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**Material Development:  
adding value to wool  
waste through innovative  
design**

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An exegesis presented in partial fulfilment of the  
requirement for the degree of Master of Design.  
Massey University, Wellington, 2015.

## ABSTRACT

*Classic Sheepskins have found themselves with a challenging problem faced by similar companies; how best to be utilizing waste material generated during their production process.*

This research project employs design and technology to add value to waste wool fibres retrieved through the manufacturing process of sheepskin tanning. It is supported through a Callaghan Innovation fellowship with Classic Sheepskins, a Napier based tannery. They have been in business for over 40 years and provide high-quality natural New Zealand products and custom tanning. The focus of this research is to find innovative solutions

for the wool waste, through material-responsive and industry-centered design methodologies and experimentation,. A critical position has been developed within sustainability, with concepts of traceability and authenticity also being examined. Consultation with Classic Sheepskins, and on-going evaluation of material properties and aesthetics in regards to potential applications, has determined the direction of products and end-outcomes.

## ACKNOWLEDGMENTS

*I would like to thank my supervisor Dr Sandy Heffernan for her guidance, support, and invaluable expertise. Julieanna Preston for always having a listening ear and helpful advice. Special thanks to all the team at Classic Sheepskins, in particular Maurice Callaghan, Troy McParland and Kieran Callaghan for their time, expertise and support for the duration of this project. Callaghan Innovations for their education fellowship funding of this project. Woolyarns, for their generous scholarship. SGS Kilbirnie, and Resene for their generosity, and willingness to contribute the project. Textile Technicians Amy Sio-Atoa and Hannah Clement for their knowledge and on-going support. And to my friends and family, in particular Bernard & Gloria Hutchinson, Julie Murphy, and Ian Johnson for their continuous support and encouragement throughout my study.*

*Thanks.*





## INTRODUCTION

This research project focuses on employing design and technology to add value to industry waste-stream materials. It is a Callaghan Innovation fellowship with Classic Sheepskins, a Napier tannery who provide high-quality natural New Zealand products and custom tanning, primarily focusing on sheep but also processing other skins such as rabbit, calf, deer and cattle.

The key waste materials identified for use in this project are wool fibers known within the tanning industry as cardings and clippings. For ease of reference, throughout my research I have categorized the fibres into two groups. These groups are short wool fibres, and long wool fibres. Short wool refers to the clippings and cardings retrieved from short woolskins, where as long wool refers to the cardings retrieved from long woolskins. (See page 7)

Classic Sheepskins are aware that the current uses they have for their waste materials, which include dumping, or having to store until reaching a bulk quantity to then sell for little return, are not effective long-term solutions, so this project set out to find better material solutions from the wool waste that they create from their manufacturing process.

In summary, this exegesis provides insight into contextual research and the best solutions determined through critical analysis and reflection.



Figure 1. Hutchinson, H. March 2014. *Classic Sheepskins retail shop entrance.*



Figure 2. Hutchinson, H. June 2014. Bales of waste product sitting in storage.

# TANNERY WASTE WOOL

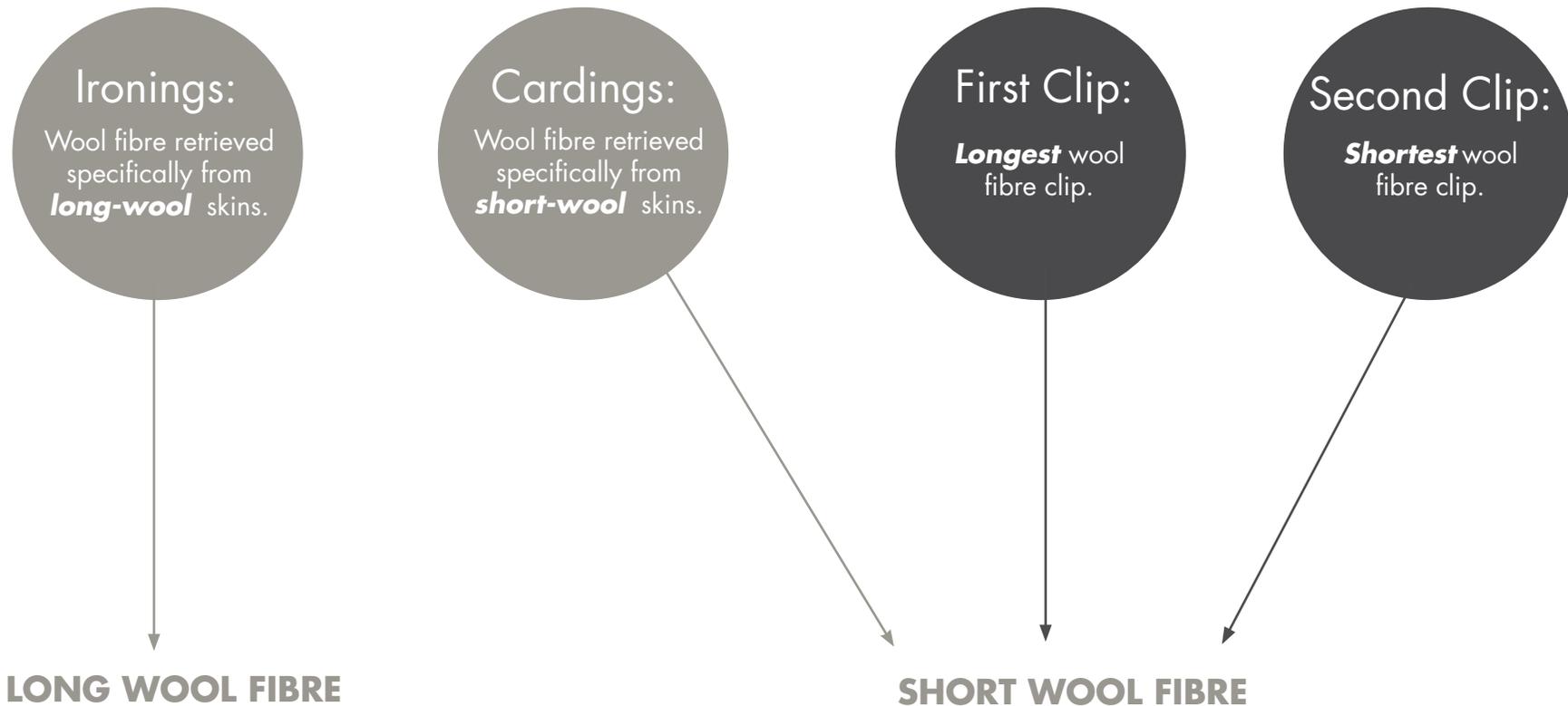
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## CARDINGS:

Wool fibers recovered from the combing of the skins. Skins are carded (combed) to lay fibres straight and in a parallel position, to enhance the aesthetic appearance of the skin, during this process some fibres separate from the skin and adhere to the comb. The longest length fibres are referred to as 'ironings'.

## CLIPPINGS:

Shorn fibres collected from mechanical shearing of the sheepskins. Currently or this wool has been to sold in bulk to insulation specialists, who pump it into ceilings for insulation.



## METHODOLOGY & PROCESS

The methodology for this project is driven by **industry-centered design**, **material responsive process**, and **practice-led iterative design**.

My process included sequential material sampling and experimentation. Records were kept through workbook documentation, technical files, and an online Tumblr research workbook. Research has been undertaken primarily in Wellington, but regular trips to Napier have occurred throughout the course of the project as required. In line with my methodology, key stages include critically analyzing and evaluating experimental material samples to take stock of how the project is moving forward. As well as self-critiquing the sampling and research, progress meetings with both Maurice Callaghan and Troy McParland from Classic Sheepskins, and my supervisor Sandy Heffernan have been conducted throughout the year, so that everyone is kept informed as the project has moved forward.

During the project I developed systems to ensure that I could integrate research and design from two key angles. One perspective was that of Classic Sheepskins, which required conscious thought to design with marketability and commercial viability at the forefront. The other perspective was that of Massey MDES, which meant researching and developing innovative ideas on a large-scale, with a desire to push R&D to the limit, without being constrained to what Classic Sheepskins can produce with current resources.



Figure 3. Hutchinson, H. 2014. *Initial workbook pages*.

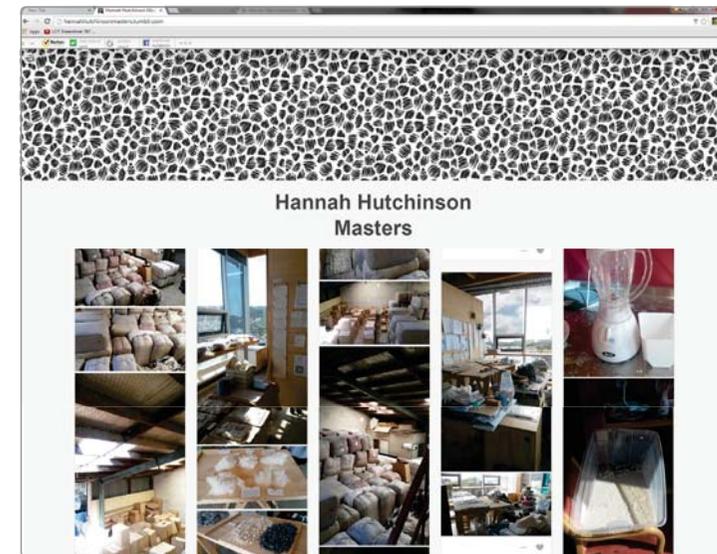
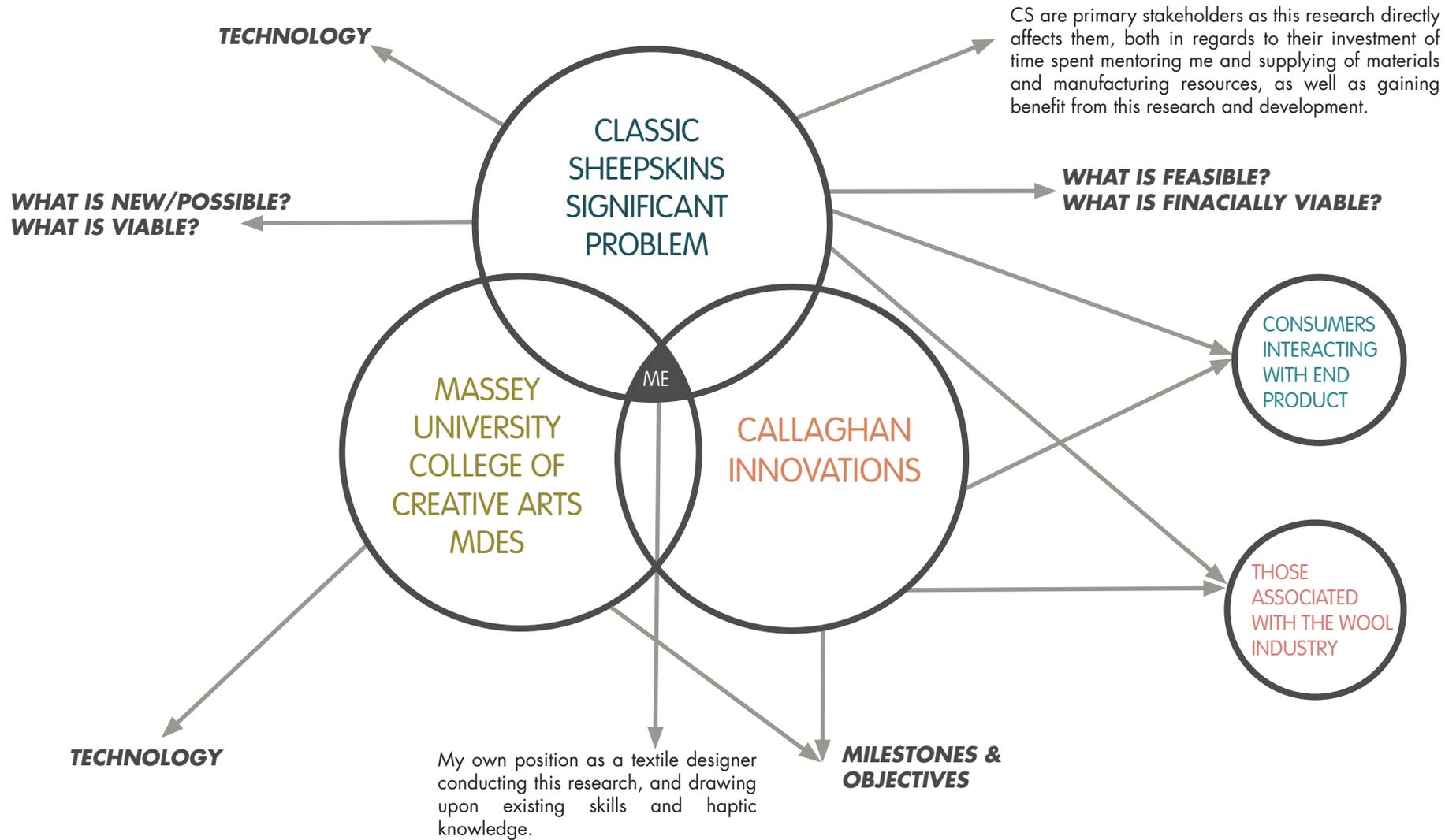


Figure 4. Hutchinson, H. 2014. *Screenshot of online research Tumblr blog*.

# INDUSTRY-CENTRED DESIGN

Design robust solutions or a multi-faceted challenge



Deeper nuanced understanding and theorization of a complex challenge or problem

## MATERIAL RESPONSIVE PROCESS

A process of *manipulating* and *experimenting* with materials, then *responding* to the way the materials perform by using the *obtained knowledge* to inform *further developments*.

## PRACTICE-BASED ITERATIVE DESIGN

A process of *critical sequential experimentation, analysis, evaluation* and *trial* and *error*.

# MILESTONES & OBJECTIVES

The key milestones & objectives that were developed at start of the project.



// Identify a diverse range of construction and finishing possibilities.

// Outline studio and industry based processes for the development of textile research and discovery.



// The literature review will be assessed for the range of sources uncovered, the level of critical analysis and reflections applied to those sources, the quality of documentation, referencing, relevance to the topic, and the gaps in knowledge revealed.



// Analysis of identified characteristics within the product and potential of the textile structures for further development to ascertain which equipment and methods are most suitable for ongoing trials.

// Technical written records will be kept of the various trials and samples. The samples will be documented and presented in a lab type manual accompanied with technical analyses. This approach will include critical response and implementation of advice from industry mentors as research develops.

The analyses of performance characteristics and potential of the textile structures for further development will ascertain the equipment configurations, techniques and methods for ongoing trials.



// A range of innovative materials showing a desirable balance between knowledge, creativity process and commercial reality. A review of the samples will determine appropriate material, processes and technology for the next stage of design trials.

// Analysis, evaluation and summary of results in labelled swatch and technical lab book format. It will meet both industry and university criteria in terms of usefulness and accessibility. The completed series of materials will be analysed for industry application by both the researcher and mentors.



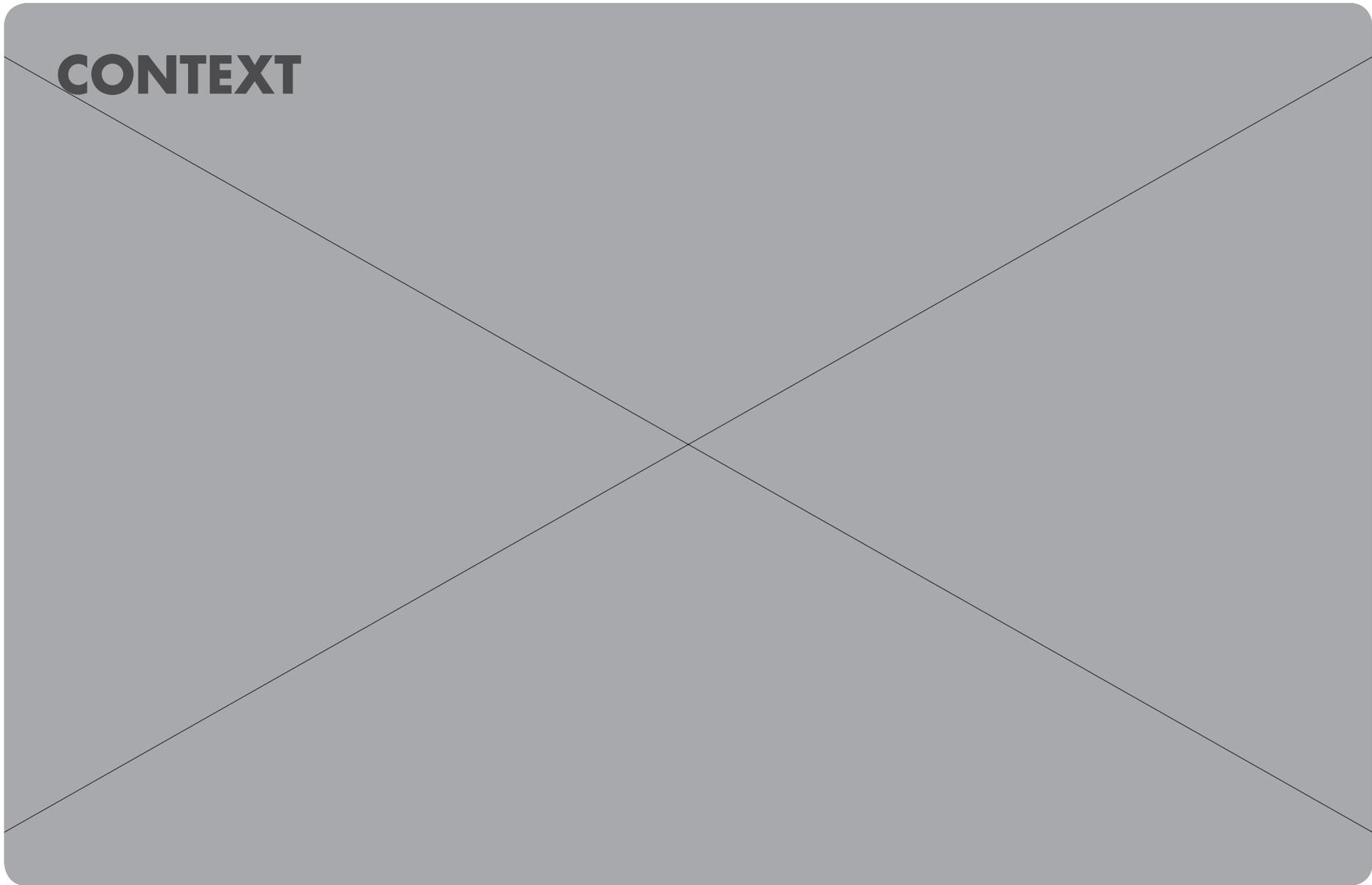


Figure 5. Hutchinson, H. 2014. *Skins drying in the sun at Classic Sheepskins.*

## ADDING VALUE

In order to gain an in-depth understanding of the context in which this research project sits, I first began by breaking-down and examining the research title, 'Investigation of added value to wool waste product.' The emphasis of this research was to discover solutions to utilize waste, and more importantly 'add value'. However, in order to achieve this, it is essential to first identify what is value in this context, and how to measure whether or not added value has been achieved, and secondly, identify who in these particular circumstances is determining value.

Value is rooted within many sectors such as financial, sustainable/environmental, increased knowledge capacity, and design and technology capabilities. Value appears to be a recurring concept throughout the wool industry, an example that is commonly referred to be that of the 'value chain'. Sandra Faulkner Chair of the Wool Levy Group in

2014, and Nuffield Scholar, addresses this in her report on the state of the NZ wool industry back in 2012; "When I began this journey, my thinking was limited to value simply being the money in the bank. I now know that money is but one component in a complex model that includes economic, social and environmental aspects. Business is powered by people, and true value is in these people feeling that they have balance in all these components." (Faulkner, S. 2012). This evoked a realization that the concept of value is multi-faceted, and so when evaluating the end outcomes of this Master's project, it should reflect a variety of different aspects of value, including but not limited to; developed manufacturing processes and sustainable systems in relation to waste bi-products, eventual higher profit returns, a unique aesthetic specific to Classic Sheepskins, and innovative utilization of technology and available resources.

# SUSTAINABILITY

## DEFINITION 1.

“Sustainability is to meet the needs of the present without compromising the ability of future generations to meet their own needs.” (World Commission on Environment and Development as cited in Evans, m. (n.d.).)

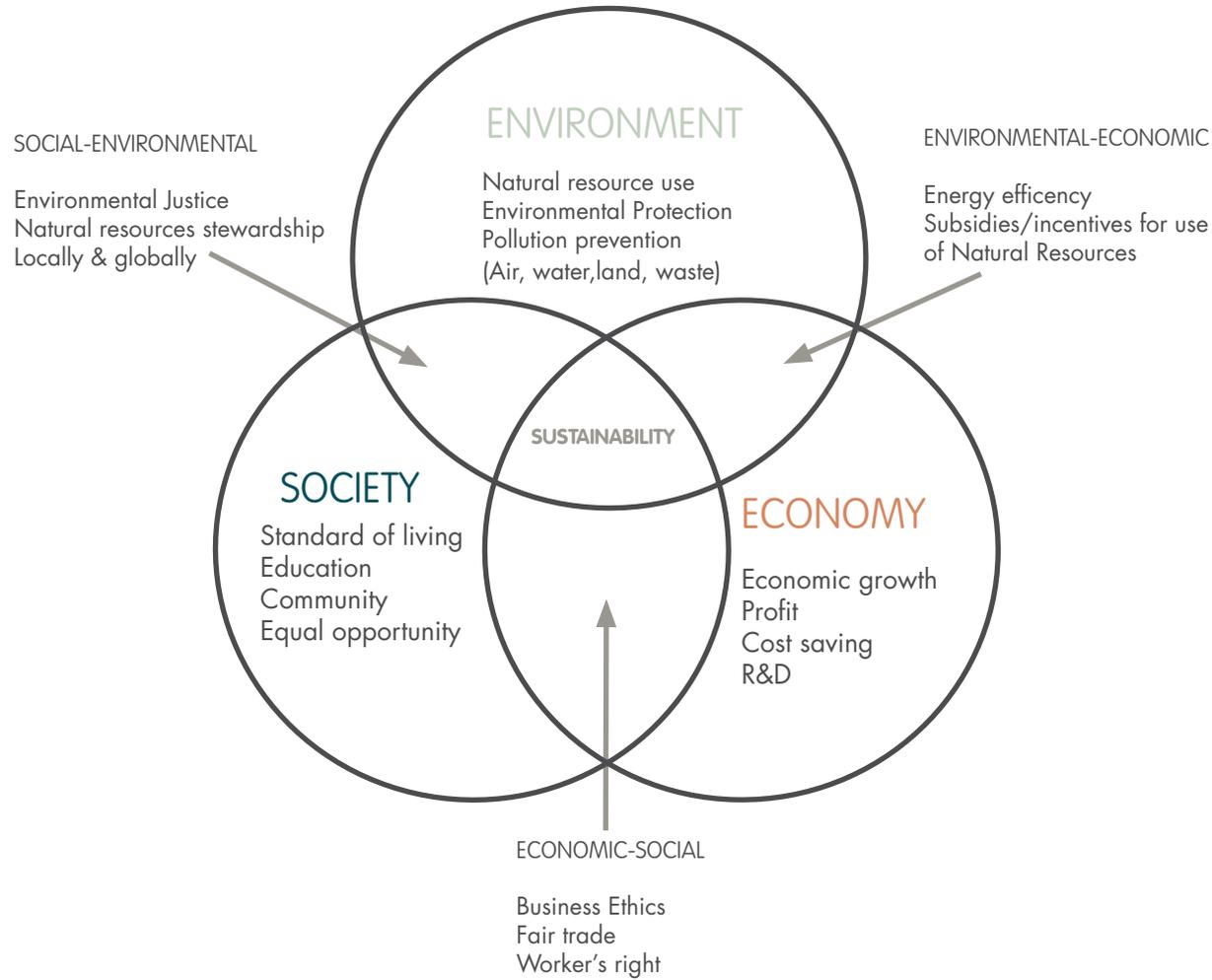
## DEFINITION 2.

“Sustainability is improving the quality of human life while living within the carrying capacity of the Earth’s supporting eco-systems.” (Environment Programme (UNEP) and World Wide Fund for Nature (WWF) as cited in Evans, M. (n.d.).)

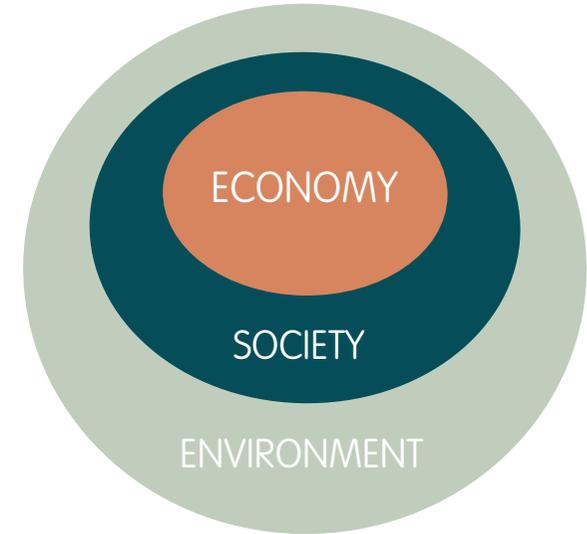
## DEFINITION 3.

“Sustainability is about stabilizing the currently disruptive relationship between earth’s two most complex systems—human culture and the living world.” (Hawken, P, as cited in Evans, M. (n.d.). )

### THE THREE SPHERES OF SUSTAINABILITY



### SUSTAINABILITY HIERARCHY



*The Three Spheres of Sustainability.* (n.d.). Retrieved from <http://www.vanderbilt.edu/sustainvu/who-we-are/what-is-sustainability>

*Sustainability Hierarchy.* (n.d.). Retrieved from <http://www.inma.org/blogs/sustainability-matters/post.cfm/a-primer-on-sustainability>

# SUSTAINABLE DESIGN

The two diagrams on the previous page visually represent the concept of sustainability. 'The Three Spheres of Sustainability,' depicts the inter-relationships between environment, economy and society how the sustainability is the central focus underpinning these different sectors. (The Three Spheres of Sustainability. (n.d.) This diagram however, despite depicting the significant factors necessary to consider when approaching sustainability, creates a perception that all three areas of equal importance. The problem with this it fails to acknowledge the finite complexities of our resources. This second diagram depicts the hierarchy within these 3 sectors, with emphasis on the environment as the most important sector, as without the environment there is no society and without society is no economy. (Gosselin O'Meara, A. (2013). This perspective places importance on sustaining our natural resources in order society and the economy to function and exist.

Sustainability is a colossal concept and as such this research only briefly touches upon it. However the concept of sustainability and in particular sustainable design has been of key importance when making decisions in regards to innovative design solutions. It is becoming increasingly difficult to ignore the need to develop smart solutions for waste products, and so this project builds focuses on coming up with innovative ideas that can turn what is considered

a waste into something of value. "Sustainable design (also called environmental design, environmentally sustainable design, and environmentally conscious design) is the philosophy of designing physical objects, the built environment, and services to comply with the principles of social, economic, and ecological sustainability." (McLennan, J. F, 2004). McLennan views sustainable design as a "philosophy that seeks to maximise the quality of the built environment whilst minimizing or eliminating negative impact to the natural environment. " (McLennan, J. F, pp. 4, 2004).

In regards to Classic Sheepskins it has been determined that an essential factor in which value can be added to waste fibre, is coming up with solutions that are sustainability conscious. This means examining a number of different factors such as the manufacturing process, including what resources are needed, such as electricity, water, what -products may be released into the environment, and the overall impact of the design decision on the environment both on a micro level in regard to Napier, New Zealand, and the overall global impact. Others aspects of sustainability and society are also important as these new innovations as well as potentially having a positive effect economically could also provide more employment.



Figure 6. Warren, L. *Sheepskins Drying*.

# WOOL

Sheep have been farmed for over 120 years in NZ, with a purpose of providing both meat and wool. Whilst meat exports have remained strong, wool exports have slumped. Over time the use of for land has moved away from sheep farming to other purposes such as dairy farming, in order to gain a higher economic return.

Federated Farmers of New Zealand's, former national president Bruce Willis, addresses the decline of wool in his introduction of Faulkner's 2012 Report. "Wool was once this country's most valuable export product, it was to our economy what dairying is today, providing almost a third of New Zealand's total export earnings. How things have changed. Wool now contributes less than 2% of our export receipts." (Willis, B. Cited in Falkner, S., 2012). Part of this decline has come about from the introduction of synthetic fibres which offered a cheap alternative. In order for the wool industry to experience higher returns many areas need to be examined along the value chain, looking at the wool from the farm, as well as the way it is marketed. It has been important to gain an understanding of the current state

of the wool industry for this research project as much as the waste product. The primary products that Classic Sheepskins manufacture are those of woolskins, which is wool fleece that is still attached to the skin. This means that CS are not only subject to the state of wool industry, but are impacted by the state of the skin & pelts sector. Because both these two sectors be are subject to fluctuating levels of demand, I have focused particular attention to examining the current state of woolskins as opposed to wool as it is the area that most significantly affect CS.

Silk, R., and Craymer, L. discuss the decrease in demand of woolskins in their article at the start of this year. One of the biggest buyers of woolskins globally is China, whom receive around 74% of all skins exported world-wide the skins, which are processed within their own tanneries. (Silk, R., and Craymer, L. January 2015). These tanned and finished skins are then sold overseas. However the market for these finished skins is reported to be in a decline, as a result of increasing regulations of tannery in relation to the environmental im-

pact they have, and a decrease in demand from countries such as Russia, whom one of the biggest buyers of the finished skins but due to countries such and the U.S and Europe placing sanctions on Russian exports are no longer importing them from China. (Silk, R., and Craymer, L. 2015).

In contrast to the article by Silk R, and Craymer, L, at the time of writing, here in New Zealand the price of New Zealand lamb wool is currently highest it has been since 2011. This is in part to a weaker NZ dollar, and NZ lambskin is being pushed as a premium above other wool types. (Morrison, T. January 30, 2015). The fluctuation and demand for woolskins is like a "moving target, it can just change rapidly like fashion fads. It is a very cyclic market, some years can be better than others depending on the trends." (Callaghan, M, personal communication 13 February 2015). Because of this fluctuation in demand it is important for companies like CS to look at the whole package not just the product they sell but the way they present themselves in order to stay current and competitive.

Branding and marketing is being seen as important tool for increasing value for wool. Another example of attempts to reposition wool, is that of Fahrenheit 212, a New York innovation company, who received funding from Wool Research Organization of New Zealand Inc to develop innovative strategies for commercial propositions of New Zealand wool back in 2013. The vision is that these solutions will help lift the prices of fibre by being used in new product streams and applications. "The four key areas they identified were baby, apparel, bedding and cosmetic application, and represent wool as a natural enhancement to peoples' lives." (Douglas, D, & Harvey, C. (n.d.)) Classic Sheepskins already have a market within two of these areas with both in the apparel and bedding areas. The key to marketing wool as a natural enhancement to peoples' lives can be achieved through effective marketing, and positioning wool as an high-quality product, with particular attention paid towards authenticity. Globally consumers are developing an increased desire of awareness to know the story of where the products they

buy come from. Overseas in the UK they are experiencing an upswing in regards to wool over the last few years due to a resurgence that has seen "annual sales soaring 50% from £180m in 2007 to 270m last year. Experts put this down to demanding middle classes in emerging markets, a swing back to sharp suits and knitted jumpers and a more conscientious customer keen to know the exact journey of their favorite winter coat." James Sudgen, managing director of weaving mill Johnston of Eglin explains it as, "I think consumers like to know more and more the story of who makes their clothes. We have mill tours with queues of people wanting to know how it's made and there is a whole education process around manufacturing." (Sudgen, J, as cited in Neville, S. 2013). I believe this is an area where Classic Sheepskins already have an existing advantage, by offering twice daily factory tours, which could open up an opportunity to use this as a marketing tool for creating a story around their products. Authenticity is evident in regards to well-established systems that allow full tracking and transparency at each

stage of the manufacturing process, from the moment they are purchased until ready for sale they are tracked. Classic Sheepskins have in place an advanced traceability system with their skins, which allows for quality control, meaning they can track back to who they were purchase from, and who was responsible for manufacturing at each key stage in case any issues arise. (Appendix 1.)

Just as marketing wool and wooskin products is important to increasing demand the other approach is by expanding the capabilities of wool though innovative design, as a way forward for raising the value of wool. I identify my project as sitting within this field, as the key tool I have for adding value to wool and is utilizing design, and drawing upon my existing knowledge and skill from a textile background. Whilst it is important to acknowledge how my potential materials will be marketed and presented to consumers, the time restrictions of this project mean that stage will need to be in the future by the development team at CS.

A successful example of both using design as a tool to add value and clever marketing has been Peri Drysdale, founder of NZ knitwear company Snowy Peak Ltd, and the brand Untouched World become leader in world-wide in wool products and sustainability. (Callaghan, P. 2009)

In 2002 Untouched World was the first in NZ, and first Fashion Company in the world given permission to carry the United Nations Decade of Education for Sustainable Development logo on its labeling. The company came about from Drysdale's observation of "shipping out all our wool basically unprocessed and obviously our other major commodity; meat was going out pretty much in full carcass form as well." Drysdale was able to build a company from the idea of using design as a tool to add value. (Callaghan, P. 2009)



Figure 7. Warren, L. 2012 . *Skin drying during the tanning process.*

## FIBRE PROPERTIES & PERFORMANCE CHARACTERISTICS OF WOOL

### ACCOUSTICS

Wool can significantly improve the acoustic performance of rooms as it acts as a sound absorber and also dampens any impact noise in a room.

### BIODEGRADABLE

When disposed of, natural wool fibre takes only a few years to decompose, and with a high nitrogen content, wool can even act as a fertilizer.

### BREATHABLE

Wool's natural structure allows it to absorb and release water vapour into the atmosphere, keeping you warm in winter and cool in summer.

### COMFORTABLE

The flexible, tactile nature of wool makes it very comfortable to wear or to feel underfoot.

### MULTI-CLIMATIC

Wool acclimatizes to its surroundings.

### NATURALLY INSULATING

Wool can insulate the home providing and retaining warmth, and reducing energy cost.

### NATURAL AND RENEWABLE

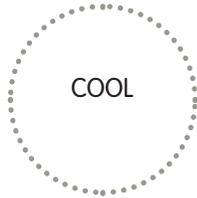
Wool is grown not made; every year sheep grow a new fleece. Wool products also use less energy than man-made fibres during manufacture.

### NON-ALLERGENIC

Wool fibre can be bent 20,000 times without breaking and still have the power to recover and return to its natural shape. Quality wool garments look good for longer.

#### Wool Properties and Performance Characteristics sourced from:

Hibbert, R. (2002). *Wool-Improved performance, developments in commercial fibre in Textile Innovation: Traditional Modern and Smart Textiles Line* (pp. 16-17). Line, Firm.  
 New Zealand Merino Company Limited  
 The Campaign For Wool. *Wool Studies*. Retrieved from <http://www.campaignforwool.co.nz/technical-and-information/>  
 The Campaign for Wool. *The Wonders of Wool*. Retrieved from <http://www.campaignforwool.co.nz/wool/>  
 IWTO Wool Booklet



Wool is also a fibre that stays cool- it breathes and will adapt to suit its environment or its wearer. So that you do not feel any discomfort.



Wool fibre can be bent 20,000 times without breaking and still have the power to recover and return to its natural shape. Quality wool garments look good for longer.



Modern wool can be machine-washed; retaining a small amount of natural oil, wool fibre resists dirt and grease.



Wool fibre has a higher ignition threshold than many other fibres and is flame retardant up to 600° C. It also produces less toxic fumes in a fire.



Wool has naturally high UV protection.



Wool is an annually renewable fibre and therefore is naturally replenished.



The complex cell structure makes wool a working fibre, the key attributes of the fleece that protect the sheep continue to perform even after it has been shorn.



The endless suitability of wool for many applications from fashion to floors to insulation show that wool is capable of adapting to its use.



Wool is the original fibre for warmth, it has insulating properties and can keep you warm and cosy in the coldest conditions.



# MATERIAL EXPERIMENTATION

SHOWCASE & OVERVIEW OF THE VARIOUS TECHNOLOGY, EQUIPMENT AND TECHNIQUES USED WITHIN THE PROJECT

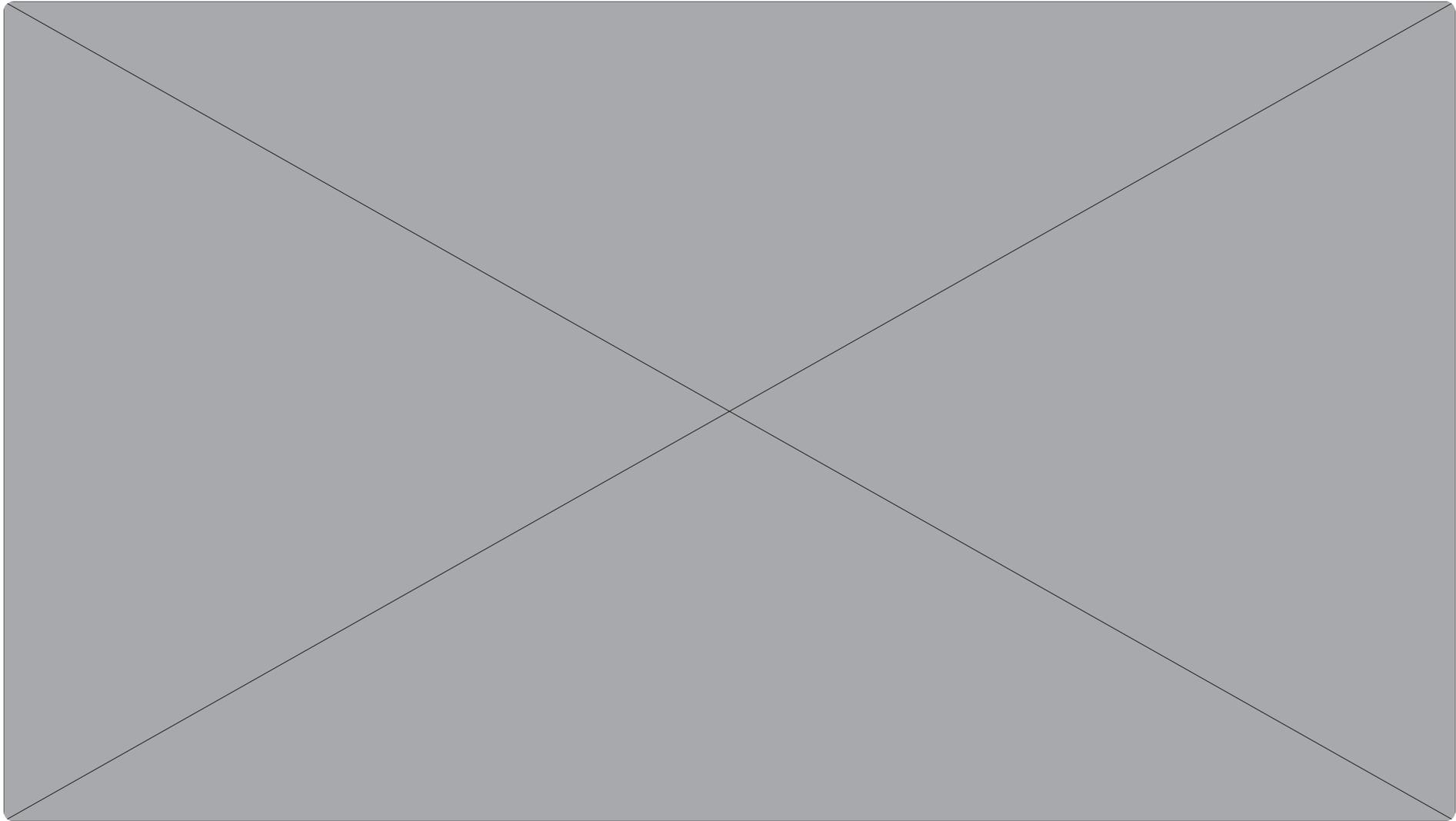


Figure 9. Hutchinson, H. 2014. *Material samples laid out for evaluation.*

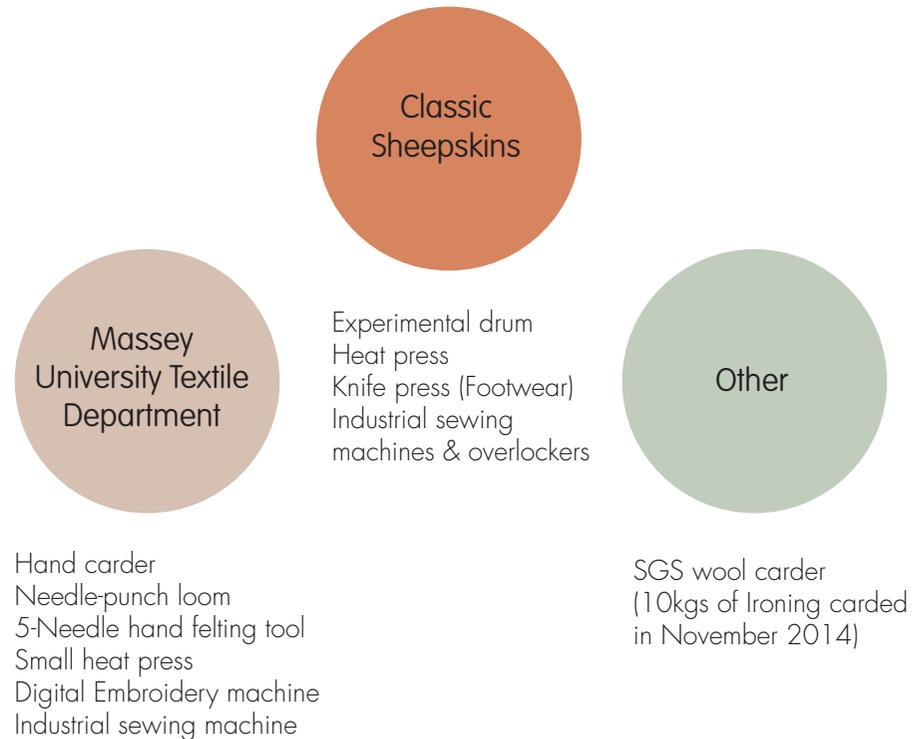
## MATERIAL EXPLORATION

The material-responsive, and practice-led iterative process methodology of this project has resulted in an expansive collection of experimentation, and breadth of many different ideas and trials expanded and resolved, which after critical evaluation have gone on to inform more focused and refined areas of research.

Various technology, equipment and construction processes were trialed both at Massey and on-site at the tannery. Analysis and evaluation of all trials revealed which experimental samples had the most potential to be developed. The most significant areas of investigation with-in both the short-wool fibre and long-wool fibre are discussed in the next section.

## EXISTING TECHNOLOGY & PROCESSES:

### TECHNOLOGY & EQUIPMENT



<sup>25</sup>SGS specialise in inspection, verification, testing and certification company for numerous industries both locally and overseas. The company has a wool testing facility in Kilbirnie Wellington, who assisted me by commercially carding 8kgs of wool.

# MATERIAL INVESTIGATIONS

*FOLDOUT FLOWCHART SHOWING ITERATIVE PROCESS WILL GO HERE*



# SURFACE STRUCTURES

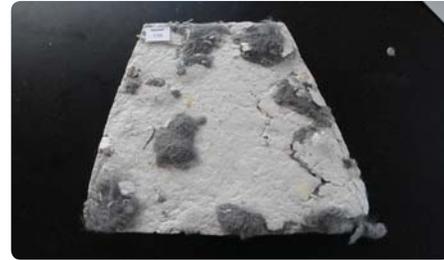


Figure 10. Hutchinson, H. 2014. *Selection of Surface Structure Experimental Samples.*

# COMPOSITES



Wool Fibre & Enamel Paint



Paper-wool Composite



Wool Fibre & Salt Dough

Wool Fibre & Cotton Gauze

Figure 11. Hutchinson, H. 2014. Selection of composite experimental samples.

# AESTHETIC DESIGN



Screenprinting with dyes mixed into pastes (Natural & Synthetic)



Natural Dye Bath



Thread Applique

Figure 12. Hutchinson, H. 2014. Selection of surface design experimental samples.

Screenprinting with various pastes; transparent, puff, gloss, opaque

Foiling



# SHORT-WOOL FIBRE

*SIGNIFICANT TRIALS, EXPERIMENTS & FINDINGS*

- 34 Wet felting in the experimental drum
- 36 Combining with resene waterborne enamel
- 38 Composites: Combining with salt dough +  
Combining with confflour/homemade glue
- 40 Paperpulp/wool composite investigation
- 42 Cotton gauze embedded with short-wool fibre

Figure 13. Hutchinson, H. 2014. *Wool bale*.

# SHORT-WOOL INVESTIGATION SERIES 1:

## WET FELTING IN THE EXPERIMENTAL DRUM

### **AIM:**

On my second trip to Classic Sheepskins, I wanted to have an with the equipment CS offered. Alongside factory Manager, Troy McFarland we used the experimental drum, which is currently used for testing tanning solution or dyes in small quantities.

### **STRATEGY:**

Diverting the existing purpose of current Classic Sheepskins technology and testing out whether it could be utilized for the process of wet felting.

### **METHOD/PROCESS:**

I began by using stockings filled with various wool fibre in an attempt to create solid felt balls, which wasn't successful as most of it didn't hold together at that size. Alongside this I took a bag of clippings and poured the fibre directly into the barrel, and through the use of hot water and cold water to shock the fibres, the waste material, which began as a dusty short seeming useless, then became small finished-look

### **REFLECTION:**

The result of this product was quite successful as it is easily implemented and changes the form of the shortwool fibre that is loose in dusty, into something more compact.



Figure 14. Hutchinson, H. 2014. *Experimental Drum at Classic Sheepskins*



Figure 15. Hutchinson, H. 2014. *Felted Neps Made From Wet Felting Clippings.*



Figure 16. Hutchinson, H. 2014. *Neps threaded together.*

# SHORT-WOOL INVESTIGATION SERIES 2:

## WOOL FIBRE & PAINT COMPOSITE

### **AIM:**

After attempting to bind the fibres together through the process of wet felting in order to not have to incorporate additional materials, I decided that I need to try combining the wool fibre with other things to create composites. I decided that I wanted to experiment with paint.

### **STRATEGY:**

In order to test out this material trial, I was supplied with a litre of Resene SpaceCote Low Sheen Ultra Deep Waterborne Enamel Paint. Ultra Deep tone isn't pigmented the same way a white is. pigment the way white paint. I approached using the paint as a way of binding the fibres together, which when dry would create a solid material.

### **METHOD/PROCESS:**

I tried a variation of ways to apply the paint, such as mixing half paint to half wool and rolling it out and setting it in blocks to dry. One of the most successful approaches was to place gladwrap over a piece of cardboard then paint 2 smooth coats of paint, the once dry, paint one more coat of paint and then lay the short fibres on it to dry.

The paint was also applied as a coating to needle punched felt to see if you could achieve a water-repellant surface.

### **DEVELOPMENT:**

An interesting finding that I discovered was the due to the smooth nature of the dry paint it created a surface that could be used to be applied to glass like a suction cup. I found this feature quite interesting as in terms of the potential to temporarily attach something which could be removed easily without leaving a mark. For example installing temporary panels with insulation and acoustic properties or privacy for an event which could then be removed. It became apparent that this use of paint and wool with suction properties had a long way in order to be fully developed, and attached to glass. The composition of the paint also presented its own intricacies in that the paint was a water-based enamel, meaning it was not oil based, which gave it the environmental tick in terms of paint choice. But it was still a plastic, which would impact on the biodegradability of the product. Also the paint was a plastic so could repel water, however if let in water over time it would disintegrate.

### **REFLECTION:**

The addition of wool to paint is not a new concept, the added value of paint to wool has been recognised as providing great humidity control. Mike Clowes R&D director of Resene, attended Crit #3 on September 24th 2014, and offered insight into the role in which wool can play in the future development of technical paints.

This series of material samples showed the potential for how paint and wool could be used, but due to the aspect of sustainability it was decided to explore other binders and coatings from more natural sources as the paint didn't quite support the concept of sustainability that is embedded within this research.



Figure 17-20, Hutchinson, H. 2014. *Various paint and wool composite samples.*

## SHORT-WOOL INVESTIGATION SERIES 3:

COMPOSITES: - SALT DOUGH + SHORT WOOL FIBRE, - HOME-MADE GLUE + SHORT WOOL FIBRE, - CORNFLOUR & SILICOLN + SHORT WOOL FIBRE

### **AIM:**

I decided to experiment with creating my own ways of adding coatings or bindings, with an emphasis on the use of natural easy-accessible natural products.

### **STRATEGY:**

The purpose of these samples was to be creating solid materials out of the dust-like short fibre that could be strong and durable enough to be functional until it was no longer required and then could be easily biodegraded as it was made from 100 % natural material.

### **METHOD/PROCESS:**

So as an experiment for utilizing the clippings, I mixed salt, flour and water together to create a salt dough mixture which I then blended with the cardings. I then rolled it out into a flat sample, as well as into a thick brick shape. The second composite was a mixture of corn flour, water and the addition of small amount of liquid silicon that came from CS, currently used for coating the sheepskins. The other sample was create a glue-like substance from flour and water, to create a liquid substance which was also mixed with the wool fibre.

The paint was also applied as a coating to needle punched felt to see if you could achieve a water-repellant surface.

### **DEVELOPMENT:**

The key properties this series was exploring was a material used for interior installation that was insulating, reduced sound, fire retardant. Comparisons between these samples and the material of compressed wood shaving which is used for ceilings was made on a visit to CS. These ceilings are popular as they utilize a waste material and use it as a functional material, however it is very flammable where as wool is slow combusting which could make a product like this more better.

An idea that was explored was that of making small balls (1-3cm in diameter) made from these composites which could then be used as insulation in construction by simply drilling a hole in the wall and pouring them in as opposed to ripping down walls in order to gain access.

### **REFLECTION:**

These took over 2 weeks to properly dry. The result was a hard material which on first glances appeared to lend to itself to insulation. I do have reservations that that the properties of wool are being diminished in this and the salt dough is the key player.

These were not particularly successful as when dry they would crack, they also caused the wool to perform detrimentally against its regular technical properties, in how it stopped the retention of water, getting wet with speed causing the coating to disintegrate.

The future potential of these samples would rely in scientific testing to determine how effective it was at retaining heat, as well as how it handles fire.



Figure 21-24, Hutchinson, H. 2014. *Various wool composite samples.*

# SHORT-WOOL INVESTIGATION SERIES 4:

## PAPER-PULP/WOOL COMPOSITE INVESTIGATION

### **AIM:**

Initial idea to use paper pulp from recycled paper and card combined with wool clippings and cardings in order to bind them in a natural way. Also to see if wool could help to increase the tensile strength of paper. Then seeing if this new material could be used to create innovative and sustainable packaging for CS existing products. (For more on packaging see page 89)

### **STRATEGY:**

I was looking to explore using cellulose through the form of paper pulp as a natural binder to combine the short wool fibres together to create new materials. I wanted to see whether the properties of wool such as temperature, insulation, moisture could add value to this. I was interested in creating both flat sheets of paper with wool, as well as molded forms created from the composite.

### **METHOD/PROCESS:**

I began by testing out my own paper making through using paper from the recycling bins on campus. I soaked up the torn paper in warm water and blended it up, then using a mesh screen layered paper with layers of felt, as well as mixing wool and pulp together in order to create sheets of paper which I then left to dry, and then heat pressed. This first series of samples was very fragile, which was due in part to the technique in which I was making the paper and also the mix of different types of papers and card.

### **DEVELOPMENT:**

I began researching recycled packaging to gain more of an understanding, and came across molded paper pulp packaging. Which uses recycled paper to create packaging, through create a liquid which is then sprayed on a mold and heated to retain a shape. What has traditionally been known for being used as egg cartons and soft drink holders, is now being marketed as a sustainable packaging alternative both in NZ and overseas for a variety of product.

From my research I discovered that there was a paper pulp factory called Hawk, within the Hawkes Bay region where Classic Sheepskins is based. Hawk primarily produce packaging trays for the avocado and other produce. They have the technology to produce egg cartons but currently still working towards whether or not they will implement this product.

I wanted to see as if whether adding wool could help these trays to last if you were sending them overseas and whether this would help retain the shelf-life of the fruit. From talking to Pete, it became apparent that for Hawk they have already developed a way of adding

Despite these findings the visit was worthwhile in terms of gaining insight as to how a large company manufactures their products, and demonstrated themselves as an example of sustainable manufacturing practice. Hawk re-use the water they use during their process. Their product is also recyclable and biodegradable. I was kindly provided with a litre of paper pulp from them, which I took back to Massey with to create a new series of paper trials with to see if it made any difference. The second series of trials was more successful as I decided to break the paper into different groups and create different pulps, I used newsprint, Hawk purple paper pulp, toilet tissue, paper towels and white printer paper. These samples were more robust than the first but still struggled when it came to folding them.

### **REFLECTION:**

A success of this project is that it was able to bind the wool, but it also showcased issues of not knowing the right application for why you would do this.

The material in its current form was not durable enough to last as packaging. I continued to examine other trials with flat sheet of paper felt created from the Hawk paper pulp combined with long wool fibre further in the next chapter (Page 80)



Figure 25 - 48, Hutchinson, H. 2014. Various wool and paper pulp composite samples.



Figure 49. Hutchinson, H. Avocado tray from Hawk Packaging.



Figure 50. Hutchinson, H. Example of molded pulp packaging.

# SHORT-WOOL INVESTIGATION SERIES 5:

## COTTON GAUZE EMBEDDED WITH SHORT WOOL FIBRE

### ***Reflection:***

This series has been found to be one of the most successful series due to how instead of trying to bind the fibres together, it has embraced the notion that perhaps trapping the fibres within another material is a way of getting the benefits of wool such as warmth and acoustics but prevents the dust-like fibre from dispersing within its environment.

Once the material began to be developed, ideas such as applying quilting pattern on the new material could enhance strength and durability while also adding a new aesthetic. An existing product of Classic Sheepskins which is a sheepskin wheelchair cover is a medical product which has wool fleece on one side, and cotton on the other. However the cotton is backed with a synthetic cushioned backing. Because this investigation series used only the wool fibre and cotton it means that this could be utilized as a natural alternative to the current synthetic backing.



Figure 51. Hutchinson, H. Laying out wool clip in between layers of cotton gauze.



Figure 52-63. Hutchinson, H. Various cotton gauze embedded with short wool fibre samples.



# LONG-WOOL FIBRE

SIGNIFICANT TRIALS, EXPERIMENTS & FINDINGS



- 48 Material Investigations With The Feltloom Needle Puncher
- 50 Screen-Printing On Felt With Pigment Print
- 52 Screen-Printing On Felt With Dye
- 54 Footwear Trials
- 60 Packaging
- 62 Digital Embroidery
- 64 Utilizing Stitch To Create 3-D Form

Figure 64. Hutchinson, H. 2014. Wool bales in storage.

# FELTING PROCESSES



Figure 65. Hutchinson, H. 2014. Felted Neps Made From Wet Felting Clippings.

WET FELTING  
IN CLASSIC  
SHEEPSKIN'S  
EXPERIMENTAL  
DRUM



Figure 66. Hutchinson, H. 2014. *Hand Needle Punching.*

5-NEEDLE  
HAND FELTING  
TOOL



Figure 67. Hutchinson, H. 2014. *Embellisher Machine*.

EMBELLISHER  
MACHINE

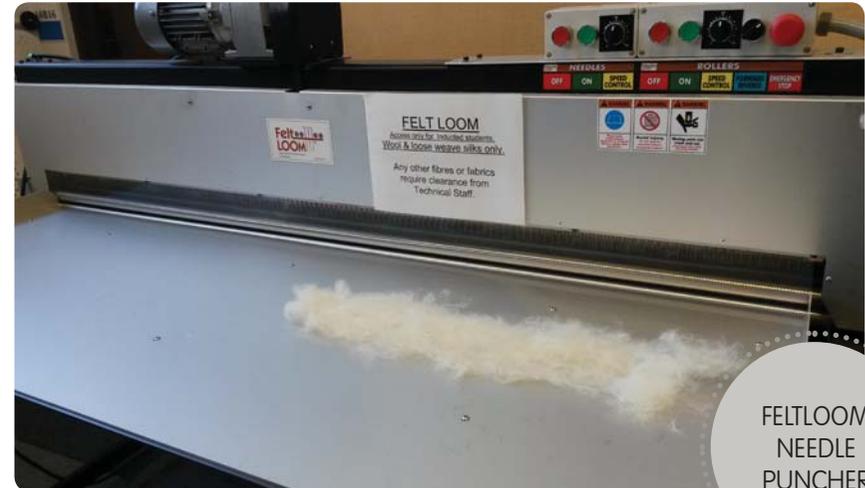


Figure 68. Hutchinson, H. 2014. *Felloom Needle Puncher*.

FELTLOOM  
NEEDLE  
PUNCHER

# LONG-WOOL INVESTIGATION SERIES 1:

## MATERIAL INVESTIGATIONS WITH THE FELTLOOM NEEDLE PUNCHER

### **AIM:**

To utilise the longwool fibres by creating a fabric that could lend itself to product design.

### **METHOD/PROCESS:**

A key characteristic of the felt that I have produced using the needle-punch feltloom is the process of heating pressing the samples on both sides to create a smooth finished aesthetic. I have primarily used the small heat press at Masey, however Classic Sheepskins also have their own heat-press on-site.

### **DEVELOPMENT:**

Once the base felt is created it was then important to develop the structure of it and the visual aesthetic. Traditional construction methods of con-joining materials which could translate into felt, exploring ideas of bending, folding, pleating, tabbing. Alongside this aesthetic is also being developed through material responsive iterative sampling. Such as felting in threads in considered decorative patterns to give a faux embroidery visual. (see fig 8). The reason for developing aesthetic is the potential to make it unique from other felt materials on the market. However it is important to acknowledge I am not just adding to it to create something pretty of that looks nice. If adding elements to create visual aesthetic, the justifying why is this being done instead of just highlighting the structure or function? An example of this is to draw attention and enhance specific areas of or distract from perceived visual flaws that naturally occur from the raw wool waste i.e. flecks of tanned skin.

### **REFLECTION:**

If Classic go to expense of purchasing a needle punch feltloom, then will have to be adding other wool to ensure enough quantity of raw material (would be ideal home for sli master wool, therefore utilizing existing technology Classic own.)

The key question in regards to this is where would the felt be produced?

I feel as though if the felt is produced in-house, it allows full quality control, and the ability to determine aesthetic first-hand



Figure 69-77. Hutchinson, H. 2014. *Investigations with the Felloom and longwool fibre.*

# LONG-WOOL INVESTIGATION SERIES 2:

## SCREEN-PRINTING ON FELT WITH PIGMENT PRINT

### **AIM:**

Using the technique of screen-printing to add a surface coating to the fabric, whilst also being an aesthetic enhancement.

### **STRATEGY:**

When I began looking at way to add colour and pattern to felt, screenprinting with a silk screen was one of my initial thoughts. I initially set out to use traditionally transparent paste as I would on other fibres such as cotton or linen, but was advised that due to the nature and texture of wool felt being not particularly smooth, and quite fuzzy, it was likely the print would not take very well. I decided to attempt with the transparent paste just in case to get an idea of the results, and with the right pressure and generous amount of paste I was able to achieve prints on the felt. This was further enhanced by then heat pressing these felt samples, which resulted in quite a flat coating to be created, and in the negative areas that were not printed on remained textured, and created a nice contrast.

### **METHOD/PROCESS:**

Because of the potential I saw in the initial screenprinting (page 34), I decided to trial a number of various of screenprinting pastes that I had access to and test the results. The pastes I used were transparent, opaque, gloss, puff, and pearl.

I chose a palette of five different colour pigment shades which I then made up into each of the pastes I had, and then printed these on to felt squares, so that I could create a series of swatches to compare the different results. All samples were heat pressed to set the print. disintegrate.

Another coating option I explored was a coating that could be aesthetic as well as performance enhancing. This brought me back to looking at my previous screen printing samples where I was able to directly add pattern and design surface detail. In the dye samples, the colour soaked through and didn't affect the handle of the felt, however the screen-print samples when heat pressed seem to create a coating. So I decided to experiment more with screen printing and tried different pastes located within the textile department at Massey. These included transparent, elastic transparent, opaque, gloss, pearl and puff paste to see what kind of effects they have. They were quite interesting especially the puff which dramatically changed the handle of the wool felt, and created a grippy texture which I thought could lend itself to footwear soles, and so made up some footwear samples using screen-printed felt. I felt they had some potential in terms of aesthetic and performance, but this was outweighed by the fact that these pastes were chemically and sustainably questionable, which meant they just don't fit in with the ethos of this project which has an interest in environmentally sustainable processes.

### **DEVELOPMENT:**

The different results all had slight different things, the two I found most interesting was that of the puff paste which created an interesting 'flocked' texture, which created grip, and gloss and transparent paste provided areas of hard strong felt, contrasted against the non printed areas of felt.

I took these pattern pieces and where I could made them in to one pieces patterns, to eliminate

### **REFLECTION:**

The idea was great in theory but it did have some limitations such as, it was incredibly difficult to manufacture the printed felt shoe as it was thick and would not move through the sewing machine with ease. As a coating it lacked some key things, it was great at adding a visual enhancement but a key coating factor/ given is water resistant and this was just not super successful in this area. The gloss coating repelled the water to an extent but not by much and so it was in fact more ineffective than just allowing the natural attributes of wool and its water repellance and absorbance to work as it would. The other issue with the pastes, was in terms of sustainability, these pastes are all made up of plastic polymers, which is why when they are heat pressed they cause such a flat coating. But in terms of environmentally friendlyness this completely impacts on the biodegradability of these products as well as can produce harmful fumes when heat pressed. So I decided to move away from this and find focus on more natural binders and coatings. such as paper. (see page 506) Negatively altered the embedded performance characteristics, attributes of wool.



Figure 78 -86. Hutchinson, H. 2014. *Experimenting with screen-printing pigment pastes on felt.*

# LONG-WOOL INVESTIGATION SERIES 3:

## SCREEN-PRINTING ON FELT WITH DYE

### **AIM:**

Ok so this whole thing was about adding colour and pattern to felt. From initial research about felted wool, i identified a gap in the markt for felt that had printed pattern on it and so decided to explore this idea.

### **STRATEGY:**

I wanted to explore printing on felt without changing the look and handle of the felt, and so the way to acheive this was to use dye. In order to applie the dye with a silk screen it was necessary to create a paste with the dye.

### **METHOD/PROCESS:**

I decided to complete trials using both synthic and natural dye to see the various results. For the synthetic dye this involved mixing the dye into a paste with manutex ( a seaweed gel-like solution). I tried a series of colours. I also tried the natural dye which meant creating using a dye solution which in this case was a walnut dye stock and a marigold dye stock. These dyes were mixed with manutex to create a paste.

To print with these pastes first I heat-press the felt to get the surface as flat as possible then printed on it. I hung up the samples to dry, then rolled them up in a calico roll, which was then added to the bullet steamer, to colour fast the prints. The felt samples were then rinsed out and gently washed then left ot drip dry, then heat-pressed.

### **DEVELOPMENT:**

The synthetic dye samples had deep vibrant colours, and didnt alter the handle of the fabric, however whilst the pattern was visible the lines and edges wernt super sharp of clear. I t meant that if using this technique on a simplified large print with minimal detial this could work quite well for applying colour, but as for these paterns with detail it wasn't the best.

The natural dye tests were far less successful when compared to their synthetic dye counterparts. Both the walnut and marigold were barely visible. This could be attributed to not enough dye within the paste.

### **REFLECTION:**

When comparing the synthetic dye vs natural it was decided that for the purposes of Classic Sheepskins, synthetic dye was the best way to go. Natural dye definitely has its benefits as it is using plants matter to provide the dye. However when exploring this on and industry level, natural dye is not economic.

It could be commercailly viable if the focus of the business was purely on the prodcution of prducing felt using natural dye, however it is simply too much of an udertaking when it is just being used as an added element to a business outputs. CS already have exisitng dye facilites and expertise which is ingrained within their current manufacturing capabilities for dyeing their sheepskins.

Adding natural dye processes would be too dificult in terms of a number factures such as sourcing large enough quantity of dye matter to produce colour, how to manufacture the dyes, how dye materials, colour fastness, and the added factor of adding the element of screen-printing.

The print was well recieved when presented to Maurice and Troy at a progress meeting, however recognise the extra cost associated with using print as the method of adding colour So while although the potential opportunity for screenprinting was acknowldge of this so this investigation series 2 & 3 were set aside in order to focus on other lines of enquiry.



Figure 79 -90. Hutchinson, H. 2014. *Experimenting with screen-printing dyes on felt.*

# LONG-WOOL INVESTIGATION SERIES 4:

## FOOTWEAR TRIALS

### **AIM:**

Existing products: Products produced at tannery or utilizing existing equipment. Footwear: How can value be added to existing footwear products?

### **METHOD/PROCESS:**

primarily working with Alex in footwear. Ales has been with Classic for over 2 years, form a woman's shoe designing background. With the help the women in footwear, they whipped up a couple of prototypes of footwear; The tui boot, Mockasins, Alfie, Tootsie.

Made a tui boot out of felt

Firstly I glued two pieces of felt together

Stamped out the pieces

Stitched them together with dark borwn thread, dark brown bingding and smapll piece of suede at the back.

Positive respones on first look

However it has been found the boot is too wide over the arch of the foot, not snuggly too gapey, pattereden would need adusting

Spent after lunch Monday and Tuesday in the footwear department,

### **DEVELOPMENT:**

On the 8th July I attended my second Critique at Classic Sheepskins my supervisor and company mentors. We discussed how last visit to Classic in June, the footwear department produced a pair of 'Tui' boots which replaced the normal sheepskin components with felt I had produced. I have been test wearing these in the studio environment at Massey over the last month and have discovered them to be extremely good at retaining warmth and shape, but they unfortunately were molting and producing a lot of fluff than you would find with traditional felt. Because of this, Maurice suggested the idea of milling. Traditionally milling is the process of how felt is put into a milling box; it is first steamed and pressed, then blasted with hot steam air. Anything that sticks out is removed, often using a sharp blade component. As I don't currently have access to milling box or a current idea of whether it is possible to source one, I will try to simulate the process, such as boiling felt, as well as steaming felt in the studio at Massey. Maurice examining the Toddler Thor boot, commented on how little fibres stick out, and their potential to work their way out of the felt. This is because they are modulated fibres, which means they also won't dye, and will scratch against skin because they are hair, not wool fibre.

### **REFLECTION:**

Classic Sheepskins had a problem with their 'Mockasin shoe where it was tearing in the toe area. By incorporating the felt product I have developed that area is able to be reinforced and didnt ter a easlily..

Currently the moccasin uses a calf skin split for the outer, they use the shoulder or butt are area as that is a stronger material, if they use the belly this is weaker and more prone to tearing. However by reinforcing the belly area with the felt its means that the area can be utilized. It is an advantage fro m a cost point for Classic: Belly and cost \$1.60-\$2, 00? square foot compared to \$5-\$6? for the shoulder or butt) Therefore that is added value to another underutilized material in the tanning industry.



Figure 91. Warren, L. 2013



Figure 93. Warren, L. 2013



Figure 94. Warren, L. 2013



Figure 92. Hutchinson, H. 2014



Figure 95. Warren, L. 2013



Figure 96. Hutchinson, H. 2014. Footwear for sale in CS retail shop.

**TUI BOOT**Figure 97. <http://www.classicsheepskins.com/tui-boot/>**TOASTIE**Figure 99 <http://www.classicsheepskins.com/toastie/>**MOCCASIN**Figure 101. <http://www.classicsheepskins.com/pampas-moccasin/>

Figure 98. Hutchinson, H. 2014



Figure 100. Hutchinson, H. 2014



Figure 102. Hutchinson, H. 2014

**TODDLER  
THOR**



Figure 103. <http://www.classicsheepskins.com/toddler-thor/>

**SLIP  
ABOUT**



Figure 106. <http://www.classicsheepskins.com/slipabout/>



Figure 104. Hutchinson, H. 2014



Figure 105. Hutchinson, H. 2014



Figure 107. Hutchinson, H. 2014

# LONG-WOOL INVESTIGATION SERIES 5:

## NEEDLE-PUNCHED WOOL & PAPER

### **AIM:**

This series was a continuation from short wool fibre and paper pulp composites. This idea developed from using the sheet of paper and combining it with wool by using a sheet of needle punched felt.

### **STRATEGY:**

I was initially hesitant when trying out this series due to the nature of the feltloom machine and restrictions into what materials can go through it as to not cause damage. The recommended materials are wool, silk or fabric with a large open weave, and paper did not fit within these.

### **METHOD/PROCESS:**

Because the sheet of paper I made was quite thin, cautiously attempted to felt it with loom. The material sample produced an interesting aesthetic of this rigid paper with texture felt and was worth pursuing further.

### **DEVELOPMENT:**

Because of the limitations of the needle punch loom and experimenting with different papers, I began by using the embellishes machine with 5 small needles to test out this process and see how it handled it. The machine handled the different papers I tried well, which resulted in deciding to trial these ideas back on the Feltloom.

The papers I tried were the 2 sheets of hand-made paper using Hawk paper pulp, paper towel, 90gsm photocopy paper and tissue paper, and placing layers of long wool fibre on top.

The purpose of this paper was to see whether I could needle punch paper which had been printed on and therefore use it as a way of adding colour and pattern to the felt in an innovative way. This wool paper could then possibly be developed within the realm of packaging. (For more on packaging see page 89).

### **REFLECTION:**

The paper samples whilst stronger than their short fibre counterparts, still had a fragility to them created from the needles. Whilst this fragility was aesthetically pleasing and visually interesting it was not very practical especially for a packaging application.



Figures 108 -112. Hutchinson, H. 2014. *Needle punched felt and paper.*

# LONG-WOOL INVESTIGATION SERIES 6:

## PACKAGING

### **AIM:**

The concept of packaging was something that was discussed when making application for the Callaghan Innovation R&D. It was seen as an area in which the new materials being created to complement CS existing product lines in particular footwear. Throughout the year decisions were made to keep the idea of packaging alive, but keep it in the background in order to allow other lines of enquiry to flourish and to develop their own identity, and then evaluate whether there was a place for these within the realms of packaging.

### **REFLECTION**

The original idea of packaging for CS existing products was well received within the group. Key things to note about packaging is that it will tie into the concept of full life cycle, the packaging will serve ongoing purpose rather than just looking good in the shop and transporting the product home, it needs to be multi-purpose or have second-life. I need to think about packaging that is as good as the product. What will packaging do once it is home, will it be used for storage? What makes it different or special?

However due to other investigations the decision was to move away from packaging and focus on other innovations and if the opportunity had presented itself move back into packaging. Due to the success of the stitching and felt series the idea for packaging was abandoned.



Figure 113. Hutchinson, H. 2014.



Figure 114. Hutchinson, H. 2014.  
Example of Classic Sheepskins current packaging.



Figure 115. Hutchinson, H. 2014.

# LONG-WOOL INVESTIGATION SERIES 7:

## DIGITAL EMBROIDERY

### **AIM:**

To explore digital embroidery in terms of aesthetic design, adding pattern and colour to otherwise natural toned wool felt. But more importantly with an approach to use digital embroidery as a tool to develop structure and strength to the felt.

### **STRATEGY:**

Due to the nature of the waste fibre and small hand carder, it meant that the needle-punched felt I was developing visibly lacked strength, one way I thought of adjusting this was to use stitch. I was aware of the value digital embroidery could add in regards to aesthetic design, but was interested in adopting the technology to stabilize the felt.

### **METHOD/PROCESS:**

To achieve this I developed patterns based on the concept of the grid. The grid was chosen as it is a design made up of horizontal and perpendicular lines that intercept each other. Because of the way the lines interlock I believed this could help increase the tensile strength of the fabric when it is stretched from all directions. I experimented with traditional uniformed grids, and also rotating the pattern 45° it created a diamond pattern.

### **DEVELOPMENT:**

A series of 5 designs were produced on squares of felt (20x20cm) using the digital embroidery machine available at Massey. These varied from a simple grid with a long and simple stitch with a large area of negative space, as well as designs with a large amount of pattern fill to examine whether a lot of stitching, vs limited stitching made a difference in providing added strength.

### **REFLECTION:**

The digital embroidery succeeded in adding strength, however there were some issues with this. The main one being the time that it took out to stitch out a sample. The cost it would take to produce large area of this fabric would be far too uneconomical. Aesthetically digital embroidery was successful in revealing the potential of using it as a way of adding colour and pattern. So if it was used purely for aesthetic reasons in a small proportion in a key area of a product, or as a branding tool it could be good. However in terms of using it to enhance the integrity of the felt it is just too uneconomical. Sample 82 which was a simple grid with a large zigzag stitch showed the most potential in terms of cost-effectiveness due to it being a fast stitch, but it would need to be costed as to whether digital embroidery would be worth it financially per sq metre.

### **REFLECTION:**

A similar effect could be achieved by using a zigzag stitch on an industrial sewing machine, but this itself has its own issues in terms of time and labour cost. Which would likely leave digital embroidery outsourcing as possibly the most cost-effective solution.

In terms of aesthetic potential, these samples were well received by CS, with Maurice Callaghan, believing there was commercial viability within this to be developed into a product. Especially when marketed towards the tourist market. By adding NZ "kiwiana" design, it would be a way to put a contemporary design aesthetic onto traditional wool felt, and used as a way of marketing other CS products.



Figures 116 -120. Hutchinson, H. 2014. *Digital embroidery on felt.*

# LONG-WOOL INVESTIGATION SERIES 8:

## UTILIZING STITCH TO CREATE 3-D FORM

### **AIM:**

The aim of this was to continue the technique of stitching explored within the realms of digital embroidery, but use it to manipulate flat felt fabric and create depth, and strength, and volume by transforing it from 2D to 3D.

### **STRATEGY:**

From the inital samples i completed I was interested in the idea of folding and pleating felt, using it to create shapes and form which could directly correlate and be developed into products, footwear was one such example of this (See page 50) in order to avoid the time and cost of stitching within manufacturing. However due to the nature of this felt, in terms of being a waste product and the restriction of manufactruning processes available, it meant it was not industrial felt, which meant that pleates and folds would unfortunately just simply not hold in place despite the use of heat pressing.

So as a result I decided to embrace the technology of sewing which is equipmnet readily available at CS, and use this to straight stitch felt which could then be gathered up to create a new look to the felt.

### **METHOD/PROCESS:**

The key technique for using stitch to manipulate wool is through gathering. Gathering refers to the technique of sewing a line of stitching then pulling the thread from one or both ends causing the fabric to bunch together, and then securing the thread in a knot so the fabric stays concenteated together. This technique cause the length of a piece of fabric to become smaller and therefore halves the length of the fabric, however it increase the thickness of the felt, whilst also having rows of stitching discretely embedded within the folds to help add strength.

### **DEVELOPMENT:**

As well as gathering, stitch has other benefitis. stitching is a technique of using thread to conjoin two pieces of material and create a seam between them. By creating these seams it allowed shapped to be formed which could be hollow such as fig 81, or create pockets which could then be filled with other material to create volume., such as short wool fibre. By trapping the short wool fibre within the these pockets it firstly utilized a waste matrial whilst creating a fabric with ridges and volume. This fabric could then lead itslef to be used for warmth or accoustic application.

### **REFLECTION:**

A drawback of using thread meant it impacted on the ability to have a 100% biodegradable product made of wool. However the perecentage of stitching to the entire product, verses the added benefit that thread had in increasing the strentgh and construction and therefore the logevity of the product, and increased time before it was necessary to have it biodeegrade, outweighed this.

OBJECTIVE  
FOUR

BIODEGRADABLE

ACCOUSTICS

SUSTAINABLE

NATURALLY  
INSULATING



Figures 121 -124. Hutchinson, H. 2014. *Utilizing stitch to create 3D form.*

## **LONG-WOOL KEY INVESTIGATION SERIES:**

FELTED WOOL PANELS USED FOR INSTALLATION IN INTERIOR SPACES

As a result of the other samples, I chose to focus on a product that incorporated ideas from other sample series such as stitching and folding, but created on large scale and used for interior application with a focus on the use of wool to alter the acoustic effects within an interior space.



Figures 125 -134. Hutchinson, H. 2014. *Felted panels for use in interior spaces.*

# DESIGN PRECEDENT 1:

ALEKSANDRA GACA- *Architextiles*

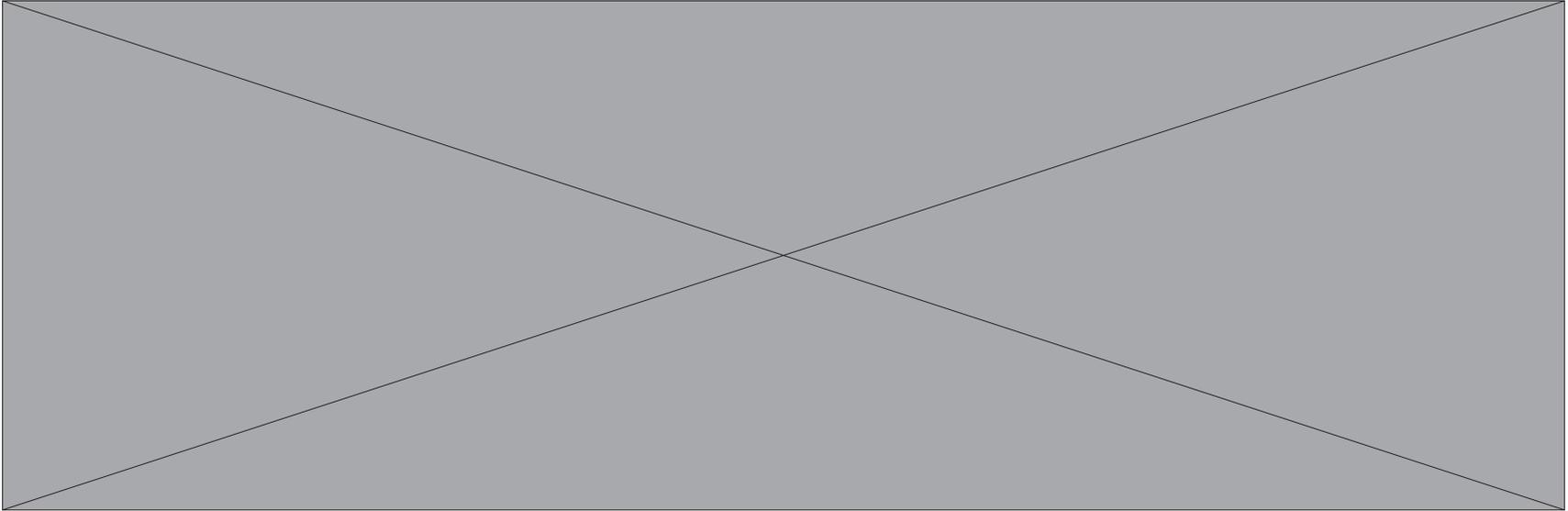


Figure 136-138. Gaca, A. Architextiles.

## DESIGN PRECEDENT 2:

RTMIS- *Yfasmatik*

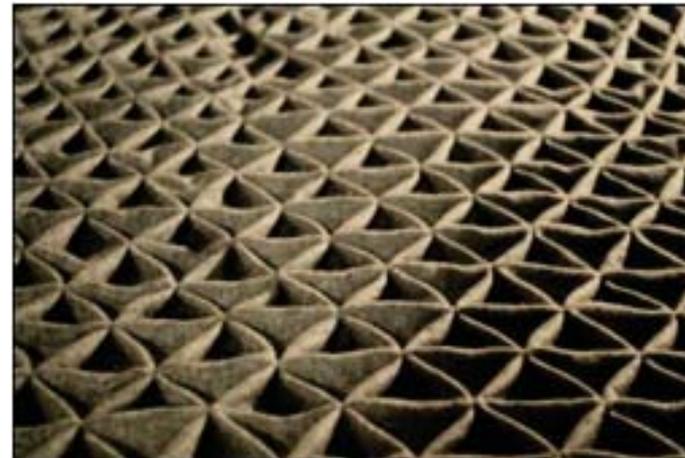


Figure 139-141 Rtmis. *Yfasmatik*. Retrieved from <http://rtmis.net/62917/3677172/gallery/yfasmatik>

## DESIGN PRECEDENT 3:

CLAUDY JONGSTRA



Figure 142-43. Jongstra, C. Claudy: 15-01-2015 Retrieved from <http://www.claudyjongstra.com/architecture/nalab/106>



Figure 144-45. Jongstra, C. Claudy: 15-01-2015 Retrieved from <http://www.claudyjongstra.com/architecture/barnes-foundation/33>



Figure 146. Hutchinson, H. 2014.

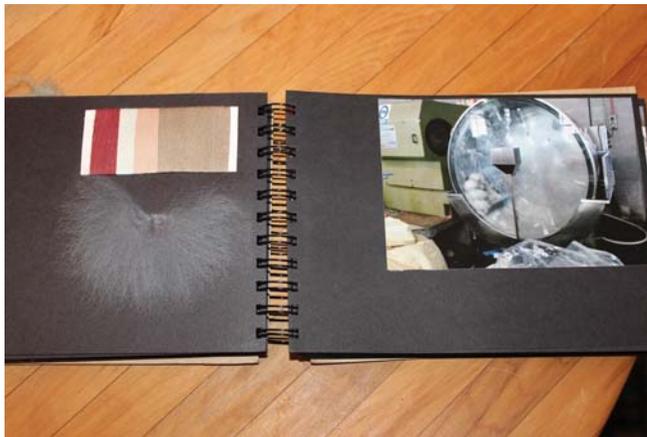


Figure 147-152. Hutchinson, H. 2014. Colour inspiration from Classic Sheepskins.



Figures 153- 158. Hutchinson, H. 2015. Stages of development for felted panel.



Figure 159-160. Hutchinson, H. 2015. Felted panel.



Figure 161- 162. Hutchinson, H. 2015. Felted panel.





Figure 163-165. Hutchinson, H. 2015. Felted panel.

# CONCLUSION

Figure 166. Hutchinson, H. 2014

When this research project began I was assigned with the task to add value, and provided with a seemingly endless supply of wool-waste fibre, from which to discover innovative solutions and create new materials. By utilising my existing design knowledge and skills, in combination with the expertise and technological capabilities of Classic Sheepskins and Massey University, I was able to explore a breadth of different concepts and potential product options. One of the first tasks that I did which helped to establish the purpose of this project, was to determine what 'adding value' meant for this project. As identified by M. Callaghan (personal communication, Feb, 13, 2015). "One of the things from this tannery's point of view is not so much the money received from the sale of that product, it's the money we are not having to spend to get it out of the factory, and the positive environmental impact that can come about from no longer having to store and dump it."

Through a considered use of different design methodologies such as material-responsive process, practice-based iterative design and industry centered design, I was able to compose and navigate a considered research approach. This allowed expansive and intuitive material process to occur through building on my existing knowledge, but also having been expanded to meet the requirements of industry.

This research project sits within a number of contextual factors. It is important to acknowledge that the concept of sustainability and creating more effective uses for the resources that we have, has underpinned this research project. Sustainability is not only reserved to environmental factors as it is commonly presented but use of all resource from society to the economy, and how different these interact with each other and as to how we can be most effectively using these.

Wool and the woolskin industry are also key factors underpinning this project. From a New Zealand standpoint it addresses the concern from many that new solutions for wool and the way it is market internationally needs to be found if wool is to regain its popularity and be once again a strong export commodity for New Zealand. One of the most important ways in which this can be addressed and in which this research addressed is the use of design and technology to increase value. We as a country need to look at ways to discover innovative and ground-breaking solutions in regards to wool that we can present to the world as opposed to sending our wool and woolskins off-shore in a raw state and carcass form, allowing others to then add value. This doesn't necessary mean all manufacturing needs to be done here in New Zealand if it is not economically viable. Instead it means that all the different sectors within the wool industry from growers and farmers to tanners and manufacturing mills to marketing teams need to consider how we wish to present our wool overseas and have chance to compete against other wool-producing nations.

The role in which design can play in this, has begun to gain traction through companies such as Snowy Peak and innovative products such as the integration of wool and footwear, but this needs to be developed. Considering the use of traceability and authenticity as effective marketing tools, moving away from the clichéd marketing of New Zealand wool with pictures of sheep grazing and mountain ranges, sheep and a mountain range, but instead offering innovative product from a sustainable and natural source that compete against fibres and materials. This and similar projects allow opportunity to look at what is considered a waste wool fibre and apply innovative design ideas towards it. By using what is considered a waste material it provides a good testing ground in which to develop and trial ideas, and opens opportunities for these ideas to potentially be taken further by Classic Sheepskins and similar companies with the same waste challenges, by opening up pathways to bring these ideas through to other individuals and companies working within the wool industry.



Figure 167. Hutchinson, H. 2014. *Felted Neps Made From Wet Felting Clippings*.

My research project has triggered communications and potential future connections and partnerships with other NZ manufactures. Working collaboratively with other NZ companies can offer the opportunity for more diverse manufacturing. As a result of particular sample investigations such as my paint series this has opened doorway for conversation. Mike Clowes from Resene who at Critique 3 (September 24th), noted the benefits that the addition of wool to paint can have. This meeting opened up the opportunity for future communication between Classic Sheepskins and Resene for potential communication in the future as whether there may be an opportunity for Resene to utilise this wool- waste within their manufacturing. M. Callaghan (personal communication, Feb, 13, 2015) recognizes that this project has not only presented solutions strictly for Classic to develop independently but can also opens up further possibilities of



Figure 168. Hutchinson, H. 2014. *Shortwool and paint composite*.

another industry with added value to be explored, “ by researching and coming up with these material solutions it could open up a whole new sector of interest from other parties who want to start that industry, as I don’t necessarily think we could do some of these ideas independently but ideas could be opened up to other manufacturers. So you’re putting not only added value to the product but added value to the concept of where it goes.” The future impact of this research is that I’ve been able to present Classic Sheepskins with information of experimental findings and solutions that they can now be taken through to the next stage of development , allowing them as a company to determine which solutions they believe to be the most applicable or offer the most potential.

These solutions range from using existing equipment already owned such as the experimental drum through the use of wet felting. This solution utilized the wool clippings in a way in which is easily achieved and the options for these formed products and potential for insulation is recognized.

Other solutions such as the felted wall panels addresses a number of considerations looked at during this project from utilizing wool properties in the form of acoustics as well as adding aesthetic. "Proper consideration of this sense is essential in the built environment. Whether it is annoying reverb, too much noise in a restaurant, or an unpleasant silence in a waiting room; acoustically awkward situations like these can be solved with the use of proper materials. Furthermore, designing with sound in mind results not just in more comfortable acoustic environments, but can also inspire more imaginative and visually beautiful spaces." Material (2015.) I have developed these felted wool panels as a way in which to look at a product that builds upon classic Sheepskins exist-

ing interior market sector as a product that provides a technical purpose and a visual aesthetic which represents Classic Sheepskins and the future direction in how they choose to market and present themselves in the future.

The presented solutions they choose to evolve will be determined by various factors, cost to implement this manufacturing, the access of manufacturing equipment and processes, and most importantly market potential. Because of this it will be important to begin looking at solutions which can be integrated smoothly into the existing capacity to test different markets and if there was an opportunity for this. At the beginning of this year it was envisioned that market testing and commercial viability would be fully determined but due to the nature of this bi-product and research necessary to work with this material and explore all the potential uses, it was discussed with Classic Sheepskins earlier in the year that the focus needed to be strongly directed towards the material development and finding a wide variety of potential uses. However it was still essential to consider commercial

viability, manufacturing capabilities and potential market when doing this research as these principles are integral to industry-centred design.

The next step forward for Classic Sheepskins to benefit from this research is to direct their development team to focus on which products they view as having the most potential. This includes how to develop a product/range of commercial products from the solutions I have presented. These critical decisions by the company will result in development of appropriate systems and practices required to deliver a consistent outcome.

Sustainability of systems and viability of products will be explained and budgeted. //Set of findings and innovations which will lead to the on-going development of a commercially viable line of products. This will be the result of processes and systems which are applied to CS for the production of new products.

//Sufficient accurate costing list and retail able margins will be presented in a profes-



Figure 169. Hutchinson, H. 2014. *Detail of felted panel.*

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**APPENDIX**

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**BATCH NO. 320 TANNING - RETAN**

REFRESH BY: craig DATE: 2-2-15

DAMAGE

WIRE WHEEL BY: DATE:

RETAN BATH NO: 8 DATE: 4-2-15

PROCESS STEPS	TIME	pH / TEMP	CHEM.	INIT.
HEAT & SCOOP		45°C		
EDTA (CHELON SP)			250grms	
ALUM			25.0kg	
FELIDERM			5.0kg	
TANKROM A.B (CHROME)			2.0kg	
RUN 10 MINS TO DISSOLVE				
DISSOLVE 20kg WRM WATER				
(SOD. FORMATE			1.5kg	
(SODA ASH			3.0kg	
ADD SLOWLY - STIRRING				
ADJUST pH 3.6 - 3.8		3.69		
ADD SKINS RUN 2 - 3 HRS	11:30			
THEN AUTO	1:35			
HEAT 45°C AUTO O/NITE				
NEXT MORNING MANUAL				
TEST pH 3.7 - 3.8		3.7		RW
Ts 80 - 90 ADVISE		2%	PASS/FAIL	RW
ADJUST				
DATE OUT.....				
RINSE		DATE: <u>1/2/15</u>		
DOLLY		COLD		
GARDILENE DEGREASER			2.0kg	RW
DISSOLVE HOT WATER				
FORMIC ACID			0.25kg	RW
ADD SKINS				
RUN 15 MINS				
PULL & HORSE 1 DAY				
SAM	<u>Rich Dave</u>			
DRY BY:.....		DATE:.....		
DAMAGE	NECK	BUTT	LEGS	SEED
More than 5				
GREASE	YES		NO	
More than 10				
WOOL	KNOTTY	WHITE	YELLOW	

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**BATCH NO. 320 TANNING PRETAN**

PRETAN BATH NO: 5 DATE: 25/1/15

TRIM BY: CRISTA, BROCK DATE: 25/1/15

FAULTS MINOR MAJOR

HOLES

FLAY

SHAPE

WOOL

FLESHED BY: CRISTA

DAMAGE:

	TIME	pH / TEMP	CHEM.	INIT.
HEAT SCOOP		30°C		
FORMIC ACID			13.0kg	RW
SULPHURIC ACID (CARE)			4.0kg	
SYNTAN			16 Buckets	
i.e. TYPE USED.....				
PELGRASSOL SF			20.0kg	
SOD. METABISULPHITE			2.0kg	RW
EDTA (CHELON SP)			0.5kg	
TEST BAUME OVER				
TEST pH 3.1 to 3.4	4.5	3.2	3	SXT
ADD SKINS				
RUN 2 - 3 HOURS				
HEAT 30°C O/NITE				
NEXT DAY PM				
CHECK pH 3.5 to 3.7				
ADD UP TO 5kg SULPHURIC				
FOLLOWING MORNING				
RUN 1 HR		30°C		
PH 3.5 - 3.8				
PENETRATION TEST				PASS/FAIL
SHRINK 70°C+				PASS/FAIL
ADVISE IF FAIL / PULL				
NEXT MORN.				
REFRESH:				

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**BATCH NO. 320 TANNING SOAK**

SKIN TYPE	SOURCE	PALLET NO.	NUMBER OF SKINS
FARM HILLS			10
SPRING CREEK FINEST GROWN			300
COW			2
TOTAL			312

INSPECTED BY

COMMENTS

	TIME	DATE:	pH/TEMP	CHEM.	INIT.
RINSE					
WATER OR			COLD		
TAN RINSE & SODA ASH				1.5kg	
RUN 5					
SOAK 30 MINS					
RUN 10					
DRAIN					
SOAK					
WATER			COLD		
GARDILENE DEGREASER				5 KG	
QUAD				5 KG	
EDTA (CHELON SP)				1 KG	
AOS NOODLES				5 KG	
RUN 10 MINS					
THEN 10 MIN EVERY					
30 MINS NEXT 2 HOURS					
SOAK O/NITE					
NEXT DAY RUN 10 MIN					
PULL					

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