

COMPARATIVE STUDY BETWEEN WOOL CERTIFICATIONS AND SWEDISH LEGISLATION – PERSPECTIVE ON SWEDISH WOOL

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Textile Value Chain Management

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Title: Comparative study between wool certifications and Swedish legislation - Perspective on Swedish wool

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Abstract

Purpose – This study aims to compare existing certification schemes to the legislation in Sweden to see which measures the best are to ensure the sustainability of Swedish wool when using it as a raw material.

Design/methodology/approach - The study follows a qualitative research approach. The comparative analysis research design was chosen as the data analysis method. Data is collected from desktop research and interviews with experts in wool, farmers, and companies working with Swedish wool and certification schemes.

Findings - Regarding Swedish animal welfare legislation covers more than the wool certifications. It is suggested to have a certificate for foreign wool as it might not have as strong animal welfare law. The consumer should be educated about animal welfare, social rights, and environmental regulations in Sweden for the legislation to be enough to prove the sustainability of Swedish wool.

Research limitations/implications - This study does not include a detailed description of all the existing global wool certifications as not all are relevant in the context of the Swedish market. Only some Swedish legislation about animal welfare and farming practices is included. This research excludes the barriers of the existing Swedish wool SC and the process from raw material to fabric.

Practical implications - Swedish wool industry and market can acknowledge the opportunities and barriers connected to the sustainability of wool and consider the right tool to support that. The comparative analysis describes the inputs and challenges of the Swedish legislation and three wool certifications for companies and farmers to decide what is best for them. The study revealed essential aspects for the Swedish wool industry on how they can grow to utilise more wool and have sustainable growth.

Originality/value – A comparison between certifications and legislation in Sweden has not been conducted before. It is essential to see the differences and similarities between them to support the growth of the Swedish wool industry. Certifications can bring critical knowledge of the quality and sustainability of the wool. Swedish animal welfare regulations and laws are extensive and more comprehensive than other countries.

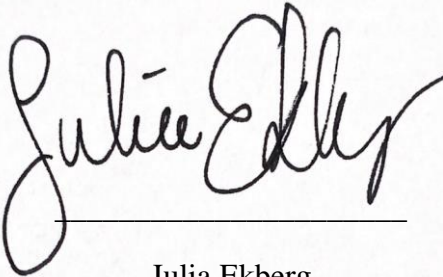
Keywords - Wool, Certifications, Labels, Standards, Legislations, Comparative study.

Acknowledgements

Due to our interest in knitting and wool, the idea of writing a thesis was created. In December 2021, Axfoundation was contacted regarding their Swedish Wool Initiative -project and asked if they would have a possibility to contribute to the thesis topic. The request from the Axfoundation side for a comparative study between certifications applicable for wool and Swedish legislation was presented. After a meeting with the authors and Axfoundation representative, it was agreed to research the topic further. The thesis is written in collaboration with Axfoundation and process. There has been discussion about the direction and scope of the theory.

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A handwritten signature in black ink, appearing to read 'Julia Ekberg', written in a cursive style. The signature is positioned above a horizontal line.

Julia Ekberg

A handwritten signature in black ink, appearing to read 'Anna Irina Torvinen', written in a cursive style. The signature is positioned above a horizontal line.

Anna Irina Torvinen

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List of Abbreviations

ABP – An animal by-product

CE – Circular economy

CoC – Chain of Custody

SC – Supply chain

WTB – Willingness to buy

1 Introduction

This chapter aims to establish background information on wool and the status of Swedish wool in the market together with Norwegian wool. Also, a small introduction is done about Axfoundation and their Swedish Wool Initiative, with whom this study is done in collaboration. The background provides insights into the Swedish wool market and the challenges in the supply chain (SC). Norwegian wool has been presented as a learning example for Swedish wool and its market. Furthermore, this chapter will discuss the purpose of the topic and identify the research gap in previous research. The introduction presents the research questions and delimitations, thus providing the study's framework.

1.1 Background

Wool is a naturally produced fibre which is a renewable and biodegradable protein that provides unique comfort, performance, and appearance to textile garments (Russell, 2009; Eriksson and Sjöling, 2018; Rajabinejad, Bucişcanu and Maier, 2019). Also, wool has many properties that affect its performance as wool can be cool or warm, and it can be worn in active or passive situations. Another essential property of wool is that the fibre is not burning well and extinguishes itself. Wool will only burn when it is in a fire and, therefore, a suitable material for buildings and furniture (Gullingsrud, 2018). As mentioned, pure wool has the properties of being biodegradable. Depending on the chemical used for the material during processing, the time it takes for wool to biodegrade is affected. However, the European Commission does not classify textile waste and materials as biodegradable products (Gullingsrud, 2018). Even though wool is a natural fibre, it does not mean it is sustainable as it has, similar to other textile fibres, an environmental footprint (Russell, 2009). However, wool is a better alternative as it is more durable and recyclable than artificial fibres and releases microplastics when washed (Costa, Vaz, de Mendonça, Restle, Kroning, Ferreira, and Farias, 2020). As synthetic fibres have risen its popularity over the years, wool has lost its share in the textile industry (Rajabinejad, Bucişcanu, and Maier, 2019). Although, wool has a significant market share in men's suits, knitwear, and carpets since the properties of wool are unmatched by other fibres regarding comfort, durability, and appearance (Russell, 2009).

Around 40 sheep breeds produce 200 wool types with diverse end-uses (Russell, 2009). The European Union has the second largest sheep population globally, with 84 million sheep. Despite this fact, the European wool industry imports most of its Merino wool from Australia and New Zealand. In addition, Australia produces approximately 80% of the world's Merino wool for the textile industry (Petek and Logar, 2020). According to the Textile Exchange's data from 2020, wool is one of the most used animal-based fibres, and the fibre stood for approximately 1 % of all the produced textile fibres in the world in 2020, the total production of all types of textile fibres for the market was 109 million mt. The amount of wool fibre from sheep produced in 2020 was 1 million mt, almost the same as the year before, even if one can see that the amount of wool on the market has been declining in recent years (Textile Exchange, 2021a).

The supply chain (SC) of wool is longer than other fibres because the fibre might change ownership often from farm to garment (Russell, 2009). The SC wool goes through several processing stages to become a fibre that can be blended or used as a yarn. The sheep are manually sheared, and wool fleece is separated from the stained and burr-contaminated wools. That wool is not thrown away but will find its purpose in the wool SC. Then the wool is

classified with criteria of fibre length, appearance and style and bales and transported to the storage. Next, the wool is washed, and dirt and other skin contaminants are removed (Ibid.). In addition, around 45% of the sheared fleece is impurities and wool wax that can be further processed into lanolin (Russell, 2009; Petek and Logar, 2020). Then the wool is carded, spun, woven, knitted, dyed, finished, and produced into garments (Russell, 2009).

Furthermore, sheep are used in multiple industries, such as the meat industry, which wool is mainly a by-product from (Russell, 2009; Eriksson and Sjöling, 2018). However, there are multiple other applications for wool than just the textile industry where wool can be utilised (Rajabinejad, Bucişcanu and Maier, 2019). For instance, wool can be used for building insulation, polymer-fibre composites, sorbent materials, and fertilisers (Russell, 2009; Petek and Logar, 2020).

The demand for raw wool has reduced and created a problem of wool waste for farmers who choose to either burn it or throw it in landfills. In the past years, wool has not brought any profit for the farmers, and sheep have been sheared for only animal welfare. That has created significant amounts of woollen waste that has become a burden to the farmers (Rajabinejad, Bucişcanu and Maier, 2019).

1.1.1 Swedish wool

The primary purpose of farming sheep is for meat production in Sweden (Svenska Fåravelsförbundet, 2020; SvD, 2020). That results in wool being a material that does not have a high value in Sweden (Martin and Herlaar, 2021) and is mainly thrown away as waste (Axfoundation, 2021; Sustain Search, 2020). As a result, wool is being classed as an animal by-product (ABP) by the law and under restrictions from the government, thus indicating that wool is a waste product without any economic value or interest (Olofsson, Brink, and Johansson, 2010; Martin and Herlaar, 2021). While at the same time, Swedish brands imported 219 tonnages of washed raw wool from New Zealand and 1240 tonnages of carded and spun wool from Norwegian, Germany, Turkey, and Peru (Sustain Search, 2020; Svenska Fåravelsförbundet, 2021a), making the use of wool contradictory in Sweden. Every year, Swedish farmers throw away wool worth millions of SEK due to low buying power and a lack of infrastructure for handling and processing raw wool fleece (SvD, 2017). For this reason, wool is not used to the extent it could and does not fulfil its potential for the market; therefore, it is essential to develop further the market for Swedish wool (Martin and Herlaar, 2021).

The Swedish Fåravelsförbundet (2021) statistics show the current Swedish wool market. Since 2016, the demand for Swedish wool has been increasing steadily. Also, between 2016-2020, the need for Swedish wool increased by 70%. Even though the current numbers seem high, only 50% of all the Swedish wool available is utilised (Svenska Fåravelsförbundet, 2021a; LRF, 2020). Today, there are approximately 600 000 sheep and lambs in Sweden (Sustain Search, 2020). Due to the number of sheep and lambs, the amount of raw wool produced and utilised is estimated to be 1000-1300 tons per year, according to the data shared by Svenska Fåravelsförbundet (2021a), which is accumulated from shearing the sheep twice a year. In 2016 approximately 83% of the Swedish wool produced was burned, destroyed, or thrown away as waste (Svenska Fåravelsförbundet, 2021a), resulting in an environmental issue. As it is a fibre that can be recycled, it is crucial to utilise all the accessible wool. Although, during the last years, the use of Swedish wool has been increasing, which can be seen from statistics provided by Svenska Fåravelsförbundet (2021a), proving that in the year

2020, 1 000 tonnes of Swedish wool were sold and used in products, which counts as 46% of the total number of wool in Sweden (Ibid.).

Even though the demand for Swedish wool is steadily increasing, the market at the moment cannot respond to the demand. There is no infrastructure or industry to refine the wool locally in Sweden (Sustain Search, 2020) due to the lack of processing facilities in Sweden (Svenska Fåravelsförbundet, 2021a). Consequently, the Swedish wool is usually sent to one country for washing and to another for carding the wool and then finally sent back to Sweden due to lower costs in other countries. There has been discussion within the agricultural, textile, and fashion industries about utilising more Swedish wool; this topic has been discussed in academia in articles from Nääs and Martinez (2020), Sjösverd (2020), and Westfelt and Tiderström (2021). They highlighted the increased demand for Swedish wool. Statistics from the Swedish Fåravelsförbundet (2021a) show that Swedish fashion and textile companies have increased demand and interest for the Swedish wool (Svenska Fåravelsförbundet, 2021a). According to the Stockholm fashion district (2021), the Swedish industry imported 1650 tonnages of wool in 2019. In the same year, the Swedish industry only utilised 1200 tonnes of Swedish wool, which stands for 37% of the available wool from Sweden (Stockholm fashion district, 2021; Filippa K, n.d). In 2020, the same statistics were: Sweden imported 1746 tonnage of wool, and the Swedish wool industry utilised 46% of the wool from the local Swedish sheep (Axfoundation, 2021b). According to the Stockholm fashion district, the imported wool has been transported worldwide before it reaches Sweden, and transport within the value chain is approximately 24 000 km (2021).

1.1.2 Axfoundation & The Swedish Wool Initiative

Axfoundation is an independent non-profit organisation founded by Antonia Ax: son Johnson in 1993. The foundation works practically and concretely towards building a sustainable society and strongly believes in business as a driving force for change. Therefore, projects are often initiated together with the private sector. Together with partners from across sectors and industries, including academia, Axfoundation is finding solutions to global sustainability challenges based on practical issues related to the things we buy, the food we eat and the resources we use (Axfoundation, 2021a).

Therefore, Axfoundation took into their agenda and started the Swedish Wool Initiative in 2020 as one of their projects toward a more sustainable textile and fashion industry in Sweden (Axfoundation, 2021b). The initiative led by Axfoundation aims to make quality Swedish wool accessible for Swedish fashion and textile brands, thus raising the competitiveness of Swedish wool on the market (Axfoundation, 2021b). Moreover, the Swedish Wool Initiative partners are working closely with some of Sweden's most influential fashion and textile companies and research centres, universities, and other experts within the field of Swedish wool. Vinnova funded the project in Sustainable Industry (Ibid.). To summarise, the vision of the Swedish wool initiative is 'Zero waste of Swedish wool' (Axfoundation, 2021b, Axfoundation, 2021c).

Axfoundation, together with its partners and representatives from the Swedish textile and fashion industry, aims to scale up the use of Swedish wool and create a competitive value chain of the raw material for all parties. At the same time, the objective is to reduce the environmental impact in the fashion and textile industry by enabling access to regional, biobased, and recyclable raw materials (Axfoundation, 2021b). Moreover, the future vision of the project is to reduce the waste of Swedish wool will be achieved with the help of cross-sector collaboration. For this reason, the foundation has set up four main targets for the

Swedish Wool Initiative, which first include supporting the climate-neutral and circular industry for fashion and textile brands utilising residual Swedish wool. Second, to set up the value chain for Swedish wool to become more resilient and resource-efficient and third, to advance the competitiveness of raw materials and products of Swedish wool. Lastly, provide a socially sustainable textile industry transforming into a circular economy. (Ibid.).

Furthermore, to scale up the value chain for the Swedish wool industry, the focus should be put on developments and investments in the value chain processes. The infrastructure should be upgraded and implemented to trade and classify Swedish wool and carry out a traceability system that can track and trace the product in the SCs. (Axfoundation, 2021b). It is forecasted that the demand for textile fibres will increase by 150% by the year 2050, which is a challenge for both the industry and the environment (Axfoundation, 2021b). A big part of the fibres in the world today are based on fossil fuels such as polyester or fibres that demand high amounts of water, such as cotton (Axfoundation, 2021b; Textile exchange, 2020). Wool from other parts of the world often has a higher environmental and social impact since it often has poorer animal welfare than Sweden and the Nordic countries (Axfoundation, 2021b). There is a considerable amount of wool in Sweden that has not been utilised due to a limited infrastructure (Svenska Fåravelsförbundet, 2021a). As a consequence of this issue, the farmers in Sweden and Axfoundation's Swedish Wool Initiative are pushing for a market that would utilise Swedish wool better. Wool is a durable fibre with many possible areas for utilisation. With the right market conditions for Swedish wool, this could be a promising material for Swedish companies since it is a regional, biobased, and recyclable material with great circular potential.

1.2 Problem discussion

The problem discussion will discuss the current challenges of the wool industry in Sweden and the sustainability challenges of Swedish wool that this thesis aims to investigate. At the end of the chapter, the research gap this thesis addresses is also explained.

1.2.1 Industry challenges

The Swedish wool industry is not developed compared to Norway, where 4 000 tonnes of wool is processed, sorted, classified, and labelled as Norwegian wool (Norilia, n.d). Norway has a robust infrastructure and industry for wool because it has been developed for a higher amount of wool compared to Sweden. The current SC for Swedish wool is not encouraging farmers to sell and label their wool due to its cost. However, the Swedish sheep farmers are pushing for a wool industry within Sweden (Axfoundation, 2021b; Svenska Fåravelsförbundet, 2021a). That, in return, drives the buyers to refine the raw wool outside of Sweden due to the unavailability of local production facilities with lower costs. On top of that, it is hard to get high-quality wool or equal quality for all the wool for companies sourcing only Swedish wool. These factors push buying companies to source wool from other origins than Sweden, resulting in the Swedish wool being left unused, burned, or buried.

To solve the issues within the Swedish wool market, implementing an official classification system would make it easier to implement a certification scheme and increase the ability to sell Swedish wool on a bigger scale (Sjösverd, 2020). To sell wool, the farmers need to state the quality of the wool for them to sell it. Westfelt and Tiderström (2021) highlight the need for a classification system focusing on the industry to build an infrastructure, which will help to get a higher quality of the Swedish wool to the market, as a result, would increase the usage of wool. However, according to Sjösverd's (2020) study, Swedish companies and markets are

not united on how a classification and wool standard should be developed and used, even though some unofficial classification systems are currently used for Swedish wool on a small scale. The classification system allows all wool to be collected, sorted, classified, and possibly certified through a common classer (Sjösverd, 2020). While the SC for Swedish wool is built more robust, it is crucial for producers and other market actors to know what tool to use to ensure the quality and sustainability of the wool.

Hence certifications would bring essential knowledge of the quality and sustainability of the wool. As there are a lot of available certifications in the industry today, only a few are developed for wool, and even fewer are applicable for Swedish wool. Axfoundation (2021c) points out that the farmers and the companies do not know which certifications to use, and which are relevant for Swedish wool as there is insufficient information. Typical for the textile market certifications is that most of them are developed for specific parts of the SC or fibres in the textile industry and then further developed to be applicable for other fibres such as wool. The scope of the most frequently used certification schemes for wool concerns the raw material to ensure that the wool is produced organically and that the animal feed is sustainable. The certifications aim to promote ecological footprint, ensure that the livestock farming is sustainable and that animal welfare and working conditions are good and follow the certification scheme.

As companies face the demand and need for sustainability, it is their responsibility to provide information to their customers about the effort done to reach that goal. Certifications are a great tool to communicate sustainability to customers, significantly as it might affect their willingness to buy (WTB) the product. Previous studies provide information about the importance of wool certifications for consumers and their WTB and preferences for animal fibre products that have been produced locally (Peterson, Hustvedt and Chen, 2012; Bernard, Hustvedt and Carroll, 2013). For this reason, the origin of wool being Sweden can also affect the WTB for consumers and their views of its sustainability. There is a need for research to know the right tool for companies to use in the sustainability communication of Swedish wool.

In comparison, laws and regulations are strong in Sweden regarding working conditions and animal welfare. The article SvD (2019) pointed out that Swedish animal welfare is considered better than other countries. To illustrate some Swedish animal welfare laws, sheep farmers need to shear their sheep once a year. If the farmer has a government grant, the sheep need to be sheared twice a year (Jordbruksverket, 2022b; Nääs and Martinez, 2020; Ullförmedlingen n.d; SvD, 2019). Another part of the law is that mulesing or coupling is not allowed, nor is castration without anaesthesia for sheep (Svenska Fåravelsförbundet, 2016; SvD, 2019; Swedish wool, 2022). Swedish animal welfare regulations and laws are extensive and more comprehensive than other countries. The legislation covers many of the same aspects as the certifications do, as they were created for countries with less significant legislation for sheep welfare. Therefore, there is a reason to explore the possibility of Swedish legislation requesting more from the farmers than certifications do. Also, are the Swedish laws stronger and if they exceed the certifications schemes. However, there are criticism of the animal welfare law, about how to interpret the law and that it is hard to understand it; moreover, there is also criticism that the purpose of the law is vague, not as defined and explained in legislation documentation. Further documents are needed to get the law explained and guide the farmers in the right direction according to the law as it is, in its pure form, hard to understand (Larsson, 2015). The primary purpose of the animal welfare law is to prevent unnecessary animal suffering and animals being poorly treated and prevent crimes against

animal welfare. This part of the animal welfare law is not clear in the law documents, according to Larsson (2015); however, if you look at the frameworks and guiding documents from Jordbruksverket, a government authority, it is understandable (Jordbruksverket, 2019).

1.2.2 Research gap

The literature implies that there is no official classification system for the Swedish wool, thus making it less attractive and easy for the farmers to sell it (Sjösvärd, 2020). Without the classifying system, it is hard for farmers to know what is expected of the quality and price of the wool. However, Sjösvärd (2020) and Westfelt and Tiderström (2021) have been proposing different ways to classify the Swedish wool that one day might be taken into practice. There have not been prior peer-reviewed research articles done about how certifications or legislation could support the classification system and attractiveness of Swedish wool in the market.

Although other industries acknowledge wool as a sustainable material and have researched the alternative usages for wool, the textile industry still lacks to do so. For example, the building industry has examined sustainability and different innovative applications of wool as it can be utilised as insulation for buildings (Korjenic, Klarić, Hadžić and Korjenic, 2015). In addition, studies have shown that wool absorbs oil and other toxins well from water and, therefore, can be applied to different industries' oil accidents (Radetic, Ilic, Radojevic, Miladinovic, Jovic and Jovancic, 2008). As wool is a by-product of the sheep farm industry and its capacity is not maximised, there has been researching on managing the wasted wool and making it a valuable organic substrate (Petek and Logar, 2020). The wool waste is quite resistant to degradation and is not only a problem in Sweden and many other European countries. Therefore, it is crucial to research and encourage industries to find alternative usages and recycling methods for wool rather than throwing it away.

Previous theses on the scope of Swedish wool and the infrastructure of Swedish wool are Sjösvärd, (2020); Olofsson, Brink and Johansson, (2010); Nääs and Martinez, (2020); Eriksson and Sjöling, (2018); Westfelt, and Tiderström, (2021), as well as Larsson (2015), discussed the Swedish animal welfare legislation. All these previously mentioned studies restate that wool is valued as a sustainable material with multiple purposes and applications. However, none of them has focused on the sustainability assessment or regulatory tools to encourage the use of wool, especially Swedish wool. In addition, very few studies have researched the right tool to ensure sustainable wool production in Sweden and how that can be beneficial for companies using Swedish wool. As a result, this study can contribute to this gap in the literature.

1.3 Purpose

This study aims to research various global wool certifications and compare them with the existing Swedish legislation that concerns sheep farming to understand the role of certifications as a market regulatory tool that promotes the sustainable Swedish wool market. The focus of comparison is to understand better which aspects of the SC and life cycle impact the wool certifications cover compared to the Swedish legislation.

The study also aims to provide insights for Axfoundation and Swedish Wool Initiative partners when it comes to certifications of wool as raw material and if, in that case, they complement existing Swedish legislation. Valid information is provided for the academic community on the role of certification schemes and regulations in promoting sustainable markets via the example of the Swedish wool sector. This information will help companies and academia to understand what is needed to reach and comply with sustainability criteria when using Swedish wool.

1.3.1 Research questions

Hence, this thesis aims to answer the following research questions to fulfil the purpose of the study:

RQ1: How can certifications be beneficial for the Swedish wool industry and the market?

RQ1.1: What affects the implementation of a certification?

RQ2: How does the Swedish legislation address the sustainability of Swedish wool?

RQ2.1: How can the legislation support the utilisation of Swedish wool?

1.4 Delimitations

This study does not include a detailed description of all the existing global certifications for wool, as not all are relevant in the context of the Swedish market. The certifications chosen for the comparison are OEKO-TEX® Standard 100, Responsible Wool Standard (RWS) and The Nordic Swan Ecolabel. These three were selected as it is possible to apply the certifications on wool as a raw material. In addition, only some of the Swedish legislation about animal welfare and farming practices are included because all the legislation is not relevant compared to the certification schemes' requirements.

The Swedish wool SC has barriers that have led the textile and fashion industry not to utilise the wool but rather import it from elsewhere. Furthermore, there are several different applications for Swedish wool besides the textile and clothing industry. This research excludes describing the barriers of the existing SC of Swedish wool and how to solve them in detail. Furthermore, the study will not describe the process and SC of Swedish wool from raw material to fabric and garment.

Throughout this study, the sustainability of Swedish wool and the measures supporting it are analysed and discussed. Sustainability consists of three pillars: economic, environmental, and social development (UN Agenda, 1992). The economic and environmental pillars of sustainability are topical for the Swedish wool and the market and hence are the focus of this study.

2 Literature review

The literature review will briefly explain the Norwegian wool industry, followed by a consumer perspective on wool certifications and wool's life cycle analysis. Further, the difference between certifications, standards and labels are explained to reduce confusion and different applicable certification schemes for the Swedish market are introduced. Lastly, the legislation for animal welfare in Sweden and the EU will be explained, including the criticism of the legislation.

2.1 Norwegian wool industry

In the past, Norway has been facing the same issues with the use of domestic wool as Sweden is facing currently (Klepp, Tobiasson, Haugrønning, Vittersø, Grøva, Kvingedal, Espelien and Kubberød, 2019). The leading research in Nordic and Scandinavian wool comes from Norwegian researchers, as they have the most developed infrastructure for wool. Tstudyrch and implementation for utilising Norwegian wool started earlier than in Sweden. Therefore, the Norwegian infrastructure, classifications system, and standards for wool are more developed (Klepp et al., 2019) than Sweden and Finland. Moreover, the Norwegian wool market is an excellent example of how raw materials and resources can be used and implemented in the Swedish wool market. On the other hand, the number of sheep and the farmers in Norway is much higher than in Sweden, complicating the same infrastructure or actions for Swedish wool. The government has supported the research centres in implementing the Norwegian wool standard and the wool industry in Norway. The Norwegian wool standard has made the wool more valuable for the farmers to utilise (Klepp et al., 2019; Norilia n.d).

The Norwegian government's investments in Norwegian wool and research infrastructure have resulted in new applications and products. Animalia developed a local classification system for the local Norwegian market, Norwegian meat, and poultry research centre, that provides knowledge and information about the industry (Animalia, n.d.). Later the classification system was implemented by the company Norilia in their sorting facility (Klepp et al., 2019). Norilia is a company concentrated on plus-products from the meat and egg industry and is responsible for sorting and classifying wool in Norway (Norilia, n.d). The Norwegian classifications system is divided into 16 levels, which helps the buyer purchase the right kind of wool for their product. Sellers do not have to put in much effort as communication occurs between the buyer and the classification company, Norilia. The classification system divides the wool into types depending on the diversity of quality and the products made from it. What is essential to have in mind is that some wool types are not suitable for knitting and clothing but can be utilised in other ways, such as isolation in buildings or vehicles (Klepp et al., 2019; Svd, 2020). In conclusion, there has been much discussion about developing a similar classification system for wool in Sweden. However, without governmental support, the industry cannot answer the demand.

2.2 Consumers' perspective on wool certifications

Consumers in the Northern Hemisphere have more preferences for sustainable and ethical textiles and are more aware of the environmental impact that the textile industry is causing (Russell, 2009). As a result, the demand for wool and other natural fibres has increased over the past two decades (Costa, Vaz, de Mendonça, Restle, Kroning, Ferreira, and Farias, 2020).

Consumers have been discerning about animal welfare in wool production, especially in Australia (Peterson, Hustvedt and Chen, 2012). The practise of mulesing, where large areas of skin around the posterior to prevent fly infestation, is done for the sheep without anaesthesia and has been common practice in Australia and New Zealand (Ibid.). Therefore, in the U.S., it is required to label the wool according to the mulesing status, such as non mulesed, mulesed, or mulesed with pain relief (Ockenden, 2010). Consumers are more willing to buy products labelled as made with organically produced wool and meet the standards of animal welfare, local origin, and a living wage of the producers (Howard and Allen, 2006).

For wool to be certified or labelled as organic, the product needs to be 100% wool and follow local regulations and legislations or requirements of a certification scheme (Russell, 2009). According to where the wool will be sold for organic farming wool, farming practices, standards, and country-specific legislation must be followed and met. If the destination is not known, farming practices must follow recognised and internationally known standards or the national standard of the country where the wool is farmed and produced (Russell, 2009). However, sheep farmers face difficulty meeting the requirements of organic standards as there are not many alternatives for medically preventing sheep internal parasites. This treatment is not approved by all the organic standards and does not encourage sheep farmers to transition to offering organically produced wool (Bernard, Hustvedt and Carroll, 2013). Also, many organic standards vary as they are developed breeds for farming in different regions (Russell, 2009).

For this reason, labels should meet the customer demand and take into consideration the consumer preferences for sustainably produced wool (Peterson, Hustvedt and Chen, 2012) as consumer expectations of environmental and animal welfare form a basis for the quality of the production processes (Costa et al., 2020). Peterson, Hustvedt and Chen (2012) suggest that consumers prefer a pro-environmental label and animal welfare claims rather than an organic label. Also, Howard and Allen (2006) mention in their study that many of the current organic standards are not meeting all the consumer concerns, such as animal welfare. GOTS and other organic standards are challenging for wool to acquire as an ABP (Bernard, Hustvedt and Carroll, 2013). Furthermore, different certification bodies are competing against each other to get the most significant market shares, and at the same pace, new specially oriented certifications enter the market. Therefore, it is hard to tell which certifications available on the market are the best, as some are not directly specific to wool (Olofsson, Brink and Johansson, 2010).

Consumers are most aware of the ecological labels available on the market (Olofsson, Brink and Johansson, 2010). Moreover, there are hundred different ecological labels on the market today, but not all of them are acknowledged and approved by the governments (Ibid.). Because the national standards are different between each country and geographical location as the areas have different needs and prerequisites (Russell, 2009). In 2008, IWTO brought up the matter of various organic labels and standards and resulted in a definition of organic wool as 'Wool grown by sheep raised on certified organic farms and harvested according to appropriate organic practices' (Russell, 2009, p.75). For the farm to be certified 'organic', it needs to be IFOAM-accredited or internationally recognised (according to ISO Guide 65) by a certifier (Ibid.).

Disinformation that has been presented to create an environmentally responsible public image by organisations is called greenwashing (Russell, 2009). Greenwashing has been increasing, which has come to the awareness of both consumers and regulators. The regulators now request environmental claims to be accurate, verifiable, and easily accessible (Ibid.). As a

result, specific terms such as 'green', 'sustainable', 'environmentally friendly' and other misleading terms that do not have any official certification system should be avoided in the marketing of the product (Russell, 2009; Bernard, Hustvedt and Carroll, 2013). The term 'environmentally friendly' is not enough to meet the consumer requirements for quality, functionality, fashion, value, and performance (Russell, 2009). European legislation aims to tackle the issue of greenwashing by changing global environmental practices and increasing information about textile processing. Overall, the EU does influence the textile industry, as they are a part of developing laws, regulations, and standards for the industry (Olofsson, Brink and Johansson, 2010). International Wool Textile Organisation (IWTO) has also worked to clarify the definitions of organic and eco-wool (Ibid.). Because wool is a natural fibre, consumers perceive wool to be environmentally friendly and sustainable. Wool is therefore advertised as a sustainable, organic, natural or eco textile, which creates confusion in the mind of consumers (Russell, 2009). Consumers have the same association with these terms as organic, which is an official definition (Bernard, Hustvedt and Carroll, 2013) and in some countries is achieved only through certification programs. Set definitions for the terms would help consumers understand if the product is certified and what it stands for. Importantly, consumers have shown more WTB for organic wool; therefore, definitions with different requirements would encourage producers to certify the wool (Bernard, Hustvedt and Carroll, 2013).

2.3 Wool's life cycle assessment (LCA)

Life cycle assessment (LCA) analyses a product's total environmental impact throughout its whole life cycle, better known as from 'cradle to grave'. From the start of the product life cycle to the end, it passes through different stages that have an environmental impact, such as water usage, energy, CO₂, and waste production. Steps of the product include product design, supply of raw material, different processes of production, use, reuse, recycling, and disposal (Duda and Shaw, 1997; Nowack, Hoppe and Guenther, 2012). LCA is an essential tool for identifying stages with the environmental effects and polluting stages and, therefore, can improve the methods and processes (Eryuruk, 2015). LCA is a scientific base for labelling, and some of the environmental labels rely entirely on life cycle assessments of products. That is evident in the case of ISO and EU eco-label that focus on the environmental effects of raw material production to waste management (Ibid.).

A study done by Cardoso (2013) describes how LCA of wool consists of processes of scouring, spinning, and dyeing the wool and the sheep's farming. It also mentions no studies about the environmental impacts when the woollen product reaches the consumer and its life cycle (Cardoso, 2013). Wool is a by-product of the agricultural sector, making LCA much more complicated to estimate the environmental footprint as emissions from the livestock have to be considered (Russell, 2009; Bhatt and Abbassi, 2021). Complications are caused because the environmental inputs and outputs have to be allocated between the products and by-products (Russell, 2009). Environmental inputs are land, water, fuel, fertiliser, and food, and outputs are urine, faeces, and biogenic methane, which is the most significant contributor to wool's carbon footprint. Also, garment care contributes to water consumption and much energy (Ibid.). Therefore, LCA analyses can rank wool as unsustainable material as the environmental impacts of farming practices and livestock greenhouse gas emissions are high (Cardoso, 2013). For this reason, sustainability assessment tools such as Higg Material Sustainability Index (Higg MSI) do not give good scores for wool (Cook, 2019; Tonti, 2021). However, the index does not consider that wool is a by-product of the meat industry and is

transported worldwide. Consequently, more research should be done to determine the activities after the wool has left the farm and the benefits of wool for carbon sequestration (Bhatt and Abbassi, 2021).

Martin and Herlaar (2021) made an LCA understand the impact problem of the Swedish raw wool in the SC. They also made a social life cycle analysis (SLCA) of Swedish waste wool from agricultural farming, for example, meat production, which showed that waste wool reduces the environmental impact compared to conventional wool SC and merino wool. In addition, Martin and Herlaar (2021) described a typical SC for a Swedish wool sweater. After the wool is sheared from the sheep, it will be washed and sorted, and then it is scoured on Gotland, Belgium, or any other country. Then the wool is further shipped to Lithuania, where the wool is spun into yarn, dyed, or bleached, depending on the end use. After that, the wool is put into a weaving machine in the example case. Once the weaving is finished, the woven wool fabric is transported to Estonia at a garment assessment plant to become a garment and then shipped back to Sweden (Ibid.). That sounds like a long and complicated SC that demands much energy. However, the same study by Martin and Herlaar (2021) demonstrates that the CO₂- emissions from the Swedish European SC for wool are a lot lower than the wool we import from Australia or New Zealand (Ibid.). European and Swedish wool also scores better in the SLCA, as animals are taken better care of in the SC due to the EU's animal welfare regulations and strong working laws (Ibid.). The same report from Martin and Herlaar (2021) shows that Swedish and European wool's SC processes reaches just above 6 kg CO₂-equivalent per sweater. Compared to a sweater from Australia, which reach around 14 kg CO₂-equivalent per sweater due to transport, processes, and the wool's impact as a raw material is significantly higher (Ibid.).

2.4 Difference between certifications, labels, and standards

Ladu and Blind (2017) described the relationship between certifications, labels, and standards to the certifications schemes as the tool that proves that a product adheres to a specific standard, where a label shows the outcome of the certification and is communicating it the buyer. Standards and certifications are, for the most part, standards and certifications are organised and led by groups of non-governmental organisations (NGO), industry and multi-stakeholder associations. Whereas some certifications and standards can also be under the industry's authority, NGOs or government agencies are led by themselves (Steering Committee, 2012). Standards and certification schemes often use third-party verification and are closely monitored to ensure their requirements are met (Steering Committee, 2012; Fao, 2003). A product, raw material, or part of a production process can be standardised or certified when the product fulfils requirements of quality, sustainability, or other information that the label or certification requests (van der Grijp and Brander, 2002). The certification is a tool of communication between buyer and seller to prove the SC complies with the standards (Fao, 2003). A product that fulfils all the certificate requirements is often marked with a logo proving the quality of the product. The advantages of standards and certifications are that they promote and provide sustainability within the SC and between the SC's stakeholders. It is believed that certifications and standards can transform markets globally as they can work and make decisions even if the science and the scientific methods are not established yet. Another advantage of certifications is that they are based on science but can be changed if needed or in the case of science changes (Steering Committee, 2012). On the contrary, it is harder to change laws, regulations, and policies as they require a longer process. The government needs to be involved in changes even if the change is needed from a scientific perspective.

The Steering Committee (2012) defines certification as 'a means of assuring that products or services comply with the criteria' (Steering Committee, 2012, p.6). In addition, the same source defines a standard as 'a defined set of social, environmental, and or economic criteria. By complying with these criteria, enterprises translate a standard into concrete practices' (Steering Committee, 2012, p.6). Both certifications and standards have principles that need to be followed. However, the essential purpose is that the different certification and standard systems provide a framework where the stakeholders can work together with joined forces to increase the sustainability and quality of work (Steering Committee, 2012). Moreover, standards are an inherent part of certification schemes; certification guarantees compliance. Thus together, standards and certification systems provide a framework for promoting and implementing sustainability in the SC (Fao, 2003). Today's market has a range of independent standards and certification systems, and their operations and developments are all influenced by the International Organization for Standardization (ISO). One of the tasks of ISO is to develop new directives for working in compliance with standards (Laitala and Grimstad Klepp, 2012).

Labels in the context of certification and standards are a communication and marketing tool which shows that a company supports and follows the guidelines for a specific initiative. The label placed on a product will indicate that the product is produced in compliance with guidelines from certification or standards (Fao, 2003). The label has verified the initiative's guidelines and will communicate corporate sustainability engagement to consumers. A certification body or standard organisation can own labels, has been. The label indicates that the product is produced according to guidelines from verified certifications or standards (Fao, 2003). Moreover, labels can act more as an initiative that drives to make something better. When the initiative's logo is put on a product market, it indicates that the company fulfils the initiative's requirements to place its label on the product (Steering Committee, 2012). Moreover, when both parties know the label's requirements, labels work as a communication tool with the end customer (Laitala and Grimstad Klepp, 2012; Fao, 2003). For the label's initiative to be trusted and recognised by consumers, the stakeholders need to understand what it stands for and how to use it properly (Laitala and Grimstad Klepp, 2012).

2.5 Certification schemes applicable for wool

Eco-labels, also known as ecological labels, was created to support the actions against environmental effects, from the design to the end product, to communicate sustainability to the customers (Russell, 2009; Eryuruk, 2015). Also, eco-labels have become a tool for companies to compete in a global market and show their customers that they are committed to reducing the environmental impacts throughout the life cycle of their products (Eryuruk, 2015). The demand for eco-labelling and certifications has lately increased, even though the process is expensive and complex. In particular, demand has been growing as consumers want to purchase sustainably produced textiles that comply with environmental standards. This demand keeps increasing in the textile and clothing industry and will change the international markets (Ibid.). Today, there are more than 460 eco-labels, of which 109 are applicable for textiles. Eco-labels are issued either by a governmental or private enterprise when the product meets the requirements of the label. An example of a governmental eco-label is White Swan in the Nordic countries, and a private label is OEKO-TEX® (Dekhili and Achabou, 2014). Regulatory tools like sustainable strategies and standards have an essential role in supporting a sustainable economy (Ladu and Blind, 2017). Because the regulatory tools help the new

innovative markets, standards have a crucial role as the markets for sustainable and biobased products are working under high uncertainty (Ibid.).

2.5.1 International Organisation for Standardisation (ISO)

The International Organisation for Standardisation (ISO) has developed many standards for environmental issues, especially ISO 14000, which includes a variety of environmental management standards (Eryuruk, 2015). ISO is designed for organisations to take action to manage environmental problems as well as a technical basis for environmental regulations in several countries. There are 570 international standards developed by ISO that include a wide range of environmental standards such as sampling and test methods and measuring the carbon footprint of products (Ibid.).

ISO has defined environmental labelling into three classes based on the ISO 14000 series of international standards (Russell, 2009). First-class, type 1 covers environmental labelling and most common eco-labels (Eryuruk, 2015). Type 1 is considered most credible as it is based on criteria across the life cycle of a product and is audited by a third party (Russell, 2009). In addition, type 1 eco-labels ensure the highest degree of transparency and assurance of minimum environmental impact when manufacturing the product. It also covers the entire processing sequence and stages (Ibid.). Second, type 2 is a self-declaration claim with no accepted criteria to be verified. Unfortunately, this type of label does not give much information to stakeholders (Eryuruk, 2015). As Type 2 is a self-declaration by manufacturers or retailers, it faces problems with verifiability and credibility, which can be seen as greenwashing. Although, consumers do not know the difference between these types of eco-labels and assume that both have official backing for their environmental claims (Russell, 2009). Third, type 3 is an environmental declaration, where a third party has determined criteria for a label verified by another third party (Eryuruk, 2015). Type 3 eco-labels are not so commonly used as they are voluntary programmes that offer environmental data of a product under pre-established categories of parameters (Russell, 2009).

ISO has developed a list of requirements for bodies and initiatives that certify products, processes, and services. This standard was earlier known as ISO Guide 65; however, it was withdrawn and replaced by ISO/IEC 17065:2012 (en) year 2012; this ISO standard has the updated name “Conformity assessment — Requirements for bodies certifying products, processes and services” (ISO, 2012). ISO/IEC 17065:2012 (en) ensures that all the different certification bodies follow the exact requirements and framework in their operations and use a third party for auditing. The certification body must also have a certification scheme dedicated to the specific product, process, service, or function to be a standardised certification body according to ISO/IEC 17065:2012 (en) (Ibid.). The reason why products, processes, operations, and services are certified is to ensure the confidentiality of the product to the interested stakeholders and customers. A certification indicates that a particular product, process, or service fulfils the requirements of the third-party certification body authority (ISO, 2012).

2.5.2 EU eco-label

An example of ISO, a type 1 eco-label, is the EU eco-label that the European Union created to respond to the consumer demand for eco-friendly labelling (Bernard, Hustvedt and Carroll,

2013). The EU eco-label is a combined certification of the European sustainability certification, including environment, health, and function (Johnsson and Russel, 2009; Olofsson, Brink and Johansson, 2010). The EU eco-label is considered a robust standard for textiles to ensure sound environmental practices in production (Russell, 2009). The EU eco-label is a label that covers all stages of the textile SC from the raw material to the end product. It has explicitly criteria for textile processing and pollution prevention and control legislation (Russell, 2009; Council directive (EU) 2014/350/EU). The EU eco-label strategy ensures that chemicals used in the processing of fibres and wool must be safe, and the detergents must be biodegradable. The SC system processing the product labelled with EU-eco label must have a waste management system. The consumption of water and energy are monitored and must be reported for all steps in the SC. However, the EU-ecolabel can be used on a completed product as a garment and for yarn or the fabric (Cai, Russell and Pierlot, n.d; Council directive (EU) 2014/350/EU).

EU eco-label is considered one of the most robust measures for textile sustainability and is advocated in many countries to be used (Russell, 2009). Unfortunately, the EU eco-label does not cover issues on the farm, such as animal welfare and environmental impacts, whereas most organic standards do. These issues are increasingly relevant for some consumers. Furthermore, the EU eco-label has a database on its website to help late-stage manufacturers find fibres produced according to the label's criteria. Nevertheless, the EU eco-label for textiles has become a poor marketing tool as many textile products do not adapt to it. That can be due to the lack of knowledge of the EU eco-label, expenses, and complexity of paperwork at the mill level.

In the context of wool, the EU eco-label database is essential as the wool SC is longer than with other fibres. In contrast, it is hard to apply for wool due to the SC being extended across several countries (Russell, 2009). The EU eco-label for wool concentrates on fibre, washing, spinning, dyeing, and finishing the fabric (Bernard, Hustvedt and Carroll, 2013). The International Wool Textile Organisation (IWTO) has determined eco-wool to be textiles and products that meet the criteria of EU eco-label in all of the stages of the SC (Russell, 2009). Also, the international wool industry is expected to adopt the EU eco-label as it will help the wool SCs and ensure sustainability (Ibid.).

2.5.3 The Nordic Swan Ecolabel

EU eco-label is the collective certification for environmental sustainability among EU member states; the certification body works with the Nordic Swan Ecolabel as they work similarly (Johnsson and Russel, 2009; Olofsson, Brink and Johansson, 2010). The Nordic Swan Ecolabel, also known as White Swan, is the official voluntary eco-label in the Nordic Countries, similar to the EU eco-label. It aims to ensure an environmental labelling scheme for sustainable consumption for companies that produce and market their products in Denmark, Finland, Iceland, Norway, and Sweden (Eryuruk, 2015). For a product to be certified with the Nordic Swan Ecolabel, the producers must prove that they follow the international and national standards and legislation to apply for the certification (Johnsson and Russel, 2009; Olofsson Brink and Johansson, 2010). The Nordic Swan Ecolabel also controls its samples by testing and making control visits (Eryuruk, 2015).

2.5.4 Swedish wool label

In February 2022, it was announced that the wool industry had started an economic association that the industry would drive in Sweden. This Swedish economic association established an initiative to label Swedish Wool under the above name and change the wool industry in Sweden (Svenska Fåravelsförbundet, 2022). In addition, the association is an industry-driven initiative that aims to implement a label for Swedish wool. For decades, wool has been seen as waste in Sweden; in recent years, and it has changed as the demand for Swedish wool as a raw material has increased. Therefore, the industry-driven initiative pushes the Swedish wool industry further with the new association (Ibid.). The label aims to increase the value and the utilisation of Swedish wool. Moreover, the label can be used on 100% Swedish wool products or products containing Swedish wool but mixed with other raw materials (Swedish Wool, 2022). The labelling will help simplify the communication within the SC and indicate that Swedish wool is a high-quality raw material from Sweden. The Swedish Wool label ensures the consumers that the product contains Swedish wool and is applied to the whole SC by partners, farmers, traders, and people involved in processing wool (Ibid.). Furthermore, the label will also contribute to more significant recognition of Swedish wool outside the borders of Sweden (Svenska Fåravelsförbundet, 2022).

2.5.5 Global Organic Textile Standard (GOTS)

Global Organic Textile Standard (GOTS) is a standard for processing organic fibres covering SC and focusing on ecological and social sustainability (Eryuruk, 2015). It is a widely accepted international organic standard for textile products (Teli, 2016) that aims to certify and specify requirements for organic fibres starting from farming through manufacturing and to the end product (Eryuruk, 2015). Moreover, it includes the whole SC of organic textiles, ensuring the quality of the product and social accountability (Olofsson, Brink and Johansson, 2010; Teli, 2016). GOTS is offered for environmentally friendly and socially responsible organic farming and textile processing (Teli, 2016). Through on-site inspections through the label or other reliable parties, that is ensured to offer consumers credible assurance globally. What makes GOTS different from other organic standards and competitive in the market is that it follows the critical norms of the International Labour Organisation (ILO). The organisation has set social criteria that include water and chemical management in the production and other environmental standards (Ibid.).

Furthermore, GOTS manufacturers can provide organic fabrics, garments, and products (Eryuruk, 2015). The standard has two levels which show the number of organic fibres used in the product. These are level 1, where the product is considered organic if made with more than 95% certified fibres. Next is level 2, where the product is made with a certain percentage of organic if it contains more than 70% organic fibres. The other less than 30% non-organic fibre should not contain more than 10% synthetic fibre except for sportswear and socks (Ibid.). GOTS has much potential to be compatible with wool, but unfortunately, it has its focus on cotton. Therefore, the industry should work together with GOTS to help to develop it further (Russell, 2009). In 2020 GOTS added new requirements addressed to wool farming and animal welfare. The GOTS 6.0 is updated to mulesing is not accepted, so even if the wool is produced organically, it cannot have a GOTS label if the sheep has gone through mulesing (Textile Exchange, 2020).

2.5.6 Responsible Wool Standard (RWS)

Responsible Wool Standard (RWS) is a voluntary standard to which farmers apply, and the certification ensures that animal welfare is followed. The standard is an initiative started by Textile Exchange in 2016, and the standard already reached a market share of 1,25% of the total virgin wool on the market in 2020. RWS consists of tools and best practices that ensure that the animals are protected with their five freedoms and includes no mulesing. RWS contains best practices for animal welfare, social responsibility, and the environment compared to other certifications. Also, the best practices concern the environment and support the farmers to protect the soil, biodiversity, native species and health of the land and the best care for the grazing land for the sheep (Textile Exchange, 2020; Textile Exchange, 2022). The best practices for social responsibility protect the social welfare, workers' safety, health, and working conditions. One other requirement the RWS requires is to identify the wool in all stages of the SC, from raw material to the end product. All actors in the SC supply must consider the certification of wool fibre at all stages in the SC, as RWS requires that all SC actors be certified to maintain the chain of custody (CoC) throughout the production (Textile Exchange 2022).

The purpose of the RWS is to provide the wool industry and farmers with a framework of best practices which ensures that the farmers producing wool have holistic respect for animal welfare and manage the lands where the sheep are grazing. Also, the objective of the RWS is to build a CoC throughout the whole SC for the certified material (Textile exchange, 2022). By 2019, the RWS certified farmers and certified sites were only represented in North America, South America, South Africa, and Australia. To ensure that audits follow the requirements and framework of the certification, farmers and value chains certified with RWS are monitored with audits by a third-party certification body (Textile Exchange, 2022). The report from Textile Exchange (2021a) says that in 2020, 1,519 farmers become certified with RWS, and in the year 2019, 745 farmers were certified; this is an increase of 774 farmers from the year before (Ibid.). The market share of the most common certifications in 2019 was Organic wool at 1%, RWS wool at 1%, ZQ certified wool -at 1% and Unspecified wool at 97%. It indicates that less than 3% of the wool on the world market was certified, labelled, or standardised in 2019. In March 2020, RWS was updated to have more inclusive requirements for the farmers on biodiversity and social welfare (Textile Exchange, 2022).

2.5.7 OEKO-TEX® Standard 100

There are around 20 environmental standards for textiles, and most have a small share in the market (Russell, 2009). OEKO-TEX® is one of the most recognised environmental standards globally, but it is different from SC and type 1 eco-labels (Russell, 2009; Eryuruk, 2015). OEKO-TEX® has six different standards within its testing and certification systems, among which are the most popular OEKO-TEX® Standard 100. Moreover, OEKO-TEX Standard 100 analyses that no harmful and illegal substances will be present within textiles (Bernard, Hustvedt and Carroll, 2013; Eryuruk, 2015) could affect people's health and environment (Olofsson, Brink and Johansson, 2010). That is done through testing, where OEKO-TEX® Standard 100 rules out one hundred harmful substances that need to pass the required criteria without exception from the products and includes a certification that the product has been environmentally friendly (OEKO-TEX, 2022b; Eryuruk, 2015). The tests also include sewing threads, linings, prints and accessories such as buttons and zippers (Eryuruk, 2015). Brands, retailers, and suppliers can use all the OEKO-TEX® certifications and standards to ensure that

their product is sustainable. Importantly, OEKO-TEX® guarantees that production processes are environmentally friendly and social accountability by assuring optimum health and safety conditions (Teli, 2016). However, what is disadvantageous with OEKO-TEX® is that it concentrates on toxics that might be dangerous for humans rather than for the environmental discharges in processing and environmental impacts (Russell, 2009). In the context of wool, OEKO-TEX® can be obtained for finished or partly finished wool, but it is much more complex for Australian and New Zealand wool due to the pesticides used in that region (Ibid.).

2.6 Swedish laws and regulations

This part gives a brief, and general description of the EU legislation as Sweden is a member state and must follow the legislation. The Swedish legislation applies to wool and animal welfare.

2.6.1 European Union (EU)

The European Union (EU) rules of the law; in other words, the EU's actions are founded on policies or treaties that member countries have voted on and approved democratically. The EU cannot propose a law on something not brought up in the commission's sitting; the treaty changes when new countries are accepted into the EU Commission (EU, n.d). When a treaty has been voted on and decided, the treaty is a binding agreement between the EU and all EU member states, this is how the EU rule of law works. The role of EU treaties and regulations in their member states is to increase the transparency in the states and corporate in more areas and make the collaboration between the EU member states more efficient. EU can also adopt laws and regulations under the treaties; these laws and regulations are the member states are obligated to implement into their legislation (EU, n.d).

EU regulations and laws also control animal welfare in their member states, as the commission has an interest in agriculture and the public health of the people in the member states. The EU voted for treaties of animal welfare in terms of regulations regarding aspects of the transport of livestock animals and how to control diseases and infections that can spread from animals to humans. This regulation guides and controls the illnesses that can spread between animals and humans during transportation. It also controls the traceability of the animals regarding regulations and laws outside of this. The EU member states have an obligation to their members to follow the animal regulations provided by the EU Regulation (EU) 2017/625, which regulates the official controls and activities to ensure animal health and welfare, agriculture, and the health of plants and plant protection. Within regulation (EU) 2017/625, the EU regulation (EC) No 178/2002 of animal food and feed law is a part that includes animal nutrition, medicated feeding stuff, food, feed hygiene, and zoonoses. EU regulation (EC) No 178/2002 also regulates food and feed law applications. It guides the ABP and products from the animal origin intended for consumption within this regulation EU law Regulation (EC) No 178/2002. Regulation (EU) 2017/625 also includes guidelines on transportation and transmissible animal diseases, including diseases resistant to antimicrobials from microorganisms that can significantly impact public health, the safety of food and feed to animals, and animal health and welfare (SFS 2018:1192). These are the same for all the EU member states, but outside of this, the countries are free to form their legislations and regulations for animal welfare (Larsson, 2015). When it comes to Swedish animal welfare, the

country does have a constitution, laws, and regulations. Most of the points from the EU regulations for animal welfare are laws within Sweden that are further developed.

2.6.2 Swedish animal welfare legislation

World Animal Protection Index (API) provides free services for ranking the animal welfare legislation per land and notes which countries are doing well and who have the legislation lagging. API also gives a possibility for comparison of the animal legislations between the countries and has a scale of scores from A- G, where A is best, and G is the worst. On this scale, Sweden has been given a score of B (Api, 2020).

The Swedish animal welfare law (SFS 2018:1192) aims to ‘ensure and promote good animal welfare and respect for animals.’ It targets animals kept by humans, testing and experimenting on wild animals. Larsson (2015) summarised the Swedish animal welfare law as follows: ‘animals must have enough space to be able to behave naturally, animals cannot be subjected to suffering, and animals should be kept under appropriate environmental conditions, as well as animals should be cared for in case of sickness and accidents’ (Larsson, 2015, p.13). Also, the animal welfare law (SFS 2018:1192) provides general regulations on how animals are to be treated, kept, and cared for and the basic animal welfare requirements. This paragraph will only focus on the parts of the Swedish animal welfare law (SFS 2018:1192) related to sheep and wool. Animals shall be treated well and be protected from unnecessary sickness, diseases, and suffering from treatments for diseases. That can be kept in a suitable environment for the animals, which encourages the animal's natural behaviour and support the animal welfare (SFS 2018:1192). As mentioned earlier in the study, sheep have a lot of wool and skin folds that make them moist and warm. These skin folds are ideal for insects to multiply, lay eggs, and live, especially around the sheep's tail and bottom. Therefore, mulesing is performed on young sheep and lambs to keep the area clean from harmful insects in many countries in warmer climates. In Australia, this is a big problem (Djurensrätt, 2021a). In Sweden, farmers cannot perform any surgeries on sheep if not recommended by veterinarians, and the sheep be put under anaesthesia.

The essential thing in the animal welfare law is that animals should have enough food and fresh water; for a sheep that is dry feed and outdoor grazing, the food shall be adjusted according to the number of animals in the herd. The feed shall not contain chemical substances forbidden in food, and antibiotics shall only be used once needed, not as prevention for diseases and ordered by a veterinarian (SFS 2018:1192; Jordbruksverket, 2021c). Therefore, animal owners and farmers must know how diseases are transmitted between animals, both between livestock and wild animals (Jordbruksverket, 2021c). Moreover, it is not allowed to spray the sheep with chemicals against pesticides or insecticides that are harmful to the sheep and the environment. Animals are not allowed to be tied up for a long time or painful for the animal. Also, the animal shall be able to move around, and it cannot hinder the animal from its necessary freedom of movement and protect itself from the weather when resting. Moreover, the law also says that an animal owner should physically hurt or abandon the animal (SFS 2018:1192).

2.6.3 Swedish Organic farming and animal welfare regulations

On organic kept farms, sheep can be an issue, which also becomes an issue that the wool is not organic if the sheep are not brought up with organic farming. The EU commission and the Swedish government updated the legislation for organic farming of sheep and goats on the 1st of January 2022. The regulation (SJVFS 2021:47) in the animal welfare law says that for organic farm animals, the farmer needs to be certified for organic production and follow the animal welfare regulations of organic animal husbandry (Jordbruksverket, 2021b). A farmer also can change the whole agriculture at the farm to become organic. According to Jordbruksverket, a farmer who decides to change his full husbandry and produce all livestock, land and crops organic, it will take 24 months before the livestock can be seen as organically sustainable (Ibid.).

Breeding of Organic sheep should be done naturally; however, inseminating is allowed. On the contrary, it is not acceptable to put an organic sheep under a hormonal treatment or other methods similar to hormonal treatment if there are no veterinarian reasons for it. The Swedish law says that if surgery on the animals is allowed, if not regularly or on a routine for all animals, the same is applicable for organic farming of livestock sheep. If an animal needs surgery, a veterinarian must operate. The surgery must be made when the animal's age is most appropriate, and the animal is developed enough. It is allowed to remove the horns from the ram (male sheep), as the horns can hurt other animals in the herd (Jordbruksverket, 2021b).

2.6.4 Future development of Swedish organic farming and animal welfare regulations

The animal welfare law and regulation are in continuous improvement; in 2021, new regulations regarding animal welfare were applied/introduced regarding the traceability of diseases and the transition of diseases. Jordbruksverket informed in February 2021 that all actors transporting animals between countries, or handling substances for breeding, need to provide the information to Jordbruksverket about where the animals currently are and where they shall be transported (Svenska Fåravelsförbundet, 2021b). That is to keep track of possible diseases and their spread (Jordbruksverket, 2022a). In April 2021, Jordbruksverket announced a new regulation (SJVFS 2021:13) in the animal welfare law which is a development on the regulation (EU) 2016/429 regarding the registration of animals. The farmer with livestock, sheep, and goats needs to register the number of sheep each December. That is a development in regulating the traceability of diseases among the sheep.

In the eyes of the law, wool is seen as a by-product of the meat industry. According to both the Swedish law (SFS 2006:805) and the EU regulation for animal welfare, no. (EG) no 1069/2009, both laws classify wool as an ABP. The laws for handling ABPs regulate the shearing of wool and the contamination between the product and the people who will contact the wool, collecting the by-product and transporting and processing the fibre (Avfall Sverige, n.d). According to Swedish law and the EU, the ABPs must be treated carefully to minimise the risk of spreading diseases between animals and humans and secure the safety of the food SC (Avfall Sverige, n.d; Council directive (EU) 2017/625; Jordbruksverket, 2021d).

2.6.5 Criticism and problematisation of the Swedish animal welfare system

The animal welfare regulation (SFS 2018:1192) says sheep shall be sheared at least once per year. However, it can be up to two times per year if needed depending on how much wool the sheep grows. Most sheep in Sweden has a significant volume of wool fleece and need to be sheared more than once per year. The Swedish sheep races are bred for meat production and not wool production (Djurensrätt, 2021b).

Djurensrätt (2021b) in Sweden claims that if humans did not have to breed the sheep for the wool, there would not have been an issue with the shearing of sheep. The sheep from the beginning did have the same wool as the goats currently have (Ibid.). The wool fleece from the animal needs to be sheared regularly to not cause any harm and issues with the sanitary of the animal. According to Djurensrätt (2021b), there have been studies regarding the sheep's well-being during shearing, which have shown that it is a stressful event for the sheep. To perform the stressful event of shearing a sheep and then not using the wool from the sheep is not just a waste of resources; it also puts the animals under stress.

Moreover, the criticism of the animal welfare law is that the law is hard to interpret and that the purpose of the law is a bit unclear, the legislation needs to be defined and explained better in legislation documentation (Larsson, 2015). As the purpose of the animal welfare law is to prevent unnecessary animal suffering and animals being poorly treated, it is essential that these statements are evident in the law documents and prevent crimes against animal welfare (Larsson 2015). However, looking at the frameworks and guiding documents from Jordbruksverket, a government authority, is understandable (Jordbruksverket, 2019).

Moreover, the animal welfare law and how Länsstyrelsen and Jordbruksverket follow it up to have a lot to do with the perception of the single person performing the audit of the farmers. Different people can interpret the law differently. Therefore, it is essential that everyone at Länsstyrelsen and Jordbruksverket is auditing and prioritising the same issues. The strategy is built on how to prioritise the questions and to get all parts of Länsstyrelsen to work strategically, in the same way, to have a sustainable agricultural production and be resource-efficient. The strategy has three main targets, 'animals in Sweden are kept and cared for following animal welfare legislation, and the monitoring of the animal welfare shall be controlled effectively and uniformly'; 'the keeping of animals shall be developed for increased animal welfare, production, and competitiveness' and 'enhanced clarity and security in the work of animal welfare' (Jordbruksverket, 2019, p.2). The three targets in the animal strategy are the animal welfare law and guidance from the Swedish Jordbruksverk, which has been criticised by many in the agricultural industry. One example is from the article by Larsson (2015), who brings up that the guidance from Jordbruksverket is inappropriate for living creatures and therefore cannot be measured with an accurate measuring instrument such as a car, for example. Jordbruksverket, together with Länsstyrelsen, is responsible for monitoring the farmers to follow the animal welfare law. The monitoring system and guidelines for controlling how the farmers are following the law can be interpreted and, therefore also, assessed correctly. The assessment is in line with the animal welfare law and will always partly be subjective as it is assessed living creatures (Larsson, 2015). In 2019 Jordbruksverket decided to create a general animal strategy for Sweden that aims to strengthen the work with animal welfare and animal infection control. To continue to a better job with this, Jordbruksverket instituted the Swedish animal strategy to work with the questions needed from the agricultural side and strategically with the questions (Jordbruksverket, 2019).

3 Methodology

The following chapter of the thesis presents the conducted methodology and introduces the chosen research approach and design. Moreover, it describes the process of data collection and data analysis. Finally, it reviews the quality of the research in detail.

3.1 Research approach/design

This thesis followed a research strategy based on a qualitative research method. The research questions were formulated to understand and discover social phenomena that numbers or measurements cannot explain (Bryman, 2016). The research within the field of Swedish wool and its relation to certifications and Swedish animal welfare legislation lacks academic research. According to Bryman (2016), the qualitative research method enables a rich data collection for an empirical study that is needed when the topic has a limited amount of previous research. Also, the thesis followed an open-ended approach where the theory and concepts result from the findings (Ibid.). The approach was used as it provides a straightforward and easy understanding method for comparative research in this study, suitable to the context of the thesis and the scope of research (Thomas, 2006). The qualitative explorative research approach allows the researcher to grasp the information from the data, as the research method is based on more exploration. The method enables the researchers to use more direct methods, containing specific searches that commit to the understanding of the research (Yom, 2015).

Qualitative research derives essential data and can overwhelm the researchers (Rabiee, 2004). Moreover, a comparative approach needs transparency, as qualitative research lacks guidelines on handling and analysing the data compared to quantitative research (Collins and Hussey, 2016). Therefore, the researchers of this study have developed their own qualitative comparative design method mentioned in 3.3, which includes the desk study and interviews to strengthen arguments as transparency in research reinforces the validity of the comparative research (Yom, 2015). Transparency can be shown as clear links between the research context and the result of the untreated data. The researchers must offer these links and demonstrate them to ensure and justify the findings from the raw data set (Thomas, 2006). Yom (2015) described comparative methodology could not intensify the existing quantitative or qualitative statistics data problems. However, it does help mitigate the issues, which is the aim of this comparative study between Swedish legislation and certifications for Swedish wool. Although, transparency is essential for the researchers as it does justify the research and can remove earlier stigmas and disfigurement from the study. In addition, transparency sprinkles light on the relation between the theory and the raw data (Yom, 2015).

The objective was to answer research questions that investigate if certifications are beneficial for Swedish wool and if the Swedish legislation covers all aspects of its sustainability. To answer the research questions, the comparative research design was adopted so that the social phenomena of two or more contrasting cases can be understood better (Bryman, 2016), in this case, the certifications and Swedish legislation in the context of Swedish wool. Moreover, interviews with experts in Swedish wool were executed to give more insights into the current state of Swedish wool and the demand for certifications for the Swedish market. Furthermore, the steps of the research are presented in *Figure 1* below.

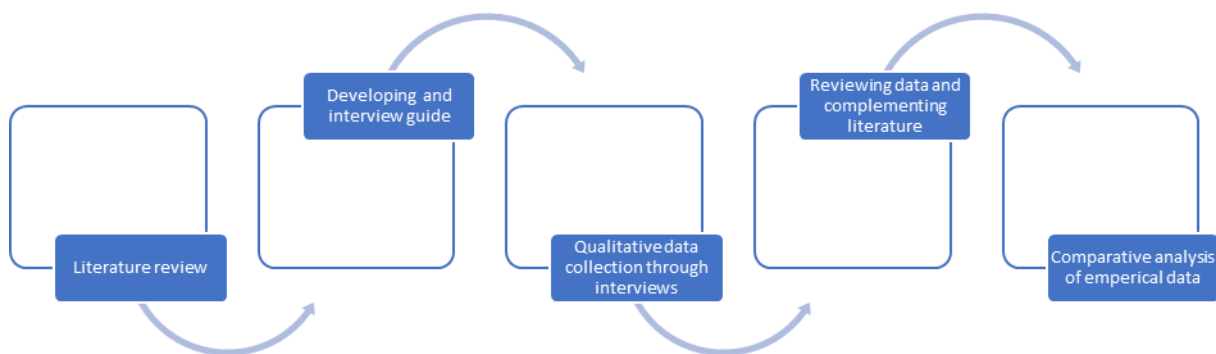


Figure 1. A figure of the research scheme

3.2 Data collection method

Qualitative semi-structured interviews were conducted based on a so-called interview guide to collect empirical data for the research topic of comparing certifications and Swedish legislation (Bryman and Bell, 2015). Semi-structured interviews are used to help the researcher keep an open mind to find concepts and theories from the data (Bryman, 2016). The empirical data collected for this study consisted of primary and secondary data. The secondary data contained peer-reviewed articles from journals, policies, laws, regulations, and company and organisation websites. Moreover, the primary data consisted of semi-structured interviews of two groups. The first group consisted of professionals in the field of wool, referred to in this study as 'experts'. The experts came from companies working with wool, farmers, researchers, government representatives and wool consults. The second group consisted of certification providers certifying different textiles or products with environmentally and socially sustainable labels. For more detailed information on the interviewees' selection criteria, see section 3.2.2.3.

3.2.1 Literature review

This study provided an overview of the Swedish legislation and regulations regarding animal welfare and briefly introduced some of the global certification schemes applicable to Swedish wool or wool. Also, the instruments for establishing a label or a certificate for the Swedish wool as raw material were discussed. Furthermore, the methodology included a literature review, primarily peer-reviewed articles, and additional grey literature; including standards; certifications documents; non-profit organization documents; legal documents; and strategies. The literature review provided a foundation for the research and presented a consumer perspective on certifications through peer-reviewed articles, various certifications applicable to the Swedish market, and the Swedish legislation for animal welfare. Current programs and developments of certifications and legislation were not included in the literature review.

To keep the study recent and relevant to the topic, the publication years of the articles in the literature review was filtered to be between the year 2010 to 2022 in the databases. It is important to mention that some sources are older due to the lack of new research in the field. Therefore, a backward snowballing method was used to continue the search further. In the backward snowballing method, the reference list of the essential articles was gone back, and relevant articles were picked from there (Wohlin, 2014). That enabled the authors to gather relevant data for the area of the research purpose. The peer-reviewed articles were found in databases such as Primo (University of Borås, own database), Scopus, ScienceDirect and Google Scholar. Following search strings and keywords were used: *Swedish wool*, *Swedish animal welfare legislation*, *wool certifications*, *comparative analysis*, and *LCA of wool*, among others. All articles and legislation documents were added to a list to keep track of the sources.

3.2.2 Interviews

Additional data was collected from interviews with experts in wool, farmers, and companies working with Swedish wool and certification schemes. The interviewees were contacted via email and asked if they would like to participate.

3.2.2.1 Sampling method

The first sampling method used was purposive sampling, a strategic method of gathering the interviewees who have essential knowledge of Swedish wool (Bryman, 2016). Purposive sampling in qualitative research aims to connect the research area to the sample group. This strategic way of sampling is used to choose samples that answer the research questions and analyse collected data (Bryman, 2016). A sampling of the interviewees was made regarding their previous experience or interest in wool, especially Swedish wool. The interviewees varied from people who had worked in the wool industry their whole life to people who had been in the industry for just a couple of years.

A snowball effect was discovered when contacting the possible interviewees. Some of the people contacted gave their connections to other experts in the wool industry whom they thought would be interested in the topic of the thesis. The snowball sampling method is a non-probability sample method. The researchers contact possible participants relevant to the study, and the contacted participants contact other participants with expertise and knowledge in the subject (Bryman, 2016). Moreover, snowball sampling enables the researchers to find more participants connected to the topic. The method often helps the researchers reach out to experts in the area they would not have been able to interview or talk to without connections with other participants (Ibid.).

A broader research topic requires a bigger sampling group for the data collection in qualitative research as there is a higher level of comparison between the groups of participants (Bryman, 2016). Moreover, as this study is a comparative study where interviews aimed to collect data from the Swedish wool market and the expertise of the certification bodies, a more extensive sampling group was required so that all sides of the comparisons were covered. Also, Norwegian experts were added to the sampling group due to their advanced knowledge of the topic. Bryman (2016) mentions that a bigger sampling size is needed for a local group of participants. Therefore, participants representing the Swedish wool market, including companies, organisations, farmers, and other professionals of Swedish wool, stand

for a more significant share of the sampling group than the experts and certification bodies, as can be seen from *Figure 2*.

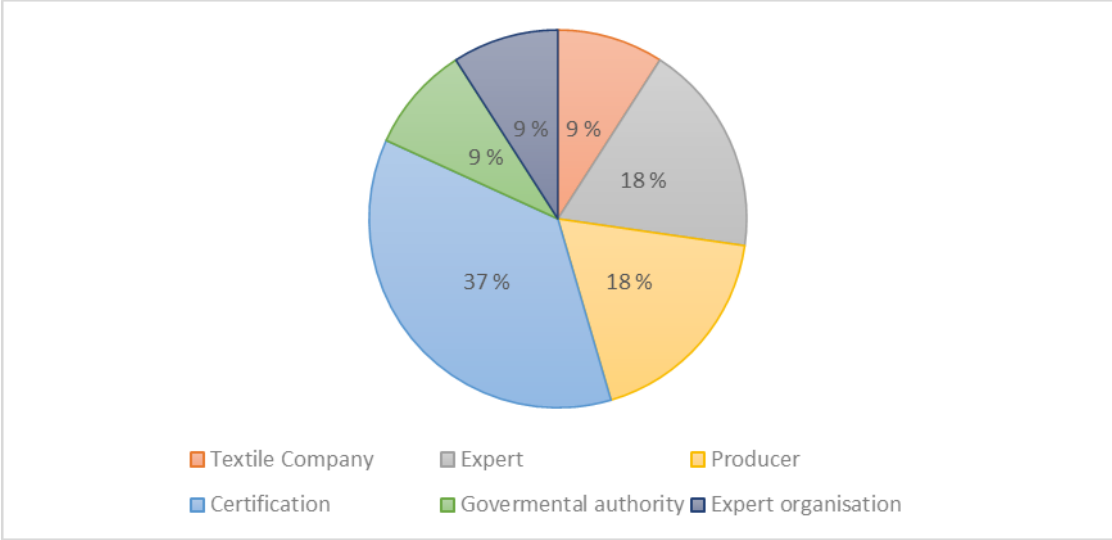


Figure 2. Diagram of the distribution of interviewees' expertise

3.2.2.2 Selected certifications and legislations for comparative analysis

The certification schemes selected to be the focus of this study were chosen for the analysis due to their possibility of applying to the Swedish wool industry. The selected certifications schemes are provided by OEKO-TEX® Standard 100, Responsible Wool Standard (RWS) and the Nordic Swan Ecolabel. These certifications qualify for comparative analysis due to two reasons: first, the certifications were discussed in the interviews to be applicable for wool and second, the certifications Responsible Wool Standard (RWS) and the Nordic Swan Ecolabel follow the ISO standard according to ISO/IEC 17065:2012 for validation and accreditation (ISO, 2012). And OEKO-TEX® Standard 100 follows the REACH directive and The Candidate List of Substances of Very High Concern (SVHC) by the European Chemicals Agency (ECHA) (OEKO-TEX, 2022a). Both which has guidelines for how the certification shall work and audit requirements. The ISO ISO/IEC 17065:2012, REACH directive, and ECHA-SVHC, have standards for certifications indicating that the certificates have credibility. The three chosen certifications can be applied to wool products and supply chains. One of the certifications RWS was developed only for wool chosen certifications, OEKO-TEX® Standard 100 and Nordic Swan Ecolabel are some of the most commonly used for certifying wool products and having a good quality scheme. In addition, Nordic Swan Ecolabel was also selected for the comparison because the certification scheme has been applied and further developed in other Nordic countries for their local wool market.

The Swedish legislation that was chosen for the comparison in this research is the animal welfare law (SFS 2018:1192), the medical care of animal law (SFS 2009:302), and additional regulations included in the comparison are the regulation for sheep, which cover the layout of the stall and bedding for sheep (SJVFS 2019:21). These legislations and regulations cover all the animal welfare aspects of sheep farming in Sweden. Adding to the sustainability aspects of the comparison from the legislation point of view, the animal welfare regulations for organic agriculture and keeping sheep (SJVFS 2021:47) were chosen as they cover and regulate regenerative farming and how to grow organically (Jordbruksverket, 2021b). Since the work environment laws for people in Sweden are strong, the thesis does not dig deep into social welfare. However, it is brought up in the comparison analysis as social welfare is a part

of the sustainability pillars. Moreover, the comparison analysis between the legislation and certification will mainly look at the health and care of sheep.

3.2.2.3 Sampling group

Reached out to 27 companies and certification bodies; 9 replied and were willing to be interviewed regarding the thesis topic. The following four companies and certification bodies agreed to answer the questions through an email questionnaire. Even though the participants are anonymous, their relation to the wool industry is disclosed to show their professional experience. More information about the participants is included in *Table 1*.

Table 1. List over interviewees, interview method and description

Participant	Interview method	
<i>Certification 1</i>	Personal Zoom/ online interview	Global non-profit certification scheme for wool that works as a third-party certifier that aims to verify sustainability in the wool supply chain from the raw material to the final product. The certification is part of a more prominent organisation that is one of the fibre and materials industry leaders.
<i>Certification 2</i>	E-mail Questionnaire	One of the leading global certification schemes for textiles that tests products for harmful substances to ensure consumer safety.
<i>Certification 3</i>	Personal Zoom/ online interview	Certification 3 is a voluntary environmental label in the Nordic countries Denmark, Finland, Iceland, Norway, and Sweden. Certification 3 is representative of Norway.
<i>Expert 1</i>	Personal Zoom/ online interview	Norwegian journalist and an author who has published multiple books about wool and is part of a significant research project in Norway related to wool.
<i>Expert 2</i>	Personal Zoom/ online interview	Swedish author, handicraft consultant, textile teacher and wool expert who has worked in the field of wool throughout their whole professional life. The expert is also working with sustainability-related questions and innovations on a national level within Sweden.
<i>Expert organisation</i>	Personal Webex/ online interview	A global authority that represents all stages of the wool SC. It also supports scientific research, education, and knowledge about wool to ensure a sustainable future.

<i>Governmental authority</i>	Personal Zoom/ online interview	Works with funded EU projects within agriculture and natural resource management within Sweden. This governmental authority is placed in all areas of Sweden and is locally based, and its responsibility is to administer the government money and targets in the local area.
<i>Producer 1</i>	Personal Zoom/ online interview	Swedish sheep farmer who started a certification scheme for Swedish wool in early 2022. The interview was executed by both the producer and the certification side.
<i>Producer 2</i>	Personal Zoom/ online interview	Swedish wool brokerage that purchases and sells wool between sheep owners and wool processors. They are developing a digital service that will make more use of the Swedish wool by simplifying the purchase and sale.
<i>Textile Company</i>	Personal Teams/ online interview	A fast-growing Swedish company that manufactures warm base layers and mid-layer garments from wool. All their products are manufactured in Sweden, from knitting to sewing.

3.2.2.4 Interview structure

Informed consent is an essential part of social research. The participants need to know their objectives and expectations for the study so that participants can decide if they want to participate or not (Bryman, 2016). Informed consent is also a part of the ethics of the study, as the participant must be aware of what the study implies, as they must make an informed decision about why and if they should be a part of the study or not (Bryman, 2016). All participants were contacted via email, where the study's authors expressed the aim and reason for the research. The authors described the intention for contacting the participant in terms of an interview. The authors also introduced themselves and their interest in the subject in the email, and the possible interview questions were added as an attachment. Further information about the topic was given at the beginning of the interviews. Each interviewee was sent a GDPR form provided by the University of Borås, which aimed to inform them how the information collected from the interviews was planned to be used.

Furthermore, the interviewees were professional practitioners and were referred to as experts in this study. The interviewees could answer freely to the questions in the semi-structured interview where a specific level of guidance was given but not limiting the answers. Moreover, the interviews were primarily held in English, but some were done in Swedish to ease the conversation. Interviews were conducted between the 10th of March and the 7th of April 2022 and lasted between 30 minutes to 70 minutes through video meeting platforms such as Zoom, Webex, Teams, and phone and email. Also, questionnaires were executed through email due to the busy schedules of the interviewees. Most of the interviews done through video meeting platforms were audio-recorded for transcriptions.

The interview guide was developed before the first interview, and questions related to the subject were set as the interview method was semi-structured interviews with open-ended questions. Also, the interview guide was approved by the supervisor before the first interview. The list of questions was added to an interview guide used for each interview. More information and clarification for questions were added from the interview guide if the participants did not follow the question or did not understand the aim of the questions. An interview guide is used as memory notes for the authors asking the interview questions and deciding which order the question shall be asked (Bryman, 2016) to have a good flow during the interviews. See the interview guide in *Table 2* below.

Table 2. Interview guide

Content focus	Interview questions
<i>Swedish wool and Sustainability</i>	1. In your opinion, can wool be considered a sustainable material source for the textile industry? Why/Why not?
	2. Specifically with regards to Swedish wool, what are its advantages/disadvantages in comparison to foreign wool?
	3. What is your opinion on having a universal classification system for Swedish wool (like in Nordic countries) that would be also certified? How can it improve the situation with the Swedish wool market?
	4. What is the potential of the Swedish wool to be also sold outside of Sweden? What are the challenges for selling it outside Sweden, if any?
<i>Certifications</i>	5. In your opinion, is there a need/demand for a sustainability certification scheme that specifically applies to Swedish wool? Why/Why not?
	5. Do you think that Swedish wool should have its own label? Why/why not?
	6. Would certifying Swedish wool bring value for companies? Why/why not?
	7. What will be the implications/consequences of establishing the Swedish wool label and certification?
	8. Which certifications does your company/organisation prefer to use?
<i>Legislations and regulations</i>	9. What is your experience with these certifications?
	10. How do you perceive the sufficiency of the Swedish legislation with regards to covering sustainability requirements for Swedish wool?
	11. Do you consider it is still worth paying for using certification schemes if the legislation is considered sufficient in Sweden?
<i>Certifications</i>	12. What can be the pros and cons of implementing a label or a certification for Swedish wool?
	13. Additional questions and comments from the interviewees

3.2.3 Transcriptions

The transcriptions were made with the help of a software program called Descript which transcribes the recorded audio into a manuscript (Descript, 2021). The software was used since transcribing interviews is time-consuming compared to one person writing down word

by word from the audio file. Also, there is an error rate of 15 words per 1 500 words by doing the transcriptions manually. Moreover, the person doing the transcript from the interview must be focused and pay attention to the transcript, not skip any words (Rev, 2019). The transcription program uses AI technology that transcribes the speech to text and has an automatic speaker detection which eases the transcription process as the interviews are participant's text files (Descript, 2020). To ensure the accuracy of each participant's transcript from the software, the authors listened through all interviews and controlled that the program detected everything correctly. Some corrections were made manually, as AI software has a 99% accuracy. Some program developers say that the programs will continuously learn as they do not understand slang, new words and dialects, and the transcription software engine (AI) learns once a word is corrected (Rev, 2019). Nevertheless, the tool is helpful as it removes the human error from being unfocused or spelling errors corrected incorrectly. The software did have the option of transcribing different languages, making it possible to transcribe both English and Swedish interviews. There were nine manuscripts, which later were coded in the themes.

3.3 Data analysis method

Data analysis consists of several stages, including examining, categorising, and listing data to reach the study's goal (Rabiee, 2004). Moreover, the data analysis goes back to the study's intention by managing the data, making sense of it, getting rid of irrelevant information, and presenting the purpose of the study (Ibid.). Furthermore, the analysis and interpretation of empirical data can lack transparency and be affected by researcher bias (Bryman and Bell, 2015). Researcher bias can also affect the reader negatively as they can lose interest due to the high amount of data (Collins and Hussey, 2013). Also, bias can be found if the reader does see an underlying concern from researchers about what they found in the data set. The readers will doubt the validation of the study due to the research method; this speaks as a consequence of not using a deductive methodology (Yom, 2015).

This study aims to display and discuss the problems that would need to be addressed in the Swedish wool SC that might bring complexity to establishing certification schemes and study if something is missing from certification schemes and Swedish legislation in Swedish wool. Moreover, the ideal for a comparative study is to share the themes, coding and links between the theories and raw data, so the reader understands the relationship and sees the transparency (Thomas, 2006; Yom, 2015). Also, comparative analysis aims to reduce data collected through qualitative research (Rabiee, 2004). The empirical data and primary data from the interviews were analysed through a comparative analysis to find answers to the research questions. The comparative analysis was clustered into themes to make it easier to follow. The themes that emerged from the data analysis reflect the parts of sustainability in the Swedish wool industry.

3.3.1 Comparative analysis research design

A comparative study aims to provide research that will give a deeper understanding and evolve causal explanation as part of the context of current and historical actors with new roles in research (Yom, 2015). Bryman (2016, p.689) defines a comparative analysis as `A research design that entails the comparison of two or more cases to illuminate existing theory or generate theoretical insights resulting from contrasting findings uncovered through the

comparison' (Bryman 2016). The study will generate theoretical insights into comparing the Swedish animal welfare legislation to the already existing global certifications to investigate if the certifications and legislation are lacking in covering the sustainability aspects of the Swedish wool industry's animal welfare and economic welfare.

3.3.2 Content analysis – coding themes for comparison

For semi-structured interviews with open-ended questions, a coding framework was set up to analyse the data from the interviews. A coding framework has the aim of gathering data connected with each question. However, the coding process for a qualitative comparative analysis has the following steps, according to Thomas (2006). Initial reading through the gathered data, identify specific segments related to the context of the study, create categories with the use of labels from the segments, reduce the overlaps between the categories, and a model is created with the most relevant segments and categories for the study (Ibid.). According to Bryman (2016), it is crucial to have a coding framework for interviews where open-ended answers shall be coded. Also, a coding manual is a part of the content analysis in a qualitative research design, together with a coding scheme (Bryman, 2016). A coding manual gives statements and more profound dimensions to each part being coded. Together with a coding schedule, the coding manual provides more relevant findings from the interviews. A coding schedule was developed and created a framework with the following themes: Sustainability, Animal welfare; Supply Chain Coverage; Monitoring, follow up systems and traceability. The coding was used to analyse the content from the interviews and its related data to a specific subject relevant to the study (Bryman, 2016).

3.4 Research quality

Validity and reliability are essential criteria to ensure the quality of quantitative research with instruments and established measures (Bryman and Bell, 2015). Thus, it can be argued that the same criteria do not measure the quality of qualitative research. Bryman (2016) presents Lincoln and Guba's (1985) alternative assessment methods for criteria of validity and reliability, such as trustworthiness and authenticity. This thesis used trustworthiness to evaluate qualitative research through respondent validation after written study results (Bryman, 2016). Trustworthiness is established through research credibility, transferability, dependability, and confirmability (Bryman and Bell, 2015; Thomas, 2015).

Credibility determines how the research follows the principles of good practice and how believable and accurate the findings are (Bryman and Bell, 2015). Each respondent validation engages respondents to confirm the researchers' interpretation of the findings, and triangulation that cross-checks the primary and secondary findings to examine the consistency of the findings is used to strengthen the validity of trustworthiness (Ibid.). The authors ensured validation of the data and sent the comparative analysis to the participants of the interviews. The participants could verify and ensure that the gathered data from each interview corresponds to the participant's intentions of the interviews and questions. That was done to provide the possibility to give feedback and comment on the results.

Moreover, the transferability proves that the findings can be applied and generalisable in another environment or used in the same context in future research (Bryman and Bell, 2015). Henceforth, this study aims to be used to encourage companies and consumers to use more Swedish wool by understanding how certifications and Swedish legislation improve the

sustainability of wool. The study was supported by interviews of actors from companies and experts in the wool industry in Sweden and Norway and certifying organisations.

Henceforth, this study aims to guide companies and consumers to use more Swedish wool in their products and increase the understanding of how certifications and Swedish legislation can improve the sustainability of wool and how we can utilise more Swedish wool with the help of legislation. The study was supported by interviews of actors from companies and experts in the wool industry in Sweden and Norway and certifying organisations.

The dependability can be endorsed with consistency or reliability in qualitative research (Golafshani, 2003). To demonstrate dependability, audit trails can be performed by independent or objective readers that assess all phases of the research process (Bryman, 2016). Confirmability ensures that a researcher's values or theoretical inclinations have not been affected when conducting the research and findings (Ibid.). Therefore, a decision was made to use comments from interviews in the comparison analysis and not mix the researcher's values in the result. This thesis strengthened dependability and confirmability by taking notes about all research steps and activities, and the transcriptions were coded into categories and themes. Coding is a tool that can prove the research purpose to be fulfilled through a structure that aims to answer the research questions (Bryman and Bell, 2015). Coding was checked by both researchers, which increased the study's credibility.

According to Bryman (2016), generalizability is connected to external validity as a concern if the study results can be generalised to other research contexts that it was initially created. This study can also be applied to other European countries as the issue of not using wool as a resource but instead throwing it away exists in the whole region. Also, animal welfare legislation is considered similar around Europe due to the regulations set by the European Union.

3.4.1 Ethical considerations

According to Bryman (2016), it is essential to be aware of ethical principles when conducting research. The primary ethical considerations are to avoid harm to participants, lack of informed consent, invasion of privacy and risk of deception (Ibid.). The following measures were taken to ensure not participating in the mentioned actions.

Before participating in this research, the participants were informed via email about the purpose and background of the study and interview questions. Also, they were informed of how much time the interview would take, as the participants should be provided with enough information to decide whether to participate or not (Bryman, 2016). The interviews were conducted voluntarily, meaning that no financial compensation was made. Moreover, The General Data Protection Regulation (GDPR) consent, provided by Högskolan in Borås, the form was sent before the interview to make sure that there would not be any misunderstandings on what was agreed. To avoid the ethical consideration of invasion of privacy, the participants were informed about the treatment of their personal data and how it will be kept private and anonymous. All participants allowed their names and company to be mentioned in the research; a more generalisable approach was selected to protect their identities. Further, the participants received the study results to verify and comment on the data before publication.

4 Comparative analysis

The following chapter will present a comparative analysis of the findings from the literature review and interviews divided into four themes with subthemes. Each theme will offer the results of the comparative analysis between Swedish legislation and chosen certifications, Nordic Swan Ecolabel, OEKO-TEX® Standard 100, and Responsible Wool Standard (RWS) concerning Swedish wool. Lastly, a chart is presented with the findings from the literature review as a summary of the comparative analysis.

4.1 Sustainability

According to the UN Agenda 21 (1992), the following themes for sustainability were chosen: *‘Countries could develop systems for monitoring and evaluating progress towards achieving sustainable development by adopting indicators that measure changes across economic, social, and environmental dimensions’*. When asked about the sustainability of wool, some of the participants discussed how the definition of sustainability varies and has multiple meanings, especially in the case of wool. As a participant from the Expert Organisation mentioned, *‘We know that science is showing us that we need to tread lighter and that we need to aim for a circular economy [...] And that is one of the things that I think would underpin a proper term of sustainability is that it is something that is coming from a renewable source’*.

4.1.1 Environmental sustainability

People are concerned about how their choices and actions affect climate change, biodiversity loss, and environmental pollution. As awareness has risen, so has the demand for measures to prove the sustainability of the bought products. Eco-labels and certifications demonstrate to the consumers and other stakeholders that the companies or manufacturers follow the international regulations and environmental standards (Eryuruk, 2015). Such as, the Certification 1 representative mentioned: *‘when we are talking about sustainability, people want to understand the outcomes, and particularly there is this climate or carbon cost of, the wool’*. Some labels and certifications use life cycle analysis (LCA) to measure the environmental effects of wool and other fibres across the SC, starting from the production of the raw material until the waste management (Eryuruk, 2015), whereas some labels only concentrate on certifying the quality of raw material, in this case, wool (Eryuruk, 2015; Koszewska, 2015). LCA can also be used as an environmental declaration that tells how the product performs instead of requirements for what certification does. LCA can also compare and improve the production systems to notice where the environmental impact is most significant. As the representative of Certification 3 explains: *‘We look at the whole life cycle of the products, and we look at environmental hotspots where there is a big environmental impact, and we set requirements from that’*.

What was discovered during the interviews was that when measuring the environmental impact of wool, the results display it as a non-sustainable fibre. The representative of Textile Company explains why: *from a strict life cycle analysis point of view, we all know that wool has quite a high carbon footprint because the methane that sheep produce is calculated into the fibre’*. As a result, LCA calculates the impact of wool as much higher than some of the

synthetic fibres, which can be seen in the Higg Material Sustainability Index (MSI), one of the market-leading tools for measuring the environmental impact of fibres. However, MSI has also proved questionable, as Expert 1 explains: *‘So far, it is the only area where one is comparing synthetic and natural fibres against each other. Moreover, that is problematic because they do not use the same boundaries and what they choose to count. When they look at what it is counting, they leave out some major issues that relate to two things that should be counted and looked at, such as microplastics and microfibrils. Also, when it comes to whether material or fibre sources is a renewable resource or not. This is a significant issue here, but that seems to have escaped those who want to make the evaluation’*. Expert 1 continues to describe how the positions of the natural fibres in the tools and systems for measuring the impacts, *‘the problem is that the current systems for and tools for evaluating fibres within the textile industry level, does not fare very well’*. What is essential is that the LCA that MSI uses depends on what they have chosen to add to it. Therefore, LCA done by someone else might calculate wool differently. It depends on what is selected to put into the impact categories and data. Furthermore, Examples of LCA labels within the certifications are ISO and EU-ecolabel. Moreover, ISO has created standards to measure the carbon footprint of products and a wide range of other standards related to environmental challenges such as air, soil quality and water (Eryuruk, 2015).

When considering the environmental impact of wool, carbon footprint should not be the only measurement. For instance, the representative of Certification 1 summarises what else they have included in their criteria: *‘We do not want people to get just blinkered about carbon. Because if you only look at carbon, you can lose out on other fundamental aspects of impact. So, with our climate categories, we do have the carbon cost or the carbon footprint of materials as a key one. However, we also have water quality, soil health and biodiversity. And we say those are underpinned by social justice and animal welfare’*. Biodiversity is all kinds of life that can be found in one area, including animals, plants, bacteria, fungi, and everything that makes our natural world. All life that lives jointly in one area creates ecosystems that support and maintain life. Biodiversity is important because it supports everything needed to survive, such as clean water, shelter, food, and medicine (WWF, 2022). The contribution of sheep to biodiversity was also mentioned by other participants as an essential factor in positive environmental impact. A Textile Company representative also said about biodiversity and how sheep can contribute to that: *‘What makes wool sustainable is that if the sheep are grazing the land as they do in Sweden, keeping it from just growing forest there, they increase the biodiversity on the open fields. Even though they produce methane, they also consume and transform the carbon into something we can use as resources’*. Moreover, by Governmental Authority: *‘Advantages of Swedish wool are linked more to the fact that we have sheep who graze here in Sweden and grazing animals in the rural landscape is a huge advantage to biodiversity. So, they provide many biodiversity services. And if we have the wool from Sweden and we have the sheep grazing here, then that is great for our landscapes’*. It is essential to think about land management and waste management to enhance biodiversity when it comes to wool. The Expert Organisation's representative illustrates: *‘Sheep are carbon sinks themselves as 50% of the wool fibre is made from carbon. The grasslands they live on act like straws to take carbon out of the atmosphere and store it back into the soil. So those attributes are essential, in my opinion, for sustainability as well; when we use fibre for a textile, we must make sure that in the production of that fibre, we are putting it back into the earth, and we are not just taking out of the planet’*.

Many of the chemicals used as pesticides to protect the lands and sheep from insects and parasites are harmful to the environment in a way that destroys biodiversity. That has recently

been discovered and introduced into certification schemes and the legislation of different countries. Nonetheless, education and support are needed for farmers to understand the risks of these chemicals. The representative of Expert Organisation explains their project on the topic: *‘We have done much work with wool farmers, making them aware of the implications of chemicals on biodiversity. And we know we could see how the uptake of chemicals has been coming down, but we did not have a measurement. And that is the kind of project you have to run over seven or eight years to get a good picture of the trend line. And we are very excited to see how those figures come down to almost zero. So, as you educate your farmer, they will take up these measurements’.*

The Nordic Swan Ecolabel certifies textile products that are recycled, organic or from renewable resources that comply with environmental requirements (Nordic Ecolabelling, 2022). The Nordic Swan Ecolabel, as mentioned above, evaluate the whole life cycle of the products, look for environmental hotspots where there is a significant environmental impact and sets requirements from that. Nordic Swan Ecolabel uses LCAs when setting its appropriate requirements and takes impacts not covered by most LCAs, such as animal welfare, biodiversity, microplastics and social aspects. The Nordic Swan Ecolabel tests samples of products in independent laboratories (Eryuruk, 2015). Moreover, it has strict environmental and health requirements for chemicals used in the production and the safety of those who produce the textiles and wear them (Nordic Ecolabelling, 2022). The Nordic Swan Ecolabel bans all the EU list of substances, including halogenated flame retardants, endocrine disruptors, antibacterial additives, and fluorinated substances. Production of textiles has to be done with water and energy-efficient technology to save water and decrease CO₂ emissions (Ibid.). Moreover, Nordic Swan Ecolabel certifies wool if it has either certified organic wool, recycled wool or conventional wool with documentation ensuring that the pesticide content is fulfilled in raw wool (Nordic Ecolabelling, 2022). Chlorine is not permitted to be used for coating wool to prevent felting. As well, other coating used should be biodegradable. What is essential is that Nordic Swan Ecolabel has requirements for the quality of the wool products from an environmental and resource perspective. It is crucial for the product to be durable and have a long lifetime. In addition, Nordic Swan Ecolabel expects that local laws and regulations are followed concerning safety, environmental legislation and working environment (Ibid.).

All the OEKO-TEX® certification systems consider the impact of production processes on people and the environment, such as water consumption, wastewater and waste treatment, and reuse and recycling of textiles (Eryuruk, 2015). Another independent testing and certification system for all stages of production of textiles from raw materials, intermediate to the end-product, is OEKO-TEX® Standard 100, which is viewed as a health standard. Further, more than 1000 tests are done in the laboratory to analyse the product of harmful chemicals and illegal substances and ensure the colourfastness and a skin-friendly pH value (Ibid.). In this case, illicit substances can be carcinogenic colourants, legally monitored substances such as pentachlorophenol, plasticisers, formaldehyde or heavy metals and other harmful substances such as tin-organic compounds, allergenic dyes, or pesticides in wool. Also, parameters for health care are tested. All parts of the textile product, such as zippers, buttons, threads, prints, and linings, must conform to the Standard 100 criteria valid for 12 months (Eryuruk, 2015). OEKO-TEX® Standard 100 does not look into the quality of the product or other properties (OEKO-TEX, 2022b) and doesn't take into consideration environmental discharges in manufacturing and can't prove that the product has been produced with low environmental impact (Russell, 2009) and is more concerned about possible harmful toxins of the finished products (Eryuruk, 2015).

Responsible Wool Standard (RWS) ensures that farms where the wool comes from have a progressive approach to managing their lands (Textile exchange, 2021b). RWS has added in their newest criteria more about land management and biodiversity. That is done for the farmers to understand what impacts the soil's health and how to mitigate damage and improve the soil health in the long run (Ibid.). Most of the criteria are related to grazing management practices to encourage biodiversity. The producers should have a biodiversity management plan that aims to conserve and enhance biodiversity on their farms. Further, fertilisers are allowed within certain limits, but they should not contain heavy metals or other substances that might harm soil microbial life (Textile exchange, 2021b). Moreover, only a minimum number of pesticides should be used on the farm to control the pest burden and minimise the risk to human and animal health or the environment (Ibid.).

While LCA or other tools are not included in the Swedish legislation, the regulations have the opportunity to make an enormous impact on environmental sustainability and reduce the carbon footprint for future generations. However, Sweden has an Environmental code (Miljöbalken) (SFS 1998:808), which is the legislation that describes the environmental responsibility for the producers and companies to follow to protect the environment and to use nature for what it is intended. The environmental code (SFS 1998:808) also mentions that work should be done for a more sustainable society and to continue the sustainable development to protect nature and the environment for the next generations. There is also additional legislation that supports the reduction of greenhouse gases and environmentally friendly practices through different regulations. For instance, the requirements to farm organic livestock in Sweden and the EU are to feed the animals organic forage or make sure that the landscape they are in is organic. To farm organically, the farmer needs to follow the regulation (SJVFS 2021:47). This regulation says that livestock animals shall always have access to eat, forage or available pasture, and 60% of the food shall be forage. Nevertheless, the farmer cannot switch from one type of farming to organic farming as the sheep and land need to take their time to adjust to being organic. That takes about six months until the farming becomes organic for sheep if it is just the sheep which will be organic and not the whole farm (Jordbruksverket, 2021b). However, the regulation for organic farming of livestock (SJVFS 2021:47) included in the animal welfare legislation (SFS 2018:1192) will change on 1 January 2024. The requirement for being an organic farmer will be to produce 70% of the forage for their livestock themselves. The farms are becoming ecologically sustainable and self-sufficient. Today only 60% of the forage needs to come from the farmers' farms for the sheep to be organically sustainable. The other 40% of the feed comes from different areas (Jordbruksverket, 2021b). The organic farming practice legislation is made to support biodiversity, protect nature, and reduce the number of pesticides and fertilisers used on farms.

To summarise, environmental sustainability is one of the biggest concerns for consumers due to climate change. The textile and clothing industry is considered one of the most polluting industries (NRDC, 2022). Therefore, it was essential to analyse and compare what wool certifications and Swedish legislation cover for environmental sustainability. Also, development points were brought up for the Swedish wool industry to be aware of when choosing the right strategy and tool for ensuring the sustainability of their wool.

4.1.2 Social sustainability

The textile industry has been stained with the social sustainability issues of the past and making consumers concerned about the safety, health and working conditions. When considering the social aspect of sustainability, it is essential to remember that every stage of the textile SC can have social and environmental impacts (Koszewska, 2015). Therefore, multiple social labels aim to inform consumers about the social aspects, such as equitable working conditions. Consequently, many of the ecolabels have included social responsibility (Ibid.) criteria by UN International Labour Organisations (ILO) standards that contain basic principles and rights at work (ILO, 2022). For instance, the representative of Certification 1 describes their social sustainability criteria: *'We would say our social criteria are quite basic. It is just the avoidance of the worst things happening, but basic oversight our stakeholders wanted. Something that we could say we have got a minimum requirement for social, which we intend to build on future'*.

With this in mind, Nordic Swan Ecolabel requests that the workers' rights in the production comply with the ILO conventions (Nordic Ecolabelling, 2022). Similarly, OEKO-TEX® Standard 100 includes occupational health and safety in its criteria when examining the impact of production processes on people and the environment. Their criteria on human ecology include issues of the impact textiles and their chemical ingredients might have on the health and well-being of humans (Eryuruk, 2015; Teli, 2016). As well as a socially acceptable work atmosphere (Eryuruk, 2015). In addition, RWS requires that the farmer demonstrates good fair hiring practices when recruiting labour; for example, forced and child labour, discrimination and intimidation are prohibited. Farmers should also have a code of conduct and policies on ensure fair hiring (Textile exchange, 2021b). Also, some of the ILO conventions should be followed on social welfare criteria. The farm and other working environments have to be safe and healthy places for the workers to work (Ibid.).

There is no government-mandated minimum wage in Sweden as the system is based on unions, and employers set the rate for minimum wage through annual collective agreements. However, in the farm industry, only 50% of the salaries are covered by the collective agreements causing fair pay not to be equal for everyone (Axfoundation, 2022). Also, in Sweden, the agriculture and forestry sectors are combined into one industry. In this sector, the risk of accidents and fatal accidents are higher than in other work sectors of the Swedish industry. The dangers connected with agriculture are working with animals, manure pits and machinery. To minimise the risk at work in agricultural workplaces, the Swedish Work Environment Authority has regulations intended to make the workplace safer (Swedish work environment authority, 2017). Except for the general legislation for the work environment legislation (SFS 1977:1166), the working time legislation (SFS 1982:673), including the regulations and updates, the farmers or employers in the agricultural sector need to follow the legislation (AFS 2008:17). It is worth mentioning that farmers cannot apply the working time law for themselves as animals need care around the clock. The biggest issue that the Swedish legislation does not cover is paid sick leave for farmers and entrepreneurs, which causes them financial problems or working while ill and causes other possible health issues. The regulation about working with animals (AFS 2008:17) applies to people working with animals and employers in agriculture. The regulation says that people working with animals shall know the animals and the animals' reactions in different situations. The employer shall also make sure that there are routines and information for the employee to perform their job safely. There is also legislation regarding other parts of the agricultural work environment which regulate the work with chemicals, machinery, pesticides and chemicals for crops and the

environment (Arbetsmiljöverket, 2022). The Swedish Environmental Act (SFS 1998:80) also applies to social sustainability, as companies or industries' operations should not compromise the safety and health of people or the health of the environment. The location of the industry or how nature is treated shall not imply accidents or people's health in danger.

To conclude, social sustainability is crucial to include as part of sustainability for Swedish wool as the reputation of the textile industry has been affected by past scandals. In every stage where human labour is present, also social issues can occur. For this reason, social responsibility was taken into the analysis and comparison so that the industry can comply with the legislation and voluntarily with the requirements of the certifications.

4.1.3 Economic sustainability

According to the University of Mary Washington (2022), 'Economic sustainability refers to practices that support long-term economic growth without negatively impacting the community's social, environmental, and cultural aspects'. Most of the wool is imported from Australia and New Zealand to Sweden, which causes more carbon emissions and takes away jobs from the local market. Certifying Swedish wool could allow value-creation that would create more jobs and thereby economic growth. Up to this date, the EU's regulation (1069/2009/EG) and the Swedish legislation (2006:805) do classify wool as an ABP. Updating existing or creating new laws to support the wool industry and wool production could help to increase the usage of Swedish wool and thus bring more income to the producers.

As the legislation for animal welfare in Sweden is so strict, it takes a lot of energy and effort from the producers to fill out the paperwork to prove that they are following the law. Such as Producer 1 expressed: *'As a sheep farmer, I think we have stringent legislation in Sweden. No other country has such high demands on paperwork as Sweden has for sheep farming. [...]. So, we (the producer and her husband) spend 60 % of our time together in the stables, then we spend 40% of the time in the office. It is not being a farmer. There is an incredible amount of paperwork behind being a farmer in Sweden. Much, much, much more than in other countries.'* Producer 2 is aligned with the comment from Producer 1 *'This is a disadvantage for the sheep farmer as well because it is incredibly bureaucratic and complicated to keep sheep.'* That time of filling out paperwork is away from other practices at the farm that could ensure more income and rest for the farmers.

Consequently, as the farmers are already following the legislation and are making much effort to prove it, one of the most discussed topics during the interviews was what kind of value would certifications bring for the wool but foremost to the farmers. As the representative from the Expert Organisation evaluates: *'There are many issues that the farmer has to deal with when it comes to certification. And you have to make sure that those certifications then add value because he or she has to see the reason why they have to fill in all these forms and keep all these records'*. And continues to explain: *'Is it worth, is it worth the time and effort for your farmer? Is that going to give him a better return on his work? Because will farmers only get one check a year, they are not like us thinking every month check. So, he has to work the whole year for that one check.'* Depending on the certification price, it could bring more value to the wool as some consumers can be more willing to pay a premium for a product that is proven to be sustainable. Such as, Expert 1 describes: *'Something being certified would increase the willingness to pay a higher price, for example, a knitting yarn which very clearly*

says that it comes from this sheep who lived a happy life in the mountains in Norway could command a pretty high because people have money to spend. [...] And people are very willing to pay for expensive raw materials if they know more about them´.

However, the certification schemes require both time and money from the farmer; therefore, it might seem risky to commit to something where the extra income is not guaranteed. When most wool certifications are strictly followed by legislation about animal welfare, the demand for the schemes has been more from consumers and retail sides. Therefore, the question of who will pay the price of certification schemes was reviewed by many participants during the interviews. Such as, Expert 1 expresses: *‘The question is who should carry that cost? Is it the consumer? Is it the farmer? Is it the government? Is it the scheme that sort of is going to pay for itself? All those are things that one needs to answer. It should not be the farmer who has to pay the price because the farmers are doing things as sustainably as he or they can anyway. And one of the problems with those types of schemes is that generally, you’re making the producer pay the price, and it necessarily shouldn’t be the producer who carries the costs because they are not the ones who have created the problem with the large industrial systems that have created the problem´.* Also, the representative of the Governmental Authority explains further: *‘if you have sheep farmers, it does not matter how much they produce. If they are not paid correctly, they will never be interested. And having any good wool to sell. You need to acknowledge the whole chain and the cost of the certification system´.*

Although certification does not guarantee more income for the farmers and ensures the sustainability of Swedish wool, teaching them how to optimise the value of the sheep could. For instance, what is the value of meat when the sheep are slaughtered? How about the value of milk and wool? What are the best sustainable practices that should be shared more publicly? Such as, the representative of the Expert Organisation mentions: *‘I think that the important question is to educate farmers on really unlocking the value of that sheep´.* Also, a classification system for Swedish wool could enable the value and the demand to increase, even for imports. Swedish wool has increased its daily demand, but the farmers should proceed by being educated on the quality and match the demand (Söderholm, 2020). In addition, the representative of Certification 1 tells how the classification system would benefit the value of the wool: *‘Certainly, I think greater awareness of quality sorting at the farm level could be a way to improve some of the value of European wool, which as you know, at the moment as well is very low value. [...] I think there is a place to look at having clear guidance for wool farmers and how to maximise the value of their wool through doing some classing, a grading on-farm´.* Importantly, establishing a combined classification and certification system could not just ensure better quality and value but also the sustainability of Swedish wool.

Along with the quality and low value of Swedish wool, the production is too low to fulfil the increasing demand in the local market. As the representative of the Governmental Authority mentions: *‘I think the demand for Swedish wool is already there actually. It is more a factor of the available Swedish wool to buy. [...] We have tiny herds in Sweden. And the majority of the herds in Sweden are around 20 sheep or something like that. And that means there is very little wool per farm. And the quality of the wool would differ a lot from farm to farm´.* Consequently, what can encourage the farmers to increase their volume of sheep production is that they can apply for a grant from the Swedish government if the farmers have seven or more sheep. This grant is named *‘Extra stöd för djuromsorg´* (Compensation for extra animal care. The grant is given to farmers who want to provide better care for the sheep and improve animal welfare. During the interviews it was mentioned the criteria for applying to get the grant; the farmer has to fulfil a list of criteria such as shearing the sheep twice a year, among

others. Jordbruksverket (2022b) mentioned that farmers could get the grant also for production planning, feed inventory, feed analyses, feed states; cutting reception; and routines when new animals are introduced into the herd.

Furthermore, legislation and regulations from the EU, strategies from the Swedish government and certifications schemes encourage companies and actors to change their practices to be more sustainable and consider sustainability when making decisions. The Swedish government does not have any legislation specifically for economic sustainability. However, they have a strategy for it, including environmental targets where the economy is introduced. As an EU member state, they follow the Paris Agreement and the EU-regulation (EU) 2020/852 about sustainable investments. The EU-regulation (EU) 2020/852 aims to establish an internal European market that will work for sustainable development based on economic growth, environmental protection, and environmental improvement. A company or an actor working and putting in effort and economic activity can significantly contribute to protecting and restoring biodiversity and ecosystems. These actions contribute to the environmental goal and the transition to a circular economy (CE) by reducing production, processing, or manufacturing waste. As well, the company shall contribute to preventing environmental pollution and emissions. The representative of Expert Organisation also noticed the importance of sustainable practices during the interviews: *‘We are looking at green manufacturing. We see many of our spinners and weavers swapping to green energy. I think that is ongoing because it is obvious that we have to do that. We have to cut our addiction to oil also in manufacturing. We have seen much work being done with effluent water being recycled because, again, water is getting more expensive. So those practices are all economic as well as environmentally friendly’.*

To summarise, the economic sustainability of Swedish wool was analysed from the perspective of what could be done to increase and support the value of the wool so it wouldn't be a wasted resource. Increasing the value and demand for Swedish wool would create more jobs and possibly decrease the need for synthetic fibres, reducing the environmental impact. Also, using Swedish wool and valuing it more could positively impact the community's cultural aspects. The industry must know how value can be increased without negatively impacting social and environmental sustainability through certifications and Swedish legislation; therefore, economic sustainability was analysed and compared.

4.2 Animal welfare

The subject of animal welfare is complex and is multifactorial as it is both ethical, economic, social, scientific, and political factors, which makes animal welfare complex in discussions (OiE, 2021a). In 1965, the World Organisation for Animal Health (OiE) developed the principles of the Five Freedoms, which is a part of terrestrial animals. The principles of the Five Freedoms do include the conditions and expectations that the animals should experience when they are under the control of humans (Ibid.). OiE(2021a) defined the five freedoms as: *‘freedom from hunger, malnutrition, and thirst; freedom from fear and distress; freedom from heat, stress, or physical discomfort; freedom from pain, injury, and disease; and freedom to express normal patterns of behaviour’* (OiE, 2021a). From the interviews, it was found that Swedish laws were perceived as a vital part due to the European Union and its regulations. The Swedish legislation looks into all aspects of farming sheep and how to treat sheep. Also, farmers follow Swedish legislation and regulations to take care of the animals in the best

possible way as they are an investment and income for the farmers. As the representative of Expert Organisation describes, ' *He (the farmer) wants the best for his animals because it is his second-biggest investment. Without that, he does not have a business. So, it is important when we talk to retail, that they understand how important these animals are to the farmers and that they understand that the farmer will take the best possible decision for those animals because he simply has to* '. The farmers, for that reason, always want to keep the animals as healthy as possible and follow regulations that have the purpose of making the living conditions better for the animals. When comparing the legislation concerning the certification schemes, it can be noticed that they do not cover all aspects of animal welfare as extensively. However, some certifications include in their criteria that the local legislation should be followed and will follow up on that in their on-site visits.

Regarding the Swedish farming of sheep and goats, the legislation is following the guidelines of OiE as the Swedish Board of Agriculture is a member of OiE (OiE, 2021b). The Swedish animal welfare law (SFS 2018:1192) is known and discussed by many sources to be one of the best in the world (Api, 2020; Nääs and Martinez, 2020). What is important to mention is that most of the EU member states are close behind Sweden in their animal welfare legislation as it is an EU regulation that all the member states must follow. One scarce thing for the animal welfare law in Sweden is the health care for sick or injured animals.

Swedish legislation is stricter than the certifications; this is something regular consumers generally do not know. During interviews, the participants answered, '*Do you think consumers are aware that animal welfare legislation is good in Sweden?*' for this question, 3 out of 9 said yes. For instance, the representative of the Governmental Authority answers the question: '*I think definitely people are aware because it is constantly sort of used in this argument to buy Swedish products and it is discussed in many different forums. So, I think people are aware. That being said, I'm not sure people are aware enough, or people could probably know they could probably be taught a lot more about it*'. Also, Expert 1 answers the same question: '*I do not think most people know what the animal legislation says to what degree it is upheld or not*'. That implies that legislation is good and might be sufficient, but consumers are not aware of it if not educated about it. Therefore, certification might be needed to indicate to the consumers good animal welfare, even though the legislation already covers all aspects of OiE.

4.2.1 Chemicals

What is common, especially in warmer countries, is that the animals are sprayed with pesticides and chemicals to avoid insect bites and parasites. These chemicals can be harmful to the sheep and the wool user at a later stage. In countries where this practise is allowed, companies require certificates that ensure and regulate which chemicals are allowed to be used to ensure animal welfare and the health and safety of the environment and people. Many of the certification schemes perform random or organised testing of the products to ensure no residues of chemicals. Unfortunately, the limits and bans for chemicals from some certifications are made for human safety and health rather than animal welfare.

For instance, Nordic Swan Ecolabel requires the wool to be tested according to IWTO draft test method 59: a method for determining chemical residues on greasy wool or equivalent (Nordic Ecolabelling, 2022). It tries the number of pesticide residues such as fenvalerate, fenchlorphos and dicyclanil (Ibid.). Similarly, OEKO-TEX® Standard 100 tests the level of pesticides in wool and has set limits and bans on the chemicals that might be harmful to

humans (OEKO-TEX, 2022b). However, it is unclear whether these prohibited or limited chemicals are detrimental to animals. RWS includes that the producers should have a strategy to prevent and control external and internal parasite infestations such as lice, flystrike, scab, ticks, and gastrointestinal parasites (Textile exchange, 2021).

Moreover, in Sweden, it is not allowed to spray the sheep with chemicals against parasites or insecticides that are harmful to the sheep and the environment (SFS 2018:1192). In Sweden, the legislation does not allow the treatment of animals with chemicals and medication such as antibiotics as prevention for sicknesses. That, in return, means that Sweden and the Nordic countries have a sparse use of antibiotics and other parasite pesticides, and the animals, sheep, are not exposed to unnecessary toxins. The chemicals used to protect the animals from insects are a part of the sustainable issues, as it is potentially harmful. The chemicals are used to protect the animals from danger, pain and sickness caused by insects they otherwise would be exposed to, which is considered an animal welfare issue. However, the chemicals need to be washed out to not be harmful to humans in a later stage, as Expert 1 mentions: *'it's a chemical that is harmful, not to the animal itself, but it would be potentially harmful if it is not taken out of the wool later on'*.

In the Nordic countries, chemicals are not used to the same degree to prevent insects and parasites, and sheep do not need the same kind of protection as in warmer countries due to the colder climate. The representative from Certification 3 said: *'There is little use of pesticides in the Nordics, almost nothing compared to Australia and the Southern hemisphere'*. Also, the representative of Certification 3 mentioned how the requirements of using fewer chemicals could provide an added value to the wool. Further, Swedish legislation regulates which chemicals are allowed on sheep to protect them from insects and parasites and the chemicals used. Such as, Expert 2 expressed: *'In Sweden, there are laws and regulations that say that sheep may not be treated for preventive purposes, for example, with antibiotics'*. Even though the farmers who participated in the study (Producer 1 and Producer 2) mentioned that they are provident with using chemicals on their sheep, producer 2 said, *'We have very sparse use of antibiotics and other parasite pesticides, which means that animals themselves are not exposed to toxins unnecessarily'*. In contrast, Producer 1 said, *'We do not use strong insecticides in the wool to fly larvae and such things on our animals'*.

Even though this does not indicate that the Nordic countries do not have issues with insects, ticks are a big problem for sheep. Sheep can be sprayed with chemicals for protection against ticks. However, it is important to wash or remove the substances from the wool before making it into a final product as it can be dangerous for humans in the final product. As Expert 1 described: *'That depends on, you know, to what degree one is, for example, using chemicals. In the Nordic region, because it is cold, we do not have to use so many chemicals on the sheep and on the wool to protect them against different insects. We have, of course, a problem with ticks, and the only easy way to avoid the sheep being attacked by ticks when they are out in nature is by using chemicals on them. And one has to ensure that those chemicals are removed before the wool is used. So, one has to be aware of the chemicals being used on the sheep to protect them.'* What is important to mention is that low use of chemicals is seen as good from a sustainable point of view, as it's good for the environment as well as it does not harm the animals or people which is good from a socially sustainable point as Expert 1 expressed it as: *'What one defines under sustainable issues because, for example, the application of the chemicals will be to protect the animal from the dangers of the insects and the pain involved in the sickness that they then would be exposed to'*. Also, the representative of Certification 3 agreed on the same topic: *'Yes, I think so in the Nordic countries, we like to think that the agriculture is very environmentally friendly, and sheep are grazing outside, and*

it is all very good, but also things happen after they will collect it. So, you are going to score it, and then you can use lots of chemicals´.

To conclude, chemicals are a crucial part of animal welfare; they are necessary for preventing pesticides and parasites on sheep. Analysis and comparison of regulations on chemicals were made for the industry to be aware of how they can protect the sheep from the chemicals and humans from the residues left on the wool.

4.2.2 Health care

Concern about animal welfare has risen amongst consumers who buy wool products due to the Australian wool industry's difficulty with mulesing. The matter has caused more certifications to cover animal welfare issues for wool imported to Europe from other countries (Djurensrätt, 2021a). It has also made consumers more interested in purchasing products that include a standard ensuring that the animals have had humane treatment (Peterson, Hustvedt and Chen, 2012). Certifications should be used in countries where the legislation on animal welfare, such as the health care of sheep, is not covered. Namely, certification schemes in Sweden are needed mainly for foreign imported wool considering animal welfare. What is important to mention is that the criteria for certifying wool should be almost as extensive as the Swedish legislation is to ensure animal welfare and sustainability. Such as Expert 1 explains more about the issue: *´You have sustainable labelling schemes, but they mainly stem from the problem around mulesing of sheep because that has been one of the major issues that wool has had to sort of tackle in the public domain because animal rights organisations have very much focused on that side of animal welfare and not so much on issues surrounding sustainability´.*

With this in mind, Nordic Swan Ecolabel does not permit surgical mulesing. Mulesing is done with liquid nitrogen on merino sheep and requires a declaration from the producer proofing this (Nordic Ecolabelling, 2022). Even though mulesing is not allowed and is targeted at merino sheep, Nordic Swan Ecolabel does not cover other animal welfare issues but is somewhat concerned about chemical applications (Klepp et al., 2019). OEKO-TEX® Standard 100 does not include animal welfare in its criteria. Whereas RWS has set various measures for animal management that aim to prevent disease, promote good health, and ensure that sick or injured animals are treated (Textile exchange, 2021). That also includes that husbandry operations should be operated so that the animal does not feel pain or distress. Farmers should monitor signs of a sick animal and offer it care if available. Consequently, ill sheep should be treated and obtain veterinary care if needed, and those who do not recover should be humanely euthanised without delay and performed by professionals. It should be noted that for all procedure that causes pain to the animal, pain relief is required if available. Most importantly, mulesing is prohibited, and so is freeze mulesing (Ibid.).

The animal welfare law protects the animals from sicknesses and unnecessary suffering as well as that the law has clear rules regarding healthcare and surgical procedures (SFS 2018:1192). An injured or sick animal has the right to get healthcare from a veterinarian if the animal requires care according to the law about the medical care for animals (SFS 2009:302). Most of the interviewed experts and representatives of certifications said that one of the best things, which also creates value and sustainability, is that Swedish farmers do not treat animals to prevent sickness or accidents. In addition, Swedish farmers do not feed the animals with antibiotics, which is common in other countries. The Swedish legislation (SFS 2009:302)

does not allow the treatment of animals to prevent diseases. Such as Producer 2 said in the interview: *'We do treat our animals if they are sick, or we do not treat animals preventively. We treat the animals if and when they become ill'*. The representative of Certificate 3 mentioned in the same context: *'I expect that this is quite similar to Norwegian legislation [...] and there are also regulations for treating sheep'*.

Moreover, the Swedish animal welfare legislation and medical care for animals say that giving animals medication to prevent other diseases or performing surgical procedures or injections is not allowed if the animals do not require care. Such practices are also not allowed if it is not approved by a veterinarian or an ethical committee to test animals. According to the animal healthcare law, all surgical procedures on animals must be done when the animal is under anaesthesia (SFS 2009:302). Countries such as Sweden, Norway, and New Zealand have forbidden the surgery without the sheep being unconscious or under anaesthesia. The procedure is a harrowing experience and should only be performed by a veterinarian. That has created considerable controversy in the industry as the same argument can also be applied to the castration of sheep. In Sweden, mulesing surgeries are very rare or non-existent. These are only performed if the animal requires it, and then a veterinarian decides if it shall be performed due to the animal's health. Although, in Australia and other parts of the world, mulesing and other surgical performances are performed on the sheep with pain relief after the surgery to ensure that the pain is limited. As Expert 1 says: *'Less and less sheep are mulesed in Australia as well, as the practice is being phased out as the sheep are being bred with less folds in the area that is prone to flystrike-attacks'*. Multiple interviewees expressed that they have never seen sheep go through mulesing surgery in Sweden or the Nordic countries. This creates value and meaning for the farmer and the buyer of the wool to know that the sheep have had a good life and have not gone through unnecessary suffering surgeries. As Producer 1 expressed: *'The benefits are all these soft values. It is that we (Sweden) do not use mulesing'*. Certification bodies can also count on the information that the sheep have not been suffering through unnecessary surgeries. Expert 1 even said that: *'mulesing does not happen outside of Australia'*.

To summarise, another concern from the consumer is the health care of sheep due to the practice of mulesing. For this reason, the comparison and analysis of the theme of animal health care were included. It is essential that the Swedish wool industry can prove either through certification or legislation that the health of the sheep has been ensured. Also, the industry should consider these aspects when importing wool from abroad.

4.2.3 Living conditions

Animal living conditions are often discussed in the industry, the media, and governmental levels. Animal welfare in Europe has had strong development in the last couple of years due to the scientific research connected to animal well-being. Much new information has been provided on the conditions of the basic needs of animals. Moreover, as the living standards for animal welfare have increased over the years, the demand for a higher quality of life for the animals has followed the society and the change in humans' respect for how we treat and handle animals (Ruokavirasto, 2021). In interviews, it was mentioned by representatives from the field's Expert, Producer and Certification body that the living conditions in the Nordics are excellent and relevant, as well as they are aligned with the OiE and the five freedoms. The Five freedoms are primary animal welfare regulations, representative of Certification 3

described *'You need to take care of the animals. You need them to have fresh water every day. You need to have a fence to keep predators out and control where your sheep are going'*.

It should be noted that Nordic Swan Ecolabel and OEKO-TEX® Standard 100 do not have any criteria on living environments for the animals as they do not cover animal welfare further. RWS, in contrast, has extensive criteria for the living conditions of sheep. The requirements aim to provide the conditions and facilities to support animals' health, comfort, safety, and normal behaviour (Textile exchange, 2021b). For example, sheep should have a minimum area depending on the amount of time indoors and must have access to dry bedding, sufficient to avoid discomfort. Also, access to the natural pasture should be available at all times, depending on the weather conditions. Also, the pastures should have sufficient shade or shelter for protection from adverse weather conditions (Ibid.).

The animal welfare law in Sweden includes a general regulation for the owner of livestock to adjust how the animals are kept according to individual and geographical conditions. Depending on the weather, the animals cannot be outside for four months during the summer, even if the legislation suggests. In some areas in Sweden, it is too cold for the sheep to be outside that period and in other areas, there can be a threat to predators or other risks connected to the local area, such as wild animals that can transmit any disease to the livestock (Jordbruksverket, 2021c). During the cold months, the animals are inside stalls regulated by a part of the animal welfare law (SFS 2018:1192). The regulation specifies the area each sheep needs depending on the size and weight of the sheep mentioned in the regulation (SJVFS 2019:21). The stall also needs to have a bedding of straw or woodchip (Ibid.). According to the legislation, the sheep farmers in Sweden need to look after their sheep at least once per day, but if they are sick, the sheep farmer shall be looking after the sheep more. In interviews, it was mentioned by representatives from the field's Expert, Producer and Certification body that the living conditions in the Nordics are excellent and relevant, as well as they are aligned with the OïE and the five freedoms. The Five freedoms are the primary animal welfare regulations; representative of an Expert Organisation described *'You need to take care of the animals. You need them to have fresh water every day. You need to have a fence to keep predators out and control where your sheep are going'*. The animal welfare legislation (SFS 2018:1192) says that the sheep shall be grazing outside 3-4 months per year. In Sweden, the farmers have fences around the sheep grazing area to control where the sheep are going and to keep predators out. The farmer looks after the sheep flock themselves once per day and the most common size of sheep flocks in Sweden are between 15-30 animals; of course, there are herds which contain around 100- 150 animals too, but that is not as common.

To summarize, living conditions for sheep are important as it affects the sheep's quality of life and also the quality of the wool they produce. The analysis and comparison of wool certifications and Swedish animal welfare law is necessary on the living conditions of sheep to ensure their basic needs.

4.3 Supply chain coverage

All certifications have different requirements for the parts in the SC. They cover, for instance, aspects of raw materials, production steps, production emissions, environmental concerns, animal welfare, social sustainability, and human rights, among others. Different certifications and legislations cover all these aspects to ensure all three elements of sustainability. Additionally, the implementation of certifications in the SC is most often driven by external

actors such as stakeholders and consumers who push parts of the SC to implement voluntary certifications. Due to the pressure from essential stakeholders such as consumers, NGOs, society, government agencies and buying companies working on the demand side of the SC increases, companies implement different certifications. In this case, certifications are chosen depending on the consumer's request and demand, as they can be used as a communication tool for the SC and the consumers (Steering Committee, 2012). Each country's legislation also has aspects and regulations that companies need to follow to operate in the market.

Nordic Swan Ecolabel has two different product and manufacturing licenses, covering different SC parts (Nordic ecolabelling, 2022). A product licence is a license to sell garments and other textile products with the Nordic Swan Ecolabel and requires production licences to be built. A manufacturing licence gives the right to produce for the product licences, but it is not valid to be used as its own for the product to be certified with Nordic Swan, and for that, a product license is needed (Ibid.). What is worth mentioning is that Nordic Swan Ecolabel certifies Norwegian wool tops as part of the classification system for wool in Norway. However, the certification only applies to the wool tops and has not yet been applied further downstream as they are processed by non-certified companies (Klepp et al., 2019). Expert 1 explains the situation: *‘Currently, we do not have a labelling scheme in Norway except the Nordic Swan, which is the ecolabel for any product in the Nordic region. The Norwegian wool is Nordic Swan Ecolabel certified until it is scoured at the scouring mill in the UK. But once it reaches spinning facilities here in Norway, they do not take the Swan label further up because they have not been able to, or they have not taken the time and money to certify the spinning mills here in the Nordic or in Norway.’* Furthermore, OEKO-TEX® Standard 100 applies to certain parts of the SC, such as fibre production, spinning and weaving, finishing and garment manufacturing (Teli, 2016). It can certify raw materials, fibres, filaments, yarns, fabrics, ready-made products, and textile and non-textile accessories. Products can be tested and certified at any part of the SC and production (Koszewska, 2015). Alternatively, RWS can be applied only for all SC sites of wool, from the farm to the processing of wool until the final product's production and the last seller's B2B transaction (Textile exchange, 2021b).

On the other hand, certifications can cover both the raw material and parts of the SC or sometimes covers the whole SC. However, a too extensive list of rules to follow for a producer and supplier makes it hard to manage the SC and enable good working conditions. Also, implementing a certification or a label for the Swedish wool with effective regulations would add to the work on the SC actors. As Expert 2 expressed: *‘I am afraid that there will be too large regulations and that the regulations may prevent and stop and complicate handling.’* Expert 2 further explained: *‘that it can make production difficult, many times if you get into too many rules’*. Too many rules from the certifications side make it hard to follow from the producer and supplier side. Although, certifications might not be needed if the practices in the SC would already be sustainable. As the representative of Textile Company explains further: *‘Certification might be too expensive for what we get out of it. We believe that it might be easier just to change how you work with the value chain. As we talked about, certification is easier, but it is more expensive, but for certain brands, it could be more beneficial to change how they work with the value chain’*.

The Swedish legislation covers many aspects and steps in the SC because no specific legislation covers the whole SC. In Sweden, there is a work environment legislation where the employers are responsible for what happens at the workplace. In the production and operations industries, Sweden has legislation that controls the safety in production and at the workplace. These are regulations the employer must follow and inform all employees. All

industries and companies in Sweden should follow the waste management regulation (SFS 2011:927) and the EU waste framework directive (2008/98/EC). There are many different regulations for chemical products and production; one of them is the reach regulation (EU) 1907/2006, which Sweden follows (Kemikalieinspektionen, 2022). The legislation also regulates chemical emissions and exposure to dangerous chemicals for the industries. In addition, there are also regulations and legislations for treating the environment, emissions, waste and working with sustainable development in the Environmental code (SFS 1998:808).

To conclude, the supply chain coverage is a crucial aspect for analysis and comparison as wool certifications, and Swedish legislation cover different parts of the supply chain. Depending on the demand and the market, the wool industry can consider what parts of the supply chain is important to be included.

4.4 Monitoring, follow up systems, and traceability

Certifications can be seen as a tool for regulatory actors to use to develop the infrastructure, as standards and certifications schemes include practical components for positive outcomes. Moreover, monitoring and follow up systems are essential appliances for certification and legislation as both require monitoring, auditing, or other follow up systems. Audits control certifications, and the person performing the audit is an auditor who works for the certification body or a third party who controls that the certification scheme is followed and has clear policies to ensure the accuracy of claims and labelling (Steering Committee, 2012). Depending on the certification and what the certification means, different kinds of audits can be performed, all from simple checklists to more extensive in-depth controls, including interviews with stakeholders, workers, and management (Ibid.). The monitoring and auditing steps also provide traceability aspects, creating a trust that the company certifying their product has the right to do so, creating credibility. Moreover, certifications support a company's chain of custody (CoC), as certifications allow companies to trace the product inputs and origin (Steering Committee, 2012). That is done to ensure that regulations and legislation are followed accordingly and that the certified products or processes follow the requirements and criteria of the certification bodies. Common for both social and environmental certifications and standards is that they focus on specific methods, services, or production steps a product goes through when being produced (Steering Committee, 2012). Requirements for the evaluation and auditing process are tailored to the specifics of the individual certification (Ibid.).

Nordic Swan Ecolabel ensures that the products' requirements are met by on-site control visits, random sampling, or similar tests (Eryuruk, 2015; Nordic Ecolabelling, 2022). The products should be traceable to the occasion, location, and raw material used. Companies that have acquired Nordic Swan Ecolabel are held accountable for traceability (Nordic Ecolabelling, 2022). The companies are also expected to follow up with their subcontractors annually and submit written documentation following the certification requirements (Ibid.). Further, Nordic Swan Ecolabel is a state-sponsored scheme where the control and certification are done by an independent third party (Klepp et al., 2019). It sets requirements on other standards, such as the CoC certification (Nordic Ecolabelling, 2022). In addition, OEKO-TEX® Standard 100 reviews samples of materials in their laboratory and the required documents. On-site visits are made to the company or production facility by the OEKO-TEX® auditors of the independent institutes (OEKO-TEX, 2022b). Moreover, RWS performs annual audits of individual sites through independent third-party certification bodies (Textile

Exchange, 2021b). According to Textile Exchange's Content Claim Standard, raw wool is tracked through transaction certifications from the farm to the final product (Ibid.).

Animal owners of 15 or more animals are monitored or controlled regularly by the government authorities Länsstyrelsen and Jordbruksverket (Larsson, 2015); they control that the owner follows the animal welfare law (SFS 2018:1192). Between 2004 and 2007, Sweden had an authority that controlled only animal welfare, named Djurskyddsmyndigheten; this was later discontinued due to a lack of resources (Larsson, 2015). The control and monitoring of the legislation follow the EU regulations (EU) 2017/625 for monitoring animal welfare. However, the EU regulations are supplemented by Swedish law, which states that animal welfare monitoring at the farms shall be performed by animal welfare trained personnel from the control authority. In that way, the government authority can ensure that animal welfare is controlled under the legislation. The control authorities, Länsstyrelsen, must always report violations to the Police Authority or other Public Prosecutor's Office when the infringements have led to the suffering of animals or involved a substantial risk of suffering, or if other special reasons for a notification occurs (SFS 2022:117) included in (SFS 2018:1192).

Government authorities should control the Swedish animal welfare legislation; however, it is hard to determine how often the controls need to take place from the legislation. The animal welfare legislation says that all controls must be performed by educated personnel from the field of animal welfare to make sure that farmers are aligned with the legislation. Moreover, both the farmers (Producer 1 and Producer 2) expressed concerns about how all farmers are not monitored regularly. Some of the farmers know that they will not be monitored, so they do not follow the regulations, handle their animals properly or do not fill out paperwork. When government authorities or the media discover them, the farmers suffer bad publicity. The low capacity to monitor the farmers following the legislation exposes negative news about farming and agriculture to the press rather than displaying those who follow the laws.

Concerns for the monitoring system for following the legislation were brought up during the interview with Producer 1 of how unequal the system is: *'The Englishmen always say that they do not know any country where farmers are so less farmers as in Sweden. Just because we are stuck in the office, we get high fines if we cannot present our papers [...] I absolutely think the regulations are sufficient, but I do not want more of them'*. Producer 1 continued, *'Then, as a fellow human being and animal friend, I can see that we have problems in how the regulations are followed up. And that there are farms that come around the system with incredibly poor animal welfare, and that is a concern. But it may not be the regulations themselves, but the follow-up of the regulations that I think needs to be strict, in the right place'*. In the interviews and the literature review, it was mentioned that Länsstyrelsen has taken over the monitoring of the animal welfare legislation and how they do not have time to control all the farmers. However, there are farms which are not controlled often, and in these cases, the issues of bad animal welfare can occur. Producer 1 also said: *'I know that the county administrative board does not have time and cannot work in the right way.'* Also, Expert 1 brought up that in Norway, the government authorities who control the animal welfare do not have the time and capacity to monitor all farmers *'The authority, who is supposed to follow up, just doesn't have the capacity to do so. Then also, in industrialised farming, there are many problems with animal welfare'*.

Both certification and legislation do monitor and control but in different extensive ways. As the representative from Certification 1 described discussions that they had during audits: *'We*

get that sometimes where people say, I do not need to do the full-on certification, because my country's legislation covers this. But what we have always said is if somebody in your country is auditing it, that is absolutely fine. But if it is not being audited, we still need to do the full audit. We need to check because we cannot assume that everybody is following the law. Again, you cannot come back to being able to say to any buyer, anywhere in the world, that this certification meets these requirements. So, in some ways, if you say the legislation is already there in terms of animal welfare, we would say we still need to have an audit checklist. That includes that question and actually things like mulesing. Because we know mulesing does not really happen anywhere except in Australia, but it is such a critical factor that we need the box to be checked, to say, the audit has been on a farm and not mulesing any sheep'. Moreover, the representative from Certification 1 explained the need for solid legislation combined with certification schemes: 'There are some, there are definitely benefits to having that stronger legislation. Because you are starting from a farmer who is already at a higher level. But generally, we would say we still need to have the checklist that at least checks those things off'. Moreover, the representative from Certification 1 described their auditing and said, 'We have had conversations with different certification bodies in different countries. When they set up the audit checklist to go onto the farms, they noted where things are legislation. And then, in terms of how much time they (auditing representatives) need to spend checking things, it might be less if it is like, well, this is already legislation. All I'm doing is checking. This farmer is aware of the legislation and is following it. Whereas, if there is no legislation at all, that is a bigger conversation to say, well, are you doing this? Are you not doing this? Do you know why you need to or not do this? [...] there are definitely benefits to having that stronger legislation'. The representative from Certification 2 is aligned with the representative from Certification 1 as they expressed, 'I am convinced that legislation alone does not help. On the one hand, the industry needs advice and support to be able to implement the requirements at all. On the other hand, it also needs independent verification and proof that the legal requirements are actually being met'. However, as the representatives of Certification 1 mentioned, 'Lots of this it is hard to get people to take up the standards because of the costs of auditing versus the value they get back from the wool at the moment'.

To summarize, monitoring, follow up systems, and traceability is important to both consumers and retailer as they cannot be assured that everything is done according to the regulations and legislation. Therefore, it is crucial that a third party would ensure that everything is followed and complied with. The analysis and comparison of wool certifications and Swedish legislation is important for the industry to know what can be done for control.

4.5 Comparison chart

A chart of the wool certifications and Swedish legislation was created; see *Table 3*. The chart compares both certifications and legislation according to the above themes.

Table 3. Comparison of wool certifications and Swedish legislation

Themes	Certifications	Swedish legislation	Clarification
Sustainability			
Environmental sustainability	Nordic Swan requires production to be water- and energy-efficient. OEKO-TEX® does 100 tests for illegal substances and harmful chemicals for the environment and humans. RWS has criteria for land management, biodiversity, fertilisers, and pesticides.	Ecological farming of livestock (SJVFS 2021:47); animals are fed ecological forage, or the available pasture needs to be ecological.	Nordic Swan certifies wool that is either organic, recycled, or conventional.
Social sustainability	Nordic Swan and RWS follow ILO conventions, and OEKO-TEX® focuses on the impact of chemicals on human safety and health.	Work environment legislation (SFS 1977:1166), Working time legislation (SFS 1982:673), Regulation working with animals (AFS 2008:17)	
Economic sustainability	Certifications for Swedish wool can create added value for the producer and create new jobs.	Sheep farmers can apply for the grant `extra stöd för djuromsorg´ (Compensation for extra animal care). EU-regulation (EU) 2020/852 aims to establish an internal European market that works for sustainable development. Adding legislation on wool being an animal by-product can help increase the usage of Swedish wool.	
Animal welfare			
Chemicals	Nordic Swan and OEKO-TEX® test chemical and pesticide residues; RWS requires farmers to have a strategy to prevent and control external and internal parasite infestations.	Banned chemicals are harmful to sheep and the environment (SFS 2018:1192); pesticides and insecticides are not allowed, and antibiotics for sickness prevention are not allowed.	All chemicals might not be harmful to the animal but can be to humans if not washed away from wool.
Health care	Nordic Swan does not permit mulesing on merino sheep, OEKO-TEX® doesn't have animal welfare in their criteria, and RWS requires that sick sheep get veterinary care if pain relief should be given if available. Mulesing is prohibited.	Injured or sick animals have the right to medical care (SFS 2009:302); Prevention of sickness is not allowed unless done by a veterinarian; surgical procedures must be under anaesthesia, such as mulesing only if needed, and Protecting animals from unnecessary suffering (SFS 2018:1192)	

Living conditions	Nordic Swan and OEKO-TEX® don't have criteria for animal living conditions, RWS sheep must have a concrete floor with bedding with the requirements of the area, and natural pasture should be available with sufficient shelter.	During winter, sheep need to be indoors (SFS 2018:1192), Area required for sheep to stay indoors (SJVFS 2019:21), bedding must be woodchip, farmers must look after the sheep at least once a day, and pastures must have fences.	
Supply Chain			
Supply Chain Coverage	Nordic Swan covers the SC in two parts manufacturing and final product, and OEKO-TEX® applies certain parts of the SC, and products can be certified at any point of it; RWS can be applied only for the SC site of wool.	Waste management regulation (SFS 2011:927), Chemicals products and production (EU) 1907/2006 including chemical emission and exposure to dangerous chemicals for the industries, Environmental code (SFS 1998:808)	
Follow up			
Monitoring, follow up systems and traceability.	Nordic Swan makes on-site control visits, and companies are responsible for traceability OEKO-TEX® reviews samples in the laboratory and on-site visits every three years; RWS performs annual audits through a third-party scheme and traceability is included.	Animal owners are monitored or controlled to follow the animal welfare law (SFS 2018:1192), and possible violations will be reported to the police or public prosecutor (SFS 2022:117)	

5 Discussion

*This chapter reflects the analysis and discusses the challenges that need to be considered when applying a certification scheme and improvements to the industry and legislation for ensuring the sustainability of Swedish wool. For implementing certifications on the Swedish wool market and to utilise the Swedish wool faces other obstacles than the sustainability aspects. Therefore, the research questions **RQ1.1: What affects the implementation of a certification?** and **RQ 2.1: How can the legislation support the utilisation of Swedish wool?** where added to discuss possible obstacles which was brought up during the interviews.*

5.1 Challenges of applying a certification scheme in Sweden

Companies and producers have noticed the increasing demand for certification schemes that have risen from the consumers. They are more aware of demanding proof of sustainability, transparency, and traceability from their products. Certifications can communicate the requirements and follow-ups for the product to be sustainable—the question and confusion of which certification companies should choose to have increased with the demand. The chosen certification should depend on the market and demand during the interviews. As Expert Organisation mentions: ‘*Certification really depends on what your market wants*’. As with Swedish wool, the need for certification depends on where the wool is used and on the market. The global market might require certifications even though the origin might bring

some sustainability connotations to some consumers. As the representative of Certification 1 explains the need for certification for Swedish wool: *'If you're a local buyer, if you've got a local supply chain and you can talk about how good Swedish legislation is, and you can talk about it, this is what I do on my farm. And you've got those direct links. You probably don't need certification. If you're trying to sell to an international market who has no idea what Swedish legislation is. It's still good even if you say Swedish legislation is really strong. Yeah, but it is certified. Do you need a certification? So, it is going to be what your, what your market is.'* Certification might be more critical for the global market as Swedish legislation is unknown outside Sweden. Although it can be applied the other way around for foreign wool, especially Australia and other merino wool producer countries, need a certification to ensure that the wool is produced according to animal welfare regulations as the legislation demands.

With this in mind, consumers can be educated about sustainability and animal welfare through certifications. Also, consumers quickly learn how to recognise certification labels, thus possibly affecting their WTB premium for the product. Therefore, many companies use certifications as part of their marketing to get the interest of a conscious consumer. As the representative of Expert Organisation explains: *'Certification schemes definitely have a place, but you have to make sure that it is something that your buyer is looking for because certification schemes are also used as marketing tools in the industry.'* While using certifications as a marketing tool is not necessarily bad, they should not be used only for marketing purposes. There is always a risk of disclosing information to the media and consumers if the certification requirements are not followed, which might harm the brand image. Such as Governmental Authority points out the risk as well as the possibilities of certifications: *'There's always the potential for greenwashing in any kind of certification area but, if you can show that this product has a certain kind of quality, or if you can associate a certification with quality, you can definitely pay more.'* And continues to explain *'I think that certification can bring more than just awareness of sustainability or animal welfare. I think certification could probably be used in other ways that would be good for the industries such as, definitely as a marketing tool, I think, just to sort of being able to show that something is Swedish.'* Therefore, it is crucial to use certifications to a make stand and commit to following the requirements for sustainability and animal welfare and the quality of the product. In addition, certification should be chosen according to the demand from the market or what the companies or producers want to prove.

It should be noted that more consumers are aware and educated about the possible issues with the wool and textile industry, and more transparency is needed. A sound certification system does not have any conflict of interest. However, it is transparent in the information on the processes, and the certification providing organisation has to be accessible and open for public comment (Fao, 2003). Transparency is vital for certification for the reason that Expert 1 mentions: *'People learn to be sceptical and learn to ask what the origin actually is'* as well as the representative of Textile Company says: *'Educating the consumer makes the consumer more critical and they will become more critical towards your other products. And so, I would say that there is, you want to show the consumer why this garment is so expensive with the certification, but it's also a risk in educating your consumers.'* Transparency can diminish the risk that consumer education could bring as there are fewer issues that might be disclosed and seem covered by the public eye. Similarly, the Swedish wool value chain should have transparency since most processes are abroad. Certifications or companies in their marketing should not misguide the consumer to believe that the product has been entirely produced in Sweden or contains only Swedish wool. Such as, the representative of Textile Company

continues to point out: *‘I do think the biggest challenge is that if you say that something is from Swedish wool, I think that the consumer generally also believes that it is produced in Sweden, but in fact, it's not. I think that it might not be bad to send it to Belgium, to wash it and to Italy, to spin it and to Romania, to sew it but because I mean it is a trade and all that. But I think that if that is not clear to the customer, we are fooling them. It is Swedish wool, but it's not manufactured in Sweden’.* With or without a certification for Swedish wool, transparency about the whole value chain should be shared with the consumer.

On the other hand, certifications are not necessarily needed for companies to prove quality and sustainability in their production and products. By changing and improving the value chain practices, companies can reach the same quality and level of sustainability as with certifications. However, certifications do third party on-site follow-ups, which can be seen from the consumer's side as more reliable. As a representative of Textile Company puts it: *‘I see it from a consumer point of view. I appreciate a certification because how will I otherwise tell that the company is doing the work?’* Moreover, a local certification for Swedish wool was brought up during the interviews, which might be more suitable than the existing global certifications. A local certification would be able to address the needs of Swedish wool and the market and adjust the qualifications accordingly. The same certification could also be used abroad and applied to different markets as the representative of Textile Company continues to address: *‘I think that Swedish wool, yes, needs some type of a label [...] but it doesn't have to be called Swedish wool. It could also be called local wool, and then the label could also be used in Poland or England, local wool for the local customer’.* Even though a Swedish wool certification already exists and is about the launch during the time of writing this thesis, it was also suggested that the food industry certifications could also be applied for wool as Expert 1 expresses: *‘I would prefer one (certification) that was already in place for the food [...] because it's the same animal that's providing both the meat and the wool and the skins and in some cases also milk. It would be ideal that it was something that the agricultural sector handled that could combine so that you did not have to double the work’.* As follow-ups are required for certifications, it would make sense to have one party that does that for both certifications or a joined one.

To conclude, this paragraph discussed the increasing demand for certification schemes for woollen products. The increased demand for certifications and sustainability requirements has created confusion about which certification companies should choose when marketing their products making the implementation of certifications harder for companies. What was found during the research was that the chosen certification should depend on the market and its demand. This relates to *RQ 1.1: What affects the implementation of a certification?* For Swedish wool, the need for certification depends on where the wool is used and on the market location. The need for certification is more important if Swedish wool will be sold on the global market.

5.2 Farmers' education and knowledge

During the interviews, the issues of how to increase the farmers' knowledge about wool and how the sheep farmers' knowledge would increase the utilisation of Swedish wool. Instead of having a certification, the farmers' knowledge of wool is almost as necessary and equal for utilising wool to a greater extent on local markets. Increasing the farmers' knowledge and the value of the wool would improve its quality, and we would probably see an increase in the demand. If there is a local market in which the farmer aims to sell the wool, given that the

animal welfare legislation is strong, farmers do not need to certify the wool if they have the proper knowledge and show it to the buyer.

Educating the farmers in Sweden on handling wool is an essential factor in increasing the utilisation and sustainability of Swedish wool. Nevertheless, there is no education program for the farmers to help them get the latest knowledge and information on farming and sheep care. During the years, there have been programs and initiatives from Governmental agencies and Non-profit organisations about wool and the education of farmers, which have been very successful. These programs affect the wool market a big deal; currently, there are no active governmental programs that provide the farmers with the latest scientific information on how to care for and treat the sheep to get the best possible outcome for the wool as the primary product meat in Sweden. Education which these programs could provide the farmers is an example, how to shear the sheep to get the best quality of wool, how the shearing place should look like and that it is clean to avoid contamination for wool, as well shearing twice per year give not only a better wool quality but also provide a better quality of the meat, among others.

As mentioned, up till this date, Sweden does not have a classification system for classifying and grading wool which is a challenge for the wool industry in Sweden. That makes it hard for the farmers to know what they are selling, and the buyers do not understand what they get when buying the wool, which is problematic. Furthermore, as the participants from the interviews mentioned, the lack of a classification system makes it hard for a buyer to get enough wool of the same quality. When it is a market without a classification system or a certification that can validate some aspects of the wool, it is crucial for the farmer to know their wool and how to classify the wool internally. It is always a challenge to sell wool; classifying and grading it as an individual farmer is complex, and the farmer needs to know.

As one participant described during the interview, the destiny of the wool, if the wool will be sold or put to waste, depends on what knowledge the farmer who sells wool has and how they assess the quality of their wool, length, colour, contamination level. Individual actors who sell wool on the Swedish market need to take a course to evaluate the quality of the wool before selling, which would help the farmer and help wool brokerage sell the wool if the farmer does sell their wool via a broker. To increase the demand for Swedish wool, the farmers would benefit from basic knowledge of wool quality, increasing the buyer's confidence in the farmers selling wool.

5.2.1 Wool contamination

When it comes to how wool can be utilised best, the Swedish animal welfare legislation does not allow the farmers to have stalls without bedding. The bedding material compromises the quality of the wool, as it is almost impossible to remove remnants of the bedding material from the wool. It makes the wool that is sheared during the spring hard to sell and use, as it cannot be spun into yarn due to the contamination from the bedding material. On top of that, the wool is hard to sell as the price of wool with high contamination is low, which means that the farmers lose income. And the resource of the wool got lost. Producer 1 expressed, *'In Sweden, it is not allowed to have a stable without bedding. You must have a bed with straw or shavings, and that makes the wool, which is shorn during the spring when the animals have been inside the whole winter, very contaminated with organic material from the bedding. And it is hard to get around this'*. The quality of the Swedish wool differs a lot depending on when

it is sheared during spring or autumn. The wool sheared in the autumn does not have the same contamination issue as the sheep grazing outside during the whole summer.

Producer 1 continues to describe the issue with contamination in the wool. It is hard for companies to motivate why they should buy Swedish wool, which is of higher price but lower quality due to the contamination from the bedding material. The market should aim to find a product where this wool can be used, as it is a waste of wool and resources if not used properly. In a report made by Sifo in Norway, it was mentioned that wool that cannot be used in garment apparel or is not spinnable could be used for other applications. Then, the wool waste could be decreased, and products made of synthetic material could be replaced with biodegradable instead (Schytte Sigaard, Løvbak and Grimstad Klepp, 2021). Overall, the Swedish sheep are well taken care of, which the majority of the interviews connected to the Swedish wool market agreed on. Producer 1 expressed it as follows, *'The majority of Swedish animals have had a very good life; they have spent a lot of time outside grazing'*. The Swedish farmer can influence the quality of the wool and the contamination, but in the end, it is the legislation that controls it.

To summarize, this part has been raising the ways how to increase the farmers' knowledge about wool and how the sheep farmers' knowledge would increase the utilisation of Swedish wool. The demand and value of Swedish wool would probably increase if the farmers' education and knowledge about the wool quality and contamination would be developed better. As the animal welfare legislation is strong, farmers do not necessarily need to certify the wool if they have the right knowledge and can prove it to the buyer. To increase the demand for Swedish wool, the farmers would benefit from having the basic knowledge of wool quality and it would also increase the buyer's confidence in the farmers selling wool. To align with RQ 2.1 *How can the legislation support the utilisation of Swedish wool?* The Swedish farmer can influence the quality of the wool and the contamination, but in the end, it is the legislation that controls it.

5.3 Animal by-product legislation

In Europe today, wool is classified as an ABP-raw material (Sigaard, Løvbak and Grimstad Klepp, 2021). Bernard, Hustvedt and Carroll (2013, p.268) mentioned ABP as *'At present, organic wool production falls into the broad category designed for livestock production that fails to address the special nature of wool as an animal by-product'*. It is in line with the EU's waste framework definitions of by-products which is *'substance or object resulting from a production process the primary aim of which is not the production of that substance or object is considered not to be waste, but to be a by-product'* (Directive 2008/98/EC). That means the wool is an output resource from the production process when sheep become meat to buy. Moreover, the by-product is not defined as waste; instead, it is defined as a product, resource, or material of a lower value than the main products, in this case, meat. Wool is ending up as waste due to its classification as ABP, as it should not, as wool is defined as waste from a legal point of view. Wool should be utilised to a bigger extent. The legislation should contribute to higher utilisation of wool and help direct to which products the different wool qualities could be used, as different qualities suit different products better (Sigaard, Løvbak and Grimstad Klepp, 2021). Sustainability aspects are also attached; if more wool can be utilised, replace products with plastic and paper, and cultivate all the available wool instead of putting it to waste, Swedish wool could be used instead of importing foreign wool. That was discussed a great deal during the interviews; however, it did not become an issue as it required

a change in the legislation from the EU to be able to do something about the matter. Since wool is still considered an ABP product, it will never rise in reputation regarding legislation. For wool to increase further than to be an ABP product is a significant issue; according to the answers from the interviews, the subject has been discussed for a long time. Something needs to be done as the wool needs to be classified as an agricultural product and not a by-product in the same way eggshells are. As the representative of the Governmental Authority said: *‘But there is a lot to be said about this. How do Swedish governmental agencies discuss wool as a resource because wool is not seen as a resource today. So, when you talk about sheep farming, you are only talking about meat. I think a lot needs to be done in that area to be in its proper place in the legislation. I’m not sure if it should be in the legislation, but it should be seen as a resource anyways’.*

The interviews brought up the importance that the legislation should adopt and learn more about the nature of wool and align the legislation with wool, as it is currently classified as an ABP. Since wool has its qualities as a renewable natural raw material, the legislation should be aligned regularly with animal welfare. The more we learn about wool as raw material and an ABP, the more the legislation should be aligned and routinely updated. As Expert 1 said, *‘European law is much stricter than most animal welfare schemes today, so sheep in the EU are, and Norway is very well protected’.* The legislation system for sheep in Sweden does not have wool in consideration in the law and how to utilise the wool. Moreover, the legislation still classes wool as ABP. As the representative of Certification 2 expressed, *‘I am convinced that the quality of the wool is primarily influenced by the welfare of the animals and the “care” of the sheep, the supply, and the quality of the feed, and less by the origin of the animals’.*

To conclude, wool is classified as an ABP-raw material in the EU, which in turn pushes wool to end up as waste and unused resource. The legislation should contribute and support wool to be used to a higher extent and help to direct which products the different wool qualities could be used, as a first step to increase the utilisation of the Swedish wool on the market. There are a lot of sustainability aspects that are also connected to this matter; if more wool can be utilised, it can replace products made of plastic and paper, and cultivate all the available wool instead of putting it to waste, Swedish wool could be used instead of importing foreign wool. This also addresses *RQ 2.1: How can the legislation support the utilisation of Swedish wool?* As wool is considered an ABP product, it will never rise in reputation regarding legislation until the legislation updates and classifies wool as an agricultural product instead.

6 Conclusion

This chapter presents the study’s overall conclusions and answers to the research question and its contribution to academia, practical implications, and suggestions for future research.

This study aimed to compare wool certifications and Swedish legislation concerning Swedish wool. This study provided insights into the Swedish wool market, different certifications applicable for wool and Swedish legislation considering animal welfare. The study aimed to answer research question 1: *How can certifications benefit the Swedish wool industry and the market?* The results show that certifications for wool are not necessarily needed regarding animal welfare as legislation covers more than the certification requirements in Sweden. While it is recommended to have a certification for wool from foreign countries as they might not have such a strong animal welfare law and mulesing can be allowed. However, it was noticed that the consumers most often are not aware of the strong legislation for animal

welfare in Sweden. During interviews, the participants were asked, *'Do you think consumers are aware that animal welfare legislation is good in Sweden?'* For this question, 3 out of 9 answered yes. What can be concluded is that the consumer should be educated about animal welfare and environmental regulations, and social rights in Sweden for the legislation to be enough to ensure the sustainability of Swedish wool. Therefore, it might be easier to use local or already known certifications to answer Swedish wool's needs and the market.

In addition, the study identified that it is up to what the market wants and its demand whether certifications are needed. Which certification should be applied depends on the requirements and fees that match the needs and capabilities of the value chain, especially the farmers? To conclude, RWS has not been applied for European wool yet. However, they are currently developing an edition of the certification that would be easier to implement for coarse European wool as they have noticed how the demand has risen. Next, OEKO-TEX® Standard 100 can be used for final wool products, but it does not cover animal welfare and concentrates on the chemicals used in the supply chain. Nordic Swan Ecolabel has been applied for wool only in Norway for wool tops and final merino wool products but not the rest of the supply chain, and in Finland for local wool products. The Swedish wool label is still new and will have much potential to develop further if more producers and companies commit to it.

Moreover, the study analysed monitoring and follow up systems, ensuring that farmers follow the requirements of certification and legislation. The monitoring process guarantees the buyer and end-consumer the quality features of the wool, animal and social welfare, traceability, and credibility. That is needed for the companies to ensure their sustainable communication with customers. The thesis showed that a monitoring system for legislation has been lacking when talking to the producers in the study. Depending on the certification, annual on-site follow-ups are required to continue with the scheme. It was also mentioned that food certifications for sheepmeat do similar follow-ups on farms for animal welfare. Therefore, it would be the most beneficial for the farmers that requirements for wool certifications would be followed up at the same time.

Further, the study aimed to also answer research question 2: *How does the Swedish legislation address the sustainability of Swedish wool?* Up to this day, Swedish legislation does not address the sustainability of Swedish wool in the aspect of utilisation, as wool is classified as ABP. However, in parts of the sustainability pillars and animal welfare, the legislation covers and considers all the sustainability aspects. ABP laws in the EU and Sweden should be updated and followed to support the wool industry in Sweden to develop and grow. It could also benefit local wool markets in the EU and not only the Swedish market. A change for wool to be a primary product in the legislation and the education of farmers to help them care for the sheep to get more value for their wool will make the industry thrive. In conclusion, both wool certifications and Swedish legislation support the sustainability of Swedish wool in different ways.

Contribution to academia

This master's thesis has investigated and compared the Swedish legislation and wool certifications that can be applied for Swedish wool and its SC. This thesis intends to contribute and provide as much helpful information as possible for the development and sustainability of the Swedish wool market and industry, from the importance of farmers' knowledge; legislation; certifications that can be implemented in the wool market; and communication to consumers. The information provided in this research will hopefully help the academia and market understand which developments of both certifications and legislation

or regulations are needed to develop the wool industry further and utilise the domestic resources in Sweden when it sustainably comes to wool and ABP products.

Practical implications

The practical implications of this study are that the Swedish wool industry and market can acknowledge the opportunities and barriers connected to the sustainability of wool and consider the right tool to support that. Therefore, this thesis sheds light through the comparative analysis on the inputs and challenges of the Swedish legislation and three wool certifications for companies and farmers to decide what is best for them. The thesis also points out how important it is for the companies to consider the ways and importance of communication for the consumer when using Swedish wool. The analysis also revealed essential aspects for the Swedish industry on how they can grow to utilise more wool and have sustainable growth.

Future research

The demand for wool certifications is not only coming from the farmers' or the industry's side; it mostly comes from the consumers' side. Suggestions for future studies are to research the consumer association and involvement with the certifications and to map out their knowledge about what each certification stands for. Also, study how the certifications affect consumer WTB the product possible at a premium price. The research could display how the most well-known and requested certifications could be implemented on wool, primarily Swedish or Scandinavian wool. It could also be researched what the consumer perception of Swedish wool regarding only the virgin wool coming from Sweden and the rest of the SC being outsourced from the Baltics is; therefore, would the consumer perceive it as 'Swedish wool' anymore. Another research for the future is to investigate the opportunities of applying Swedish wool to various products and applications as there are different qualities of wool, and much wool is wasted in the production due to the fibre being too short.

Notes from the authors

In the interviews and the desktop research on this thesis, it became apparent that there is a need for a classification system of Swedish wool. The authors of this thesis have read about the demand for a classification system for wool to have a well-functioning market; it has also been discussed with the participants during interviews. Therefore, we want to mention that a classification system for wool is in the pipeline in Sweden. Also, there has been work done which aims to start a sheep farmer organisation, which might get the implementation of a classification and certification system or development of a certification body to work.

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