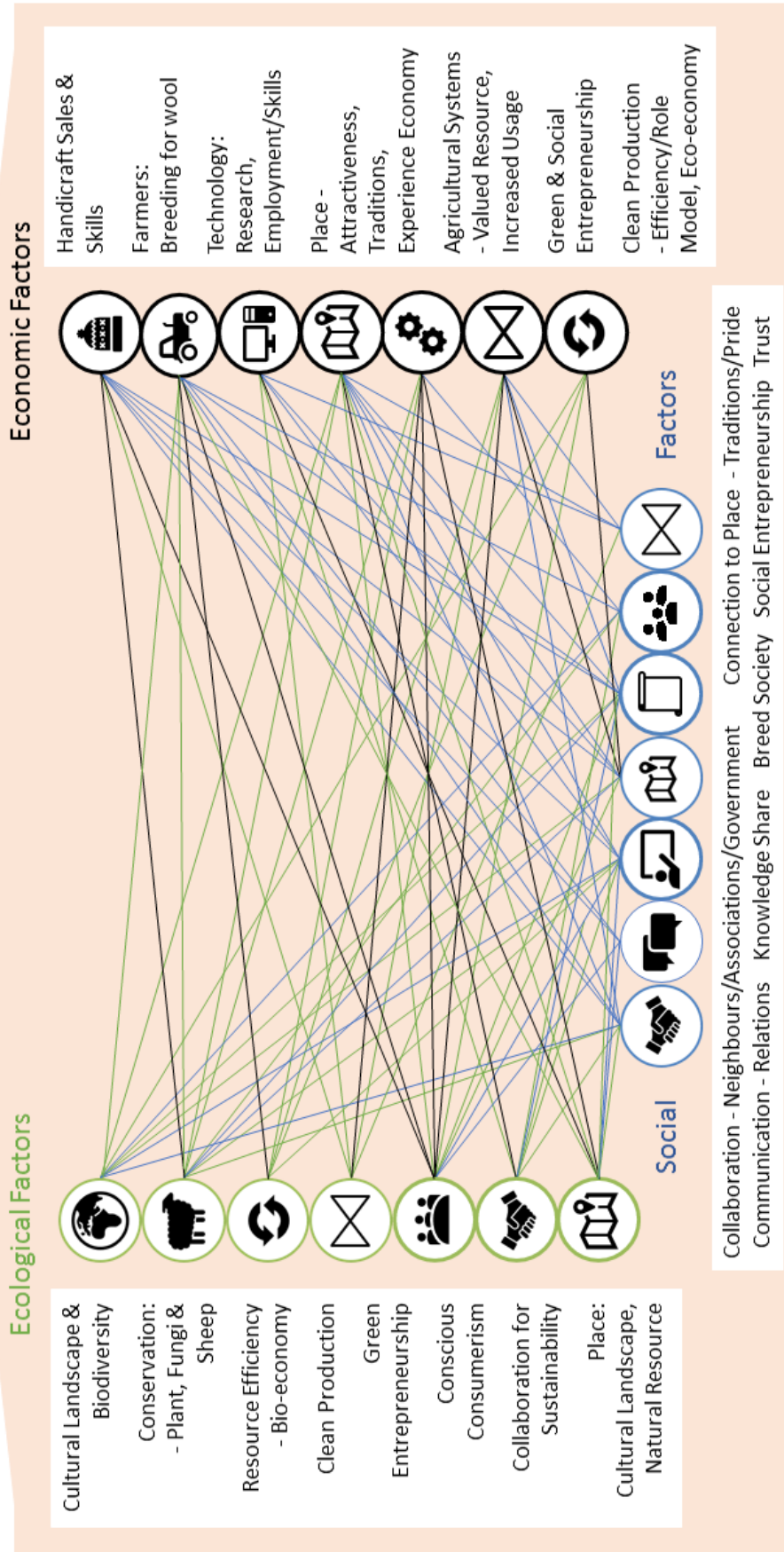


Figure 16 - Multiple Connections of The Actor-Network Assisting Sustainable Regional Resilience

Human and economic resources are essential to make the change towards a sustainable and resilient society. The Norwegian Association of Local and Regional Authorities refer to the lack of human or economic resources as potential local and regional barriers, preventing a transition to a low-emission, or more sustainable society (Kommunesektorens Organisasjon, 2016). Where Trøndelag's local wool industry can be seen to be preserving and utilising local ecological resources and building up the social or human capital; a lack of access to economic capital makes additional resilient improvements difficult (see Chapter 5.2.3). Economic limitations in small firms is not a new phenomenon, however it does not necessarily mean that small firms are less innovative (Mitra, 2012). Marsden (2016) describes many European initiatives designed to help communities re-finance innovative and sustainable eco-economies that, as with Trøndelag's local wool industry, have moved beyond the neo-liberal model.

It is perhaps only a matter of time before the value of the local wool industry is recognised on regional and national levels. National and regional focus on 'local quality' that recognises the importance of strengthening local opportunities exists already, such as The Norwegian Association of Local and Regional Authorities report *Kortreist Kvalitet* (see Chapter 2.3.2). This report emphasises the potential in local solutions regarding resource use and efficiency by connecting work, living spaces, shopping and activities to local networking and shared spaces. If we can, as a society, incorporate network thinking in relation to ANT, perhaps we can truly become a more equitable and sustainable society. This would require fully integrating and understanding the connections we also have to nature and the power that nature has in relation to our existence on this planet. Who better to help us understand the power of nature, than the people who are helping to preserve biodiversity and are relying on nature's benevolence on a daily basis; the sheep farmers and wool enthusiasts of Trøndelag's local wool industry? They are certainly the clothing (and food) providers we have easiest access to in our unpredictable and uncertain future.

6.3 Further Reflections & Possible Research

The question of just how resilient the local wool industry will be in the long-term is still open. It will be interesting to follow the progress of the spinning mill, especially in relation to increased capacity for spinning yarns and the effect this has on the niche production that many farmers are currently marketing. What will happen if the Selbu spinning mill doesn't survive? This is a question that I didn't ask the farmers and it would have been interesting to hear if they would use another spinning mill, even though it would mean production wasn't local any more. Or would they have done whatever possible to keep the local spinning mill in operation?

There is also a question of quantity regarding resources; even within the eco-economy, resources are not endless but finite (Marsden & Farioli, 2015). Where it has been said that the pigmented breeds are more sustainable grazers or browsers (see Chapter 5.1.1), this also relates to “moderate grazing” (Austrheim et al., 2016). Is there enough wool if demand increases? How far can the breeds increase in flock size before changing ‘moderate grazing’ to ‘over-grazing’? This is an important issue in connection to development of the capacity for producing local wool. At this point in time it is difficult to get an overview of how much wool is being produced from the different sheep breeds, although this should change with the database being created through Animalia, the breed societies and GRC (see Chapter 2.3.1).

The local wool industry was shown to have strong connections to ‘place’, where the landscape itself had agency in giving meaning and resilience to the network. ‘Place’ is a recurrent theme throughout the Analysis chapter. This is perhaps an aspect that could be researched further in relation to the effect ‘place’ can have on the local residents in connection to sustainability issues. The promotion and protection of Trøndelag’s eco-economies may also be relevant in the future if resources are in danger of being overused. A scheme for ensuring the ongoing sustainability of mountainous regions in Switzerland was proposed, in order to counter potential overuse of local resources; at the same time promoting local and regional uniqueness through creating “label regions” (Boesch, Renner & Siegst, 2008). This type of regional branding is in general a promotional activity but it is also; “a geographical representation of the place” (Messely, Dessein & Rogge, 2014, p.292). Branding alliances were discussed briefly in this study with regards to shared meaning connected to a place (see Chapter 5.1.4). They were also seen as positive for all parties in relation to a sustainable image; if utilised properly and a true representation of sustainable values (see Chapters 5.2.1 & 5.3.3). The connections of sustainability, tourism and ‘place’ can potentially have negative or positive effects on rural development and residency, which will require some level of management or governance (Marsden & Farioli, 2015). Some farmers mentioned conflict with mountain cabin owners and grazing of sheep, which could also intensify if sheep flocks were to increase in certain areas. Where should priorities lie? It is important that true sustainable options are sought for rural and urban places, to ensure the negative effects of ‘greenwashing’ that have been associated with industry (Baumgartner & Ebner, 2010), are not transferred to the promotion of eco-economies or experience tourism.

7 REFERENCES

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8 APPENDICES

Appendix A - Interview Guide for Farmers

(Interviews were conducted in Norwegian)

BACKGROUND

- Can you tell me a bit about your personal background?
 - *Where did you grow up – on the farm, another farm, in Trøndelag, city?*
 - *How long have you been a sheep farmer?*
 - *Where did your interest in sheep farming and wool come from?*
 - *What are your reasons for breeding sheep?*
- How many sheep do you have?
 - *Which breeds, colours?*
- Are you full-time farmers?
 - *Is it your main income or what percentage?*
- How much wool (on average) is produced each year?
- How many times do you shear your sheep?
 - *What do you do with the wool once sheared?*
 - *Any difference between spring cut and autumn cut wool?*

NETWORK

- What is your relationship to Selbu spinneri?
 - *How did you hear about them?*
 - *How long have you been processing wool there?*
 - *Why did you decide to process your wool there?*
 - *What is your wool processed into?*
- Do you sell the wool directly to Selbu spinneri or send it through the wool station?
 - *Any difference in price for the wool at the different places?*
 - *Any difference in distance for delivering the wool?*
- What did you do with the wool before you processed it?
- What do you do with the yarns/end product?
- What kind of market do you have for your yarns?
 - *How do you find a market?*
 - *Where do you sell them?*
 - *Where do your customers come from/how do they hear about you?*
 - *Do you sell ALL the yarns you produce?*
- Can you describe how you market your products?
 - *Anything that 'sells' the product? – (Local, sustainable ...?)*
 - *Any special labelling?*
 - *Telling a story?*
- Does Selbu spinneri have a role to play in the sales of any of your products?
 - *How?*
 - *Do you think they could play a larger role – how?*
- Has anything changed for you since the spinning mill moved to Klæbu?

- *Can you envisage any ways the move might affect you or your sales?*
- Do you sell other products from the farm?
 - *What do you sell, where and how do you market them?*
- Are you part of a network for selling/marketing your products?
 - *Can you describe any advantages or disadvantages with this?*
 - *How does it work?*
 - *Do you work together with other farmers for selling your products?*
 - *Can you describe any cooperation or competition between farmers of the same region selling yarns or wool products?*
- Would you be interested in being part of a network for promoting and selling local wool yarns and products?
 - *Can you envisage any advantages or disadvantages with being a part of such a network?*
 - *How could you see it working?*

SUSTAINABILITY

- Particularly in the last decade there has been a lot of emphasis on the need for sustainable development and the role of farmers in relation to food and fibre security through ecologically sustainable and socially responsible processes. In Norway this has also been called “Den grønne skifte”.
 - *What does sustainability mean to you as a sheep farmer - and seller of yarns?*
 - *Can you describe your sheep-farming as sustainable?*
 - *How? Or why not?*
- How is the economic situation for breeding sheep?
 - *Can it cover all costs? (Is it economically sustainable?)*
 - *Was there an economic difference after you began processing the wool?*
 - *Has your flock number changed since you began processing wool?*
 - *Any plans to change the flock size?*
- Are you organic or conventional farmers?
 - *Are there any reasons for this choice?*
 - *Are there any plans to change?*
 - *Do you think being organic could alter the sales of your processed wool?*
 - *If Selbu spinneri was registered for organic production would this influence your farming choice?*
- Would you describe sheep farming as environmentally friendly or a strain on the environment?
 - *How, particularly, in relation to your ways of farming?*
 - *Are there any benefits to local society or regional culture?*
 - *What support or response have you had from local people, kommune, shops?*

FUTURE

- Do you have any future plans for either the sheep farming or the products you sell?
- What do you feel (hope) is the future for sheep farming in your region?
- What do you feel (hope) is the future for selling locally produced wool yarns products?

Appendix B - Interview Guides for Selbu Spinning Mill

QUESTIONS FOR INGVILD ESPELIEN - Managing Director of Selbu spinning mill - Interview 1

(Interviews were conducted in English)

BACKGROUND

- Can you tell me a bit about your personal background?
 - *Where did you grow up – city, country, on a farm, Trøndelag?*
 - *What is your educational background?*
 - *Where did our interest in wool come from?*
- What were the key motivations for establishing the spinning mill?
 - *Was establishing the mill your idea/decision alone?*
 - *Were there any factors that suggested there was a need for a small-scale spinning mill?*
 - *In Norway and/or Trøndelag?*
- When was the spinning mill established?
- Can you describe what the mill does?
 - *What are the basic procedures?*
 - *What resources are used under production?*
 - *What waste is produced?*
- What was the original business model and the goals for the mill?
 - *Has it achieved these?*
 - *Have they changed anyhow?*
- Why was the mill established in Selbu?
 - *Were there advantages and/or disadvantages with having the mill based at Selbu?*
 - *How did the local community respond to the mill?*
 - *How did local municipality (kommune) respond to the mill?*
- Why did the spinning mill move to Klæbu?
 - *Are there any advantages and/or disadvantages apparent after moving?*
 - *How have the local community responded to the mill?*
 - *How have the local municipality (kommune) responded to the mill?*

NETWORK

- What is your role at the spinning mill?
- How many employees does the spinning mill have and what are their roles?
 - *Has this changed through the years?*
 - *Where do the employees live?*
 - *Are there others working or helping with the mill - Volunteers, interns, family, friends...?*
 - *How essential are these extra workers?*
- Most businesses are part of a network of suppliers, customers and other companies. Can you describe Selbu spinneri's network?

- *Who are your customers – how do they hear about you?*
- *Who are the most important connections and why?*
- *Would you say there is competition or collaboration within the network?*
- *Can you see any way that this might change?*
- *How has the network been established?*
- What effect does the region of Trøndelag have on the spinning mill and vice versa?
 - *Do you have any plans or hopes for how the spinning mill can be a positive element in the region?*
 - *Do you have hopes/plans for extending the network regionally, nationally, globally?*
 - *What potential changes do you hope for through widening the network?*

SUSTAINABILITY

- Particularly in the last decade there has been a lot of emphasis on the need for sustainable development and the role of commercial enterprises helping to stimulate economic and ecological sustainability alongside social responsibility. In Norway this has also been called “Den grønne skifte”. Does the business model of Selbu spinneri take sustainable development into consideration?
 - *How does the business currently work towards economic, ecological and social sustainability?*
 - *Are there any plans or hopes for further sustainable development for the mill?*
- Is sustainable development an issue that arises in connection to other actors within the network?
 - *Do members of the network influence each other anyhow in relation to sustainable development?*
 - *Does the network influence the region of Trøndelag or other regions in relation to sustainable development?*
- In what ways could the spinning mill have a positive influence on the network in relation to sustainable development?
- In what ways could the spinning mill and/or network have a positive influence on the region of Trøndelag in relation to sustainable development?
- Any interest in becoming organically registered?
 - *How would this change the status, costs or benefits for the spinning mill?*
 - *Have any farmers or customers asked after organic wool/yarns?*

FUTURE

- Do you have a future goal for the spinning mill?
 - *How does this work together with sustainable development locally, regionally, nationally?*

QUESTIONS FOR INGVILD ESPELIEN - Managing Director of Selbu spinning mill - Interview 2

1. Did you get any funds from IN in the beginning?

- *Have you applied since?*

- *What has been the result?*

2. Why not collaborate with Fatland as well as Norilia?

3. Do farmers lose subsidies when they deliver wool to you instead of to Nortura?

4. Why do you have a minimum of 30kg when Telemark's is so much less (5kg)?

5. Have you ever connected farmers so they can spin together?

6. Do you discuss what sort of yarns the customers want?

- *What criteria do you look at for this? (Soft or hard yarns?)*

7. Do you give advice to the farmers regarding the price they should have for their yarns?

- *Have you done that since the beginning?*

8. Do you keep farmers informed as to what is happening with their yarns, give them an idea as to how long it'll be before they get the yarn back?

9. Some farmers have had help from you with advertising their yarns, is there any reason for that?

10. I see the yarn prices have increased on your website, what are the reasons for this?

- *Has it made a difference to your sales?*

- *Any feedback from customers?*

- *Has the price for commission spinning also gone up?*

11. Do you know how many sheep of different breeds there are in the region/country?

- *Are there concentrations of different breeds in different regions and traditions/reasons for this?*

12. Would it be simpler to have one spinning mill for spæl and one for crossbred wool?

13. What are the preliminary findings for the characterisation of wool, particularly GTS, OSS & Villsau?

Appendix C - Interview Guide for Norilia

QUESTIONS FOR - Marion Tviland - Director of Wool Department at Norilia - Norwegian Cooperative for Skins, Casings & Wool

(Interview was conducted in Norwegian)

BACKGROUND

- Can you tell me your job title and a bit about what your job entails?
- *Where did your experience and interest in wool come from?*
- What is the role of Norilia in connection to Norwegian wool?
- *When & why was it established?*
- Does Norilia give advice to farmers as to which breeds may be best suited to their farms?
- *Does recommendation for farming particular breeds depend on regional conditions, landscape, predators...?*
- Does all Norwegian wool come through your system?
- *Where is most of Norwegian wool sold or sent?*
- *Do you know what happens to the other wool?*
- Are all sheep farmers and their flocks registered?
- *Is it possible to get numbers of how many sheep of different breeds there are in the country and/or region?*

NETWORK

- Most organisations are part of a network of. Can you describe who are the main actors in Norilias network?
- What connection do you have to the Norwegian spinning mills and Selbu spinning mill especially?
- *How do you work together?*
- Does it make a difference for Norilia if the wool is being sold locally or on the world market?
- *Financially, for the reputation of the organisation, personally, environmentally?*
- *Does it make a difference for the farmers?*
- Has there been a noticeable change in sales of wool within Norway?
- *Since when?*
- *What has caused this?*
- *Any regional differences?*
- Has there been a noticeable change in interest for different breeds?
- *Since when?*
- *What has caused this?*
- *Any regional differences?*

- Has there been a change in popularity and flock sizes of different breeds?
- *Has this changed through the years?*
- Are there any regional traditions in breeding sheep of particular breeds?
- *Any changes to this in recent years?*
- Any changes in demand for white and/or pigmented Norwegian wool?
- *In Norway and/or the world market?*
- *Since when?*
- *What has caused this?*
- *Any regional differences?*
- Any changes to wool quality in white and/or pigmented wool?
- *Since when?*
- *What has caused this?*
- *Any regional differences?*
- Do you feel the establishment of Selbu spinning mill has had or can have any positive effects on wool growing in Norway and especially central Norway?

SUSTAINABILITY

- Particularly in the last decade there has been a lot of emphasis on the need for sustainable development and the role of commercial enterprises helping to stimulate economic and ecological sustainability alongside social responsibility. In Norway this has also been called “Den grønne skifte”. How does Norilia, especially in the area of wool, work towards promoting sustainability?
- *Within the organisation itself?*
- *Within its network?*
- Farmers obviously need economic sustainability to continue farming. Can you describe the differences between the prices given for pigmented and white wool?
- *Do you think this will change if there is an increased interest in pigmented wool?*
- Would you say sheep farming has a part to play in the Norwegian landscape and/or culture?
- *Does this alter when referring to different breeds?*
- *Any difference in connection to flock size?*
- *How important that Norway keeps its sheep farmers?*
- Is there the capacity for increasing flock sizes or the amount of sheep farmers generally in Norway?
- *Does Norilia actively encourage this?*
- As a part of the ‘local’ (kortreist) movement, customers are often very interested in the traceability of products. Is this possible when buying wool from the collection points (mottak)?
- *If not, any ways this could be possible in the future?*

Appendix D - Interview Guides for Local Government

QUESTIONS FOR – Local government (Selbu – 1) (Klæbu – 2)

(Interviews were conducted in Norwegian)

BACKGROUND

- How long have you lived in Trøndelag?
- *Where did you grow up, study...?*
- Can you tell me what your position is and a bit about the work you do?
- What are the main forms for income for Selbu/Klæbu?
- *Agriculture? Sheep farming?*
- Can you describe briefly any policies or strategies the kommune has in regards to regional development?

NETWORK 1

- What was your involvement with the establishment and development of Selbu spinneri in Selbu?
- Did you feel the spinning mill was a positive addition to the kommune & region?
- *Is this sort of small-scale business encouraged to establish in the region?*
- Farmers are obviously key actors in the spinning mill's network did you feel there were any positive repercussions for local sheep farmer's having the mill in Selbu?
- *Any other positive effects the mill had on the kommune/region?*
- Do you feel there will be changes to the kommune/region now the mill has moved to Klæbu?

NETWORK 2

- What has been your involvement with the move of Selbu spinneri to Klæbu?
- What do you feel the spinning mill can bring to the kommune & region?
- *Is this sort of small-scale business encouraged to establish in the region?*
- *How does the municipality work to do this?*
- Would it be beneficial to Klæbu and the region if the spinning mill were to expand?
- *Can you see ways where the local government could be supportive to expansion?*
- Farmers are obviously key actors in the spinning mill's network do you feel there can be positive repercussions for local sheep farmer's having the mill in Klæbu?
- *What about if the mill expands?*

SUSTAINABILITY

- Particularly in the last decade there has been a lot of emphasis on the need for sustainable development and the role of commercial enterprises helping to stimulate economic and ecological sustainability alongside social responsibility. In Norway this has also been called “Den grønne skifte”. How is Selbu/Klæbu kommune working towards this?
- It has been said that Trøndelag has a particular focus and awareness of the need for sustainability – what are your thoughts on that statement?
 - *Does your municipality have any particular connections with sustainable development?*
- Do/did you feel the business model of Selbu spinneri takes sustainable development into consideration?
 - 2 - *The spinning mill has hopes to eventually become even more sustainable in its production; eg. Recycling their waste water and becoming organically certified – Can the kommune be supportive or assist in any further sustainable development?*
- Do you feel established businesses working in a sustainable way can help to influence the municipality/region of Trøndelag towards more sustainable development?
 - *Could/Did Selbu spinning mill have any similar influence to other companies in the municipality?*

FUTURE

- Do you have a future goal for sustainable development in Selbu/Klæbu?