

CONSUMPTION RESEARCH NORWAY (SIFO)

The way forward for WOOLUME

Knowledge transference between a country of high wool utilisation (Norway) and a country of low wool utilisation (Poland)

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Summary:

This note looks at knowledge transference between a country of high wool utilisation (Norway) and a country of low wool utilisation (Poland). The findings that are presented here, are collected through semi-structured interviews, via Zoom, in person and also with one written response. All interviewees were project partners. Economics and scale are important themes, especially for moving forward with better use of local wool. As identified in other projects, things need to happen in the right order and there must be an economic fundament that ensures a professionalism and not that what one does is done on a hobby basis. The skills gap is an important issue if there is to be a future for the wool industry in Europe, and this must be addressed at national and EU level, this is not something a project or industry can fix on their own.

Keywords:

wool, Poland, Norway, sustainability, LCAs, local fibres, value chains, value creation, knowledge transfer

Preface

This note presents the findings from WP2 ('Good enough': Resource maximation) in the project WOOLUME: Polish sheep wool for improved resource utilisation and value creation. The project has received funding from the EEA research program POLNOR, as a collaboration between the Research Council of Norway and the National Centre for Research and Development in Poland.

We wish to thank our collaborating partners in the WOOLUME project, Jan Broda, Monika Rom, Katarzyna Kobiela-Mendrek at the University of Bielsko-Biala in Poland and Ingvild Svorkmo Espelien at Selbu Spinneri.

The note has been reviewed and quality assured by Alexander Schjøll.

Oslo, May 2024

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Summary

As part of the WOOLUME project and deliverables in WP2 ('Good enough': Resource maximisation), this third note looks at knowledge transference between a country of high wool utilisation (Norway) and a country of low wool utilisation (Poland).

The findings that are presented here, are collected through semi-structured interviews, via Zoom, in person and also with one written response. All interviewees were project partners, and they were chosen in order to include the widest possible range of actors in the project. In addition, WP2 held a workshop during the final conference for the project in Poland during the fall of 2023, which involved both the project partners and other participants from outside the project. Because of the wider geographical spread in the workshop than only the two countries in this bilateral project, other aspects related to knowledge transference around utilisation of wool and understanding of cultural, economic and policy drivers in Europe, were identified and recorded.

The main focus of this note is the knowledge transference, which has been a big part of the WOOLUME project, as the partners came from very different backgrounds and two countries with very different histories, also related to the use of wool. The wool from Polish mountain sheep has been characterised, Selbu spinning mill has tested the wool for different purposes, finding the best applications and also transferred knowledge on how to sort and treat the wool. Market research has been conducted, both on acoustic panels and carpets, and on fertilizer pellets and other uses for surplus (vacant) wool that finds little current use.

Economics of scale is an important theme, especially for moving forward with better use of local wool. As identified in other projects, things need to happen in the right order and there must be an economic fundament that ensures a professionalism and not that what one does is done on a hobby basis. One of the partners had experienced firsthand how others in the region thought it was a project funding that drove development, when in fact it was not. The main issue that the wool industry is struggling with, is how wool (along with other natural fibres) does not fare well in sustainability rankings and tools, for example in the Higg Index MSI and EU's Product Environmental Footprint category rules for apparel and footwear.

The skills gap is an important issue if there is to be a future for the wool industry in Europe, and this must be addressed at national and EU level, this is not something a project or industry can fix on their own.

The question we would like to answer is: *In addition to the concrete research results, how has a project like WOOLUME contributed to the development and transfer of knowledge between the two countries?*

It was a clear premise for our sheep farmers, that anything related to breeding, must be for the sheep, and their welfare. All wool can be a good quality, for its specific use and finding that use is at the core of what the project has been looking at. Sorting needs to be done already when the sheep are sheared, the fleece must be 'skirted', and it is vital that this competence is at the local level, before the wool is packed for further use.

On the other hand, finding novel uses for 'surplus' (vacant) wool has not been a problem, and the end-uses for all wool seem almost endless.

Fertilizer pellets, green construction, green roofs, strengthening hills to avoid soil erosion – the new uses for surplus wool, the most coarse, dirtiest and kemp-ridden wool especially – point to a bright future for product-development, alongside better use of "strong" wool in general, in interior solutions such as sound absorbing panels, tufted carpets and heavy yarn-types.

1 Introduction

The WOOLUME project aims to improve the utilisation of wool from Polish mountain sheep, by cooperation between research and businesses in Norway and Poland. Much of the project has been based on the fact that Norway is a country with high wool utilisation, with a functioning value chain for wool and where consumers use wool in clothing and interior textiles. Poland, on the other hand, is a country with low wool utilisation, where local wool is being discarded to a large degree, where the value-chain for local wool has collapsed and where daily clothing and interior textiles to a much lesser degree are made from wool. While the other two reports from the project explored how the wool from local sheep breeds in the Beskid mountains could be used in areas other than clothing, finding better use for wool that is deemed too coarse for use in apparel, this note has a more over-arching view and asks what we have learned from each other and what can be a way forward for better utilisation of surplus wool.

Various activities took place in order to gather and transfer knowledge between the various partners in the project and the public. These included several visits to the two partner countries by work package leaders and others involved, co-writing, sharing experiences in social media, via the newsletter and sharing all the reports and knowledge created within the project.

The knowledge transference has been focused on the business-research-education-triangle.

1.1 Results of research activities

The results of research activities cover an array of different areas. The wool from Polish mountain sheep has been characterised, Selbu spinning mill has tested the wool for different purposes, finding the best applications and also transferred knowledge on how to sort and treat the wool. Market research has been conducted, both on acoustic panels and carpets, and on fertilizer pellets and other uses for surplus (vacant) wool that finds little current use. The biodegradability of wool and the length of time that wool releases nitrogen were important factors in this research.

The project identified the issue of carbon-storage in grazed lands as a potential next step to look into. This theme ties closely with the discussion around wool's ranking in sustainability tools and footprint calculations, which feeds into the timely debate around EU's Textile Strategy. An analysis of how the discourse on maximizing resource use in relation to environmental issues has penetrated in mainstream and social media, was one of the project's milestones. This was explored, among other places, in the book *Local, Slow and Sustainable Fashion: Wool as a Fabric for Change* (Palgrave Macmillan, 2022), in the catalogue for the exhibit *Oltra Terra* at the Norwegian National Museum of Art, Architecture and Design (Verlag der Buchhandlung Walther und Franz König, 2023), and in lectures for the Symposium 'Designing Beyond Human' at the same National Museum in Oslo, for the Natural Fiber Connect Conference in Biella, for the Gotland Baltic Wool Conference, for the IWTO Roundtable in Nürnberg and for the final WOOLUME conference in Istebna, Poland. Besides these research activities and results, find listed in the following sections the publications related to each of the themes.

In the following we will list up the publications from the Woolume.

1.1.1 Characteristics of the Polish mountain sheep wool

- Kobiela-Mendrek, K., Espelien I., Rom, M., Kohut, M., Broda, J., Klepp, I.G. & Tobiasson, T.S. (2021): Coarse sheep wool as a precious raw material for production of rug yarns. In: *Proceedings of the 5th International Conference on Natural Fibers - Materials of the Future: Book of abstracts*. Pp. 365 – 366.
- Rom, M., Przywara, L., Broda, J., Espelien, I., Kobiela-Mendrek, K., Klepp, I.G. & Tobiasson, T.S (2021): Concentration of selected metals in sheep wool; In: *Proceedings of the 5th International Conference on Natural Fibers - Materials of the Future: Book of abstracts*. Pp. 363-364.
- Rom, M., Broda, J., Kobiela-Mendrek, K. & Kohut, M. (2022): Local wool as a challenge for producers and users; In Ferreira, F.B.N., Rocha, A.M., Zille, A., Marques, A.D. & Fangueiro, R. (Eds.) *AUTEX 2021 - 20th World Textile Conference - Unfolding the Future. Book of Abstracts*. Baech: Trans Tech Publications. Pp. 321-322.
- Kobiela-Mendrek, K., Bączek, M., Broda, J., Rom, M., Espelien, I. & Klepp, I.G. (2022): Acoustic performance of sound absorbing materials produced from wool of local mountain sheep. *Materials*, vol. 15, iss. 9, pp. 1-15. [10.3390/ma15093139](https://doi.org/10.3390/ma15093139)
- Broda, J., Kobiela-Mendrek, K., Bączek, M., Rom, M. & Espelien, I. (2023): Sound absorption of tufted carpets produced from coarse wool of mountain sheep. *Journal of Natural Fibers*, vol. 20, no. 2, pp. 1-21. [10.1080/15440478.2023.2246103](https://doi.org/10.1080/15440478.2023.2246103)
- Rom, M., Broda, J.; Kobiela-Mendrek, K., Przywara, L. & Kohut, M. (2023): Sustainability and safety of polish mountain sheep wool. *Textile Institute World Conference*. 3rd-6th July 2023, UK, Huddersfield.
- Kobiela-Mendrek, K., Rom, M., Broda, J. & Kohut, M. (2022): I have the best wool I have. The impact of the WOOLUME Project on the Activities of the Centre of Reginal Produce in Koniakow (Poland). Baltic Wool Conference, 6th October 2022, Sweden, Visby.

1.1.2 Market research of wool products

- Sigaard, A.S., Berg, L.L. & Klepp, I.G. (2021): WOOLUME: Mapping the market for acoustic and sound absorbing products made of wool. Report 18-2021. Oslo: Consumption Research Norway, Oslo Metropolitan University. <https://hdl.handle.net/11250/2839326>
- Berg, L.L., Klepp, I.G., Sigaard, A.S., Broda, J., Rom, M. & Kobiela-Mendrek, K. (2023): Reducing plastic in consumer goods: Opportunities for coarser wool. *Fibers*, vol. 11, iss. 2, article 15. [10.3390/fib11020015](https://doi.org/10.3390/fib11020015)

1.1.3 Biodegradability and use as fertilizer

- Broda, J., Gawłowski, A., Rom, M. & Kobiela-Mendrek, K. (2023): Utilisation of waste wool from mountain sheep as fertiliser in winter wheat cultivation. *Journal of Natural Fibers*, vol. 20, no. 2, pp. 1-14. [10.1080/15440478.2023.2200047](https://doi.org/10.1080/15440478.2023.2200047)
- Rom, M., Broda, J., Kukulski, T., Gawłowski, A. & Kobiela-Mendrek, K. (In press): Biodegradation of sheep wool intended for plant fertilisation. *Journal of Natural Fibers*.

1.1.4 Carpets and sound insulation

Kobiela-Mendrek, K., Bączek, M., Broda, J., Rom, M., Espelien, I. & Klepp I.G. (2022): Acoustic performance of sound absorbing materials produced from wool of local mountain sheep. *Materials*, vol. 15, iss. 9, pp. 1-15. [10.3390/ma15093139](https://doi.org/10.3390/ma15093139)

Broda, J., Kobiela-Mendrek, K., Bączek, M., Rom, M. & Espelien, I. (2023): Sound absorption of tufted carpets produced from coarse wool of mountain sheep. *Journal of Natural Fibers*, vol. 20, no. 2, pp. 1-21. [10.1080/15440478.2023.2246103](https://doi.org/10.1080/15440478.2023.2246103)

Kobiela-Mendrek, K., Rom, M., Espelien, I., Bączek, M., Broda, J. & Kohut, M. (2022): Sound absorbing properties of tufted fabrics made from the wool of Polish mountain sheep. *Aachen -Dresden- Denkdorf International Textile Conference*, November 30th – December 1st 2022, Germany, Aachen

1.2 Knowledge transference activities

The visits to the respective project countries, was the most important knowledge transference activities.

Dates	Participants	Description
September 6 th – 12 th 2021, Norway	Selbu spinning mill (host) Monika Rom, Katarzyna Kobiela-Mendrek, Jan Broda (all UBB) and Maria Kohut (Pastoral Center, Koniakow) In Oslo: Ingun Grimstad Klepp (SIFO) and Tone Skårdal Tobiasson	Course in sorting wool for specific applications, technological tests and sample preparation, and visit to the Mitten Museum A short visit to Oslo, to Værbitt yarn shop.
June 27 th – July 1 st 2022, Poland	UBB (host) Pastoral Center (host) Ingvild Svorkmo Espelien (Selbu). Lisbeth Løvbak Berg (SIFO)	Workshop with staff and students from UBB, dissemination of WP2 results Workshop on teaching children about wool Wool sorting at the Pastoral Center.
October 19 th – 23 rd , 2022 Norway	Selbu spinneri (host) Monika Rom, Katarzyna Kobiela-Mendrek, Jan Broda, Anna Salachna and Damian Chmura (all UBB) and Maria Kohut (Pastoral Center, Koniakow). Ingun Grimstad Klepp and Lisbeth Løvbak Berg (both SIFO) and Tone Skårdal Tobiasson.	Study visit to farm Nerklubben on Frøya island, Norwegian heather landscape. Wool-dyeing lab with Nina Alsborn. Main conference: 'Use to conserve – the utilization of local wool from traditional sheep breeds in Europe'.

October 26 th – 27 th , 2023 Poland	UBB (host) Pastoral Center (host) Ingun Grimstad Klepp and Lisbeth Løvbak Berg (both SIFO). Ingvild Svorkmo Espelien and Marte Espelien (Selbu) Tone Skårdal Tobiasson.	Woolume end conference. Visits to two businesses in Bielsko-Biala vicinity Workshop on knowledge exchange and the way forward for increasing wool usage.
April 12 th , 2024 Norway	SIFO (host) Ingun Grimstad Klepp and Hanne Torjusen (both SIFO). Ingvild Svorkmo Espelien, Marte Espelien and Maja Espelien (all Selbu). Tone Skårdal Tobiasson.	Meeting with Rosa Pomar from Portugal and the Fibershed Nordenfjeldske board (including Nina Alsborn) to discuss Woolume knowledge transfer and possible further cooperation.

1.2.1 Physical visits

The pandemic delayed the plan for physical visits, but finally, during the second half of 2021, the Polish team were able to travel to Norway. Two visits to Poland, and two visits to Norway took place during the project period.

1.2.2 Workshop Selbu spinning mill

Four of the Polish partners travelled to Norway in early September 2021, and Selbu spinning mill held a workshop where they analysed wool fleeces from Maria Kohut's sheep flock in Poland, finding that these varied widely. The fleeces contain fine wool (inner coat), coarse guard hairs (outer coat) and kemp. For some fleeces there were also additionally intermediate fibers. The content of kemp varied between 5 to 20%. For some fleeces the fine wool and guard hairs could be easily, for others the separation is more difficult. The black fleeces were softer than the white fleeces. Before processing the fleeces were sorted, so that plant matter contamination, short and dirty fibers, fibers sheared from legs, head, etc. were removed. Depending on the fiber quality, the fleeces were classified for specific purposes, and these were identified as:

- false twist rug yarn
- rug yarn (ring spinning)
- knitted yarns (ring spinning)
- handspun yarns
- felting



Figure 1-1: The workshop at Selbu spinning mill, processing the wool.
Photo: Jan Broda.

Depending how compact the yarn is, it would be suitable for either tufting or might be more suitable for weaving. To produce ring spun yarns, the wool from fleeces with less content of guard fibers is most suitable. After manual cleaning, washing and drying, the wool is cleaned by a fiber separator. In the process, some of the kemp is removed. Then, the wool is carded and formed into rowings. In the next process - drawing through the wool comb – a sliver is formed. The yarn is formed with a ring spinning technique. To produce knitted yarns and hand-spinning rowings, the wool was selected from fleeces with the lowest or low content of kemp. For the production of felted material, wool bats from the carder were used. The felting machine works for approximately 30 minutes. During the process the bottom plate makes small horizontal reversing movements. For a more compact structure the felting can be repeated. The wool from the Polish sheep is very suitable for felting.



Figure 2-2: The workshop in Selbu spinning mill, using the Polish wool for felting.
Photo: Jan Broda.

The Polish team also travelled to Oslo, where they visited Værbitt yarn shop to see a collection of several other spinning mills' yarns with Norwegian wool and dyed by the owner of the yarn shop.

1.2.3 Workshop UBB/Koniakow

During the trip, which took place at the very end of June in 2022, the Norwegian team held three workshops/seminars. The seminar ‘How can wool replace plastic?’, was held at the University of Bielsko-Biala, discussing the advantages and obstacles to this, based on SIFO’s research reports on wool products. The example of Selbu spinning mill was used to show how the local wool comes into play in this context and underline the advantages of wool vs. plastic in relation to preserving heritage, creating a circular bioeconomy and degrowth. 22 people participated in this seminar.



Figure 1-3: The two teams in Koniakow and studying the wool.
Photo: Jan Broda.

At the University of Bielsko-Biala, teachers and pedagogy students were also invited to a workshop about teaching wool to children, emphasizing the creative potential as well as cultural aspects of wool. Through a short lecture, they were introduced to how different actors in Norway who work with wool and children, and then they practiced wet felting, carding and hand spinning.

The third workshop held during the trip was a wool sorting workshop at Maria Kohut’s venue in Koniakow. It gathered 20 people, both sheep farmers, other locals and academics. The sorting showed great variety in the quality of the wool, from finer longer fibres to coarser fibres. The participants could also see that through sorting, the variety of products that can be made from the wool greatly increases, including softer yarns for garments like socks and sweaters.

1.2.4 Selbu Conference in Klæbu and Frøya Island

The international seminar on ‘Use to conserve – the utilization of local wool from traditional sheep breeds in Europe’ was organized by Ingvild Svorkmo Espelien (Selbu spinning mill) and held in different locations in Trøndelag (Norway) on October 19th – 23rd 2022. The seminar started on Wednesday (October 19th) with a study trip to the farm Nerklubben on Frøya island. The owners of the farm, Ola and Brit Vie, showed the participants the coastal heathland dominated by *Calluna vulgaris* and talked about the specifics of sheep grazing in this type of vegetation. The sheep’s main food is young, annual shoots of heather. Brit presented products made from yarn spun at Selbu Spinneri. The wool from these sheep shares qualities with the Polish sheep wool. In the afternoon the participants visited the fisherman’s cottage at Titran, Kjervågsundet. There, during a short walk, the participants could see an Atlantic-type peatland with specific vegetation, dominated by bryophytes, heather, cranberry and juniper.



Figure 1-4: Vie's sheep flock and the flock of participants on Frøya Island.
Photo: Jan Broda.

On the second day of our seminar (Thursday, October 20th) there was a workshop on yarn dyeing conducted by Nina Alsborn (Fibershed Nordenfjeldske). Each participant dyed a sample of wool yarn by themselves, using different dyes, keeping the appropriate temperature and pH during the dyeing process. During the meeting, the Woolume consortium discussed the further work in the WP2 and how to enhance the knowledge transfer, an issue that has been made difficult by the pandemic. There is, however, an agreement that there has been knowledge transfer from a 'high local wool use' country to a 'low local wool use' country and that evidence and experience from this would be collected in a SIFO report through interviews with the formal project partners and the workshop participants so that this can be built on in new projects.

The main conference day: The main theme of the international conference was the use of local wool in several different countries and for different purposes, all depending on the quality of the wool. All wool can be a good quality – for a specific use. In the opening lecture Professor Ingun Grimstad Klepp and journalist Tone Skårdal Tobiasson talked about the book *Local, Slow and Sustainable Fashion: Wool as a Fabric for Change* (Palgrave Macmillan), and how the theme of the book ties into the current debate around Lifecycle Analysis and the controversy where natural fibers are deemed less environmentally and climate friendly than synthetics.



Figure 2-5: The dyeing workshop at Selbu spinning mill.
Photo: Tone Skårdal Tobiasson.

This was followed by a presentation of Fibershed Nordenfjeldske by Nina Alsborn and Árolilja Svedal Jørgensrud. Fibershed is also important in the new discourse around a more community-based and localized industry; where the local biological premises (as described in Anna Salacha's report) play an important part. The Estonian-Norwegian, the Polish-Norwegian, and finally the Portuguese-Norwegian projects were all presented. Ave Matsin mainly informed about the technical results from spinning, felting, textile and fiber in relation to Estonian wool, while Eli Wendelbo and her team of students presented the waulking/fulling results. WOOLUME gave a very detailed presentation, as did hiWOOL from Portugal (online). These last two projects are

funded by the EEA bilateral funding. All the projects were part of a physical exhibit in the meeting hall. As the conference wrapped up, Ingvild presented Selbu spinning mill's role in projects. There were almost as many online participants as in person, with Germany and Denmark represented. The following institutions were also present: Norwegian University of Science and Technology, and the University of South-Eastern Norway.

The last day (Saturday, October 22nd) was also practical. The workshops were organized in parallel sections: wool sorting (led by Ingvild), spinning (led by Marte), felting, waulking and weaving.

1.2.5 Woolume end conference Istebna/Koniakow

It was the Beskid mountains that was the setting for the end seminar, and through the network of Norway-grant projects (including the Portuguese hiWool project and the Polish craft school from Zamek Cieszyn), the plus-factor of meeting across disciplines and projects was exponential. As an end-exercise for the seminar, the Norwegian partners arranged a workshop on knowledge-transfer and ways forward, which garnered enthusiasm and ideas for further projects and cooperation, also with countries that so far have not – in a wool context – been blessed with Norway grant funding or other support for change. Slovakia being one and long overdue.

The program for the conference filled two days. Here is an overview of the lectures:

Wool in the modern world

- Wool policies and the understanding of sustainability – Ingun Grimstad Klepp and Tone Skårdal Tobiasson
- Wool of Polish mountain sheep – Monika Rom
- Reducing plastic: Is the system rigged against wool? – Lisbeth Løvbak Berg
- Wool with potential for textile processing – Katarzyna Kobiela-Mendrek
- Wool applications in agriculture as fertiliser – Andrzej Gawłowski
- Sheep grazing and biodiversity – Damian Chmura/Anna Salachna

Environmental and cultural aspects of sheep raising

- Native sheep breeds - effects of implementing programs of genetic resources protection – Aldona Kawęcka
- Cultural meaning in the pastoral community of the Silesian Beskids – Katarzyna Marcol
- Sustainable pastoral economy in traditional sheep grazing – Piotr Kohut

Policy, objectives and activities – Simon Gill, European Wool Association

Wool application – case studies

- Selbu Spinneri - small-scale local processing of coarse wool – Ingvild and Maja Espelien
- Estonian-Norwegian Wool Project - properties of fabrics made from the wool of six different sheep breeds – Diana Tuulik
- Estonian and Norwegian local sheep wool project and testing results – Astri Kaljus
- Situation of local wool in Slovakia, our enterprises and challenges to change it – Alena Niňajová and Ľubica Noemi Kováčiková
- Portuguese Wool and Breeds – Gianni Montagna and Carla Peirera
- Possibilities of using sheep wool in green construction – Joanna Grzybowska-Pietras
- Craft School Cieszyn - case study – Lubomira Trojan

- Contemporary woolen kilims from Tartaruga Studio – Wiktoria Podolec

Workshop way forward (questions listed in Annex II)

There were more 'hands-on' workshops as well, related to the local lace-tradition that met us in every window in the small town, and even painted in large scale on house-walls. Maria Kohut's take was to transfer this traditionally very delicate technique to wool and thus other applications.

When it came to applications, though, the whole work around fertilizing the soil with wool, using wool that has no use in other areas as mats and pellets for gardens, pots, city roofs or deserted open sores in the landscape from mining – the list seemed endless and so promising that any urban planner or someone trying to restore landscapes should be inspired. A visit to a local upstart company reinforced the impression: This area for development will be a major force in the future use of problematic wool that is currently burned, including shavings from skin and leather tanning.

Using wool for its best purposes rather than manipulating the market, the breeds or other things that compromise the well-being of the sheep was a recurring theme, and a major learning point from both earlier Norwegian wool projects and WOOLUME. The detailed testing from the Estonian-Norwegian bilateral project underpinned this (also under Norway grants), and there is now a comprehensive database to back this on all in all six sheep breeds. Much of the research in WOLLUME has also centred around the 'best use', so these two projects have major cross-pollination.

Revisiting the whole backdrop for the WOOLUME project, but also the local very dense and complicated history which in the past had delivered a rich cultural and economically viable industry that had made marks internationally, brings forward a lot of things to discuss in the light of EU's textile strategy. The tapestry of history, economy and cultural elements that have shaped this for better or worse, is further described in *Local, Slow and Sustainable Fashion: Wool as a Fabric for Change*.

With pride, Jan Broda who has led the project successfully for three years, told the conference that WOOLUME has been awarded a major Laureate prize, more specifically the Polish Smart Development Award in the category 'Project of the Future', from the Polish Intelligent Development Forum Foundation, Center for Intelligent Development. This is the reason cited for the prize:

'For the achievements of the project, which may result in a positive impact on social and economic development. The award is granted for an open approach to promotion and communication with society, in order to present the importance of the benefits resulting from the implemented solution, and an attitude focused on actively maintaining a positive and interesting image of Polish science and research and development works.'



Figure 1-6: The whole WOOLUME team in Koniakow. From left, back: Ingun Grimstad Klepp, Lisbeth Løvbak Berg, Katarzyna Kobiela-Mendrek, Monika Rom, Damian Chmura, Andrzej Gawłowski, Anna Salachna, Jan Broda, Ingvild and Maja Espelien. From left, front: Tone Skårdal Tobiasson and Maria Kohut. Photo: Marcin Baczek.

1.2.6 Meeting in Oslo with the Norwegian partners

This meeting was made possible as there was some travel funding left in the project, and the need to discuss some of the 'loose threads' in the project was identified. As the Crown Princess of Norway had invited the Norwegian partners to a Symposium on weaving, the opportunity was 'given' for a date to meet at SIFO and tie the loose ends.

The program for the meeting:

- Experiences from WOOLUME: Transferring competence and knowledge. Presentation by Ingun Grimstad Klepp and Tone Tobiasson
- Amazing Grazing update by Hanne Torjusen
- Rosa Pomar about her work in Portugal
- FELTWOOL: Transferring competence from WOOLUME to FELTWOOL (2024-2025)
- Ongoing projects and other plans for 2024, including better mapping of the value chain and resources in Norway
- Discussion

As there was a dinner scheduled after the meeting, the discussion continued during the dinner, mainly about the low score wool receives in different sustainability measurement tools and policy instruments. This is hindering wool being used, for example, by major architecture firms, who ask for LCAs to ensure that the materials used have a good rating in environmental comparisons.

2 Methods

The main goal of this note is not to summarize all that has happened in the project, but instead summarize what this has led to of knowledge transfer. In order to document this, we have conducted interviews with some key stakeholders and also included some insights from the end conference.

2.1 Semi-structured interviews

The interviews were done over Zoom, in one case the interview was done via email and in one case in person. The interviews were recorded and then were transcribed in the language they were conducted, and those done in Norwegian were translated to English. The interview via email was translated from Norwegian to Polish, answered in Polish and then translated back to English.

The questions are listed in Annex I.

Table 2-1: List of interviewees.

Name	Title	Role in project	Interview format	Date
Ingun Grimstad Klepp	Professor	WP leader WP2	In person	August 21 st 2023
Ingvild Espelien	Spinning mill founder	Partner for spinning experimentation and skirting course	Teams	August 23 rd 2023
Monika Rom	Researcher	WP leader WP1	Teams	September 8 th
Maria Kohut	Sheep farmer and business owner	Partner	Teams	September 27 th 2023
Andrzej Gawłowski	Professor	WP leader WP4	Email	N/A

The workshop was held at the end of the conference days in Istebna, where the participants were divided into three groups and discussed a list of questions supplied by Lisbeth Løvbak Berg (listed in Annex II). Each group assigned a note taker, and the notes were then shared with the workshop organisers. Before analysing the answers, everything was read through to better understand exactly what themes were brought forward. Main themes that emerged were the differences in historic backdrop, cultural aspects, economics, scale and education.

3 Results

We have organized the results of the interviews according to themes, in order to make it easier to understand what the main areas of knowledge transfer and learning has been. The themes that follow in this section were identified when reading through the transcripts of the interviews and did not necessarily relate directly to the questions posed. Some answers could relate to more than one theme, therefore some of the themes also overlap slightly. However, this was not a major issue in writing the note. Not all interviewed touched on all the themes, as is a result of the method being semi-structured interviews and the conversation follows the flow of the themes that arise. We start with the main differences, related to the historic backdrop of the two countries.

3.1 Main differences

The history surrounding the use of wool and how this has affected the value chain is a recurring theme in the interviews. From the Norwegian perspective, the lack of a functioning value-chain in Poland and how wool had become a waste product with absolutely no value matched what we know about other European countries, but not Norway's situation, which is markedly different. From the Polish perspective, the small-scale aspect of the wool industry, that it did not have to be a large-scale operation in order to be viable, was an important learning-point. For everyone, the many applications for wool that is not necessarily suited for apparel or next to skin, were eye-opening. This opens up for further research opportunities. We knew from the outset that the two country-teams had different perspectives in approaching the project, the Polish team being overall much more technical than the Norwegian team, who gained a lot of learning from this.

Sheep farming and wool use has long history in both countries, but there are differences. In Poland pastoral management was introduced in the thirteenth century. This system of herding is called transhumant pastoralism and is still in practise. The main product from sheep in Poland today is cheese. Polish history in the twentieth century is dramatic, with a lot of changes. The collapse of the Soviet Union give independence, but also a collapse in the wool industry and the wool market. The sheep population decreased from 5 million in 1986 to less than 1 million in 1994 (Haugrønning et al. 2022). With political changes also the understanding of DIY, knitting, repairing and other DIY praxis was affected in the post-soviet countries (Gurova 2015; Kucher 2022). Consumption of ready-made 'western' clothing became mainstream.

In Norway, a substantial part of the industry also closed down in second part of the twentieth century, but for other reasons and the process took a longer time. Parts of the industry survived despite Norway became a rich country. Reasons for this was partly the strong positions of the bunad (national traditional costumes) and knitting, as a part of a 'norwegianess' (a notion dating back to Norway's independence from Denmark, Sweden and lastly Nazi Germany). Both in knitting and in the bunad, wool being the most important material. Norwegian pastoral practices (setring) have similarities with the transhumance system in the sense that grazing areas in mountains and woods are utilized, but because the sheep are not milked, they are not followed as closely. Today meat is the main product (Klepp et al. 2019).

There was a clear consensus that the project-partners were a good match because of the differences, and since everyone was very eager to cooperate, the project ran smoothly, in spite of the difficulties created by Covid, which limited the possibility of travelling.

3.1.1 Cultural factors

From the Polish perspective, there is an enormous pride, at least in the Beskid Mountain region, in their use of shepherds and their practice of transhumance, as described by Rom: *'They combine tradition with religion. [This is] typical for the mountains, not the rest of Poland. In the mountain area, where tourism is strong, they come, they see, they try, they buy.'*

The descriptions of the religious and cultural celebrations around this practice were very interesting for the Norwegian team, and how these were used in tourism. However, that the local wool was not used in the traditional clothing that was used as part of the celebrations, was surprising. The distinct white woollen cloth was made with imported wool and had been for a long time.

That more could have been explored around the relationship between the two country's cultural history and today's use of wool, is clear – and was brought up in the interview by Klepp. As she has earlier looked at this in relation to Norway and Sweden's very different cultural history specifically related to wool, and even more specifically to the modern use of wool. The market for wool and wool products are tied to traditions both in production and use. It is not only the traditions that differ, but also the knowledge, use and attitudes towards them. Whether it is regarded as something of value and whether it is regarded as something that is okay to 'sell' to visitors, will be important. Both too much and too little value might be in the way for utilising it for product development.

'There is no lack of cultural history in Poland, while in Norway the use of knitted sweaters and folk costumes are more 'modern', yet old-fashioned. There is more undone than done to understand this.'

Klepp goes on to say that much more could be studied around tradition on how we use clothing today. That there is no mention in the EU Textile strategy about the rich heritage and traditions tied to textiles, which is an obvious omission; the lack of any discussion around tradition and our past as a resource to be tapped into. That this is not discussed as part of a sustainability strategy.

'In Norway this is more visible, because they have a presence, not just as "festival clothing", but actually as clothing being used in daily life.'

Gawłowski repeated the same, but from the Polish perspective: *'People are much more interested in wool products, e.g. clothes, in Norway than in Poland, which is due to cultural conditions and the level of ecological awareness.'*

Another cultural factor is related to history, and recent history, the fall of the Berlin Wall. This, we will hear, is related to how industry and scale is viewed in Poland, but also to 'the culture of crafts'. As it is fairly recent that the economy in Poland has improved, knitting in public is frowned on, according to Kohut. The situation for small scale home production, DIY and so on is different in the post-Soviet situation, as discussed by Gurova (2015) and Kucher (2022), mentioned earlier, but also an important theme in the interviews.

'She's a professor and she is knitting in public!' (Kohut on Klepp's knitting while listening to the end conference in Poland.)

She also described how it was so nice to see people handknitting in public in Norway. That the level of embarrassment on this in Poland is very high for doing any sort of craft in public. *'[We need to] give them an understanding this is something precious. (...) but they are ashamed.'* She adds that especially older people don't want to teach their crafts to younger people, while in Norway there is a pride in knowing crafts. She does, however, see a change of the attitudes of the younger generation, which she finds positive.

In one of the groups during the workshop during the end seminar in Poland, this was said: *'Now this may be changing for a new generation rediscovering craft, DIY, natural fibres, etc.'*

Kohut talked about this in her interview, as mentioned, how the young generation were easier to convince to try out her wool, while the older generation had little interest, neither to take up their knitting needles again nor to explore the local wool.

Rom mentioned that she thought the 'Norwegian way of thinking' had positively surprised the Polish team on their first visit to Norway (as part of the pre-project before Woolume started): *'The mindset is crucial, in Norway you understand that there is a value in wool, that it is helpful in many situations, in education for example. In Poland we used to have the mindset that wool is history, wool is the past. The industry had collapsed, and people had lost their jobs. It was a very negative context for wool.'*

Another 'mindset' was brought up by Kohut. Being open and willing to share: *'You are so open and honest with all the problems. To show us even the machines. In Poland, [they] wouldn't show us the machines, the chemistry, how they do it.'*

Espelien underlined that establishing Fibershed, an NGO type organization which originated as a grass-root movement in California, USA, in Norway has enabled better cooperation between the different actors in Norway. *'I've said for years that we need to stick our heads up and look around. Do we need more spinning mills? Should we instead look at another part of the value chain? The same thing will (eventually) happen in Poland. (...) What is missing? Then we can develop the businesses together and get good end-products. This will be more stable, give a more lasting effect, better salaries and create value.'*

Rom also described how people are 'so happy to see the sheep in the mountains', but that there was a need for the tourists to add two and two in order to 'get four', to connect the sheep they see in the mountains with the actual wool that they could access.

Returning to transhumance as a cultural practice, which is in essence shepherding, but over longer distances than what was usual in a Norwegian shepherding tradition, where this practice is over shorter distances (Klepp & Tobiasson 2023; Reinton 1979). For the Norwegian team, seeing other practices in relation to what the team thought was a uniform Norwegian practice, was a good learning-point, as we will shortly return to.

The practice of transhumance has partially, for Poland, survived much because of Ukraine seasonal workers (as for Maria Kohut's other farm work). She described how both Covid and the war with Russia had impacted this. In one of the first papers of the project, see Salachna et al. (2022a, 2022b). The papers describe the practice, and it was a wish from the Norwegian team to experience the 'send-off' or the return ceremonial festivities, but this was not possible because of different obstacles, such as the academic year-wheel.

We have perhaps not equally communicated the care-practices of sheep in Norway to our Polish partners, mainly because the practices did not have the same cultural position with lack of a similar colourful tourist-friendly backdrop. Also, the Norwegian team lacked a thorough understanding of the actual practices in all parts of Norway. Espelien mentioned in her interview that shepherding does take place in some parts of the South-West in Norway, and Klepp discussed in her interview whether looking after the sheep weekly during the summer when they are 'free grazing' otherwise unsupervised in the mountains, forests or in the heathlands (which is mandated by Norwegian law) also constitutes a type of herding. Traditions for setring/transhumance have a very long history and are tied to different landscapes and places in both countries. How this is practiced today and even more how it is – or is not part of the

development and marketing of wool product are questions we touch upon again and again, but still it is mainly unexplored.

Espelien mentioned twice in her interview that Norway has something to learn from how the Polish galvanise the cultural aspect of for example bringing the sheep down from grazing in the fall, which then could be more effectively tied to the products we receive from our sheep. She saw the heathland traditions as something equally powerful to use in communicating cultural aspects of grazing-practices, and as an undervalued story in this aspect. She also mentioned the mountain-grazing, but admitted this she knew less about. All in all, Espelien called for exploring and emphasizing cultural history better and more related to grazing practices.

Thus, the world is not as black and white as thought earlier, namely that in Norway, we 'let the sheep loose in the spring and do not look after them', while in Poland they are herded in a transhumance system and always protected.

The last claim, when we have learned about wolves attacking sheep also when shepherded, as they have been able to enter the night-enclosures and kill many individuals with no resistance, shows that many myths have been proliferated that do not necessarily withstand scrutiny.

'There are endless things that do not go as planned. Some animals quarrel, some become friends, some seek solitude. (...) It is so much more complicated, messy, difficult [than industrial animal agriculture]. It is much easier to say no to meat and choose plastics.' (Klepp)

That said, the sheep in the Beskid mountains have to be shepherded, as they are milked, and the cheese made from the milk is one of the most important products. In Norway meat is the most important product, and that entails slaughter in the fall, so daily handling of the animals is redundant.

Rom said in her interview that the Norwegians could probably learn to use more products from sheep than Norwegians do today, for example cheese. This would of course mean a big change in how the sheep are kept during the summer, and would affect the wool quality of the ewes, which was also a point brought up by Kohut, that there are trade-offs.

However, one last point was interesting, that Rom brought up: *'When something happens elsewhere, we just follow. We are not avant-guard. If it happens in Norway or Germany, we will follow.'* This may very well be a cultural by-product of the post-Soviet area.

3.1.2 Education and safeguarding knowledge

In this section, it is mainly Rom and Kohut, but also Espelien who have the key insights. Kohut talked about one of the most important things she had learned during the workshop at Selbu spinning mill on the first visit to Norway: *'I also learned a lot about the selection of wool. Collect the dirty wool for fertilizers, [now] also selecting for carpets, for knitting'*.

She goes on to describe how she was weary of adding more work for her Ukrainian employees when it came to the farm work, which included milking the sheep, making the cheese and shearing the wool. However, after the workshop on sorting the wool for different purposes and end-uses, she had brought this knowledge back to her workers. She started doing it herself, while the sheep were being sheared, based on end-uses, but then 'the magic happened':

'(...) after half an hour everyone started sorting the wool better than I do. Most are Ukrainian, they still do it at home, and normally. They told me I did it wrong. 20 years ago, we stopped the selection. It was all seen as waste. Now, when I gave it a chance, they knew it and it wasn't additional work. Amazing to me. It occurred like this and did it even better than me.'

Espelien stressed how much doing the initial sorting during the shearing means for realising the wool's potential, and made all subsequent processes much easier, including capturing the economic value. She has, also in other projects, seen that this simple implementation is very important in knowledge transfer. *'It doesn't need to be as advanced as in Norway, but someone locally needs to have the competence to sort. We had a project with Estonia where we did the same, with an initial sorting and then classifying, so that one is targeted and can utilise all the wool in the best possible manner. The core of value creation lies here, it is point number one. (...) You must know what you have, then you can plan the processing. And then you can discuss breeding with the farmers. First, you look at survival in the Carpathian Mountains, then the milk-production, and finally the wool. This is the last selection-point (for breeding). Milk-sheep will never produce Merino-wool, but you can keep an eye on the wool.'*

There was also the question of end-users, and their learning-process connected to the wool.

'I had workshop with students. From all technical universities, it was fantastic. Adults having the first contact with wool. Small pieces of felt, very nice. My Master student [was] doing the felting. She came to us to do her Masters, she was doing this wet felting, so relaxing. When they start, they want to experiment, do more. Before they have the contact, they are suspicious. They can feel that something changes. The work that they are doing, depends on them, [their actions and movements].' (Rom)

'I also had one other workshop with students from undergraduate level of high school. Design. I proposed a workshop on wet felting. When you want to be a tailor, you need to think differently on how you approach design, use of colours. I forgot about this. Very good workshop.' (Rom)

'The first thing that I learned was that my knowledge is unique. Second thing, the work at the lowest level, for students, for children, should have fewer other duties in my other work. Nice for me was the enthusiasm of the young people. Gave me a lot of satisfaction. When I was in school, we were making scarves. Some grandmas or moms were doing this. Maybe children will have to do it on their own, as their mom's do not know how. They will love it or hate it.' (Rom)

'I feel that it is changing. More initiatives in media on wool, especially on the internet. Small companies, artists. When we started, [there were] only two places that sell spinning wheels, now more [are] popping up.' (Rom)

'For the new generation, they want the real thing, not just the packaging. It is changing, that you cannot lie any more. Tell them the truth, they appreciate it.' Kohut on how things are changing around the perception of wool and marketing in general.

'How to increase wool utilization in Poland? Education, education, education.' (Rom)

And a sigh from her as well: *'If something is done for only three years, and then stops, this is not good, we should work more continuously on such things, not be so reliant on funding that is cut off when the project ends. Continuity is key.'*

Espelien had some insights related to this theme. Her insights were mainly that the Polish team's technical focus and expertise had sharpened how she had approached their tasks. *'This has been a learning.'* She described how the Polish team repeated questions about specifications over again, to make sure Selbu actually delivered top notch trials, and that the Polish team later could reproduce the yarns. Ingvild said this was something they very much appreciated, because they felt they needed to be pushed on this. She also expressed how impressed she was with their level of publications on these very technical results.

3.1.3 Economic and scaling factors

The premise for the existence of an economically viable industry and value-chain in the two countries was understood very differently. Rom said: *'In Poland, when you talk about processing, the first thing people think about is a huge factory with thousands employed. If you start talking about a mini-mill, it's 'just a laboratory. Not a factory. The way of thinking is completely different. In Poland, textiles and textile processing is still at the highest risk level.'*

Espelien also mentioned this: *'It hit me already when we had the pre-project before WOOLUME, the sheer scale of the textile industry in Poland. Had the [factories] been in Norway, they would have been seen as very large, but in Poland they were still viewed as small.'*

However, it was agreed upon from participants from both countries that the availability of cheaper, mainly synthetic resources, made it hard to compete with products. The process of scouring wool, and other processes needed to make the wool usable, adds to the expense of the raw material. These processes are mostly not necessary for synthetic fibres. In the interview with Klepp, there is mention of wool having been used in audio-speakers, house-isolation and more, uses that had disappeared due to both price-points and ease of access:

'Processing of natural materials is more complex; one has to go through industrial processes that are similar to handicraft processes. The other materials, the more standardized like plastics and glass-wool, can be mass-produced at a whole different scale.'

As mentioned under 3.1.1, folk costumes (called 'bunad' in Norwegian) are used more often and more visibly than traditional dresses in Poland; and interestingly the wool fabrics for this type of clothing is often much higher priced than other woollen fabrics. If one looks at this phenomenon in comparison with how plastics and glass-wool have been taken into general use because of their comparatively cheaper price point, this has not at all happened in the more traditional apparel. Also in knitting yarn, the willingness to pay more for wool, including local, Norwegian wool from small-scale 'gourmet' spinners, has been noted by both the Polish and Norwegian teams. Additionally, in knitting yarns and bunad materials, there is no place for acrylic or polyester. This is different in other countries, for example when it comes to Austrian folk dress, where synthetics are common, and in knitting yarns where acrylic is prevalent in the rest of Europe.

The traditional white Polish men's trousers are today produced with imported wool, however, Espelien expressed hope that with proper selection and classification, it would be possible once again to produce the woven material with the local wool. All in all, she saw more potential for the tufted, acoustic panels; but she had herself developed a coarse interior yarn ('Stuggu') in parallel with WOOLUME and had appreciated the encouragement from the Polish partners in doing so. Crocheting coarser interior elements with this type of wool has commercial potential, in her opinion. Only the finest fleeces from the local wool, held potential for knitting-yarns.

'If you look at who is knitting, it is the old people. Not the young people. [If you] (c)hange the school program, perhaps do repairs, mending. But not sure the teachers are ready. Knitting and crocheting was lost during the last 30 years.' (Rom)

'In Norway, knitting means wool.' (Klepp)

She relates this to an understanding of handicraft and tradition and tied this to a conversation with a Turkish yarn mill owner who had said that it is neither worth the time nor the effort to even try to sell acrylic yarns in Norway. This is an important question, and it has yet to be properly explored, but she believes the combination of an understanding of the quality of the wool yarns and the willingness to actually pay good money for the quality underpins that demanding a higher price is acceptable. Understanding the cultural history in this context is therefore important.

One explanation, brought forward by Klepp, is that Norwegians on average earn more than what is a mean wage in Poland; however, if one compares to Sweden, where acrylic yarns are sold and they use more synthetics, especially in winter as long-johns and undershirts (Klepp et al. 2016) and there is no big difference in average income; Klepp concludes this cannot be the explanation. There must be more to this than a purely economic factor.

Kohut and Rom both describe the other side of this coin, in the Polish context. Accessing knitting yarns in 100% wool is almost impossible in Poland. Rom, when speaking about price levels, stressed that wool yarns are very expensive and customers prefer to buy something cheap, i.e. synthetic. *'This is changing, but not very fast. (...) People with money will choose something in the luxury sector, for example Italian.'* And: *'We have a lot of acrylic yarns, from Turkey and the Far East. If you try to buy wool for knitting, it is 3 to 4 times more expensive than acrylic.'*

Rom also said that they in Poland would not immediately think of wool for knitting or weaving, for textiles in general, but for other applications. (Her background is in geo-textiles.) *'It may take years to make knitting and weaving popular again. (...) We learned from you "the slow life".'* She also pointed to the social safety net, that quitting a safe job to start a business in Norway, is much easier than in Poland, where the social safety net to catch you if you fail is not there.

From one of the groups during the workshop at the end seminar in Poland, we found this comment: *'For our parents' generation, cheap plastics were a dream-come-true. "Finally, acrylics!" Now this may be changing for a new generation rediscovering craft, DIY, natural fibers, etc.'*

There is also the economic factor that taking proper care of animals is costly besides being time-consuming. There are technological developments, as Klepp pointed out, but still there is a lot of work that consumers are perhaps not willing to pay for.

This relates to animal welfare, a theme Kohut is passionate about, and that she talked about in her interview. The theme arose, for her, in the discussion of the price of shearing the sheep and related to the practice of transhumance; where sheep from several different farmers are herded together during the spring, summer and fall; while they live on the farms they belong to during the winter.

However, Kohut had one over-arching animal welfare issue that was non-negotiable if she was to participate in the project, and that was that breeding would not be an issue, i.e. breeding the sheep for softer wool. Her experiences with earlier projects had left her weary of such conclusions.

'[But] (w)e will not change the animals. If that is the solution, we will not be part of it. We will cope in the traditional way.'

Kohut was also happy that all the teams, also the partners from Norway, respected her view. As this was her most important premise. Espelien backed her up on this, as discussed above, however, pointing out that as the last selection criteria for breeding, one can keep an eye on the wool, e.g. medullation.

'My sheep, I am very proud of them, their wool is protecting them from harsh conditions.'

This was, of course, in opposition to how the situation for wool had developed in the region, where wool was seen as waste, something they had to pay to get rid of. So going from this to a situation where they could get paid for the wool and cover the pay for the shearers, was a process that was still ongoing. They started out with what she calls 'playing' with it and that the goal was to cover the costs, not to make a profit. However, she had reached a point where

making money from the wool had become a goal. The profit was currently 5%, and she felt that it should be 20%, for souvenirs as much as 50%. She sees this as 'giving back' in a way for something that is 'stolen from nature', that she can afford to hire people to process the wool, felt acoustic panels and make souvenirs.

Much of this push for making money from the wool, had been developed after the first visit she made to Norway and seeing how things worked in there, where the farmer is actually paid for the wool and the shearers are paid. So, she started calculating exactly who needed to be paid what and has landed on 4 euros per kilo for the best hand-spinning wool is fair, 3 euros for wool with more general use.

She also tied the product development to scale, as she had many ideas, 100s as she described, for smaller products that she could sell to tourists visiting their educational farm. This came up against the number of people she employed and their work. She tended to sell out more quickly than what she could produce. The 'storytelling' of how they worked with the wool, etc. made the souvenirs popular. She currently only has a month and half in spring and autumn that her workers could dedicate to produce what she could sell as souvenirs, which is not enough: *'When we talk so much about the wool, they want to buy.'* (Kohut)

A solution would be to work more with local craftsmen, but she found it hard to convince them to use her wool.

'The oldest are the hardest to convince, the young are very open!'

Convincing the farmers to take back their own wool and sell it alongside the cheese in their 'chalets', was another ongoing struggle. It was a struggle in two different ways, as one was to convince them that they could turn a profit on their wool if they sold it alongside the cheese (which they had been trying hard to sell to tourists 20 to 30 years ago, but this had changed in recent years and become very profitable). The other problem was that some had gotten the idea that the project had paid Kohut money, and this was what made it profitable. This was especially frustrating for Kohut, as this was not at all the case; she had done this on her own and without being paid to do so. *'The farmers need to understand they can do it on their own. They do not need a project.'*

For her, the increase in wool sales had gone from 1.5 tonnes yearly to 5-6 tonnes, which is quite formidable. One reason she wanted to cooperate with other farmers, was also that to scale up the felting, as much as 20 tonnes was the minimum needed. For knitting-yarns the minimums were lower and manageable with her own wool. She saw the price-range for the wool for felting being between 2-3 euros but selling 20 tonnes of felted materials would also constitute a challenge, if they were to sell it themselves. She said she was not lacking ideas, but things needed to be done step by step, so as not to chew off too much at once.

This also related to investment in machinery: She had invested in a carding machine, which was not cooperating. When the project team visited her farm, Espelien looked at the uncooperative carding machine and identified the problem, the question was if it could be fixed. Kohut had evaluated whether or not to buy a mini-mill (after visiting Selbu spinning mill), but was so far happy with using the Polish spinning mill which works with all of Europe. Her initial experience with the mill had been difficult, as they had sent her back 'mixed wool', saying they had mixed in some other wool they were scouring. A hand-dyer had called her and complained, saying something was very wrong with the spun wool. It turned out what was mixed in was polyester. Once she confronted the mill with this, they understood they could not fool her and now deliver only her wool back.

'I have to pay them a little bit more, to make sure I get back what I give them.'

Espelien also talked about this dichotomy. How her small-scale mill could ensure the farmers received their actual own wool back, but also that the small-scale mill gave her leverage to be a test-laboratory. For bigger industry, setting aside one machine for experimentation means it does not produce at capacity, hence it represents a loss. This was an industrial 'reality' the Norwegian team had met earlier in discussions with industry in Norway as well. Espelien also mentioned something that is seldom talked about: The price of new machinery is non-negotiable, it does not matter where you are in the world, what your costs or your revenue is. So, for Kohut to invest in a mini-mill, in a low-cost country, would represent a much larger investment than for example in Norway. There just is no scaling for a country's GDP.

'So, capturing this cost would mean higher prices for the end-products, and this is a barrier for small-scale (in Poland).'' (Espelien)

3.1.4 The Circular Dilemma

EU has decided that Europe will become circular (Directorate-General for Environment 2022) and in this process, recycling textiles has emerged as a proposed way forward, but without pointing to the paradox of all the people who will be needed in the recycling industry. This industry will be competing for the same people as those in a wool value chain.

Rom is sceptical to the interest over-all within the EU, also Poland, to seek jobs in the textile industry. She calls it a 'dirty industry' as opposed to industry with cleaner industrial production lines.

'I have the impression that the employment situation is tougher in Poland than in Norway.' (Espelien)

This was also clear when we visited a recycling facility during the final trip to Poland, where the working conditions were questionable by Norwegian standards and would have led to the factory being shut down immediately. During the visit, Kohut commented on this: *'If I had treated my animals like this, I would have had to close down.'* Kohut also commented after visiting Selbu spinning mill that it made her happy to see so many people in the mill working hard. The point being that many hands were needed in a more handicraft-based industry and countering stereotypes of rich Norwegians being lazy and not willing to work in factories.

'The lack of people will be an equally important obstacle as the issue of economy of scale.' (Klepp)

This is in stark opposition to what politicians are discussing today, which is the need for more jobs in the EU and EEA. The question remains if these are jobs people want. Rom also described a development in Poland the last 25 years where parents have encouraged their children to pursue more academic educations, rather than those related to industry or textile engineering. This is contributing to a skills gap in Poland, a tendency that is visible in Norway as well, but there the oil industry has been the main 'competition' in the industrial sector.

'You need to have people [who are] willing to risk money on investing in the value chain. The next is people to work in the production. Needs to be clean, not dirty and smelly. The situation on the job market. We have not enough people to work. People choose the jobs that are clean. The knitting-factories, there is lack of people with skills. It is like this in the case of knitting companies. The people quit, because it is too difficult. There is a skills gap. [We need] (m)ore support for companies who are training, better systems for apprenticeships. We used to have professional schools on weaving and knitting, but when the industry collapsed, the schools disappeared. In the

past, half went to professional schools, in the 1990s, parents were telling their children to go to universities, a lot of private unis and academies. If they take a master's degree, [they are] not willing to work with menial work. They should understand this on the national level, that this needs to change, and signal from the market that the jobs are there. It is a "bad loop".' (Rom)

The need for the 'right' skills to facilitate a better value chain in Poland, was also discussed in the workshop during the end seminar in Poland. Here is what was noted from the three workshop groups: 'Skills, knowledge', 'need popularisation of knowledge', 'more respect for work' and '*loss of knowledge, the information flow has been severed around breeds, animals, wool, processing, machines, etc., [e]ducation is lacking, (...).*'

3.1.5 Product development

From the Norwegian perspective, the number of possibilities that opened up was striking, also for the use of the very coarse and wool that found absolutely no other uses. As Klepp stated: '*It is not at the product- or the application-side that the obstacles lie*' (Berg et al. 2023). In her view, it was very much the aforementioned economic or cultural factors, or the lack of value-chain, that was and is the main hinderance for better utilisation of the surplus wool.

For Kohut other uses than knitting-yarns, especially if sweaters and scarves were perceived as end-use for the knitting-yarns, was vital: '*I know it is itchy, but I am still proud because I know why it is itchy.*'

The uses seem endless, and this was also repeated in the workshop held in Poland during the end-seminar. Fertilizer pellets, green construction, green roofs, strengthening hills to avoid soil erosion were mentioned in two of the three workshop groups as surprising and interesting solutions, and was also repeated in the interviews as an important learning-point of the project.

The wool pellets that can be used in fertilizing, was one of the more promising developments, as described in the interview with Gawłowski. If one compares the wool pellet fertilizers developed during the project, the release of nitrogen from wool occurs gradually and '*is coordinated with the needs of plants*'. He stressed that nitrogen losses are small compared to artificial fertilizers, where this loss is a big problem, up to 40%.

There is, however, a flip side, if the ambition is large-scale, rather than just for gardening purposes. Here, described, by Rom: '*When talking about fertilizers, there is a market, but if it is too popular, [we] will not have wool for other purposes.*'

Gawłowski agrees with her. '*[The farmers] pointed out that in the case of large, cultivated areas, there may not be enough raw material to produce fertilizer from sheep wool due to the limited number of sheep. Therefore, in my opinion, more potential is to use this fertilizer in gardening.*'

He also brought forward two important aspects, that the commercially available fertilizers available today on the market only contain maximum 50% sheep wool, while the pellets they had developed in the project were 100% sheep wool. The second point was that this would be a by-product from pastoralism that would provide economic benefits.

Monika also discussed the issue around the drastic decline in sheep numbers in Poland and the fact that Polish people do not eat mutton or lamb, while in Norway 'fårikål' (mutton in cabbage) is the national dish, something both national teams discussed early in the project. '*[For] more wool, [we] need more sheep, and then it is the question of eating the meat.*' She goes on to describe the situation around mutton and lamb in Poland, which has been mainly mutton, not lamb (as cheese is the main product). Therefore, the mutton is currently exported to the Middle East.

However, she did see an increased interest in kebab, and saw this as a use for the meat that could help the sheep population.

This discussion shows how closely related food and fibre production is, and also scale and volumes.

Rom also described how, after talking on a local radio about wool panels with local wool, replacing sound absorbing panels made of synthetic foam, sparked an enormous interest. *'This story made it more interesting. (...) Customers who are willing to pay a lot of money for this uniqueness.'*

Which brought her around to discuss making the products available to a large market, vs. more exclusive products that have limited up-take. Ready-made vs. hand-made and a discussion of scale. The theme is recurring and addressed in the next part.

For Kohut, better handling of the fleeces as skins, was also an important product development. This was particularly related to the visit the Polish team had to Gotland for a conference, where Kohut saw how valuable the skins from the Gotland sheep were. By brushing the wool on the skins, a very simple operation, she suddenly saw an increase in value.

Ironically, one of the things Espelien mentioned was that Kohut sold her skins way too cheaply. According to Espelien, it was a gross undervaluation.

An area Espelien found very promising, was tufting. In her opinion the coarser Polish wool had a potential for this process. Tufting basically involves stitching yarn into the backing fabric so that a loop or cut pile is formed on the surface. It is similar to a straight stitch produced on a sewing machine but sewn with a loose needle thread and without a bobbin thread. Katarzyna Kobiela-Mendrek, leader of WP3, described the history of tufting to the project in one of the newsletters, with the title: *Tufting and the intriguing story of female entrepreneurship/Tufting was a woman*. The name tufting comes from English and means 'decorating with tufts', and was invented by Catherin Evans Whitener from Dalton, Georgia, USA in 1892.

Espelien found the visit to the carpet-factory that produces – among other things – tufted carpets and panels – very interesting, how well-organized it was, but also the end-products. Sadly, when we returned to Poland for the end conference, a visit there had to be cancelled because of illness. The interview with the CEO was also cancelled, so that this note lacks this perspective.

3.1.6 The Elephant in the Room (boundaries and premises)

What has been missing in the discussions that we hope the project will help make clearer and feed in to, has been a more over-arching policy- and EU-wide interest in under-utilised local agricultural by-products. On the one hand, bio-based resources are pointed at as a means of making Europe less reliant on fossil-based resources; however, seeing that this also stretches into textiles has been a blind spot. In one of the deliveries from the project, the book *Local, Slow and Sustainable Fashion* (Klepp & Tobiasson 2022) this was a major theme and also points to elements in the EU Textile strategy that are not aligned with the willingness, as Klepp calls it, for policy or tools that would enable better use of the undervalued and wasted resource that is local EU wool.

'I really do not see this willingness. But the project has contributed to make this clearer, that there is not a willingness for good resource utilization.' She points to the boundaries, the framework conditions, the competition from the much cheaper industry- and fossil-based materials. In the report *The Plastic Elephant*, Klepp et al. (2023), in another project from Consumption Research Norway, this is also looked at, in relation to policy, brands and NGOs.

This was a discussion theme during the end-conference in Poland and resulted in engaged discussions.

4 Discussion

In this chapter, we will follow the value-chain more than the themes that we identified during and when reviewing the interviews. Therefore, we start with the sheep, and move along the value chain. The question we would like to finally answer is: *In addition to the concrete research results, how has a project like WOOLUME contributed to the development and transfer of knowledge between the two countries?*

It was a clear premise for our sheep farmers, that anything related to breeding, must be for the sheep, and their welfare, not to 'satisfy' our needs for softer wool. But some breeding aspects can be implemented, such as less kemp. All wool can be a good quality, for its specific use and finding that use is at the core of what the project has been looking at. It was mainly during the June 2022 workshop where Espelien transferred knowledge around this to Kohut. Sorting needs to be done already when the sheep are sheared, the fleece must be 'skirted', and it is vital that this competence is at the local level, before the wool is packed for further use. The knowledge was there, among the Ukrainian workers Kohut had hired, she had just not been aware of this.

The amount of wool available in Europe is contingent on how many sheep are farmed, which again is mainly tied to other agricultural products such as meat and/or milk mainly used in cheese. As we in Norway use sheep meat for human consumption, mainly lambs meat, this means that sheep are generally slaughtered in the fall, and the abundance of lambswool ties to this. Milk-producing sheep will not be slaughtered, but will still need to be sheared, but their wool will be coarser and less lambswool will be available. A menu-change would need to be for more wool fit, for example to knitting yarns to be viable. An influx of guest-workers from Turkey and thus higher demand for kebab could make a difference.

How the sheep are farmed and how this is communicated to consumers (or tourists) varies a lot between the two countries and is especially colourful and heritage-related to the practice of transhumance, pastoralism and religion in the Beskid mountains in Poland. Finding similar powerful cultural practices in Norway could strengthen the standing for both meat and wool, and one of our interviewees suggested the heathland-system as a possible cultural practice that could be given more attention, also in tourism.

Tourism is also linked to display of traditional costumes, but differently, related to gender, activity, materials and significance. Summed up, in Norway the traditional knitwear has been translated into tourism items besides being used locally, while the traditional costumes have less of a tourism display function and are more tied actual activities and festivities. And much more so in Norway than in Poland, the clothing praxis related to traditional clothes has kept the local industry and value-chain in place.

This relates to several factors, but Poland being a post-Soviet country and Norway's whole history from becoming independent in 1905, World War II boosting our nationalism related to our wool heritage and also the Olympics in Lillehammer in 1994 all play together in quite a different scenario than what for Polish people ends up being an attitude that 'Wool is history, wool is the past', while for Norwegians wool becomes our DNA. The 'oldness/newness' dichotomy from the Norwegian situation very much fascinated the Polish team.

This delicate interplay, with history's harsh disruptions, merciless economic realities, surprising curveballs and lucky opportunities – all leading in one or the other direction to either a functioning value-chain which generates economic value or the opposite, collapse.

Bringing back value to the value-chain, all the way back to the sheep-farmer, is one of the major obstacles. Shearing pricing-levels, what value can be captured for different products in different

markets, has been an important learning, as to become economically sustainable, a lot of consideration must go into understanding how much monetary value each process requires. Learning from other countries in other settings, has also played in here. Traditions that ensure more handcraft, hands-on processes than those with synthetic or other highly industry-processed feedstock, and that these capture value for the end-user was seen for example through bringing forward this through media and social media.

On the other hand, finding novel uses for 'surplus' (vacant) wool has not been a problem, and the end-uses for all kinds of wool seem almost endless. It is not at the product- or the application-level that the obstacles lie, at all, it is more a question of how industry is 'rigged', as the 'easiness' of industrialized solutions, which capture consumers when emerging from cumbersome and time-consuming practices, has resulted in many wool-based uses being thrown on waste heap of history, and these are in danger of further becoming obsolete because of the measuring tools provided by Lifecycle assessments and databases that underpin these favour synthetics. So not only are the natural solutions more expensive and labour-intensive, but they are also seemingly worse for the environment. Only when local wool comes into play in this context and underlines the advantages of wool vs. plastic in relation to preserving heritage, creating a circular bioeconomy and degrowth, there is a chance to counter this tendency. At least in theory, this needs to be further explored.

The balance between many of the themes that surfaced in the knowledge transfer, around scale, education, LCAs, reindustrialization – both in conjunction with local resources but also 'the circular economy' and recycling – had many common denominators touching on economic issues, consumption patterns, globalism, resources, policy and working conditions. Here we found a lot of common ground that showed us how entrenched we are in a global economic system that may have to be challenge in order to make the small-scale, local and more artisanal approaches actually work. The disruption of value-chains has led to a 'brain-drain' or skills gap, which must be addressed, but there are also possibilities that should be safeguarded and that can be a key in future research. We will discuss this further below.

Things that need to be safeguarded in moving forward, perhaps not so much in future research, but to ensure a sustainable future for local resources, local knowledge and local economies, are finding a balance between the price of products in the market and the costs, including those contributing to the value-chain being paid for their work. Also, learning from the rigorousness of the Polish research team, something that also resulted in the project being awarded a high-ranking prize for the work, was important for one of the Norwegian partners. This points to that coming from a country where research funding has been perhaps easier to come by. Excellence in research still needs to be strived for and the results must be held to rigorous standards. On the other hand, the Polish team learned a lot from, and were surprised by, the willingness of the Norwegian team and other businesses in Norway to share and be open about successes and failures. That there was a culture of transparency that was an enabler for success, and that cooperation could foster new development. Unlearning scepticism was an important thing to bring forward in future collaboration – also for businesses to succeed.

The scepticism that the older generation, who had been under the yoke of the Soviet system, was in the process of changing, as the attitude among the younger generation is more open also to crafts, to using the 'old-fashioned' fibre wool and to transparency and putting sustainability at the forefront. Thus, optimism for a woollen industry in Poland based on local resources, is well placed.

In moving forward, looking up from the research, the findings, the development of new products and a situation where Europe is struggling to tackle a textile industry that they seem to think it

needs 'fixing' by addressing things at a product level, rather than at a systems level – thus not seeing local production as a way forward – it is increasingly important to de-silo how we approach this. 'We' in this case is the collective 'we': Industry, academia and policy. So, where do we need to go from here, when galvanising what we have found? We address this in the next chapter.

5 Conclusion

WOOLUME has been a bilateral project with only two countries involved, and few project-partner institutions. Usually projects involve more countries, many more institutions and therefore also are 'messier' in the way that one needs to involve all actors in several research questions and WPs. On the other hand, the research in more complexly structured projects is often more limited and must stick to one problem-definition in order to make the project doable. In this case, building on previous projects related to wool, for example [Valuing Norwegian Wool](#), [VikingGold](#), [KRUS](#) and [Amazing Grazing](#), along with having done a pre-project with the University of Bielsko-Biala, Selbu spinning mill and Maria Kohut earlier; and Selbu's involvement in other bilateral projects and also one with Portugal ([hiWool](#)) that both SIFO and Selbu were partners in – it was easier to have more complex questions explored. Thus, the project could look at everything from the wool itself, the best uses for the wool, follow up on the sound-absorbing technical qualities and the actual effectiveness of the wool fertilizer pellets.

That the project included two rather different countries, with contrasting history and cultures, which in different manners influenced the use of local wool, was easier to identify than in other projects, where the countries have perhaps been more similar in the historic development. We see more clearly that being a post-Soviet state results in different attitudes towards crafting, than in Norway. We also see how the importance of religion in Poland, related to cultural practices, is stronger; and that the use of national dress has followed another trajectory than in Norway, and can perhaps find the reasons for this in our own history; where the union with Sweden and that Norway before this was a part of Denmark, leads to other mores and cultural traditions growing in importance.

The variation in the competences and expertise of the academic institutions and the business/wool actors, turned out to be one of the biggest strengths of the project. The wide array of subject-matters coming into play created rich material, both in the form of new knowledge and the publications, that were many and varied in content. Ingvild's hands-on approach to both the sorting/skirting of the wool fleeces and testing, brought forward results that Kohut could utilize, and feedback from Kohut ensured uptake and understanding of what can and what cannot be implemented.

Despite the pandemic and that we could not travel as much as planned, it has been possible to work together. We believe that as we had already met before and therefore had developed a good relationship and respect for each other's work, it was easier to continue this although we could not travel as much as planned. As the plan for the project was well thought through, and the Polish team had a technical approach, the more humanities and consumer/market approach from OsloMet, was a good match. Selbu spinning mills' small size also made it possible to do experimentation in a way that any larger operation would have struggled to handle, so that the differences between the countries' industrial history and opportunities worked in the project's favour.

We did know that the project partners all had a big heart for wool and had a common goal for better utilization of local resources. We would perhaps go so far as to characterize our participating partners as zealots. People who are willing to kickstart things, and just do them despite lack of backing, are important to create actual change. Both Espelien and Kohut are zealots in their own way, and through creating change around them, can be seen to contribute to community development, which hopefully will also influence policy and other businesses. Both Espelien and Kohut are extremely creative and solution-oriented, which is perfect for the more practical side of such a project as WOOLUME. This also makes it easier to talk together and find solutions, also when one finds oneself in the middle of a pandemic. The team also clearly stated

that being kept on a tight rein by the Polish academic team and their demands for technical specifications was very much appreciated, also by those with non-technical minds. This type of very clear leadership is especially important when encountering obstacles that are not foreseen, but the ability to come up with creative solutions in the face of problems is also equally important. Having both in this project, a strong lead team and very creative minds, has been a major asset.

Harnessing the energy and zeal, translating this into societal change and actual policy and industry and bringing it beyond small-scale, niche and hobby, is of course the aim of our partners. This means that they are in today's situation butting against a many-headed troll where measurement tools for sustainability give preference to synthetic fibres, where infrastructure has collapsed, vital competences have more or less disappeared, where uniformity is demanded for material input and where processes that demand more hands and crafting have a too high price-tag. The project has, however, taken a giant leap in shining a light at the obstacles, and highlighting the opportunities that arise once the obstacles have been pinpointed and creative ideas emerge from the seemingly impossible situation of surplus wool going to waste.

6 Further research

The optimism for the future of better use of local resources in one bi-lateral project, should also translate to further opportunities for other related research projects. During the end-conference in Poland, the team met one of our hiWool project partners, and this project was shared with the participants at the conference, pointing to the Norwegian partners' contributions in opening new perspectives for the Portuguese wool actors. This also manifested in that one of the most important people within the use of local Portuguese wool that we met in Lisbon, Rosa Pomar, was able to come to Norway some months later to further share her work with the Norwegian team and for her to learn more about the Norwegian value-chain, cultural history and array of products. This further enriched our learning and competence sharing. We certainly hope that Portugal as a country with a vibrant textile industry, though with low use of own wool, can be part of future research and projects.

At the end-conference we also met two Slovakian women, Alena Niňajová and Ľubica Noemi Kováčiková, who have taken into their own hands to use Slovakian wool both in hand-spinning kits and in machine-made knitting yarns. We decided to check if there was any possibility for a bilateral pre-project with them, and found that if we acted immediately, there was an imminent deadline for a cultural exchange pre-project under the same EEA grants that had financed both WOOLUME and hiWool. We quickly assembled an application and were granted a small funding for our Sloovool project in March 2024. This resulted in an online webinar exploring the traditions surrounding the national dress in both countries and the use of wool. The webinar went over a full day, with speakers from both countries and fruitful discussions. As we do not know if the EEA grants on wool will continue, we are still hoping that other opportunities will arise to make it possible to continue research and projects also with our Slovakian partners, as the mutual cultural exchange was extremely fruitful. Coupled with the learnings brought in from the project Selbu spinning mill also had with Estonia, and as they were present both at the conference in Norway, arranged by Selbu and in Poland at the end-conference, the exponential effect from these cross-pollinations is something that will inspire future research and project proposals.

One thing that has engaged all the wool actors we have come in contact with and that the project identified and wrote about in *Slow, Local and Sustainable Fashion* (Klepp & Tobiasson 2022), was the issue of LCAs problematic scoring of wool, and this was discussed as one of the key concerns at the end-conference. This was also discussed further at the meeting in Oslo, attended by Pomar, Espelien, Klepp and members of the Nordenfjeldske Fibershed board, who have been granted a mapping project by the Norwegian agricultural fund ([more about the project in Norwegian](#)). One of the main potential areas to push for further research and further international – both at an EU level and at a global level – was agreed upon at this meeting needs to be exploring how carbon-storage in grazed lands is contributing positively to the emission calculations on wool. And as the EU currently has a Soil Mission addressing exactly this, a potential next step is to look into the issue of carbon sequestration. This theme ties closely with the discussion around wool's ranking in sustainability tools and footprint calculations, which feeds into the timely debate around EU's Textile Strategy (Directorate-General for Environment 2022).

If we are going to be scaling textile industry in Europe, based on our local resources and better use of them, many things must happen at the same time. One is that those who grant money for research must be aligned with the planetary boundaries and with making a positive impact for planet, people and animals. The zealots also must have room to 'play' outside the strict confinements of complex EU funding, which most probably must be backed by national governments, who see the value of being self-sufficient not only when it comes to food, but also for textiles.

Wool can be the fabric for the change. Let us hope that this note inspires the funding bodies and policy makers to invest in the potential for a 'wooluminously' world of well-being where sheep find their rightful place as custodians of a holistic economy where all wool, and other natural resources, are used for its best purposes – always.

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Annex I: Interview guide to WOOLUME knowledge exchange note

Knowledge exchange between a country of high wool utilisation (Norway) and a country of low wool utilisation (Poland).

The goal is to capture what we have learnt from each other and how the work can be brought forward. What are the obstacles/needs etc. to ensure collaboration, trust etc. to enable the utilisation of the wool?

1. What is/has been your role in the project? What activity have you participated in? How did you get involved?
2. What was your motivation for joining? (Has your motivation changed?)
3. What was your relationship with wool when joining? Has it changed?
4. What are the similarities/differences between Norway and Poland? What learnings can be taken from one country to the other? (Ask about the value chain, prices, products, heritage, etc.) (alternative questions for specific research on wool fertilizers):
 - How do the wool fertilizer products compare to conventional fertilizers?
 - How is the response to the wool fertilizers from farmers (or other potential users)?
 - What has changed during the research period?
 - What changes in products have been made?
 - What are the prospects for wool fertilizers?
 - What is the right price for wool fertilizers?
 - What are the prospects for additional wool products, e.g., geotextiles?
 - What is the right price for wool geotextiles?
5. For all interviewees: What have you learned? From what activity?
6. What has changed during the research period?
 - What changes in products have been made?
 - What are the prospects for additional wool products?
 - What is the right price for this kind of wool product?
7. How can payment for shepherds be ensured?
8. What is still needed to make the value chain work?
9. What things need still to change to increase wool utilisation?

Annex II: Way forward discussion

Group discussion questions

Share your views in the group and take notes.

What have you learned? (Through the project and/or the seminar)

What are the main barriers to your work with wool?

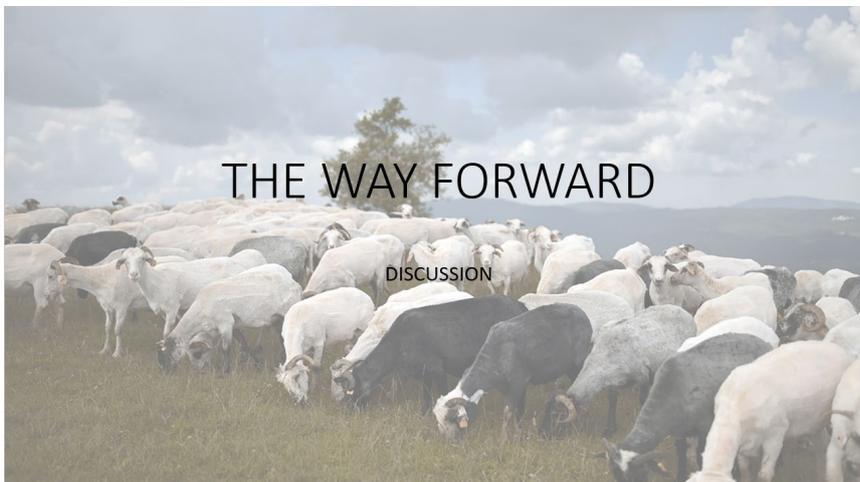
What needs to change for the value chain to work? (Economy, infrastructure, products etc.)

How should we continue the work with wool in Europe?

- **What would you like to work with?**

- **Who could you collaborate with?**

NB! We will collect the notes (or you can email them to lisbethl@oslomet.no)



Group discussion questions

Share your views in the group and take notes. Dziel się swoimi spostrzeżeniami w grupie i rób notatki.

- **What have you learned? (Through the project and/or the seminar)**
Czego się nauczyłeś? (Poprzez projekt i/lub seminarium)
- **What are the main barriers to your work with wool?**
Jakie są główne bariery w Twojej pracy z wełną?
- **What needs to change for the value chain to work? (Economy, infrastructure, products etc.)**
Co musi się zmienić, aby łańcuch wartości działał? (Gospodarka, infrastruktura, produkty itp.)
- **How should we continue the work with wool in Europe?**
Jak powinniśmy kontynuować pracę z wełną w Europie?
 - **What is needed? Co jest potrzebne?**
 - **What would you like to work with? Z czym chciałbyś pracować?**
 - **Who could you collaborate with? Z kim mógłbyś współpracować?**

NB! We will collect the notes (or you can email them to lisbethl@oslomet.no)

Uwaga! Zbierzemy notatki (lub możesz je przesyłać e-mailem na adres lisbethl@oslomet.no)

Consumption Research Norway (SIFO) is a non-profit, transdisciplinary research institute at OsloMet – Oslo Metropolitan University. SIFO`s research aims to understand the role of consumption and consumers in society and to provide the knowledge basis for public consumer policy in Norway.

Core research areas:

- Sustainable consumption
- Market based welfare
- Technology and digitalization
- Clothing and textiles
- Food, nutrition and food culture

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