# Integrating Product Stewardship into the Clothing and Textile Industry: A New Zealand Case Study

by

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## Abstract

The clothing and textile industry has become one of the world's greatest polluters as tremendous volumes of clothing are produced, used, and disposed of at alarming rates. The amount of resources, both renewable and non-renewable, required to continue at the current rate of consumption, along with high levels of textile waste, is unsustainable and must be promptly addressed. The industry must transition from its linear take-make-waste model towards a circular economy where textile products are kept in circulation and waste is minimized or eliminated.

This transition requires a systems change, with all stakeholder perspectives within the clothing and textile industry considered when exploring effective solutions for textile waste. Product stewardship, a strategy where stakeholders take responsibility for the environmental impacts of products through design to the end-of-life stage, is one option to enable the circular economy. Product stewardship schemes are gaining traction within the clothing and textile industry, with many brands providing take-back services to reduce the waste and environmental impacts associated with their products. At a regional level, product stewardship schemes have been developed in France or are in the developmental stage as with the Usedfully - Textile Reuse Programme in New Zealand.

In this research, a human ecological systems perspective and case study methodology were used to explore product stewardship for clothing and textiles in New Zealand. The aim of the study was to examine Usedfully's product stewardship work at a regional level and to explore stakeholder drivers, barriers, and strategies for product stewardship participation. Qualitative data was gathered using interview and survey methods to gain an understanding of stakeholder perspectives on addressing the environmental impacts of clothing and textiles through product stewardship. Stakeholders included those working to develop the product

stewardship scheme as well as New Zealand based designers, manufacturers, and retailers who are current or potential future members of the Usedfully - Textile Reuse Programme. Interviews with 12 participants and survey data from 13 respondents were qualitatively analyzed for emerging themes. Additional information was collected from publicly available documents including company reports and government documents to provide context for product stewardship in New Zealand and to corroborate the interview and survey findings.

Study findings indicate that Usedfully is developing a product stewardship scheme through a step-by-step, co-design process with relevant stakeholders. The study outlines this process within the broader New Zealand context and provides insights into stakeholder drivers and barriers for product stewardship engagement. The results also identify stakeholders' current environmental practices that align with product stewardship strategies as well as the factors that enable product stewardship and the transition to circularity. Key findings suggest that product stewardship operating within the current linear system can only go so far; changes must occur at every stage of the value chain with all stakeholders making efforts towards circularity. Furthermore, the results highlight the importance of contextual factors and capacities for tailoring regional product stewardship schemes to local needs. The study also provides insights into the impacts of the global COVID-19 pandemic on participants' sustainability efforts and potential consequences for product stewardship.

## Preface

This thesis is an original work by Lauren Degenstein. No part of this thesis has been previously published.

The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Integration of a product stewardship model into the Canadian textile waste stream: A New Zealand case study”, No. 00097937, 2020.

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## List of Abbreviations

B2B: Business to business

C&T: Clothing and textile

CE: Circular economy

CF: Circular fashion

$CO_2$: Carbon dioxide

CSR: Corporate social responsibility

EMF: Ellen MacArthur Foundation

EPR: Extended producer responsibility

GFA: Global Fashion Agenda

LCA: Life cycle assessment

MfE: Ministry for the Environment

NGO: Non-governmental organization

NZ: New Zealand

NZD: New Zealand Dollar

OEC: Observatory of Economic Complexity

PRO: Product responsibility organization

PS: Product stewardship

R&D: Research and development

RQ: Research question

TPSP: Textile Product Stewardship Project

TRP: Textile Reuse Programme

UK: United Kingdom

US: United States

USD: United States Dollar

WRAP: The Waste and Resources Action Programme

## Glossary of Terms

*Circular economy*: "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (Ellen MacArthur Foundation, 2013, p. 7).

*Closed-loop recycling*: "collected textiles are reprocessed into new fibre to use for new garments, re-entering the same production system that the textile originally came from" (Payne, 2015, p. 106).

*Closed-loop system*: a system "in which products are designed, manufactured, used and handled so as to circulate within society for as long as possible, with maximum usability, minimum adverse environmental impacts, minimum waste generation, and with the most efficient use of water, energy and other resources throughout their lifecycles. This includes recycling of waste back into production systems, as well as making products reusable or repairable" (Common Objective, n.d., para. 6).

*Clothing lifespan*: "the length of the period of clothing use […] often expressed in years, or sometimes number of wears, or number of washes" (Laitala et al., 2018, p. 11).

*Cradle to cradle*: "the design and production of products of all types in such a way that at the end of their life, they can be truly recycled (upcycled), imitating nature's cycle with everything either recycled or returned to the earth" (Sherratt, 2013, para. 1).

*End-of-life*: While definitions of end-of-life vary in the literature, this study uses a definition informed by study participants, separating it from end-of-use textiles. End-of-life refers to "the point at which a product ends its current useful life, and cannot be reused, repaired or repurposed" ("Glossary", n.d., para. 7).

*End-of-use*: "the point at which a product is no longer useful for the user i.e. it is no longer wanted, or is no longer able to be used" ("Glossary", n.d., para. 8).

*Life cycle thinking*: "considering the cradle-to-grave impacts of a product encompassing production, use and disposal" (Payne, 2015, p. 103).

*Linear economy*: a system in which "large amounts of non-renewable resources are extracted to produce clothes that are often used for only a short time, after which the materials are mostly sent to landfill or incinerated"; also known as the take-make-waste model (Ellen MacArthur Foundation, 2017, p. 3).

*Open-loop recycling*: "a system in which a product's raw material is broken down to be used in a second, often unrelated product system"; also referred to as downcycling (Payne, 2015, p. 106).

*Producer*: any actor who first introduces a product to the market (e.g., manufacturer, importer, retailer, etc.) (Cassel, 2008).

*Product stewardship*: "the principle that everyone involved in the manufacture, distribution or consumption of a product shares responsibility for the environmental and social impacts of that product over its life-cycle" (Lewis, 2016, p. 5).

*Recycling*: "the breakdown of a product into its raw materials in order for the raw material to be reclaimed and used in new products" (Payne, 2015, p. 105).

*Reuse*: "an existing product being used again within the same production chain" (Payne, 2015, p. 105).

*Reverse logistics*: "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal" (Rogers & Tibben-Lembke 1999, p. 2).

*Stakeholder*: "any group or individual that can affect or is affected by the product throughout the product's life cycle. A stakeholder could either be from the external or internal organisational environment" (Nilsson & Fagerström, 2006, p.169). In relation to the fashion or clothing and textile industry, Ki et al. (2020) differentiates between internal stakeholders which include "employees, managers, the Board of Directors, and owners who are engaged in supplying, designing, manufacturing, retailing, and/or marketing fashion products or services" and external stakeholders which include "governments, agents, or consumers who affect, or are affected by, the fashion business" (p. 3). Lewis (2016) adds environment groups to the list of relevant external stakeholders.

*Supply chain*: "a generic label for an input-output structure of value-adding activities, beginning with raw materials and ending with the finished product" (Gereffi et al., 2001, p. 3). In this study, the supply chain refers to the upstream processes taking place from the design to retail stages.

*Sustainable development*: ensuring our current needs are met "without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 41).

*Take-back program*: initiatives implemented by producers or retailers to gather products from consumers at the end-of-use or end-of-life stage and bring them back to the product manufacturing or processing stage ("Take-back program", n.d.).

*Value chain*: "the relative value of those activities that are required to bring a product or service from conception through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use" (Gereffi et al., 2001, p. 3). In this study, the value chain refers to upstream supply chain activities but also extends to downstream processes from consumer purchase to disposal and end-of-life activities.

# CHAPTER 1: Introduction

Clothing is an essential part of everyday life for humans, both for physical protection and the expression of one's identity (Gwozdz et al., 2017). While clothing continues to serve these functions, the use and value of clothing has changed drastically with the rise of fast fashion capabilities (Gwozdz et al., 2017). Prior to industrialization and garment mass production, clothing and textiles were inherently valuable due to the time and labour required to produce them (Goldsmith, 2012). Clothing was used, reused, repaired, and recycled until it "literally disappeared" (Goldsmith, 2012, p. 19). The life cycle of clothing was thus innately circular as garments were made with longevity in mind, valued through its use and reuse, and its natural components could degrade if disposed. However, streamlined supply chains, the introduction of shorter fashion seasons, and affordability of clothing compared to other consumer goods (Remy et al., 2016) meant that clothing could be purchased in large volumes, used for a shorter amount of time, and disposed of without a second thought. Increased use of synthetic fibres and notions in garment production also led to prolonged environmental impacts of discarded clothing as these materials persist under landfill conditions (Birtwistle & Moore, 2007; Fedorak, 2006). The linear economic system of clothing brought on by the industrial revolution remains in place today (Gabriel & Luque, 2020).

If sustainable development is defined as ensuring our current needs are met "without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 41), then the fashion industry can be considered the opposite of environmentalism or sustainability (Hawley, 2015; Shephard & Pookulangara, 2014); we are producing far more than we need, without considering the long-term environmental or social consequences. Fast fashion manufacturing has substantially sped up the turnover of clothing as garments are produced in tremendous volumes and are worn less before they are discarded. Global production of clothing has more than doubled between 2000 and 2015, beyond 100 billion units annually, while the average number of times a garment is worn before being discarded decreased by 36% within this same period (Euromonitor International, 2016 as cited in Ellen MacArthur Foundation, 2017). An increased level of clothing production coupled with lower rates of clothing utilization has inevitably led to high volumes of waste. In our current system, the Ellen MacArthur Foundation (EMF) (2017) estimates that we dispose of 48 million tonnes of used clothing per year, the majority of which is landfilled or incinerated. High rates of

clothing production and resultant waste has led to a host of environmental problems, all of which are increasingly important to address in our current climate crisis. These problems can be even more difficult to tackle due to the lack of transparency and fragmentation of the clothing and textile (C&T) supply chain. Many proposed solutions to mitigate the environmental impacts of the supply chain do not address the complexity of the fashion industry; rather, they focus on individual stakeholders, particularly with an emphasis on consumer adoption of sustainable clothing practices (for examples see Gam et al., 2010; Gam, 2011; Hustvedt et al., 2013; Twigger Holroyd, 2016). However, this consumer-focused approach does not address the fundamental changes to the fashion system that are required to achieve a sustainable future for the C&T industry.

The industry needs to move away from its linear model back to a circular model to stop the overuse of resources, reduce emissions, and minimize clothing and textile waste. A transition to a circular economy within the fashion industry has been suggested to address the environmental impacts created at all stages of the clothing life cycle (EMF, 2013; 2017; Koszewska, 2018). The first step in working towards a circular economy is through product stewardship (PS) (Shareef & Harding, 2018) whereby all stakeholders play a role in "minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages" (Product Stewardship Institute, 2012, p. 1). Within a product stewardship framework, the responsibility for clothing waste is shifted from being solely on the end-user to being shared amongst producers, importers, retailers, and those working at end-of-life management. Product stewardship for clothing is gaining traction in the industry with brand-specific initiatives, regional models such as France's national program, and the industry-led Textile Product Stewardship Project (TPSP) within the Usedfully - Textile Reuse Programme (TRP) in New Zealand.

To find effective strategies for reducing clothing waste, this research focused on product stewardship in New Zealand as a case study, using a human ecological and systems thinking approach. Through qualitative methods, this study explored the development of a product stewardship scheme (Usedfully) as well as stakeholders' perspectives related to the drivers, strategies, barriers, and enablers for product stewardship participation. The aims of the study were to examine stakeholder perspectives of product stewardship within a region working towards product stewardship scheme development for textiles and clothing. The main

contribution of the study is the description of a regional product stewardship development process and addition of stakeholder perspectives to the growing body of literature related to the circular fashion economy and product stewardship.

### 1.1 Background of Problem

The current fashion system is predicated on producing large volumes of clothing, to be used for a short period of time by consumers and subsequently discarded, eventually leading to landfill disposal. Within this linear economy, there is no effort to recover valuable or useable material at end-of-life (Rathinamoorthy, 2019). The term "fast fashion" emerged in the late 1980s/early 1990s to describe a trend-driven fashion model with the primary goal of agility and speed to market (Bhardwaj & Fairhurst, 2010; Doyle et al., 2006), whereby clothing is designed and delivered to customers in as little time as possible (Fletcher, 2007; Schiro, 1989). Fast fashion brands now deliver far more than the traditional four seasons of clothing, even refreshing stock in retail stores every week (Remy et al., 2016). These garments are typically low quality, cheaply made and easily replaceable (Cooper et al., 2010), leading to the consumer perception that fast fashion clothing is disposable (Collett et al., 2013; Hawley, 2015; Lewis, 2015). For instance, consumers may discard their clothing after wearing it less than ten times (Remy et al., 2016).

Fast fashion garments are often designed with "planned obsolescence" because of the rapidly changing trends they conform to and their poor-quality construction and materials (Niinimäki & Hassi, 2011, p. 1878). To cut costs and speed up production times, labour-intensive manufacturing techniques that characterize high quality garments, such as using shorter stitch lengths to increase the strength of seams or lining the interior of garments, are forgone (Cline, 2012). Despite the limited lifespan of fast fashion garments, the amount of time and resources to grow or extract fibres, spin yarns, weave or knit fabrics, and finish garments remains the same (Fletcher, 2007), indicating that energy, matter, and both the material and perceived value of clothing is lost when it is prematurely discarded (Gabriel & Luque, 2020).

The inherently shortened lifespan of fast fashion clothing has consequently led to increased clothing waste. According to a report released by Value Village (2018), the average North American throws away approximately 37 kilograms (81 pounds) of textiles each year despite the potential for this material to be recycled or reused. Accelerated and inexpensive manufacturing capabilities coupled with a disposal mindset have meant that not only are trend-

driven garments thrown out more easily, but textiles in general. Clothing that ends up in the landfill leads to serious environmental consequences; non-biodegradable synthetic textiles can remain in landfills for hundreds of years (Fedorak, 2006) while biodegradable textiles made from natural fibres can pollute air and water, form toxic leachate, and emit greenhouse gases as they decompose (Barlaz et al., 1997; El-Fadel et al., 1997; MacBride, 2008; Tammemagi, 1999). Prematurely disposed clothing creates a demand for both landfill space (Weber, 2015) and for replacement garments produced from scarce or non-renewable resources. The current trajectory of the C&T industry is unsustainable both in its endless extraction of resources and environmental pollution, requiring immediate action within the industry. It is important to note that while fast fashion is a major contributor to textile and clothing waste, I refer to the clothing and textile industry as a whole throughout the manuscript to acknowledge all types of clothing/textiles that may not fall within the fast fashion category but still needs to be included in the solution.

Growing awareness of the C&T industry's negative environmental impact has prompted the search for clothing waste reduction strategies. At the consumer level, some research has focused on how environmental attitudes relate to sustainable clothing disposal (e.g., Bianchi & Birtwistle, 2010; Joung & Park-Poaps, 2013; Koch & Domina, 1997). However, environmental concerns and attitudes do not necessarily translate to pro-environmental behaviour as personal and societal barriers may exist or take priority over environmental behaviour (Kennedy et al., 2009; Terlau & Hirsch, 2015). This phenomenon has been deemed the attitude-behaviour gap or environmental-values behaviour gap (Kennedy et al., 2009; Terlau & Hirsch, 2015). Research findings also suggest that people are unsure of their disposal options for damaged or unwearable clothing (Ha-Brookshire & Hodges, 2009) and often opt for trash disposal for these items (Degenstein et al., 2020). This body of literature demonstrates that solutions need to be developed to overcome personal and societal barriers and equip people with the knowledge and ability to carry out disposal behaviour consistent with their environmental values. Individuals need accessible and convenient options so that even those who are not motivated by environmental concern can participate in solutions as well. However, consumers are constrained by the lack of sustainable disposal options available to them.

Beyond the consumer level, industry stakeholders are seeking ways to lower their environmental impacts and close material loops in their supply chains. However, much of these

efforts are siloed and there is a need for greater collaboration amongst stakeholders to move towards circular systems. Finding solutions to clothing waste by shifting away from the current linear economy is highly complex as consumers, industry and government are all implicated in carrying out effective solutions. All stakeholders have varying motivations, capacities and barriers which enable or constrain them to make changes within the textile value chain. Product stewardship, as a tool within the circular economy, presents one way to bridge the attitude-behaviour gap and to address the complexity required of sustainable solutions.

### 1.2 Significance of Study

Despite the environmental consequences of the C&T industry (discussed further in 2.1.1), the problem of textile waste can often be dismissed as it typically accounts for smaller percentages of waste streams and is not considered hazardous or priority waste. However, when the small percentage of textiles in the overall waste stream translates to millions of tonnes being landfilled each year, the problem can no longer be deemed as insignificant. In 2015, all United Nations Member States committed to the 2030 Agenda for Sustainable Development which calls Member States to act on 17 Sustainable Development Goals ("Sustainable Development Goals", n.d.). Many of these goals are directed at ensuring environmental sustainability by tackling issues that contribute to climate change ("Sustainable Development Goals", n.d.). In particular, Sustainable Development Goal 12 relates to responsible consumption and production, emphasizing the need for efficient resource and energy use to reduce our environmental footprint (Gabriel & Luque, 2020). Due to the global reach and environmental impacts of the C&T industry, it becomes clear that the industry is a critical area of concern and must be addressed to help fulfill the Sustainable Development Goals. One of the ways to reach Sustainable Development Goal 12 is through circularity (Gabriel & Luque, 2020). In working towards a circular economy, the results of this study provide potential ways to address and mitigate the environmental impacts of the C&T industry through PS. Through an understanding of PS processes and perspectives for clothing and textiles in one context, recommendations can be made for how to best approach PS in other contexts.

### 1.3 Research Purpose and Questions

It is evident from the growing amount of clothing and textile waste and the lack of sustainable disposal options that we need to move away from the current linear take-make-waste

model that characterizes the fashion industry, towards a circular economy (EMF, 2017). Product stewardship models require manufacturers to take environmental responsibility for their products by finding alternative options to landfilling at the end of a garment's usable life (EcoTLC, n.d.; Lewis, 2016), functioning to increase circularity of the industry. Therefore, the purpose of the research was to explore product stewardship in New Zealand by examining the practical steps taken by an organization working towards the development of a product stewardship scheme (Usedfully) and to identify potential drivers, barriers, and strategies for integrating a product stewardship model for clothing and textiles from the perspectives of industry stakeholders. The main research questions (RQ) of this exploratory research were:

RQ1: How is Usedfully developing a product stewardship scheme for clothing and textiles within New Zealand?

RQ2: Why are stakeholders motivated to participate in product stewardship?

RQ3: How do stakeholders' current sustainable management practices align with product stewardship strategies?

RQ4: What barriers do stakeholders face for participating in product stewardship?

RQ5: How have New Zealand stakeholders' sustainability initiatives been impacted by COVID-19?

RQ1 aimed to address Usedfully's process in developing a product stewardship scheme while RQ2–4 were informed by Lewis' (2016) product stewardship framework. RQ5 was added to account for the global impacts of the COVID-19 pandemic on the industry which was anticipated to have implications on related organizations' sustainability efforts. In answering the research questions, the study will highlight factors needed to move towards greater circularity and lend itself to practical recommendations for clothing and textile product stewardship.

### 1.4 Thesis Outline

This thesis is organized into seven chapters. Chapter 2 covers the relevant clothing and textile literature, including the environmental impacts of the industry as well as linear and circular approaches to addressing these impacts. The methodology for the study is described in Chapter 3, while Chapters 4 and 5 present the case context and description, and the interview and survey findings, respectively. Chapter 6 discusses these findings and relates the study results to the literature. Finally, Chapter 7 concludes with a study summary, limitations of the research, and areas worthy of further study.

# CHAPTER 2: Literature Review

This review begins with an overview of the environmental impacts of the clothing and textile industry from production through disposal in its current linear form. Then, I briefly discuss the global reach of the industry and the various stakeholders who are affected by or can affect change in the industry. An understanding of the scale of the industry and its impacts leads into a review of solutions proposed in the literature and describes the need to look beyond individual stakeholder efforts. The last subsections discuss the required transition from a linear economy to a circular one and how this can begin by implementing product stewardship and by taking a human ecological systems approach. The organization of the literature review follows my own line of discovery of the need to seek holistic and broad solutions to sustainability issues within the industry through product stewardship.

## 2.1 Environmental Impacts of the Take-Make-Use-Waste Linear Model

### *2.1.1 Take and Make: Clothing Production*

The low price of fast fashion garments does not accurately reflect the environmental and social costs of production (Cataldi et al., 2013). Indeed, every stage of the garment life cycle affects the environment (Niinimäki et al., 2020)[1] in the linear fashion economy, known as the "take-make-waste" model (Figure 2.1). The environmental impacts of clothing throughout its lifespan can be summarized into five categories: energy consumption; water consumption; chemical use and release; solid waste production; and carbon emissions (Resta & Dotti, 2015). These impacts differ based on fibre type, production and transport processes, consumer use behaviour and the method of garment disposal. Beginning with the fibre production stage, clothing can be made from natural, regenerated, or synthetic fibres, all of which can have significant environmental consequences (Dissanayake & Perera, 2016) (Table 2.1).

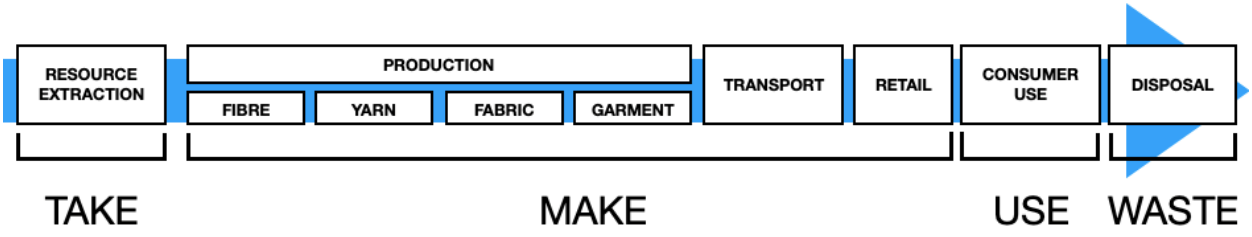


*Figure 2.1: The current linear "take-make-use-waste" model of the clothing and textile industry. This model has been changed to include the use phase, which has significant environmental impacts and is therefore given a separate phase.*

[1] For detailed reviews of the industry's environmental impacts, see Choudhury (2014); Niinimäki et al. (2020).

*Table 2.1: Environmental concerns during production, based on fibre type (Dissanayake & Perera, 2016; Kadolph, 2011; Niinimäki et al., 2020). Fibre types with similar environmental concerns have been grouped together.*

| Fibre Type | | Environmental Concerns |
|---|---|---|
| Natural | Cotton | Freshwater use, pesticide/chemical use, soil erosion |
| | Wool | Soil erosion, shearing practices, energy consumption, freshwater use, carbon dioxide ($CO_2$) emissions |
| | Silk | Freshwater use, chemical use |
| | Flax | Soil erosion, water contamination in retting process |
| Regenerated | Lyocell | Water use |
| | Rayon (Viscose) | Forest clear-cutting, air and water pollution in processing wood pulp, water use |
| | Acetate | Air and water pollution in processing wood pulp |
| Synthetic | Polyester<br>Acrylic<br>Nylon<br>Spandex | Manufactured from non-renewable petrochemicals, energy consumption |

Recent estimates of global fibre production show that polyester fibres make up just over half of total production at 51% (54 million tonnes), with cotton fibres accounting for 25% of production (26 million tonnes) (Niinimäki et al., 2020). These two highly produced fibres represent different, yet significant, tolls that fibre production can have on the environment. As Kadolph (2011) explains, for cellulose to form, temperatures must remain above 21°C (70°F). Cotton crops are therefore grown in areas with temperate to hot climates and require tremendous amounts of water to grow, at least 50 centimetres of rainfall annually. Regions that do not have consistent rainfall must rely on diverting natural water sources for irrigation. Furthermore, cotton crops are often treated with pesticides and other chemicals to enhance growth, which pose problems when these chemicals contaminate surrounding groundwater. While organic cotton is grown without the use of chemicals, it still requires significant amounts of water for production as it has a lower fibre yield than conventional cotton per acre. Further resources including water, chemicals and energy are needed to clean, dye, and finish cotton fabrics. It is estimated that 2,700 litres of water are used to grow the fibre for a single cotton

t-shirt (World Wildlife Foundation, 2013).

As a synthetic or manmade fibre, polyester uses less water in production but is processed from petrochemicals and demands high amounts of energy. Estimates of the energy required for polyester fibre production range from 96–125 MJ/kg while the climate impact per kilogram of fibre produced ranges from 1.7–4.5 kg of $CO_2$ equivalent (Sandin et al., 2019). If the industry continues production on its current trajectory, EMF (2017) estimates that 300 million tonnes of non-renewable resources, including oil and fertilizers/chemicals for fibre manufacturing and processing, will be consumed annually by 2050. In response to resource intensive fibre production, other fibre types with claims of lowered environmental impacts have been introduced to the market. However, the environmental impact data of these newer fibres, such as artificial protein fibres or orange fibres, is not always available and therefore little evidence exists for supporting claims that these fibres are more sustainable (Sandin et al., 2019).

Resource use continues after the fibre manufacturing stage with wet processing in yarn and fabric production. In particular, large amounts of water, energy and chemicals are used to clean, bleach, dye and finish textiles (Niinimäki et al., 2020). Beyond its extensive use of resources, the textile industry has been cited as one of the biggest polluters of fresh water (Kant, 2012). The industry utilizes more than 3600 dyes and 8000 chemicals throughout the manufacturing process, many of which directly or indirectly harm aquatic life, human health, and pollute nearby soil and water sources (Hussain & Wahab, 2018; Kant, 2012). Millions of gallons of textile mill effluent containing toxic substances including heavy metals and formaldehyde are dumped by mills, having drastic impacts on aquatic life and people who are exposed to these chemicals (Kant, 2012). In addition, the textile production stage is a significant contributor of greenhouse gas emissions. In 2015, the industry was responsible for emitting 1.2 million tonnes of $CO_2$ equivalent, more than the combined emissions from international flights and shipping (EMF, 2017). This is anticipated to increase to account for 26% of the global carbon budget in 2050, if production rates continue (EMF, 2017). Estimates about the industry's carbon emissions often do not include the emissions produced through the use phase (Niinimäki et al., 2020), suggesting that the environmental impacts are even higher than assumed.

### *2.1.2 Clothing Use*

As clothing production has ramped up, so too have the purchasing habits of consumers. Consumers in Western nations are now buying up to 60% more clothing than 20 years ago

(Remy et al., 2016) as pressure mounts to keep up with rapidly changing fast fashion trends. The speed of fast fashion turnover creates a feeling of urgency for consumers to buy now since the next time they shop, the items will most likely be gone (Bhardwaj & Fairhurst, 2010; Byun & Sternquist, 2011). Consumers are also likely to wear clothing fewer times before disposal (EMF, 2017). The ease and low cost of garment replacement has meant that mending clothing, and thus repair skills, have become unnecessary (Twigger Holroyd, 2016). Furthermore, the low quality of fast fashion garments can make them unfit for reuse or repair.

Other maintenance practices within the clothing use period such as dry-cleaning or laundering uses extensive resources. Professional dry-cleaning processes utilize solvents that have been linked to groundwater contamination and other environmental hazards (Kadolph, 2011). Each load of laundry performed at home uses over 150 litres (40 gallons) of water, while drying clothes is a very energy demanding process; so much so, that eliminating drying and ironing can reduce the carbon footprint of a t-shirt by one-third (World Wildlife Foundation, 2013). Jack (2013) argues that laundering is a form of inconspicuous consumption as the amount of water, chemicals and energy used in laundry routines are hidden. In her survey of Australian consumers, 52% of respondents stated that they performed laundry out of habit, a more common response than spotting visible dirt on a garment (31%). In addition, almost half (45%) of respondents washed their jeans after only 2–3 wears, suggesting that resource use could be reduced if laundering based on habit was broken. Furthermore, the mechanical action, detergents, and heat used in these habitual laundering practices can cause fibre damage, reducing the lifespan of garments (Laitala et al., 2011). This was demonstrated in McQueen et al.'s (2017) experimental study, which found that jeans that were washed after two wears versus jeans that were washed after 20 wears had less mass, greater colour loss, and decreased tensile strength. Despite washing and drying machines becoming more water and energy efficient, the environmental impact of the use phase is highly dependent on consumers' laundering practices (Laitala et al., 2011).

Attention has also been drawn to textiles as a contributor to the vast amounts of microplastics entering oceans through the release of microfibres during laundering. These synthetic microfibres (<5mm in length) enter the environment through production processes, laundering in the use phase, and from discarded textile fragments (Henry et al., 2019). Approximately 500,000 tonnes of microfibres are shed during washing and enter oceans each

year (EMF, 2017). In their global assessment of ocean microplastics, Boucher and Friot (2017) estimate that microfibres shed from synthetic textiles during the laundering process account for about 35% of primary microplastic pollution. Human health and ecological effects of microfibres can be attributed to physical (ingestion or inhalation), chemical (leaching) and biological (microbial colonization) mechanisms (Henry et al., 2019). While current, albeit limited, research suggests that microfibre exposure levels are not toxic to humans, the long-term impacts of ingestion and inhalation of microfibres on human health is unknown (Henry et al., 2019).

### *2.1.3 Waste: Clothing Disposal*

Finally, the disposal stage of clothing poses environmental harm through the landfilling and incineration of textile waste. Pre-consumer or production waste includes the fibre, yarn or fabric waste created in the manufacturing process as well as unsold or returned product, while post-consumer waste refers to the textiles discarded after the use period (Niinimäki et al., 2020). As previously mentioned, the Ellen MacArthur Foundation (2017) estimates that 48 million tonnes of textiles are disposed of each year (based on volumes of production), with 73% of these items being landfilled or incinerated. Only about 1% of clothing is recycled in a closed-loop process into new products of comparable quality, while approximately 12% of clothing is downcycled into products of lesser quality (EMF, 2017) (issues with textile recycling are discussed in Section 2.3.3).

Waste statistics from around the globe report that textiles make up anywhere from 4.69% (WRAP, 2020) to 7.73% (Environmental Protection Agency, n.d.) of municipal solid waste. However, a lack of regular textile waste monitoring means that we could be disposing of much higher volumes than are reported. In addition, these figures may not account for corporate wear (e.g., uniforms, workwear), which is poorly understood due to limited recording and reporting, but also significantly contributes to total textile waste volumes (Bartlett et al., 2012). Bartlett et al. (2012) estimate that 90% of the 39.2 million garments that were provided to United Kingdom (UK) employees in 2010 were landfilled, incinerated, or shredded. Clothing and textiles that are sent to the landfill can contribute to greenhouse gas emissions as is the case with natural fibres that release carbon dioxide ($CO_2$) and methane as they break down (Barlaz et al., 1997; El-Fadel et al., 1997; MacBride, 2008; Tammemagi, 1999) or can remain in landfills for hundreds of years as is the case with synthetic fabrics (Fedorak, 2006). This is a particular issue when it comes to corporate wear as it is most often made of durable polyester fibres (Bartlett et al., 2012). Added

dyes and finishing chemicals can leach out of textiles as they decompose, which contaminates ground water if the landfill is not effectively lined (Tammemagi, 1999). Furthermore, Li et al. (2010) found that some textile finishes can also slow down the rate of degradation of natural fibres, demonstrating that even clothing made of natural fibres is best kept out of landfills. Incinerated waste is also unfavourable due to the possible release of harmful particulates and contribution to global warming potential, although it is preferred to landfilling when energy is recovered from incineration (European Commission, 2008; Yacout & Hassouna, 2016).

Waste diversion initiatives for clothing are present through direct reuse such as rental models, donation, or private channels; however, the low quality of fast fashion garments might make them unfit for reuse or repair, indicating that waste diversion through reuse may not be a realistic possibility. Only about 20% of donated garments are sold domestically through charities or secondhand shops (Claudio, 2007; Norum, 2017). The rest are either sold to recyclers or rag dealers where they are recycled into lower-grade material such as rags or insulation, which may eventually be landfilled, or baled and shipped to international markets in low-income countries (Claudio, 2007; Degenstein et al., 2021). Buyers of these bales do not know the conditions of the clothing they have purchased (Claudio, 2007), taking a chance that the items inside will be profitable. Unsold clothing can then become an environmental hazard in these low-income countries that do not have the necessary infrastructure to handle the vast amounts of waste by clogging waterways and posing further potential environmental health problems (Bick et al., 2018). Therefore, even current attempts to divert clothing and textile from landfills in Western nations are insufficient for dealing with the scale of waste and are simply shifting the problem elsewhere. It is clear that the C&T industry has detrimental environmental impacts at all stages of the clothing life cycle and that solutions are needed at each stage to curb further destruction.

### 2.2 Clothing & Textile Industry Stakeholders

The clothing and textile industry plays an important role in the global economy (Gabriel & Luque, 2020). As of February 2019, the retail market for apparel was worth $1.7 trillion US (Lissaman, 2019), although Circular Fashion Summit (2020) estimates the market share of the industry to be $3 trillion. The industry has grown substantially over the past 20 years in terms of greater locations of production and the ability for more countries to increase consumption as disposable income rises. Increased apparel sales are anticipated as the middle-class population of countries with emerging economies rises, as in China, Brazil, India, Mexico, and Russia (Remy

et al., 2016). For many low-income countries, participating in clothing and textile production is the first step towards industrialization due to the ease of market entrance, low start-up costs and the relatively low-skilled labour force it requires (English, 2013; Fukunishi & Yamagata, 2014). Many countries rely on the industry as a major share of their exports and for providing employment to over 300 million people globally (Euromonitor International, 2016 as cited in EMF, 2017). For example, ready-made garment exports accounted for 83% of Bangladesh's total exports in 2020 (Statista, 2020a).

Stakeholders within the industry include not only fashion brands, producers, retailers, and consumers, but auxiliary industries, government, and non-governmental organizations (NGOs) (Figure 2.2). Auxiliary industries include agriculture and petrochemical industries in the production of fibres (Niinimäki et al., 2020), chemical industries involved in the dyeing and finishing of textiles, and transportation services used throughout the supply chain. Governments at the local, state or provincial, and national level play important roles in creating legislation that mandate how textiles can be produced (i.e., working conditions and standards), consumed (i.e., consumer education) and disposed of. For instance, in 2017, Markham, Ontario became the first North American municipality to ban textiles from curbside garbage collection to divert textiles from landfill and facilitate textile reuse and recycling (City of Markham, n.d.). Residents drop off their unwanted textile items at bins across the city where they are picked up by charities that sort the items for resale or recycling (Javed, 2017). Within the first nine months of the program, the city collected 1.4 million kilograms of textiles (Javed, 2017), demonstrating the important role that government intervention can have for textile waste diversion.

In addition, NGOs such as Fashion Revolution, Remake, Fashion Takes Action, Textile Exchange, and the Waste and Resource Action Programme (WRAP) advocate for change within the fashion industry and educate the public on the industry's social and environmental impacts. For instance, since 2014, Canada's Fashion Takes Action has delivered educational workshops to over 22,000 students on responsible fashion consumption (Fashion Takes Action, n.d.). NGOs' efforts extend beyond educational campaigns and can play important roles in connecting internal and external stakeholders, conducting environmental impact and waste reduction research, and recommending relevant industry policies to government. Diverse efforts such as these are

exemplified by the Ontario Textile Diversion Collaborative (OTDC), led by Fashion Takes Action, which has developed a textile waste audit template for municipalities and is working to reverse Canadian legislation that encourages retailers to landfill obsolete or surplus products through a drawback or refund program (Government of Canada, 2016; OTDC, n.d.) Again, NGO's serve an essential stakeholder role in transforming the industry to be more sustainable.

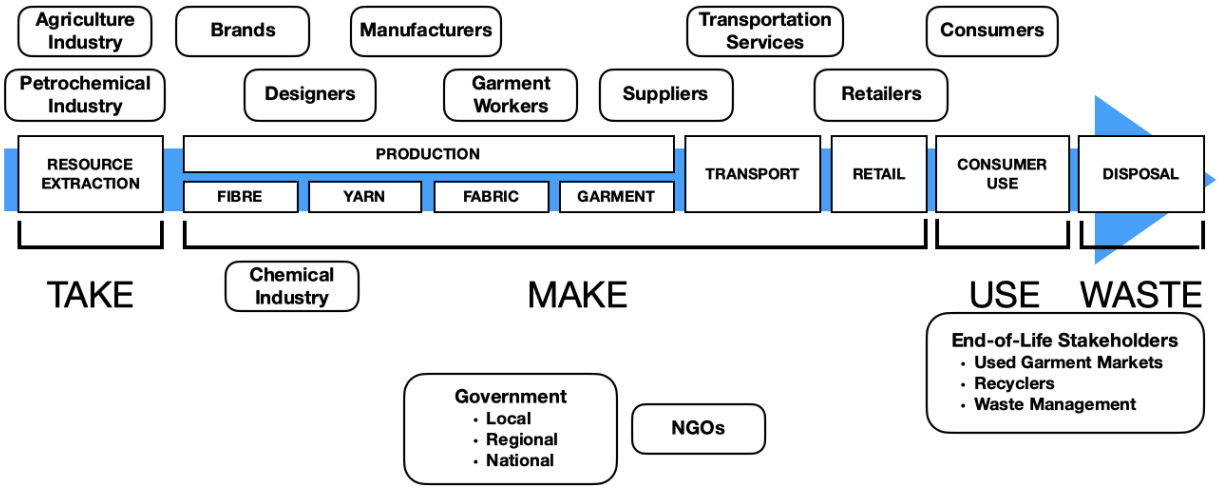


*Figure 2.2: Stakeholders in the clothing and textile industry organized by their most relevant position in the linear value chain. Many stakeholders' roles can extend to multiple positions in the value chain (e.g., government and NGOs).*

The broad reach of the industry demonstrates the importance of both within-industry and cross-industry collaboration when searching for sustainable solutions. However, different stakeholders have varying levels of influence or power in inciting change in the industry. Power asymmetries exist between and within stakeholder groups. For instance, governments hold power by being able to make legislation that dictate what industry or consumers can and cannot do. Within industry, large companies such as H&M will have much greater influence over other stakeholders and can more easily coordinate activities needed for a systems transition (Lahti et al., 2018). Further, large brands are in more secure positions, financially, to change their practices to be more sustainable and invest in circular solutions (Lahti et al., 2018).

Despite the mechanization of many textile processes, garment construction remains highly labour intensive, which means that to remain inexpensive and competitive, companies have sought to produce in countries with low labour costs (Niinimäki et al., 2020). In the search for the lowest cost of production, the C&T supply chain has become highly fragmented with

greater separation between sites of design, production, consumption, and disposal, making environmental impacts all the more difficult to address. Brands have begun making their supply chains public so that consumers have information on the conditions of garment manufacturing. However, the possibility of factories subcontracting orders clouds supply chain transparency as brands themselves may be unaware of all production practices or locations within their supply chain (Harris et al., 2016; Rathinamoorthy, 2019). This lack of transparency can be used as an excuse by brands for why they do not take accountability for the supply chain, since there are some acts of production that are beyond their control. Furthermore, many producers do not currently have mechanisms in place to take back their products, so the end-of-life opportunities remain out of their control as well.

With industry fragmentation and intense pressure to meet manufacturing deadlines comes serious labour and human rights violations. Garment workers are often subject to harsh working conditions and long hours (Claudio, 2007; Remy et al., 2016). Hazardous working conditions have led to respiratory health issues and cancer from poor ventilation (Bick et al., 2018; Gallagher et al., 2015) and worker depression (Gnanaselvam & Joseph, 2018). Fears of unionizing due to possible physical repercussions and job termination prevent improvements to working conditions (Human Rights Watch, 2015). One of the most high-profile examples of the industry's hazardous working conditions was the Rana Plaza factory collapse in Bangladesh in 2013 which killed over 1,100 workers and injured thousands more (Brydges & Hanlon, 2020). Despite horrific and preventable events such as this, safety standards have not considerably improved (Taplin, 2014). These issues were compounded with the COVID-19 pandemic when numerous brands cancelled orders, some on products already produced and shipped, leaving millions of workers unpaid for their labour (Clean Clothes Campaign, 2020). Within three months of the pandemic, brands owed garment workers an estimated $3.19–5.79 billion (US) (Clean Clothes Campaign, 2020). Thus, the pandemic has only served to reinforce the deep inequalities between brands, retailers, and garment workers (Brydges & Hanlon, 2020). Not only do changes need to be made to protect the health of the planet but also the health and lives of garment workers.

An industry so reliant on natural and human resources must change the way it operates if it wants to survive a future where finite resources are even more scarce. However, degrowth cannot come at the expense of completely ending manufacturing as this would have social and

economic consequences for countries with high levels of textile exports (Niinimäki et al., 2020). Strategies are needed to continue to support an industry that is the livelihood for so many, but in a manner that prevents further exploitation of the environment and those working in the industry. While the number of players in the industry implies fierce competition and power differentials, it also means that countless opportunities exist for stakeholders to come together to incite effective change in the industry, should they be willing to do so.

## 2.3 Current Solutions to Clothing and Textile Environmental Impacts

### *2.3.1 Production Stage*

Efforts to address the environmental impacts of clothing production, use and disposal have arisen through the respective stages of the value chain. These proposed solutions have often focused on changes made by individual stakeholders, although in recent years there has been a shift towards collaboration and finding connections between individual stakeholder solutions. Beginning with the design stage, fashion designers and brands are taking steps to reduce the environmental impacts of a garment before it is even created. The design stage is incredibly important when considering the lifespan of a garment, particularly material choice, as it dictates "the overall footprint of clothing from cultivation (land, fertilizer, water use) to processing (energy, chemical and water use) to use (microplastics pollution) and ultimately recyclability at end of use" (Lacy et al., 2020, p. 186). The fashion market is incorporating the use of sustainable fibres, primarily organic cotton and recycled polyester (Dissanayake & Perera, 2016), as well as fibres made from biodegradable materials including pineapple leaves (Piñatex®), milk protein (Qmilk), algae biomass (BLOOM™ Foam), microbes (BioCouture), and by-products of citrus juice (Orange Fibre). However, textiles made from these materials remain mostly niche products (Dissanayake & Perera, 2016). Research into the production of bio-inspired polymers (termed biomimicry) that imitate the functional properties of nature such as mechanical strength and moisture absorption is another promising avenue for sustainable fibres (Dissanayake & Perera, 2016).

In addition to material choice, designers can consider the functional or aesthetic shortcomings of clothing that cause consumers to dispose of their garments. Laitala et al. (2015) examined the reasons for clothing disposal in 16 Norwegian households and, in response, recommended design strategies to extend the useful life of clothing. For fit and size issues, the

researchers suggest "[increasing] the user involvement in design by trying sample patterns on differently sized and shaped bodies, instead of basing the grading on small model sizes" (p. 101) to accommodate for various body types as well as improving garment size labels to be more accurate and standard among different brands. Production techniques such as increasing the seam allowance or cutting patterns diagonally would accommodate for changing wearer size or increase flexibility of the garment, respectively (Laitala et al. 2015). These changes would enable garments to fit properly upon purchase but also extend the life of the garments by allowing them to change along with the wearer. In response to physical changes in clothing such as pilling, Laitala et al. (2015) recommend designers choosing higher quality materials that are intended for garment use and implementing quality control measures.

Other improvements at the design stage include modular design or designing for easier sorting and disassembly to enable reuse or recycling of either entire garments or garment parts (Durham et al., 2015; Karell & Niinimäki, 2019). In addition, zero-waste apparel design and pattern cutting can be implemented to maximize fabric use (Carrico & Kim, 2014; Ramkalaon & Sayem, 2020). In traditional pattern cutting, the full width and length of the fabric are not used because irregularly shaped garment pattern pieces are placed with fabric spaces between them (Carrico & Kim, 2014; Ramkalaon & Sayem, 2020). Therefore, zero-waste approaches maximize fabric use by strategically designing, configuring, and cutting patterns using different techniques to eliminate fabric scraps in the production process (Carrico & Kim, 2014; Ramkalaon & Sayem, 2020). Clothing personalization such as custom-made garments or otherwise involving the wearer in the design process has also been suggested to strengthen wearer attachments to garments and thus prolong the life of clothing (Maldini et al., 2019; Niinimäki & Hassi, 2011). However, in their wardrobe study of 40 participants in the Netherlands, Maldini et al. (2019) found that personalized clothing was not kept nor worn more often than ready-made garments. While this is only one study, the findings demonstrate the need for additional studies to determine the effectiveness of product personalization and other design strategies for prolonging garment lifespans (Maldini et al., 2019).

Life cycle assessment (LCA) tools are used to analyze environmental impact categories such as carbon emissions, ecological and water footprints, acidification, human toxicity, and eutrophication of products through its lifespan (Muthu, 2015). Researchers have used LCA to determine the impacts of different fibre types (Astudillo et al., 2015; Henry et al., 2015; Rana et

al., 2015; van der Velden et al., 2014), the use of clothing libraries (Zamani et al., 2017), and reuse/recycling of donated clothing (Woolridge et al., 2006). The Higg Materials Sustainability Index (MSI) developed by the Sustainable Apparel Coalition and the MADE-BY Fibre Benchmark are the most commonly used tools for assessing impact categories of different fibre types (Laitala et al., 2018). These tools are useful in guiding industry stakeholders in analyzing their performance throughout the supply chain (Ravzi, n.d.). While the first edition of the Higg MSI only covered the impacts from resource extraction to garment construction, the second edition set to launch in 2021 includes impacts from distribution to the post-consumer use stage (Ravzi, n.d.). Laitala et al. (2018) emphasize the importance of including the use phase in product comparisons based on fibre type as different fibres affect the functionality and required care of the product.

To differentiate fast fashion garments from sustainably made articles of clothing, the addition of garment eco-labels or certifications provide consumers with information regarding the environmental impacts of products at various life cycle stages (Clancy et al., 2015). Eco-labels act as communication tools and certify that a product is made using specific materials or manufacturing processes with lower environmental impacts, that they are safe for consumers, or that they are made under certain working conditions (Almeida, 2015; Henninger, 2015). Over 100 eco-labels apply to textiles (Almeida, 2015). Certifications for clothing can be industry specific in that they only are used for textile products or apply to various industries and products as is the case with B Corporation, Forest Stewardship Council and World Wildlife Foundation (Henninger, 2015). Furthermore, certifications can apply to a company or to an individual product. Clancy et al. (2015) point out that greater attention has been paid to the upstream value-chain processes (i.e., production processes) than the downstream processes such as reuse, recycling, and disposal. This focus is reflected in garment eco-labels as most certifications in Table 2.2 relate to sustainable production processes. While eco-labels can help guide consumer decision making (Henninger, 2015), eco-labels "cannot guarantee that a product is more environmentally sustainable overall compared to one without an ecolabel" (Clancy et al., 2015, p. 346). The lack of comparability and the sheer volume of applicable eco-labels may confuse consumers if the meaning of the label is not understood, therefore lowering the value of an eco-label as a consumer communication strategy (Harbaugh et al., 2011; Henninger, 2015; Joshi & Rahman, 2015).

*Table 2.2: Summary of select textile certifications related to environmental and social impacts.*

| Certification | General Certification Criteria | Industry Specific[1] |
|---|---|---|
| B Corporation | Overall environmental/social performance (B Corporation, n.d.). | No |
| Better Cotton Initiative (BCI) | Sustainable farming and cotton sourcing (Better Cotton Initiative, n.d.). | Yes |
| bluesign® | Consumer safety, environmental/social performance, responsible resource use (Bluesign, n.d.). | Yes |
| Cradle to Cradle (C2C)™ | Overall environmental/social performance (Cradle to Cradle, n.d.). | No |
| Fairtrade | Sustainable farming, fair trade, production conditions (Fairtrade International, n.d.). | No |
| Forest Stewardship Council (FSC) | Environmental performance, forest management (Forest Stewardship Council, n.d.). | No |
| Global Organic Textile Standard (GOTS) | Organic fibres, environmental/social performance, supply chain practices (Global Organic Textile Standard, n.d.). | Yes |
| Global Recycle Standard | Recycled content, environmental/social performance, chain of custody (Textile Exchange, n.d.-a). | No |
| Oeko-Tex | Harmful substances, production conditions (Oeko-Tex, n.d.). | Yes |
| Organic Content Standard Certification | Organic fibres, chain of custody (Textile Exchange, n.d.-b). | Yes |
| PETA-Approved Vegan | Animal welfare, vegan products (PETA, n.d.). | No |
| Regenerative Organic Certified (ROC) | Animal welfare, soil health, social fairness (Regenerative Organic Certified, n.d.). | No |
| Responsible Down Standard | Animal welfare, chain of custody (Textile Exchange, n.d.-c). | Yes |
| Responsible Wool Standard | Animal, land and social welfare, chain of custody (Textile Exchange, n.d.-d). | Yes |
| ZQ Wool | Animal welfare, environmental/social performance (ZQ, n.d.). | Yes |

[1]Refers to whether the certification applies specifically to the textile industry and/or textile materials/products.

Following the design phase, improvements in other processes in the supply chain have been developed to reduce resource use in various stages of production, dyeing, finishing, and transport. Developments that seek to reduce environmental impacts at a broader level include sustainable or green supply chain management and lean production. Sustainable or green supply chain management is:

> the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements (Seuring & Müller, 2008, p. 1700).

Companies working within the supply chain must fulfill these requirements to stay within it (Seuring & Müller, 2008). Sustainable supply chain management has been applied to the textile industry in studies by Diabat et al. (2014), Oelze (2017), Turker and Altuntas (2014), and Zimon and Domingues (2018). Lean production is a management technique that focuses on the continuous improvement of products and processes by the ongoing identification and elimination of waste sources (Nicholas, 2010). Here, waste refers to processes or activities such as space, transport, inventory, labour, or resources that do not add value to the final product (Maia et al., 2013). Within this strategy, all employees are trained to identify and eliminate waste that slows down the supply chain (Nicholas, 2010). Lean production in the textile and clothing industry has been examined in studies such as Bruce et al. (2004), Hodge et al. (2011), Maia et al. (2013, 2019) and Raj et al. (2017).

Taking a narrower approach, Choudhury (2014) describes several techniques to minimize waste or resource use during wet processing including substituting chemicals with less harmful alternatives; reuse and recovery of water, chemicals, and dyes, where possible; and machinery automation to control volumes and processes, among others. Additional water conservation practices and innovations were reviewed by Hussain and Wahab (2018). They discussed several techniques for the treatment of wastewater using methods such as filtration techniques, reverse osmosis, ozonation, electrochemical treatment, ion exchange and chemical coagulation. Due to the various temperatures, pH levels and chemicals used, a combination of these techniques is often required to make water reusable. Innovations for water use prevention include enzyme or plasma pre-treatment and alternative dyeing methods (micelle, foam, or electrochemical dyeing). In particular, the authors highlight the use of supercritical $CO_2$ (SC-$CO_2$) dyeing[2] to dye textiles and low liquor ratio machines (reducing the liquor required to dye a specified amount of textile material) as water conservation techniques. However, the cost, complexity, and absence of

[2] Supercritical $CO_2$ refers to carbon dioxide at a specific pressure and temperature that possesses the characteristics of both a liquid and gas (Eren et al., 2020).

infrastructure to implement water conservation strategies limits the feasibility of some of these options (Hussain & Wahab, 2018).

Further along the supply chain, a report by McKinsey and Global Fashion Agenda (GFA) (2020) suggests changes that fashion brands can take within their direct operations to reduce greenhouse gas emissions, including improved transport, packaging, and retail operations. Improved transport would mean relying more on sea transportation as opposed to air transport and the electrification of transport fleets. Packaging improvements entail greater use of recycled materials and lighter packaging while decreased emissions from retail operations could be achieved by reducing energy consumption (e.g., lighting, heating, ventilation) in physical retail stores. Additionally, minimizing e-commerce returns and reducing overproduction would contribute to lowered emissions. These decarbonization tactics could save up to 18% of emissions should they be implemented (McKinsey & GFA, 2020).

### *2.3.2 Use Stage*

Within consumer behaviour literature, responsibility to lower the environmental impacts of clothing during the use phase is put on the consumer two-fold; consumers must become aware of clothing sustainability issues and demand change from the industry, while also changing individual clothing practices to be more sustainable (Claudio, 2007). In the former case, efforts are premised on the idea that increasing consumer knowledge of the industry's impacts will cause them to pressure unsustainable brands to change their practices. Studies support the need for consumer education and engagement to improve the sustainability of their consumption and to help them distinguish sustainable products (Joshi & Rahman, 2015; Kant Hvass, 2014), consequently increasing demand for these items. As for the latter, individuals are encouraged to reduce consumption, purchase secondhand or sustainable clothing, repair, launder less frequently or at lower temperatures, and dispose of clothing through donation or recycling channels (Claudio, 2007). Research has accordingly sought to determine which consumer segments are more likely to adopt sustainable clothing behaviour based on variables such as clothing consumption rates (Gwozdz et al., 2017), interest in fashion (Weber et al., 2017), or environmental knowledge or attitudes (Hiller Connell & Kozar, 2014). However, studies have found that stated environmental knowledge or attitudes do not always lead to environmental action, which is known as the attitude-behaviour gap, environmental-values behaviour gap, or intention-behaviour gap (Carrington et al., 2010; Kennedy et al., 2009; Rausch & Kopplin, 2021;

Terlau & Hirsch, 2015). For instance, Park and Lin (2020) investigated the attitude-behaviour gap among Korean participants in their intention and actual purchasing of secondhand and upcycled fashion products, with an understanding of attitudes being a weak predictor of sustainable purchasing. As anticipated, over 35% of participants stated that they intended to purchase either secondhand or upcycled fashion products but did not follow through in the behaviour.

Other studies have also explored ways to bridge the attitude-behaviour gap by identifying the barriers for carrying out sustainable behaviours (Jacobs et al., 2018; Rausch & Kopplin, 2021; Wiederhold & Martinez, 2018). These real or perceived barriers for practicing sustainable clothing behaviour can prevent people from acting in a manner consistent with their environmental attitudes. These barriers include the price of purchasing ethically made garments compared to mainstream retailers (Kozar & Hiller Connell, 2017; Wiederhold & Martinez, 2018); the cost, time, or skills to repair damaged clothing (Gibson & Stanes, 2011; Goworek et al., 2012); the availability of sustainable clothing in varying sizes, styles or product categories (Hiller Connell, 2010); or the impression that sustainable clothing is less fashionable (Joergens, 2006; McNeill & Moore, 2015). Furthermore, simply providing consumers with sustainable clothing consumption options is not enough to change behaviour as consumers are diverse when it comes to their sustainability concerns (i.e., animal welfare concerns versus labour concerns) (Harris et al., 2016). Laitala et al. (2014) aptly summarize that “to place the responsibility for change on consumers is to give the responsibility to those without the means to take it” (p. 146). While studies solely focusing on consumer efforts are no doubt useful in understanding consumers as a vital stakeholder in the C&T industry, they are inadequate to address the full complexity of the problem if they do not advocate for systems change. Therefore, interventions to promote more sustainable clothing behaviour must happen both at the individual and societal level (Harris et al., 2016).

### *2.3.3 End-of-Life Stage*

Once a garment is no longer wanted or considered of value to the owner in its current form, it has reached the end-of-life stage. In other words, the item will not be reused in some way by another consumer, but instead will be turned into a different product or thrown away. Within the linear economy, strategies to reduce the environmental impacts of the industry at the end-of-life stage typically align with the waste hierarchy approach of reduce, reuse, recycle,

energy recovery, with landfilling as the least preferable option (European Commission, 2008). Where clothing consumption cannot be reduced or garments directly reused, recycling is the next best option. If textile products cannot be recycled, these materials can be used as feedstock for ethanol production (Jeihanipour & Taherzadeh, 2009; Nikolic et al., 2007; Taherzadeh & Karimi, 2007) or waste-to-energy processes via incineration (Bartl, 2011; Hawley, 2006). While these options provide alternatives to landfilling, keeping garments in its highest possible value through direct reuse is preferred.

Clothing for recycling is often collected via charity donations that are unfit for direct resale and instead sold to recyclers (Hawley, 2006) or through retailer/brand take-back schemes (Hawley, 2015). In mechanical recycling, textiles are cut and shredded into small fibrous pieces where it is re-spun into yarn or used in nonwoven textile manufacturing (Payne, 2015). Textiles that are chemically recycled are broken down to its polymer form and then repolymerized before fibre extrusion (Payne, 2015). Depending on the condition of the textile, it is either recycled in an open-loop process (downcycled) whereby the quality of the resulting product is decreased or recycled in a closed-loop process where textiles are reverted to its raw materials to be made into a new textile product (Hawley, 2015; Payne, 2015). Downcycled products include rugs, mattress stuffing, wiping materials, and pet bedding (Hawley, 2015).

While textile recycling is beneficial as it can save resources by eliminating the need for new materials (Payne, 2015), there are a number of factors that make current recycling processes difficult. First, there is limited infrastructure and coordinated efforts for the collection and recycling of textiles (Lacy et al., 2020; Payne, 2015). To improve recycling rates, Lacy et al. (2020) suggest partnerships between secondhand retailers and delivery companies to better receive, organize, and prepare textiles for recycling. Second, the energy savings from recycling materials instead of virgin fibre production depends on the state of the fibre being recycled. For example, Bartl (2011) explains that there are greater energy savings if the process maintains and reuses the fibrous structure (termed “recovered fibres”) than if the fibre needs to be melted down, thus losing its fibrous structure, and re-spun (p. 174). However, recovered fibres are typically damaged and shortened in mechanical separation processes, ultimately lowering the quality of the fibre (Bartl, 2011). Third, the increased cost and lowered performance of garments made from closed-loop recycling processes relative to virgin materials is also seen as a hindrance on industry recycling and instead many items are downcycled (Lacy et al., 2020).

Durham et al. (2015) state that the design of clothing does not facilitate recycling due to the multitude of fibre types (often intimately blended), fabrics, and metals/plastics that can be found in a single garment. The heterogeneity of materials makes them difficult to separate economically for mechanical recycling. Instead, it is preferred when a garment is made of one type of polymer or when garment pieces composed of different materials are easy to separate (Durham et al., 2015). Technological limitations in terms of automated sorting as well as mechanical and chemical recycling processes also hinder efficient sorting and recycling (Filho et al., 2019). One way to automatically sort textile waste is to use infrared spectroscopy, which identifies materials based on its chemical groups when exposed to infrared light and the resultant spectral data is compared to a known fibre sample (Houck, 2009). In their study identifying pre- and post-consumer textiles using a near-infrared spectrometer, Cura et al. (2021) found that factors such as fabric thickness or thinness, finishes or coatings, colourants, and even the age of the textile can affect the accuracy of fibre identification. The authors suggest further studies to examine how these factors can be accounted for in the identification and sorting process. A recent report by Circle Economy (2020) has highlighted the inaccuracy of fibre composition on clothing labels, with only 59% of studied labels listing the correct fibre content, demonstrating additional complications for garment sorting and separation. Furthermore, producers are not required to disclose the source of recycled fibres (i.e., from textile waste or other waste streams such as plastic bottles), although standards for recycled materials are gaining importance as popularity for these fibres grow (Weber, 2019). An accurate understanding of the fibre composition of a textile is important to find end-of-use or end-of-life solutions that will keep the textile at its highest possible value. In summary, significant logistical, technological, and economic barriers hinder closed-loop textile recycling.

All of these individual solutions are needed at various stages of the value chain to lower the industry's overall environmental impacts (summarized in Table 2.3). However, these efforts cannot exist in isolation of one another; collaboration amongst stakeholders is necessary if the goal is to achieve a sustainable and circular system for the C&T industry.

*Table 2.3: Proposed stakeholder actions to lower the environmental impacts of the C&T industry.*

| Stakeholder | Proposed action to lower environmental impact |
|---|---|
| Designer | • Design for longevity; user involvement (Laitala et al., 2015)<br>• Design for recyclability (Durham et al., 2015) or sortability (Karell & Niinimäki, 2019)<br>• Design using recyclable or recycled materials (Laitala & Klepp, 2011)<br>• Use new, sustainable fibres; biomimicry (Dissanayake & Perera, 2016)<br>• Product personalization; involve the consumer in the design process (Maldini et al., 2019; Niinimäki & Hassi, 2011)<br>• Zero-waste apparel design (Carrico & Kim, 2014; Ramkalaon & Sayem, 2020)<br>• Eco-labels (Almedia, 2015; Clancy et al., 2015; Henninger, 2015) |
| Brands | • Life cycle assessments (Astudillo et al., 2015; Henry et al., 2015; Muthu, 2015; Rana et al., 2015; van der Velden et al., 2014; Woolridge et al., 2006; Zamani et al., 2017)<br>• Green or sustainable supply chain management (Diabat et al., 2014, Oelze, 2017, Turker & Altuntas, 2014; Zimon & Domingues, 2018)<br>• Lean production (Bruce et al., 2004, Hodge et al., 2011, Maia et al., 2013, 2019; Raj et al., 2017)<br>• Transport improvements, reduce or use recycled packaging, reduce energy consumption, minimize returns, and reduce overproduction (McKinsey & GFA, 2020) |
| Producers | • Chemical substitution, reuse or recover resources (Choudhury, 2014)<br>• Water conservation techniques (Hussain & Wahab, 2018) |
| Retailers | • Take-back schemes (Hawley, 2015)<br>• Consumer education (Joshi & Rahman, 2015; Kant Hvass, 2014)<br>• Reduce energy consumption in retail stores (McKinsey & GFA, 2020) |
| Consumers | • Reduce consumption, reuse, repurpose, and repair (Claudio, 2007)<br>• Reduce laundering frequency (McQueen et al., 2017) |
| End-of-life stakeholders | • Textile recycling (Bartl, 2011; Cura et al., 2021; Durham et al., 2015; Filho et al., 2019; Lacy et al., 2020; Payne, 2015)<br>• Waste-to-energy (Bartl, 2011; Hawley, 2006; Jeihanipour & Taherzadeh, 2009; Nikolic et al., 2007; Taherzadeh & Karimi, 2007) |

## 2.4 Circular Approaches for Addressing Clothing and Textile Environmental Impacts

### *2.4.1 Circular Economy*

Research points to the need for a more holistic approach to tackle the environmental issues of the clothing and textile industry, with an understanding that both individual and

collective action is required. Niinimäki et al. (2020) argue that we must abandon the fast fashion model to ensure a stable future for the industry, which will require collaboration and changing the mindsets of industry and consumers. Abandoning the fast fashion model in its current form would mean to transition from a linear to circular economy (CE). EMF (2013) defines the CE as:

> an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models (p. 7).

While other definitions of the CE are presented in the literature, Kalmykova et al. (2018) identified maximizing resource value, eco-efficiency (minimizing resource use), and waste prevention as common principles among definitions. These principles are realized using the 4R's of Reduce, Reuse, Recycle, and Recover (Kalmykova et al., 2018). In essence, the CE is the opposite of the linear economy; individuals "become users and creators" instead of consumers (Stahel, 2015 cited in Stahel, 2016, p. 435); resources are minimized, used longer, and at their highest value; and materials and products are recycled after use (WRAP, n.d.). The aim of the circular business model is not to make a profit from selling large volumes of product; rather, profits are made "through the flow of resources, materials, and products over time, including reusing goods and recycling resources" (Lahti et al., 2018, p. 3). The emphasis on "units sold" is transferred to "times used" (Circular Fashion Summit, 2020, p. 18). This transformation requires stakeholders to collaborate and coordinate with one another to close production loops by developing models that resemble the cyclical flows and resource use of nature (Lahti et al., 2018). Within the circular economy, resource and energy limits are recognized in the global "system" and efforts are made to minimize waste and resource or energy use (Ki et al., 2020; Lahti et al., 2018, p. 4). In fact, one of the main goals of the circular economy is to eliminate the final stage of the linear model — the waste stage (Rathinamoorthy, 2019). Therefore, the CE incorporates a proactive approach to waste minimization by preventing or reducing waste in the first place (Niinimäki et al., 2020).

While sustainability and the circular economy are not mutually exclusive, transitioning to a CE is key to achieving sustainability in the clothing and textile industry. Geissdoerfer et al. (2017) categorized this as a conditional relationship between CE and sustainability in that circularity is a necessary component for attaining a sustainable system. Gardetti (2019), describes the necessity of circularity when he states:

> And, of course, as sustainability is systemic, we cannot talk about sustainability without referring to the circular economy. The circular economy is based on the natural operation of the universe. It leads us to a comprehensive understanding of our context, and reappraises the resources we use to conduct an undertaking. It guides us to a more frugal, less fictitious way of living, considering every circumstance within its context and becoming aware of the impact of every action we take (p. 1).

Gardetti's quote, when applied to the clothing and textile industry, implies careful consideration of all processes from garment design to the end-of-life stage.

The Ellen MacArthur Foundation (2017) outlines three principles of the CE: "design out waste and pollution; keep products and materials in use [at their highest value]; and regenerate natural systems" (p. 48). Designing out waste involves intentional design using non-toxic biological components that can be composted or high-quality technical components that can be used again through disassembly and refurbishment. Extending the use of materials and products is possible by creating diverse and resilient systems that prioritize versatility, modularity, and adaptivity. Resiliency is achieved through better management of resources, helping to mitigate the risks of resource scarcity and volatile resource costs (EMF, 2017; Gardetti, 2019; PwC, 2019). Within the CE, durable products are reused and recycled so that resources are conserved and recirculated (EMF, 2017). The resultant circular systems should ultimately rely on renewable energy sources instead of fossil fuels and support regeneration by "returning valuable nutrients to the soil" (EMF, 2017, p. 49).

In applying these circular principles to the C&T industry, textile value chain functions are grounded in a cradle to cradle approach (Kazancoglu et al., 2020) whereby the entire life of a garment, including the end-of-life options, is considered in the design and production phases (Sherratt, 2013). Virgin natural fibres, recycled synthetic fibres, production waste, and post-consumer waste are all used as raw material inputs (Kazancoglu et al., 2020). Resource use is reduced in terms of fibre production while also implementing more sustainable production practices that reduce the use of water, chemicals, and energy. Textile products are designed with longevity in mind, by using high quality materials and durable production techniques that are fit for the item's functional purpose. Garment life extension strategies such as reuse and repair are employed during the use phase (Sillanpää & Ncibi, 2019). An additional step of collecting production waste or end-of-life textiles is then added to the value chain where these materials are sorted based on condition and reusability to either be recycled or used as inputs at the beginning of the production cycle, as textiles at the end-of-life stage are no longer considered waste

(Kazancoglu et al., 2020). In effect, the value chain becomes a closed loop, with materials and processes flowing in a self-sustaining, cyclical manner (Kazancoglu et al., 2020) (Figure 2.3).

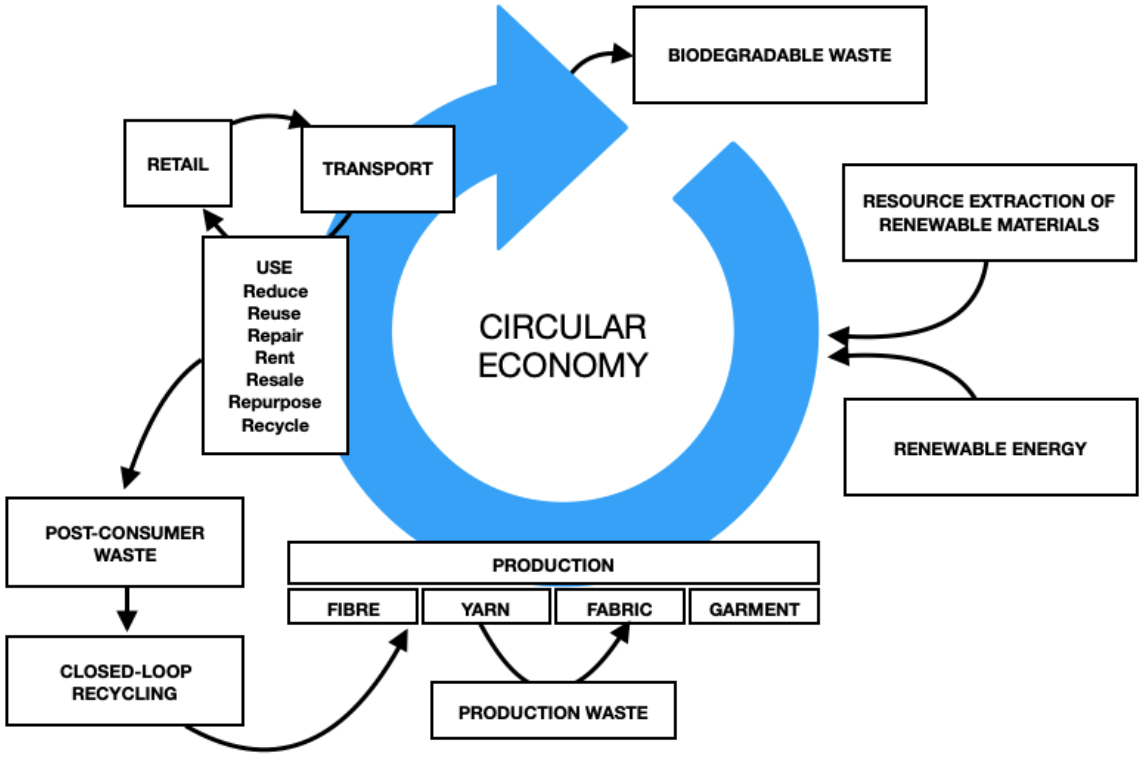


*Figure 2.3: Circular economy model for the clothing and textile industry.*

In general, academic publications related to circular fashion (CF) have increased since 2017 and been mainly exploratory and qualitative (Ki et al., 2020). NGOs and fashion brands have also begun to release reports on how the industry can transition to a circular model (Kalmykova et al., 2018). Publications differ on the scope of the circular initiative (e.g., from substances to entire systems) and the stage of development (e.g., from planning stage to market implementation) with CE initiatives addressing mostly the use and recovery stages of the value chain (Kalmykova et al., 2018).

Jia et al. (2020), Kazancoglu et al. (2020) and Ki et al. (2020) reviewed the available CF literature and developed conceptual frameworks for drivers, barriers, strategies, and practices for implementing circular fashion which range from specific to general (Table 2.4). These drivers, barriers, strategies, and practices can be categorized as being internal or external to C&T industry stakeholders (Ki et al., 2020). In summary, these studies found stakeholders are motivated to implement CF practices for several reasons including improving the environmental

impacts or health effects of their products; customer or competitor pressures; government regulation; to be seen as an industry leader; or to create new business opportunities. In fact, a recent report published by the Circular Fashion Summit (2020) estimates that circular fashion could be a $5.3 trillion market. Sillanpää and Ncibi (2019) argue that the C&T industry is "one of the industrial sectors with major opportunities for CE for resources' reduction (primary ones), recovery, and recycling, with substantial economic and environmental benefits" (p. 152).

However, stakeholders face obstacles in CF implementation due to limited stakeholder knowledge/awareness, lack of technical and physical infrastructure, lack of policy or enforcement, and financial barriers, among others (Jia et al., 2020; Kazancoglu et al., 2020; Ki et al., 2020). To overcome these barriers, the literature suggests various strategies to enable easier and effective CF practices (Ki et al., 2020). These strategies include collaborating with other stakeholders, incorporating CE principles in the design phase, or setting up take-back programs for waste textiles. Additional factors suggested to enable CF found in the literature include support from management, stakeholder education and training, financial support, improved infrastructure, raising consumer awareness and support of CF initiatives, and increased support from government (Ki et al., 2020). In terms of actual CF practices adopted by C&T stakeholders, Ki et al. (2020) categorized these as closing resource loops (keeping materials and products in circulation through closed- and open-loop recycling and avoiding incineration/landfilling); slowing resource loops (designing and producing products to be used longer); and narrowing resource flows (using less resources to make the product). Additional circular practices include collaborative relationship development between stakeholders throughout the supply chain, product re-design, pollution prevention through supply chain changes, innovative product design, and product stewardship (Jia et al., 2020).

*Table 2.4: Internal and external stakeholder drivers, barriers, practices, and suggested strategies and enablers for implementing circular economy practices (Jia et al., 2020; Kazancoglu et al., 2020; Ki et al., 2020). Note that this is not an exhaustive list of all potential drivers, barriers, practices, strategies, and enablers.*

| | |
|---|---|
| **Drivers** | • New business models<br>• Competitive pricing<br>• Leadership and commitment<br>• Community/consumer knowledge or pressure<br>• Competitor pressure<br>• Government support/legislation<br>• Environmental/sustainability concerns<br>• Health concerns<br>• Improvements in technology |
| **Barriers** | • Internal management/decision-making processes<br>• Labour and qualified staff to implement CE processes<br>• Design challenges<br>• Recyclability and quality of materials<br>• Lack of governmental rules/regulations and enforcement<br>• Technological limitations<br>• Resource management (collecting, sorting, and processing used textiles)<br>• Technical infrastructure<br>• Costs<br>• Information, knowledge, and awareness of CE<br>• Integration and collaboration<br>• Stakeholder support<br>• Lack of performance measurements<br>• Power (im)balances |
| **Current Practices** | • Closing, slowing, and narrowing resource loops<br>• Supply chain collaboration<br>• Product re-design<br>• Supply chain reconfiguration<br>• New/innovative product design<br>• Product stewardship |
| **Suggested Strategies and Enablers** | • Embracing circular design<br>• Increase product value<br>• Stakeholder collaboration<br>• Improve operational efficiency<br>• Governmental/policy initiatives<br>• Technological innovation<br>• Increase social/consumer awareness<br>• Support from management<br>• Stakeholder education and training<br>• Improve infrastructure<br>• Financial support |

There is no standardized process for the transition towards a circular economy (Koszewska, 2018) and established businesses could take longer to shift because of the major changes required to enable circularity (Lahti et al., 2018). Large or dominant companies may have an easier time moving from linear to circular business models because of their ability to incorporate circular guidelines in contracts (Lahti et al., 2018). A firm's willingness and capacity to collaborate depends on their position and relative size in the supply chain and companies could refuse to implement circular practices if the environmental or economic benefits are not worth the time or effort of implementation (Franco, 2017). Fast fashion giant H&M, for instance, has initiated several collaborations both within and outside the fashion industry to attempt to achieve closed-loop production using biodegradable or recycled/recyclable materials (Lahti et al., 2018). On the other hand, two firms in Franco's study (2017) had a difficult time convincing a larger chemical supplier to adhere to cradle to cradle practices in processing their products because the overall sales from these two firms was relatively low compared to the rest of the chemical supplier's sales. However, one firm was successful in its collaboration with another similarly sized company as both firms invested equal time and money into production. Few studies on CF (Franco, 2017; Jia et al., 2020) have discussed these power balances in stakeholder relationships (i.e., manufacturer-supplier or buyer-supplier relationships) despite the importance of addressing power dynamics in collaborative efforts, thus posing yet another challenge in the transition to the circular economy.

Achieving circularity means a number of changes are needed and the above review demonstrates that the transition will not be instant, without challenges, or as a result of siloed stakeholder efforts. Rather, circularity "will be the result of well-coordinated actions initiated at different parts of the system" (Franco, 2017, p. 842). It is important to understand the difficulties individual companies face in implementing CE practices as industry firms must transform before the industry itself can become circular (Franco, 2017). This prompts the question; how can we build systems that synthesize the best practices of individual stakeholders and achieve industry circularity? The next section presents a possible answer of product stewardship as a means to implement circular practices among industry firms and work towards circularity within the C&T industry.

### *2.4.2 Product Stewardship*

Product stewardship has been described as the first step towards circularity (Shareef & Harding, 2018) as well as a practice that supports or enables the circular economy (Jensen & Remmen, 2017). Product stewardship, as defined by Lewis (2016, p. 5), is "the principle that everyone involved in the manufacture, distribution or consumption of a product shares responsibility for the environmental and social impacts of that product over its life-cycle". Here, the responsibility for products is removed from being solely on consumers or whomever is in possession of the product at the end of its usable life; rather, many stakeholders work collaboratively based on the stage of the garment life cycle they have control over. Of particular importance is the role of manufacturers because of their effect on the product life cycle, especially end-of-life opportunities, due to initial decisions made regarding materials and manufacturing processes (Cassel, 2008; Lewis, 2016; Product Stewardship Institute, 2012). Product stewardship does not necessarily mean that the enactor is achieving circularity, yet product stewardship is necessary for developing circular business models (Shareef, 2020, 19:06). Indeed, Ashby (2018) frames product stewardship as one proactive strategy that progresses a firm towards a closed-loop supply chain.

The term product stewardship is often used interchangeably with extended producer responsibility (EPR), yet there are distinctions between the two (Lewis, 2016). PS is broader in scope as it applies to all product stages, includes social initiatives in addition to environmental ones, and can either be voluntary or regulatory, while EPR typically has some type of regulatory framework or penalty to account for free-riders[3] of the program (Lewis, 2016; Martin, 2016; Watson et al., 2014). EPR also generally applies to regulation promoting end-of-life producer responsibility (Lewis, 2016). At minimum, producers[4] must manage the post-consumer use stage of a product as well as its packaging (Martin, 2016; Product Stewardship Institute, 2012). Furthermore, EPR policy transfers the financial responsibility and physical management of products at end-of-life from the public to producers and provides financial incentives for producers to minimize the environmental impacts of products in the design phase (Product

[3] Free-riders are those companies who participate in the benefits of a PS or EPR program by accessing systems to manage end-of-life products without paying membership fees or otherwise contributing financially (Cassel, 2008; Martin, 2016; Watson et al., 2014).

[4] In Europe, the term "producer" refers to any actor who first introduces a product to the market (e.g., manufacturer, importer, retailer, etc.) (Cassel, 2008).

Stewardship Institute, 2012). However, voluntary PS can be used effectively in place of regulation or to begin industry engagement prior to regulatory policies for products (Martin, 2016). I use PS throughout the thesis to keep consistent with the terms and approach used by study participants and New Zealand legislation.

The Product Stewardship Institute (2012) outlines the following principles to guide EPR legislation:

- Producer responsibility – In order to sell products, manufacturers must create and fund end-of-life programs which incorporate all products and packaging from businesses in the industry. Orphan products, or those which can no longer be identified as belonging to a specific brand or manufacturer must still be included. Producers can use existing infrastructure to gather and sort products or create and manage their own.
- Level playing field – The same guidelines apply to all producers of a certain product. These producers can work by themselves or in collaboration with each other to meet these requirements.
- Results-based – Producers must manage products in a way that protects environmental and human health and follows the waste hierarchy (e.g., reduce, reuse, recycle). Producers can design a system to manage products, provided the system adheres to government requirements. Producers must also offer education programs to the public and ensure product collection is convenient and accessible for consumers.
- Transparency and accountability – The transparency and accountability of the product management system is the responsibility of the government. In addition, all stakeholders have the chance to provide feedback on said product management system.
- Roles for government, retailers, and consumers – Government responsibilities include ensuring equal opportunities for all producers involved, providing support via industry procurement, implementing, and enforcing EPR requirements, and improving public knowledge of the program. Retailers must only sell products from those producers participating in the EPR program and must provide consumers with program information. Lastly, consumers are responsible for reducing waste, purchasing more sustainable products, reusing products, and participating in program end-of-use initiatives.

Many PS schemes are a reaction to legislation or external pressure; however, PS can be a proactive and intentional approach to creating shared value, where firm competitiveness is built

over the long-term while at the same time improving social and environmental impacts (Lewis, 2016; Porter & Kramer, 2011). Voluntary PS can implement the same principles as mandatory schemes or EPR, the difference being that PS members are accountable to each other instead of the governmental agency that mandated the scheme.

Nation- or continent-wide EPR schemes exist for a number of hazardous or priority products such as Europe's Waste Electrical and Electronic Equipment Directive, the German/European Packaging Ordinance, or Canada's national program for ozone-depleting substances (Cassel, 2008). However, France is currently the only country with a mandatory EPR program for C&T (Bukhari et al., 2018; Watson et al., 2014; WRAP, 2018)[5]. According to legislation enacted in 2007, French producers, importers, or distributors are responsible for managing the end-of-use period of textiles, linen, and footwear, which includes collecting and finding reuse and recycling options for these items (Bukhari et al., 2018; Watson et al., 2014). Consistent with the EPR principles from the Product Stewardship Institute (2012), France's program requires producers to either collect and recycle textile products on their own or to join and contribute to a collective program run by the country's only accredited product responsibility organization (PRO), Refashion (Bukhari et al., 2018; Watson et al., 2014). PROs may work with existing operators or subcontractors to carry out the collection, sorting and recycling processes (Watson et al., 2014). About 93% of French producers, importers, or distributors have joined the collective PRO scheme, with 7% acting as system free-riders (Watson et al., 2014). The participating organizations pay fees to the PRO based on the number and size of products introduced to the market and are incentivized to use pre- or post-consumer recycled content in their products as this reduces their annual fees (Bukhari et al., 2018). Another discount was introduced in 2018, where fees could be reduced 75% on select textile products if they met minimum quality standards such as abrasion resistance and dimensional stability to incentivize product durability (WRAP, 2018). Collected fees are then used for financing the program, consumer and community education, funding research and development (R&D) for improving textile design, sorting, and recycling activities, and for subsidies given to collection organizations (Bukhari et al., 2018; WRAP, 2018). In 2018, over 239,000 tonnes of textiles, linen, or footwear were collected, representing approximately 38% of the products put on the market (Refashion, n.d.). Items that are collected are either reused as is (58.6%), recycled or

[5] Interested readers in France's EPR program can find a detailed summary in Bukhari et al. (2018).

recovered (ragged, shredded, used for fuel or energy recovery; 41%), with only 0.4% landfilled (Refashion, n.d.). Diversion efforts have been successful; between 2009 and 2017, France's diversion of waste textiles doubled from 18% to 36% (WRAP, 2018). France's EPR model demonstrates that PS initiatives are not necessarily circular but help move the system in the direction of circularity.

The Telaketju Tekes project in Finland demonstrates another example of PS at the regional level as the project focused on textile circulation in Finland through a public R&D project alongside confidential business projects (Heikkilä et al., 2019). The Telaketju project — short for "textile recycling, sorting and utilizing network" in Finnish ("About Telaketju", n.d., para. 2) — was coordinated by VTT Technical Research Centre of Finland Ltd. and took place between April 2017 and January 2019 (Heikkilä et al., 2019). While this project was not mandated through EPR legislation, it was influenced by two national regulations related to waste, one from 2016 which mandates the diversion of organic waste (including textiles) from landfill and the second from 2017 whereby the European Commission announced that members must collect textile waste separately from other waste by 2025 (European Environment Agency, 2019; Heikkilä et al., 2019). According to the authors of the Telaketju Tekes project report (Heikkilä et al., 2019), the project was developed with the understanding that achieving a circular textile ecosystem and industry-scale recycling requires new ways of doing, technologies, and knowledge, thus necessitating multidisciplinary collaboration. Therefore, a total of 32 organizations participated as partners or by providing financial support with the Finnish Ministry of the Environment as one of the funding bodies. The main outputs the project aimed for included:

1. Quality requirements for textile sorting
2. Specifications for sorted and pre-processed materials for industrial recycling processes
3. Product demonstrations made from a wide range of textile waste fractions
4. Tools for companies to introduce principles of overall sustainability in their business (Heikkilä et al., 2019, p. 11).

These outputs were achieved through various activities including a collection trial; manual sorting pilots; consumer education; sorter education; cost modeling of collection and textile pre-processing; and many demonstrations showing the possibilities for product design and mechanical, thermal, and chemical recycling. The outputs and demonstrations have been communicated through several reports. Heikkilä et al. (2019) argue that the biggest benefits of

project participation were network opportunities and building a shared understanding of the necessity of a circular economy.

While PS developed in response to growing amounts of solid waste and decreased landfill space, it goes beyond the end-of-use activities such as recycling and waste diversion by engaging producers to design with end-of-life in mind (Lewis, 2016). In fact, all business operations must take product stewardship into account for it to be effective (Lewis, 2016). Figure 2.4 depicts a product stewardship framework as proposed by Lewis (2016). In this framework, stakeholders are motivated to implement PS schemes for three main reasons and use four general strategies to achieve the desired business benefits or sustainability outcomes, which are dependent on the industry and products of concern. Drivers motivating PS include internal and external stakeholder expectations and concerns regarding the product, the sustainability impacts of the product, and business objectives (Lewis, 2016). Understanding these drivers helps to clarify the necessary strategies for PS.


*Figure 2.4: Product stewardship framework. Republished with permission of Taylor & Francis Informa UK Ltd – Books, from Product Stewardship in Action, Lewis, 2016, p. 29, Figure. 2.1; permission conveyed through Copyright Clearance Center, Inc.*

As summarized below, Lewis (2016) identifies four distinct, yet interrelated, strategies that are commonly used to manage a product's environmental and social impacts: policy, design, procurement, and recovery. Policies refer to corporate social responsibility (CSR) or company sustainability policies that specify company goals and concerns. These policies should provide motivation and shared meaning for both employees and customers to be successful. Sustainability policies provide company guidance for design, procurement, and recovery efforts.

Design decisions dictate the environmental impacts of a given product throughout its life. For instance, the product materials, additives, and construction will define the resources required for production and use, potential harmful impacts of the product, its recyclability, and other options for end-of-use. Design strategies for product stewardship thus take into consideration the

product's environmental and social impacts through the entire lifespan. Designers use life cycle analyses or assessments to estimate the potential impacts that different product designs can have on the environment.

Procurement strategies are related to reducing impacts in areas of the value chain that companies do not have direct control over, yet can influence by means of developing industry standards, contract specifications, or company-supplier collaborations. These tactics enable companies to take responsibility for stages in the value chain that they may not previously have had a say in. Finally, recovery strategies refer to end-of-life initiatives for product reuse, recycling, or responsible disposal. These include company-, industry-, government- or waste management-led take-back and EPR programs, improved infrastructure for end-of-life initiatives, or the creation of recycling standards for products. Take-back programs or reverse logistics are where products are returned to a retailer or manufacturer to be reprocessed. Specifically, take-back programs refer to producer or retailer services to collect products from consumers at the end-of-use or end-of-life stage and bring them back to the product manufacturing or processing stage ("Take-back program", n.d.). These initiatives can be coordinated with reverse logistics providers, those involved in materials reprocessing ("Take-back program", n.d.), with other industry stakeholders, or managed by a company individually (Lewis, 2016). Reverse logistics are needed for take-back schemes and refer to:

> the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal (Rogers & Tibben-Lembke 1999, p. 2).

These terms are often used interchangeably in the literature. While reverse supply chain management is important for effective product stewardship (Klassen & Johnson, 2004), activities must go beyond take-back schemes to move towards circularity.

Kant Hvass (2014) studied the post-retail activities of nine medium- to premium-priced fashion brands. She found that the two main post-retail strategies these brands took were either take-back schemes or resell/reuse platforms for their textile products. These strategies could be organized through donation partnerships with charities, coordination with a third-party collector, or internal take-back services. Third-party collaborations appeared to be more suitable for brands with a global presence while internal take-back services were well suited for brands producing

premium products with a high resale value. Several companies in the study offered vouchers to customers upon returning their products to encourage brand loyalty and return visits.

Post-retail or EPR activities for the clothing and textile industry are just beginning to emerge and best practices for these activities have yet to be established (Kant Hvass, 2014; Kant Hvass & Pedersen, 2019). Where these activities exist, they are mostly initiated by individual brands, rather than driven by regulation (Kant Hvass, 2014) (Table 2.5). Brand level PS initiatives can apply to all products sold by a company or specific product lines. For instance, all Eileen Fisher products can be returned to the company to be sold secondhand as Eileen Fisher Renew garments if they are in good condition, with damaged products recycled or upcycled into felted items (Eileen Fisher Renew, n.d.). Despite having PS initiatives in place, the remainder of a company's products or business model can still operate mainly in a linear manner. For example, while H&M has several initiatives aimed at textile sustainability for their products, including a textile recycling program through a take-back scheme (Wang, 2018), it is still considered a fast fashion brand and produces massive volumes of garments each year. As demonstrated by Table 2.5, many PS schemes are realized through take-back schemes with greater potential for circularity when this is scaled up to a regional level.

Several reports by NGOs have been published advocating for PS or EPR and proposing policy strategies for implementation (e.g., Policy Hub, 2019; Watson et al., 2014; WRAP, 2018). These environment groups also play an important part in educating the public on industry impacts. In addition, some companies also open source their PS learnings so that other businesses can follow suit. For instance, the Fuji Xerox Roadmap to Product Stewardship outlines the following six steps for company PS: (1) become aware of product impacts from design to end-of-life; (2) understand and build solutions to reduce impacts; (3) create a scheme or management plan (e.g., costs and benefits; timeline) and develop a management team; (4) implement the plan and communicate its impacts within the business; (5) share the scheme as a case study with others outside the business; and (6) measure the effectiveness of the PS scheme by comparing it with baseline data and continuously find areas of improvement (Shareef & Harding, 2018).

*Table 2.5: Examples of textile product stewardship initiatives at the brand and regional level.*

| PS Name | PS Level (Brand, Regional) | Description |
|---|---|---|
| Eileen Fisher Renew | Brand | Take-back scheme of Eileen Fisher products for resale, recycling, or upcycling (Eileen Fisher Renew, n.d.) |
| Elvis & Kresse | Brand | Incorporates textile waste from other industries as raw materials for luxury accessories (Pandit et al., 2019) |
| H&M | Brand | Take-back scheme and textile recycling (Rathinamoorthy, 2019; Wang, 2018) |
| Interface | Brand | Manufactures carpet tiles from recycled fishing nets (Bocken et al., 2016) |
| Markham Textile Recycling | Regional | Municipal-level textile recycling program (Markham, Ontario) (City of Markham, n.d.) |
| MUD Jeans | Brand | Jean rental and repair; manufactures jeans made of post-consumer recycled denim (EMF, 2017; Rathinamoorthy, 2019) |
| Nudie Jeans | Brand | Take-back scheme of Nudie Jeans for resale or to be recycled into new products; repair services (Rathinamoorthy, 2019) |
| Patagonia | Brand | Take-back scheme (Worn Wear); manufactures with recycled materials; repair services (Gardetti, 2019; Lacy et al., 2020; Rathinamoorthy, 2019) |
| Refashion (formerly Eco TLC) | Regional | France's national EPR program managing collection, sorting, and recycling of clothing, linen and footwear (Bukhari et al., 2018) |
| Telaketju Tekes project | Regional | Collaborative network developing an ecosystem for textile recycling in Finland (Heikkilä et al., 2019) |

However, as with studies on the circular economy, academic literature on PS implementation for the C&T industry, particularly for voluntary schemes, remains largely exploratory. In addition, little work has been done to understand the implementation of circular practices across firms (Franco, 2017). PS implemented at a broader level (i.e., regional level or product sector) is a way to connect individual stakeholder actions (as discussed in Section 2.3) and provide a means to achieving circularity. But, just as there is no standardized process for circularity, there is no "one size fits all" approach for product stewardship as local context and needs must be understood (Martin, 2016, p. xv). To my knowledge, few PS schemes for C&T that address the product or regional sector have been addressed in the literature, besides France's national EPR program, Markham, Ontario's textile recycling program, and the Telaketju Tekes project. Furthermore, information is lacking about how these processes come about and why PS

is chosen as a circular strategy to address clothing and textile waste. Therefore, this research aims to provide insights into how a product stewardship scheme beyond the brand level is developed, connecting the various efforts of individual stakeholders, as well as the perspectives of industry stakeholders on product stewardship initiatives.

### 2.4.3 Human Ecological Systems Perspective

**2.4.3.1 Human Ecology Perspective**. A human ecology perspective is useful when considering the transition from a linear to circular system. Human ecology is the study of humans, their environments, and the reciprocal interactions between the two (Visvader, 1986; Westney et al., 1988). In North America, home economics was one of the first fields to adopt a human ecology perspective when in 1892 Ellen Swallow Richards proposed "oekology" as the scientific study of people and their environments (Bubolz & Sontag, 1988; 1993, p. 420). This field of oekology was eventually named home economics (Bubolz & Sontag, 1988; 1993) with subject matter focused on human development, consumer education, nutrition, family studies, fashion, and the environment (Westney et al., 1988). European foundations of human ecology can be traced to German zoologist, Ernest Haeckel, who in 1873 referred to "oekologie" as an emerging science to study organism/environmental relationships (Bubolz & Sontag, 1993, p. 419). Human ecology perspectives from this European standpoint appeared in other social science disciplines such as sociology, geography, anthropology, and psychology (Bubolz & Sontag, 1993). The root of the word ecology is the Greek *oikos*, which translates to "household" (McIntosh, 2011, p. 48). We can apply the term ecology in a literal sense by studying the family and household, as is often done in the field stemming from home economics, but also in a broader sense by considering the earth as "the 'household' in which we live" (McIntosh, 2011, p. 48).

Human ecology is, therefore, described as an interdisciplinary field as it creates new paradigms from the merging of disciplinary concepts, theories, and methods (Bubolz & Sontag, 1988). Considering this interdisciplinary perspective, we can define human ecology as:

> the study of humans as social, physical, biological beings in interaction with each other and with their physical, socio-cultural, aesthetic, and biological environments, and with the material and human resources of these environments (Bubolz & Sontag, 1988, p. 3).

York and Mancus (2009) have termed this "critical human ecology" as it "combines the strengths of the biophysical human ecology tradition in environmental sociology with those of historical

materialism" (p. 122). In other words, there is an acknowledgement that biological and geographical factors have an influence on society, but that social phenomena occur within the context of historical conditions (York & Mancus, 2009). In this thesis, I draw on both North American and European streams of human ecology as they share similar theoretical foundations and a central point of study of the interactions between humans and their environments.

Among other motivations, human ecology seeks to improve quality of life and the human condition (Westney et al., 1988). It questions "[w]hy do we do things the way we do?" and means to re-evaluate how we live and those aspects of our lives that have become unsustainable (Loening, 2011, p. 32). A human ecology perspective moves away from an anthropocentric view towards an eco-centred value orientation that acknowledges humans as just one part of the world as a living, interrelated system (Vaines, 1990). Westney et al. (1993) note that "humans have a responsibility of stewardship with respect to other living species and the nonliving environment" which includes conserving our life-sustaining environment (p. 427). In this sense, human ecology is transformative; it questions not only our current relationship with nature, but what this relationship "ought to be" (Vaines, 1990; Visvader, 1986, p. 126).

There are various models depicting the interactive relationship between humans and their environments. From Westney et al.'s (1988) perspective (stemming from home economics), human ecology attends to two types of human environments: the internal environment consisting of an individual's physiological and mental processes, and the external environment involving the micro and macroenvironment. The external microenvironment includes those beings or things near the individual such as clothing or apparel, while the external macroenvironment consists of broader factors impacting the individual including the economic system, government and policies, social system, and environmental health (Westney et al., 1988). Kilsdonk's (1983) model represents three major and fluctuating components consisting of the natural environment, the social-behavioural environment, and the human-built environment. Despite the different conceptualizations of human ecology, these models are consistent in acknowledging the interactions between the different environments and how they mutually influence one another. The models also highlight the importance of contextual factors that influence, and are influenced by, factors in the various levels of the environment. These models, in particular, centre around the individual person or household; however, the underlying principles are still relevant to larger

systems in that the micro and macroenvironments and context surrounding a system will have important implications for the function of the system.

Applying a human ecological framework to product stewardship means that contextual factors within the natural, social, and built environments such as infrastructure, consumer behaviour, resource availability, policy (e.g., company or organizational frameworks guiding sustainability), or regulation (e.g., government mandated PS or EPR) will impact a circular textile system (Figure 2.5). An understanding of these factors and how they interact with one another is important to understand how changes within one factor will affect other parts of the system. Individual stakeholders (e.g., brands, manufacturers, retailers, etc.) placed at the centre of these models are then influenced by the various factors in their internal and external environments. For instance, policy and regulation (mandatory PS or EPR) at the government level would fall in the external environment of an individual brand or organization, while sustainability policy would be part of the internal environment of the organization as this would guide company actions. Of course, the sustainability policy of the organization would be influenced by factors in the external environment. Although this research focuses on industry-led product stewardship, a different conceptual model that explicitly includes policy or regulatory factors would be more appropriate for examining mandatory PS or EPR.

While this research tends to environmental impacts, it is with the recognition that the impacts of the clothing and textile industry do not stop at the environment; rather, environmental impacts are direct or indirect consequences of human (in)action, and they have reciprocal consequences for humans. In improving environmental conditions by transforming individual and systems-level practices, it is anticipated that humans will benefit by living in a healthier, sustainable, and just environment. By recognizing the mutual relationships between humans and nature, human ecologists strive to understand how we can fulfill our own needs without compromising the needs of others or the environment (Dyball & Newell, 2015), consistent with definitions of sustainable development. This recognition is pertinent to studies related to clothing or textiles, as our habitual practices of purchasing, use, and disposal can lead to widespread environmental damage. This damage, in turn, can have negative effects on human health. Therefore, understanding the ripple effects of stakeholder actions is important to find effective solutions for environmental and social problems caused by the clothing and textile industry.

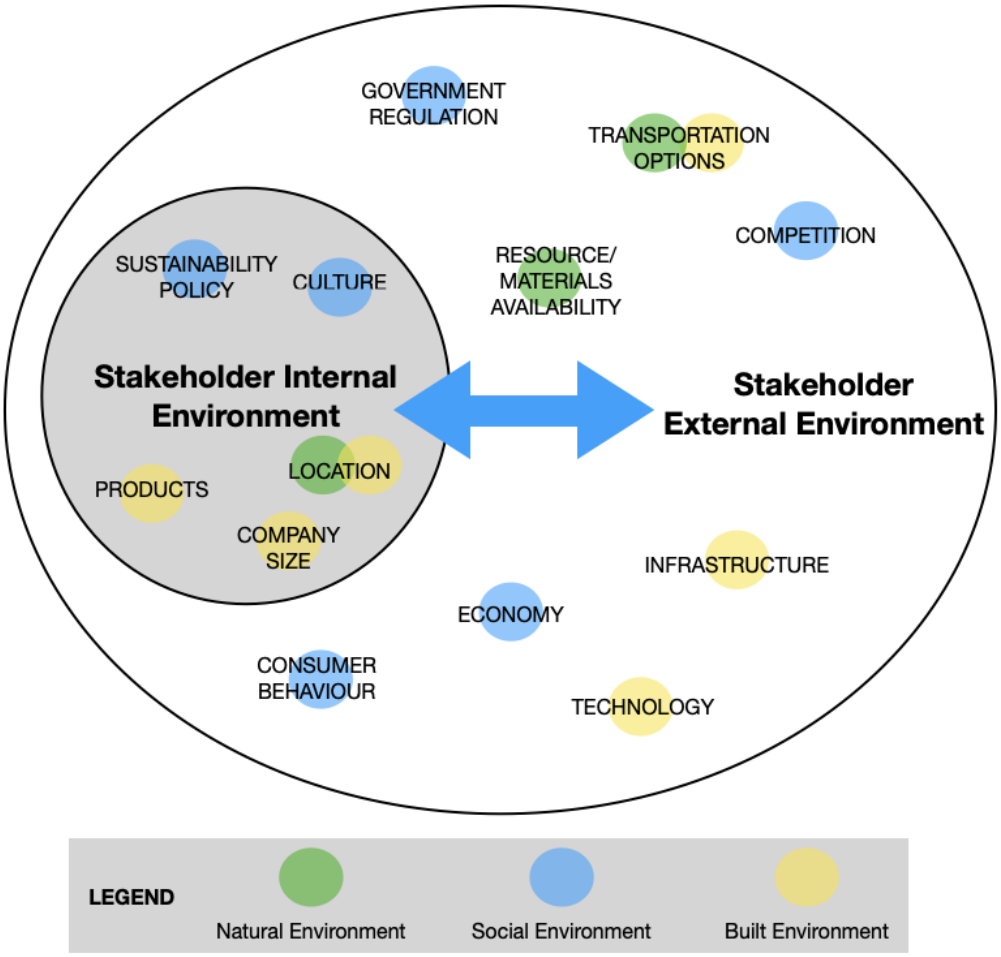


*Figure 2.5: A human ecological model applied to the clothing and textile industry (adapted from Kilsdonk (1983, p. 42) and Westney et al. (1988, p. 134)). This model demonstrates the mutual influence and interdependence between a stakeholders' internal and external environments made up of various contextual factors belonging to the natural, social, or built environment.*

**2.4.3.2 Systems Approach**. Gabriel and Luque (2020) argue that because "sustainability is systemic", a comprehensive view of the entire value chain should be taken (p. 25). Human ecology aptly utilizes a systems approach (Bubolz & Sontag, 1993), which enables a clearer understanding of a complex whole, such as the C&T industry or the textile waste management system (Kieren et al., 1984; Seadon, 2010). As described by Kieren et al. (1984), a system is "a set of interdependent but independent parts which work together for a common purpose" (p. 24). The system may be comprised of people, objects, ideas, or a combination of these things (Kieren et al., 1984). Systems thinking is fundamentally holistic whereby the entirety of a system is considered, as opposed to reductionist approaches which isolates a system down to its individual parts (Capra, 2008; Seadon, 2010). Relationships occur between the various functional elements or parts of the system, which are interdependent and interact with one another (Kazancoglu et al.,

2020). Something new (an action, awareness or understanding) is formed within these interactions that influences the parts of the system and thus the entirety of the system to change, maintain, or grow (Kieren et al., 1984). Within a human ecological systems approach, the individual is considered the element which processes these interactions (Westney et al., 1988).

Kieren et al. (1984) equate systems relationships to circular relationships because of the dynamic and mutual influence of the parts on each other. The parts of the system are referred to as subsystems which may overlap with other subsystems, demonstrating a more intimate relationship between them than simply linking together (Kieren et al., 1984). In applying this thinking to the research, all stakeholders in the industry are viewed as interrelated, in that the decisions of one stakeholder influences others in the system, inciting change in the overall system. The fragmented nature of the current C&T industry, with sites of production, consumption and disposal spanning all areas of the globe demonstrates that sustainable change cannot happen by isolating one company, one stakeholder group, or even one stage in the value chain. Therefore, the stakeholders and materials/resources through all stages of the value chain need to be considered in order to find solutions that will work for the whole system.

A similar approach using systems thinking was taken by Ekström and Salomonson (2014) in their study of clothing reuse and recycling possibilities in Sweden. Through a network or macromarketing approach, they advocate for collaboration between the various actors in a network, rather than competition, to address societal problems like mounting textile waste. The Ellen MacArthur Foundation (2017) in their report advocating for a transformed textile industry, argues for a systems thinking approach in order to achieve systems-level change. Seadon (2010) also described the benefit of systems theory for improved waste management practices. Other research on the circular economy as it pertains to the textile industry has drawn upon systems theory as well (e.g., Hawley, 2006; Kazancoglu et al., 2020). Furthermore, systems thinking is another important principle within the circular economy as this approach recognizes the critical role of feedback systems along with the interdependency and mutual influence of different parts of the system on one another, contributing to the resiliency of the CE (Rathinamoorthy, 2019). Therefore, a human ecological systems perspective that draws on systems theory is warranted and appropriate for my research.

Sustainability and circularity are not new concepts by any means (Mitchell, 2011). Human-nature interactions are rooted in indigenous worldviews of our connection with the

environment and its cyclical nature (Nakashima et al., 2000). In acknowledging where this notion for circularity comes from, indigenous voices need to be part of the conversation on what a circular economy looks like. While seeking the perspectives of indigenous groups is outside the scope and ethical approval of this research, it is important to acknowledge and give credit to the originators of these ideas and to ensure they are part of the design and implementation of sustainability initiatives.

# CHAPTER 3: Methodology

The research questions were addressed through a qualitative approach using case study methodology. Qualitative methods were deemed appropriate for the research as it allows for an in-depth exploration of areas of study where relatively little work has been done. Qualitative approaches are used with the understanding that reality is socially constructed where researchers investigate how experiences and processes are created and made meaningful (Denzin & Lincoln, 2000). The following sections describe the case study selection, research context, the interview and survey methods used in the study, and how the validity and reliability of the data have been addressed.

## 3.1 Study Methodology

If humans are at the centre of human-environment interactions (Westney et al., 1988), then it follows that people should be at the centre of investigations which seek to improve these interactions. Of particular importance to this research are stakeholders within the C&T industry working towards systems transformation. Thus, a qualitative case study approach was chosen to address the research questions and to gain a deep understanding of product stewardship for clothing and textiles. Yin (2018) defines case study research as an in-depth description of a contemporary phenomenon in its real-world context. Case studies are best suited to answer "how" and "why" questions about a specific, unique, integrated, or bounded system (Creswell, 2013; Stake, 1995; 2008; Yin, 2018). Qualitative studies in the form of exploratory case studies are often chosen for the topic of clothing and textile sustainability or circularity (Curwen et al., 2013; Jia et al., 2020; Ki et al., 2020; Weber, 2019), demonstrating the fit for this thesis research. The case facilitated an understanding of which stakeholders and contextual factors are relevant for product stewardship schemes (Stake, 2008).

### *3.1.1 Case Study Selection and Research Context*

This research examined product stewardship in New Zealand, particularly the Usedfully system and stakeholder perspectives of product stewardship, as a single case study. Usedfully is led by The Formary, a textile research and development company based in Wellington, New Zealand (NZ). Usedfully is dedicated to promoting circular systems change in the textile industry through the Textile Reuse Programme (membership-based industry leadership group), Usedfully® Resource Management System (digital platform providing visibility over resource

flows and environmental impacts), research and development of circular solutions, and the Textile Product Stewardship Project. At the time of the research, Usedfully was working on the development of this PS scheme for clothing and textiles in New Zealand, a unique industry-led regional product stewardship scheme differing from other regional schemes which have typically been regulated or government mandated and other industry schemes which have remained at the brand level. The case was bound by a specific place (NZ) and time (during Stage 1 of scheme development) (Creswell, 2013). The decision to study New Zealand product stewardship and the Usedfully Textile Product Stewardship Project was in hopes that it could provide a means for comparison of other PS programs and to highlight an alternative process for PS program development. In this sense, the study can be viewed through the comparative lens of Weber's (1969) ideal type in that evaluations can be made between current product stewardship in New Zealand and the ideal product stewardship model or circular system. The ideal type is most often fictional and illustrative but can be used to classify data based on its proximity to the ideal type (Secher, 1969). PS is an ideal type in that it – when effective and scalable – minimizes or eliminates environmental impacts through the entire life cycle of a product and enables industry circularity. Therefore, New Zealand product stewardship and Usedfully's system can be examined with the purpose of identifying the factors that both enable and prevent current systems from reaching the ideal type — a closed-loop or circular system.

Data collection for this research was intended to take place in NZ over the period of April-June 2020. However, the World Health Organization (2020) declared the outbreak of the novel coronavirus (COVID-19) a global pandemic on March 11, 2020. New Zealand's first confirmed case was reported on February 28, 2020, making it the 48$^{th}$ country to confirm a COVID-19 case (Ministry of Health, 2020). A State of National Emergency was declared on March 25 (New Zealand Gazette, 2020) prompting the lockdown of the country and closure of international borders. New Zealand moved through Alert Levels 1-4 which placed varying restrictions on individual and business activities. Their most strict lockdown (Alert Level 4) remained in place for five weeks before transition to Alert Level 3 for another two weeks (Baker et al., 2020). New Zealand transitioned to Alert Level 1 (elimination of virus) on June 8, 2020, and remains in the post-elimination stage at the time of writing (Baker et al., 2020).

Despite New Zealand's successful approach at eliminating the virus, those companies and individuals of interest to the study were still considerably impacted by the pandemic and border

closures prevented me from traveling to NZ to conduct the research. While the timing of the research provided a unique opportunity to explore how companies were impacted by COVID-19 in real time, the pandemic had an impact on the research in terms of data collection methods, participant availability, and their sustainability efforts. These impacts will be described further in 3.1.2 and in the findings and discussion chapters.

### *3.1.2 Data Collection*

Multiple sources of data were collected between April 2020 and March 2021 for the purpose of exploring the case in-depth and to understand the case within its real-world context (Yin, 2018) (Table 3.1). Semi-structured interviews were conducted with key informants of the Usedfully - Textile Reuse Programme and circularity consultants in New Zealand. Semi-structured interviews were suitable for the research as it works well for professionals who have limited time to offer for interviewing and makes use of an interview guide (Bernard, 2011). The structure of the interview guide varied based on the type of stakeholder being interviewed although there was overlap between them. In alignment with the research questions, interview questions related to the development of the PS project, the types of clothing and textile waste interviewees were responsible for, company environmental policies, opportunities, and challenges for reducing clothing/textile waste, support for sustainability initiatives, and the impact of COVID-19 on their company operations and sustainability efforts (Appendix C). Questions focused on clothing and textile waste due to PS originating for the purpose of waste prevention/reduction; however, if the participant chose to talk about other relevant aspects of PS, environmental initiatives, or waste reduction efforts, then this was encouraged. Although questions were prepared in advance, some questions naturally emerged from the interview discussions. In this manner, the interview resembled more of a guided conversation (Yin, 2018), co-constructed by the researcher and participant. Notes were taken during the interview to further inquire about specific topics that were not covered by the interview guide.

The closure of the New Zealand border and recommendations for only essential travel made it infeasible to interview participants in person. Instead, all interviews occurred using the Zoom video conference platform, except for one telephone interview. Initial interviews ranged in length from 26 minutes to 2 hours and 14 minutes. Participants were interviewed during different COVID-19 Alert Levels (between Alert Levels 3 and 4); however, this was not seen as an issue as they were able to recount the initial impacts of COVID-19 on their business. Nine

interviewees also participated in follow up interviews 4-5 months after the initial interview. These follow-up interviews functioned to track the progress of the PS project through its development, to determine how companies had been impacted by COVID-19 over time, and to ask follow-up questions that arose from the first interview or from other participant interviews. Follow-up interviews were shorter and lasted 21 minutes to an hour.

After determining that it may be difficult to recruit stakeholders to participate in scheduled interviews due to COVID-19, particularly those who were not already involved in Usedfully programs, the interview questions were translated to an online survey using Google Forms. Survey questions were a combination of open-ended, multiple choice and check-box responses to save time for the respondents. Questions covered the same topics as the interviews but were adjusted slightly with additional probes to account for the lack of researcher-participant interaction. Some questions were added based off preliminary themes from initial interviews, literature on PS engagement (Bukhari et al, 2018; Mia, 2011), and the Fuji Xerox Product Stewardship Roadmap (Shareef & Harding, 2018) (Appendix D). In this sense, the survey could be considered a hybrid semi-structured interview as participants had the opportunity to elaborate on their responses as much as they liked but could do so without needing to coordinate a time with the researcher. Although interview participants had the opportunity to review the interview guide before the interview if requested, the survey was beneficial as participants could see the questions and take time to write thoughtful responses to the questions or to locate answers to questions (e.g., regarding the company's environmental impacts or company policies, if available). Four survey participants also completed the follow-up survey with the same purpose of determining the impacts of COVID-19 over time. The questions included in the follow-up interviews and surveys can be found in Appendix E. Prior to the interviews and on the first page of the survey, participants completed a company/organizational survey to provide background information on the size and location of the company/organization to ensure their headquarters were in New Zealand. (Appendix B).

Consistent with case study research, data was gathered from New Zealand based documents and statistics on textile waste reduction, publications related to the case and company-specific reports, where possible. This data was important in contextualizing product stewardship in New Zealand and corroborating the interview and survey findings.

*Table 3.1: Overview of data types.*

| Type of Data | Description |
|---|---|
| Interviews | Semi-structured initial and follow-up interviews with key informants of the Usedfully - Textile Reuse Programme, relevant stakeholders, and circularity consultants |
| Survey | Online initial and follow-up surveys with New Zealand based clothing designers, manufacturers, and retailers |
| Company documents | Websites and sustainability reports published by the companies/organizations represented by interview and survey participants; Usedfully documents |
| Media publications | News articles and press releases related to Usedfully, The Formary, or the Textile Reuse Programme |
| Government documents | Web resources, reports and statistics provided by the New Zealand government, Ministry for the Environment, and Stats NZ |

### *3.1.3 Research Participants*

While a systems approach considers all possible stakeholders, a study that would fully account for all of these perspectives was beyond the scope of this research. Therefore, interview participants were initially identified by their current or former membership with the Usedfully system and purposefully selected based on their knowledge of the system and demonstrated interest in the PS project or Textile Reuse Programme (Maxwell, 2013). Many current or former members of the Textile Reuse Programme members had taken action to reduce their clothing and textile waste, so they were ideal participants to begin with as they would have previous experience with attempting to integrate sustainability initiatives into their waste streams. Additional participants were recruited through recommendations of interviewees and due to their knowledge of circularity and product stewardship in New Zealand.

The use of theoretical sampling allowed for an in-depth exploration of topics as additional participants could be interviewed based on the emergence of important concepts (Corbin & Strauss, 2008a). Some participants held multiple roles by working for circular businesses but also by having positions on different advisory boards related to advocating for sustainability in New Zealand. A total of 12 participants were interviewed, a sample size consistent with other case studies examining similar topics (Curwen et al., 2012; Weber, 2019). For those participants representing a clothing/textile company, a summary of company characteristics represented in the interviews and participant codes is presented in Table 3.2. Of these five companies, two were Usedfully - Textile Reuse Programme Foundation Partners, one

was a Collaborator, one a former Partner, while one had demonstrated interest in joining the TRP. Participant codes were also given for Usedfully key informants (I-101; I-102; I-103; I-104) and circularity/sustainability consultants (I-301; I-601).

*Table 3.2: Overview of companies/organizations represented by interview participants .*

| Company category | Years in operation* | Enterprise type | Number of employees | Participant Code |
|---|---|---|---|---|
| Textile rental | 100+ | Complex | 500+ | 1-201 |
| Waste management | 2.5 | Simple | 1-4 | I-401 |
| Apparel manufacturing | 88 | Complex | 100-199 | I-501 |
| Apparel manufacturing | 35+ | Complex | 500+ | I-701, I-702 |
| Mail and logistics | 173 | Complex | 500+ | I-801 |

*At time of interview

Survey participants were also purposefully selected based on their role and knowledge of the industry but were limited to those responsible for the design, manufacture and sale of clothing and textiles in New Zealand. These participants were chosen as they were the types of businesses relevant for the Usedfully - Textile Reuse Programme but had not previously participated in any of Usedfully's programs. Participants were found through a web search using the terms "New Zealand" + (clothing OR textile OR fashion) + (brands OR designers OR manufacturers OR retailers) or were mentioned by participants during the interviews. A list of companies was created with each company then searched individually to find contact information, to ensure the company was still in business, and that they were based in New Zealand. The list was member checked by a key informant in New Zealand to confirm relevant companies had been added. Companies were contacted via website contact form or e-mail. After making initial contact with someone from the company, the survey link was forwarded to 38 interested individuals, resulting in 13 completed surveys. A summary of company characteristics represented in the survey responses can be found in Table 3.3. The number of participants for the interviews (12) and survey (13) was deemed sufficient as saturation in qualitative studies can be reached with six to 12 participants (Patton, 2015).

*Table 3.3: Overview of companies/organizations represented by survey participants.*

| Company category | Years in operation* | Enterprise type | Number of employees | Participant Code |
|---|---|---|---|---|
| Clothing/textile design; Apparel manufacturing; Non-apparel manufacturing | 40+ | Complex | 50-99 | S-01 |
| Clothing/textile design | 5 | Simple | 1-4 | S-02 |
| Apparel manufacturing; Retail | 11 | Complex | 200-499 | S-03 |
| Apparel manufacturing; Retail | 74 | Simple | 50-99 | S-04 |
| Retail | 5 | Simple | 1-4 | S-05 |
| Apparel manufacturing | 3 | Simple | 1-4 | S-06 |
| Retail | 47 | Complex | 200-499 | S-07 |
| Apparel manufacturing; Retail | 46 | Simple | 20-49 | S-08 |
| Clothing/textile design; Apparel manufacturing; Retail | 25 | Simple | 5-9 | S-09 |
| Clothing/textile design; Apparel manufacturing; Retail | 25 | Simple | 5-9 | S-10 |
| Apparel manufacturing; Retail | 20 | Simple | 20-49 | S-11 |
| Clothing/textile design; Apparel manufacturing; Retail | 2 | Simple | 1-4 | S-12 |
| Apparel manufacturing | 38 | Simple | 50-99 | S-13 |

*At time of survey

### *3.1.4 Ethics*

Ethics approval for the interviews and surveys was obtained through the University of Alberta's Research Ethics Board. All participants were given an information sheet outlining the purpose, benefits, and risks of the study as well as their expectations as participants (Appendix A). All participants provided consent to take part in the research. Interview participants provided written consent either through a scanned or digital signature or through e-mail demonstrating their agreement to participate. The information form was reviewed at the beginning of the interview and participants were given the opportunity to ask questions. During the follow-up interviews, participants were reminded that their participation was voluntary and that they could withdraw at any time during the interview. Survey participants provided implied consent by

completing and submitting the survey. The research was considered to have minimal risks, but attention was paid to maintaining participant confidentiality and anonymity throughout the study. Basic personal information was collected at the beginning of the study (e.g., name, contact information, position within company/organization). Participants were given a code and any identifiable information was removed from the data. Only I had access to the raw data and all electronic data was stored on a password protected computer.

While collecting data for this research, I was invited to be part of the Advisory Group for the Usedfully Textile Product Stewardship Project. As I did not have ethical approval to collect data from these advisory meetings, it was agreed that data would not be collected from these meetings. Instead, the meetings informed questions for follow-up interviews so that important discussions or details from the meetings regarding the progression of the project could still be used for the research. Additionally, Usedfully hosted a series of workshops, both in-person and online, during the development of the project. Again, this workshop was outside of the scope of my ethics approval, but I was able to observe the online workshop and take notes to inform subsequent interviews. Throughout this process, it was important for me to separate my roles as researcher and as advisor or workshop observer. To ensure this separation, notes for each of these purposes was kept separately from any notes used for data analysis and follow-up questions based on the advisory group meetings and workshop were written up in separate files.

### *3.1.5 Data Analysis*

With the permission of the interview participants each interview was recorded using a handheld audio recorder or recorded through Zoom. Following the interviews, I wrote notes on initial key concepts discussed by participants. Using the Otter.ai speech to text platform, the audio files were uploaded and transcribed automatically then reviewed to ensure accuracy. The decision for full, partial, or summary transcription was dependent on each interview and which portions of the interview related to answering the research questions (McLellan et al., 2003). Preliminary data analysis began immediately after the first interview and guided subsequent data collection by informing who should be interviewed next and what additional questions should be added to the interview guide (Corbin & Strauss, 2008a). Responses to the open-ended questions of the survey were also analyzed qualitatively using the same techniques as the interview data analysis.

The data was analyzed using the qualitative research software NVivo 11 to organize and compare codes. The first step of thematic analysis occurred through initial or open coding by "taking raw data and raising it to a conceptual level" (Corbin & Strauss, 2008b, p. 2). As described by Charmaz (2001), open coding was accomplished by line-by-line coding that requires assigning a descriptive or preliminary code to each line of interview text. Depending on the topic being analyzed, coding may have occurred in this line-by-line manner ("splitting") or by grouping lines together and assigning a code to the group of text ("lumping") (Saldaña, 2016, p. 23). Initial coding was data-driven (Gibbs, 2007); in other words, I avoided assigning codes based on *a priori* categories that I may have found in the literature. Approaching the data with an "open mind" (Gibbs, 2007, p. 44) enabled the emergence of concepts from the data that I had not previously considered. Open coding was followed by axial coding, where codes that frequently appeared across multiple interviews were synthesized and conceptualized into analytical or thematic categories (Charmaz, 2001). Second level coding was concept-driven (Gibbs, 2007) and guided by the research questions, particularly research questions 2–4 which were informed by Lewis' (2016) product stewardship framework as well as the circular fashion conceptual frameworks developed by Jia et al. (2020), Kazancoglu et al. (2020), and Ki et al. (2020). Categories were then compared to one another, with conceptually similar categories becoming higher-level categories and eventually themes (Corbin & Strauss, 2008c). This process continued until no other themes emerged from the data (Corbin & Strauss, 2008a). The process of moving from codes to sub-categories and categories and then to broader themes is illustrated in Appendix F.

Analytic memo writing functioned as an important part of data analysis (Saldaña, 2016). Memos were written through use of a codebook to define the properties of the codes, categories, relationships between categories, and the broader themes that were found (Charmaz, 2001; Gibbs, 2007). This ensured that the codes were applied consistently to the data and that it was interpreted in a reliable manner. As mentioned above, codes were informed directly from the data itself as well as through concepts from the literature review. Three overarching themes emerged from the data analysis (Table 3.4) which will be described further in Chapter 6.

*Table 3.4: Emergent themes from the coding process.*

| Theme | General description of theme |
|---|---|
| PS within the current system | Relates to the parts of the system that currently exist to enable circularity including the development of the Usedfully TRP and TPSP, participant drivers for PS, and participant strategies that align with Lewis' (2016) PS framework |
| Factors preventing system circularity | Refers to the necessary parts of the system that might be currently missing or otherwise preventing a circular transition, including the barriers to the TRP/TPSP development and stakeholder barriers for PS |
| Closing the loop: moving from the current to ideal system | Relates to addressing stakeholder barriers and changes to the surrounding context that would better enable PS, as well as what needs to be considered in moving from the current system to an ideal circular system |

### *3.1.6 Data Validity and Reliability*

Qualitative research involves an interpretive element on behalf of the researcher (Denzin & Lincoln, 2000) and therefore threats to validity and reliability of the data must be attended to. Three tests have been addressed to ensure quality of the research design for this exploratory single-case study: construct validity, external validity, and reliability (Yin, 2018). These three tests have been defined by Yin (2018) as follows:

> *Construct validity:* identifying correct operational measure for the concepts being studied
> *External validity:* showing whether and how a case study's findings can be generalized
> *Reliability*: demonstrating that the operations of a study — such as its data collection procedures — can be repeated, with the same results (p. 42)

Construct validity of the data was addressed through triangulation by using multiple data types to ensure that the findings are valid (Maxwell, 2013). Triangulation of the data is "the display of multiple, refracted realities simultaneously" (Denzin & Lincoln, 2000, p. 6). In other words, different data types were used to view the topic from multiple perspectives with secondary data corroborating the interview and survey findings. In addition, interviewing multiple people from the same company allowed for member checking among participants and the use of follow-up interviews presented opportunities for participants to provide clarity on topics and confirm the researcher's interpretation of the initial interviews. A final member check by presenting key informants with a summary of the case description and getting feedback on the final thesis also contributed to the study's construct validity.

Case study research allows for analytical generalizations rather than statistical generalizations (Yin, 2018). It is important to note that these generalizations are made about the case study and not the case itself (Yin, 2018). The test of external validity determines whether analytical generalizations of the case study can be made (Yin, 2018). This was ensured by basing the research plan and questions on the relevant literature and by comparing the study findings with the literature throughout the data analysis. Finally, the reliability of the study was addressed by maintaining a thesis research portfolio throughout the study to document study procedures and using a codebook to consistently apply codes, categories, and themes to the data during analysis. Table 3.5 summarizes the tactics used in this research to address these three tests and ensure validity and reliability of the data.

*Table 3.5: Case study tactics used for validity and reliability tests (adapted from Yin, 2018, p. 43).*

| **Tests** | **Case Study Tactic** |
|---|---|
| Construct validity | • Multiple sources of evidence<br>• Follow-up interviews and survey<br>• Final member check of findings |
| External validity | • Developed “how” and “why” research questions based on relevant literature<br>• Compared codes/categories/themes with literature |
| Reliability | • Documented case study procedures using thesis research portfolio<br>• Used codebook for data analysis |

# CHAPTER 4: Case Context and Description

In order to address the first research question related to how Usedfully is working to implement clothing and textile product stewardship in New Zealand, I first present the context in which Usedfully operates, including the clothing and textile industry in New Zealand and the national waste context. I then describe the development of the Usedfully - Textile Reuse Programme and the Textile Product Stewardship Project.

## 4.1 New Zealand Clothing and Textile Industry

New Zealand is a small, island country with a population of just over 5 million residents (Stats NZ, 2021a). The C&T industry in New Zealand is small on a global scale, accounting for less than 1% of total textile exports (by value) in 2019 (Observatory of Economic Complexity [OEC], 2019a). In that same year, NZ exported $677 million (M) (USD) worth of textiles, 1.67% of the total national exports ($40.5 billion [B], USD) (OEC, 2019b). Of these textile exports, the majority were wool fibre (51.7%) followed by tufted carpets (9.49%) and awnings, tents, and sails (3.82%) (OEC, 2019b). For clothing products, the greatest exports were for knit sweaters (2.87%) and non-knit men's and women's suits (2.57% and 1.97%, respectively) (OEC, 2019b). The main destinations for NZ's textile products were Australia, China, United States, United Kingdom, and Italy (OEC, 2019a).

Comparatively, imports for textile products in 2019 were $1.82B (USD), comprising 4.56% of the total $39.9B (USD) imports (OEC, 2019b). Top clothing imports included non-knit women's suits (8.8%), knit t-shirts (6.73%), knit sweaters (6.5%), and non-knit men's suits (5.95%) (OEC, 2019b). House linens and tufted carpets were the top non-clothing textile imports for NZ in 2019 at 5.28% and 4.31%, respectively (OEC, 2019b). These imports were primarily from China, Australia, Bangladesh, India, and the United States (OEC, 2019a).

Although a number of apparel manufacturers were present in NZ during a protectionist period in the 1970s, manufacturing began to decline in the mid-1980s with market changes resulting in tariff reductions, increased competition, and access to cheaper international manufacturing, thus driving manufacturing offshore (Ministry of Business, Innovation and Employment, 2018). In the 1990s, manufacturers turned their efforts to niche products and exports to keep up with competition (Ministry of Business, Innovation and Employment, 2018). Over the last 30 years, manufacturing in New Zealand, including apparel manufacturing, has

transitioned to value products where items are distinguished based on better quality, brand name, enhanced performance, product innovation, or fulfilling a specific function or service niche (Ministry of Business, Innovation and Employment, 2018). Figures from 2019 state that approximately 15,000 people are employed by 2,000 textile businesses in NZ (AUT, 2019). These businesses usually fall within the categories of clothing, footwear, carpet, smart textiles, and general textiles (AUT, 2019). Most NZ fashion brands have sought low-cost offshore manufacturing in China or South-East Asia (Tearfund, 2019). Additionally, stages of garment manufacturing occur outside of NZ, even if the last steps of garment production (i.e., cut-make-trim processes) are performed locally (Tearfund, 2019). Even so, these companies will be importing fabric or raw materials for final stage manufacturing (Tearfund, 2019). Some local manufacturing still takes place for premium designer or ethical fashion brands (Tearfund, 2019), yet it is unlikely that substantial production will return (Ministry of Business, Innovation and Employment, 2018).

According to MarketLine's (2020) profile of NZ's retail apparel industry, the market is fragmented due to the number of international retail brands in NZ, which functions to increase competition. Fast fashion retailers (e.g., Zara and H&M) who have recently entered the market are proving to be a profitable industry sector. While some large NZ companies (i.e., with over 100 stores) exist such as Hallenstein Glasson Holdings Ltd. and Cotton On Group, the majority of NZ retailers are smaller, independent companies. Clothing, footwear, and accessories specialty retailers hold the top spot for the industry's value, accounting for 49.4% of revenue in 2018, followed by department stores (28.8%). Online retailing is growing with larger companies capitalizing on both physical and online sales (MarketLine, 2020). For instance, Glassons was the most popular online fashion store in 2018, generating over $26M (USD) in e-commerce net sales (Statista, 2021) In that same year, online pureplay sales, or companies who solely sell online with no brick-and-mortar stores, had a 1.7% share of the apparel retail industry's distribution, with online sales only anticipated to grow (MarketLine, 2020).

As with the rest of the global C&T industry, the COVID-19 pandemic caused disruptions for the industry in New Zealand. Early figures indicate that the value of clothing and textile manufacturing and total spending in clothing, footwear, and department stores, significantly declined in the first quarter (January 1 to March 31) of 2020 (McElhinney et al., 2020; Statista, 2020b). Compared against the previous year, the value of manufacturing sales for textile, leather,

clothing, and footwear fell by $21M (NZD) in the September 2020 quarter (Stats NZ, 2020). Encouragingly, clothing, footwear, and personal accessory retailing as well as furniture, floor coverings, houseware, and textile goods retailing increased in sales value in the December 2020 quarter compared to the same quarter in 2019 (Stats NZ, 2021b). However, the long-term impacts of the pandemic on each stage of the textile value chain are uncertain (Brydges et al., 2020).

The relatively small size of the C&T industry in New Zealand, along with its geographic remoteness, will have implications for which strategies are feasible when it comes to addressing the industry's environmental impacts. These will be further explored in the discussion.

### 4.2 New Zealand Product Stewardship and Waste Context

The New Zealand government is working towards a circular economy approach when it comes to addressing waste (Ministry for the Environment [MfE], 2019). In 2021, New Zealand joined the Global Alliance on Circular Economy and Resource Efficiency (MfE, 2021a). In addition, the Ministry for the Environment is presently developing NZ's new waste strategy which will provide direction and guidance for addressing waste and recovering resources (MfE, 2021c). New Zealand's current waste management practices align with the waste hierarchy of Reduction, Reuse, Recycling, Recovery and Residual Management (MfE, 2005 as cited in Mia, 2011). At the time of writing, three governmental Acts provide the legal framework for waste management and minimization in New Zealand: the Resource Management Act 1991; the Local Government Act 2002; and, the Waste Minimisation Act 2008 (MfE, 2018). The Resource Management Act is the central environmental legislation for NZ and offers a framework for environmental management (MfE, 2018). The Act was recently amended to simplify the Act, allow for greater public participation, improve enforcement, and strengthen NZ's climate change response, amongst other changes (MfE, 2020a). The Local Government Act identifies the responsibility of solid waste management (collection and disposal) to be at the local authority level and thus decisions for waste to be made by local government (MfE, 2018). The purpose of the Waste Minimisation Act is to provide environmental protection along with environmental, social, economic, and cultural benefits by encouraging waste minimization (MfE, 2008a).

As part of NZ's new waste strategy, the Waste Minimisation Act 2008 will also be updated and strengthened (MfE, 2021c). In its current form, the Waste Minimisation Act provides a framework for national product stewardship including how priority products are

determined and communicated, application and requirements for stewardship accreditation, and monitoring accredited schemes (MfE, 2008a). Products that are considered to cause environmental harm or could produce substantial benefits through better management can be declared priority by the Minister for the Environment (MfE, 2008a). The Minister communicates a particular product as a priority through the *Gazette*, the government's official newspaper, and can provide guidelines concerning a scheme and its anticipated effects (MfE, 2008a). These guidelines could include the scheme's duration, reporting requirements, the expected scheme objectives, and the expected environmental harm reduction of the scheme (MfE, 2008a). Once declared a priority product, a scheme must be created and obtain accreditation (MfE, 2008a). Currently, six products have been declared as priority: tires, electrical and electronic products (i.e., e-waste), agrichemicals and agrichemical containers, refrigerants, farm plastics, and plastic packaging (MfE, 2020b).

Voluntary schemes for non-priority products can also be accredited through the same process as priority products (MfE, 2008a). Within this process, applications must identify the effects of the proposed PS scheme as well as the scheme contents (MfE, 2020b). The anticipated effects of the scheme include how it will use resources in a circular manner, internalize end-of-life costs, be accountable to the public, and how it will be collaborative (MfE, 2020b). Information related to scheme contents include governance, scheme operations (i.e., waste collection, sorting and processing; reporting; personnel training) and performance targets (MfE, 2020b). Currently, the only accredited, voluntary scheme for textile products in New Zealand is a scheme for carpet tiles (MfE, n.d.-c).

The Waste Minimisation Act also describes the waste disposal levy and the role of the Waste Advisory Board which provides advice to the Minister about product stewardship and the waste disposal levy (MfE, 2008a). The purpose of the waste disposal levy is to raise funds for waste minimization initiatives and to increase awareness of the negative environmental, societal, and economic impacts of waste disposal (MfE, 2008a), incentivizing the use of alternative disposal methods (MfE, 2021c). The government has plans to progressively increase the waste disposal levy and expand it to apply to more landfills over the period of 2021–2024 (MfE, 2021a; 2021b). The current waste levy is $10 (NZD) per tonne, set to increase to $60 (NZD) per tonne in 2024 (MfE, 2021b). Funds from the waste levy are split between the Waste Minimisation Fund and city/district councils for their own waste reduction initiatives (minus the

costs for administration) (MfE, 2021b). The Waste Minimisation Fund is a fund whereby any legal entity in New Zealand can apply for "projects that increase the reuse, recovery and recycling of materials" (MfE, n.d.-a, para. 1). Applicants are expected to pay for a portion of the project with this portion dependent on the type of applicant (40% for large, established organizations; 5-20% for small or community organizations) (MfE, n.d.-a). Since 2017, The Formary, on behalf of the Usedfully - Textile Reuse Programme, has been awarded funding for three projects from the Waste Minimisation Fund (MfE, n.d.-b).

Few formal options for waste or unwanted textiles exist in NZ. People can donate their clothing to charities or opportunity shops (op shops) for resale within the community, put in clothing bins, or bring to vintage or consignment shops. Often, unsold clothing and those put in clothing bins are exported to low-income countries (Casey, 2019) with used clothing exports in 2019 accounting for 1.23% (over $8M USD) of NZ's textile exports (OEC, 2019b). According to the country's last waste audit in 2008, textiles (clothing and carpet) account for 4% of overall waste composition, based on an average of four landfill indicator sites (MfE, 2008b; MfE, 2009). More recent estimates from Auckland Council put textile waste closer to 9% with textiles being Auckland's fastest growing waste stream (Casey, 2019). Currently, the costs of landfilling textile products are borne by the individual who disposes of it; for consumers, it is through the costs associated with bags purchased for curbside garbage pickup and, for companies or organizations, it is the waste disposal levy they pay to landfill items. As identified by one interviewee,

> There's very few ways, apart from clothing bins, free ways of getting rid of waste. And we have quite a large proportion of poor so, unfortunately, op shops are seen as a nice way to get rid of your waste, basically. We've increasingly got poor quality clothing coming through to us which couldn't – had to go to landfill – we have to pay for landfill. So, at the end of the day, someone has to pay for it. (I-401)

This same participant stated that her organization's costs for landfilling has jumped from $18,000 (NZD) to $32,000 in a span of two and a half years. Other participants echoed how the charity model of clothing disposal is increasingly no longer financially viable with the large volumes of unsellable garments being donated. It has become clear to these participants that alternative methods of dealing with NZ's clothing waste onshore are needed.

It is evident that the government is supportive of product stewardship initiatives and with upcoming changes to the waste strategy, waste disposal levies, and the Waste Minimisation Act, the appeal to join a PS scheme for C&T could be more enticing. The fragmentation of clothing and textile manufacturing as well as current options for waste management in NZ will have

implications for the scope and capabilities of a PS program. The context in which a PS scheme is being developed is important for understanding what factors will contribute to the scheme's success as well as how approaches for other products or in other contexts will need to be modified to meet local needs (Martin, 2016).

### 4.3 The Formary

The Usedfully - Textile Reuse Programme is a result of many years of effort led by The Formary, a New Zealand textile research and development company established in 2008, with the purpose of addressing end-of-use and end-of-life textiles. The Formary provides consultancy and R&D services to manufacturers, suppliers, or buyers of textiles to address sustainability issues within the value chain. Additionally, they have worked to find solutions for end-of-use textiles to prevent landfilling of these items, helping to retain the value and resources that have gone into manufacturing the textile. Since its inception, The Formary has worked with many major New Zealand and international companies to address different textile products ranging from coffee sacks to corporate uniforms. Initially, The Formary worked with companies as individual projects to create products from their textile waste streams. While similar "one-off" projects were great learning opportunities, they often had high overhead costs and it became evident to The Formary that these projects would not make a significant change in the production, consumption, or overall waste of these textiles; instead, a systems change was needed.

In 2016, The Formary was invited to review a project in which a New Zealand corporation was attempting to upcycle their uniforms but found that the project was not scaling. To cover the R&D costs for a scalable systems solution, The Formary proposed that the corporation ask other businesses to join the project. This suggestion kick started what is now the Usedfully - Textile Reuse Programme which was established in 2016 and officially launched in its current stage in 2018. The TRP is a collaborative effort between the private and public sector with the purpose of designing and developing a system to capture waste textiles, find solutions for them, and measure the impacts of these solutions. Following the idea of New Zealand as "an ideal user-testing market" for products and services, The Formary chose NZ as "the ideal market to develop and test a macro circular system for used clothing" (Casey, 2019, p. 3).

### 4.4 Usedfully - Textile Reuse Programme

The Usedfully - Textile Reuse Programme is intended for "any organisation that produces, supplies, or uses clothing or textiles" including uniform suppliers, clothing brands, charities, corporates, government agencies, and resource management companies ("Who's the Textile Reuse Programme For?", n.d., para. 1). Within the TRP are a range of projects and solutions to help build clothing and textile circularity in New Zealand. The aim of these different solutions and services is to enforce a systems change by engaging and connecting people within the textile ecosystem. Through the TRP, the following proof of technology, solutions, and services have been developed for textiles ("Our solutions", n.d.):

1) Fibre-to-fibre proof of technology takes polyester clothing and recycles it into polyethylene terephthalate (PET) that can be used for any plastics-based product as a raw material.
2) A fibre-to-roading solution which uses waste cellulosic textiles as a roading additive.
3) Usedfully's fibre scanning service uses a handheld scanner (technology developed by NZ company, Sagitto) which uses spectroscopy to identify or validate fibre and textile composition for efficient textile sorting.
4) Usedfully® Resource Management System enables users to register garments at any point of the value chain where they can be reused or reprocessed by others. The digital platform also provides environmental impact metrics on the registered garments based on data from WRAP UK with additional calculators to be added so users can choose between data sets.
5) Usedfully's On the Mend education series provide free events which teach sewing and repair skills to enable clothing life extension and to inform the community of clothing's environmental impacts.

These solutions and services are a result of several phases the TRP has worked through during its development (Table 4.1). The first stage was investigative, where program partners were audited on their corporate clothing consumption to gain an understanding of the volumes and types of fibres that solutions would need to address. Phase two included a feasibility study, in collaboration with Scion, a Crown Research Institute, to determine what existing solutions were available in the New Zealand market and what emerging solutions were being developed elsewhere that could potentially be brought onshore, given the volumes and fibres identified in

phase one. Phase three involved developing the Usedfully digital platform and proving it as a minimum viable product as well as building a pilot aggregation centre to receive, identify and process garments. The final part of phase three was testing one of the feasibility pathways identified in phase two. The pathway was a collaboration between the TRP, Scion, New Zealand Transport Agency, WSP New Zealand, and MfE whereby waste cellulose-based textiles were converted into additives for roading construction. This pathway was deemed successful and commercially viable, with the project discussed to trial in 2021 (Callaghan Innovation, 2020). Phase four is ongoing and involves the commercialization of these R&D projects, building up the Usefully digital platform, and the development of the Textile Product Stewardship Project which Usedfully members consider the "last piece" of the Usedfully system.

*Table 4.1: Activities involved in each phase of development of the Textile Reuse Programme and the phase outcomes.*

| Phase | Activities and Outcomes Involved Within the Phase |
|---|---|
| 1 | • Corporate clothing audits; identified volumes and fibre types |
| 2 | • Feasibility study; identified possible onshore and offshore end-of-life solutions |
| 3 | • Built digital platform (Usedfully® Resource Management System)<br>• Created and tested aggregation centre<br>• Trialed feasibility pathway for fibre-to-roading solution |
| 4 | • Commercialization of R&D projects<br>• Building up the Usedfully® Resource Management System<br>• Textile Product Stewardship Project |

The TRP consists of Foundation Partners, Partners, Members, Sponsors and Collaborators, all with different levels of program benefits to acknowledge the time and investment of those who have been with the program since its inception and those who have recently joined. Foundation Partners — those organizations who joined at the beginning of the TRP — have a representative from their organization on the Steering Committee where items such as funding and budgets are reviewed by the Committee. Foundation Partners also provide matched funding when required, for instance, as needed with projects funded by the Waste Minimisation Fund. Members receive the benefits of the program but do not necessarily have a say in the program. Sponsors provide support to the TRP financially through one-time payments or providing project funding such as the Ministry for the Environment which sponsors the program through the Waste Minimisation Fund. Lastly, Collaborators including academic

organizations, scientists, and Crown Research Institutes, provide services and product development to help build the system.

### 4.5 Textile Product Stewardship Project

Usedfully is working to implement PS through a step-by-step process, co-designing a scheme with New Zealand stakeholders throughout the C&T value chain. The project officially started in April 2020 with Usedfully receiving funding from both the Waste Minimisation Fund and through the TRP's Foundation Partners. The project is realized through two year-long stages with each stage containing its own objectives and milestones (Table 4.2). Stage 1 involves four milestones aimed to plan and scope the second pilot stage. The steps within Milestone 1 were, firstly, to invite people onto the Advisory Group to provide guidance and feedback on the planning and progress of the project and, secondly, to determine the scope of the project. Scoping included identifying relevant and priority stakeholders for the project and categorizing them based on the level of anticipated engagement within the project. Usedfully also met with service providers to design the stakeholder engagement process and a framework for social media engagement.

The objectives of Milestone 2 were to map textile flows throughout New Zealand to account for a lack of national data and to begin the stakeholder engagement process. This was accomplished by gathering primary data through one-on-one interviews with 36 priority stakeholders and secondary data statistics provided by government and academia. These stakeholders were asked about their sustainability strategies, their current or planned sustainability activities, drivers and barriers for getting involved in the project, as well as the volumes handled and end destinations for their textiles. Usedfully cast a wide net of stakeholders to estimate the total volume of textiles flows and to bring as many stakeholders as possible through to the pilot stage. From these findings, Usedfully released a report entitled Looking in the Mirror: A Review of Circularity in the Clothing and Textile Industry in Aotearoa (Casey & Johnston, 2020). A summary of the textile flows from this report can be found in Table 4.3.

The focus of the TRP to date has been on Business to Business (B2B) clothing and textiles (e.g., corporate uniforms, workwear, and commercial textiles) as these textiles often only have one life (due to physical condition and security issues of branded uniforms) and result in massive volumes of waste. Previous work by The Formary identified that New Zealand's twenty biggest organizations use approximately 860,000 garments, annually (Casey, 2019). Corporate

textiles, therefore, require large scale industrial solutions. Furthermore, the TRP purposely began with B2B textiles to have known volume and fibre content with which to build a system around. However, the TRP has plans to broaden to incorporate domestic or consumer textiles as well. These domestic textiles can have several lives through reuse, resale, and repair, indicating that the end-of-use possibilities for these textiles can differ from B2B textiles and may, therefore, require different solutions.

As part of Milestone 3, Usedfully hosted three in-person workshops and one virtual workshop for stakeholders to start to build a shared understanding of the current textile system. A total of 80 workshop participants identified barriers and opportunities for adopting a circular approach to textiles in New Zealand and then brainstormed possible project concepts that the pilot stage could address. Sixteen pilot concepts were identified from the workshops, falling within one of five themes: Collection/Aggregation/Sorting; Education & Awareness Building; Circular Proof of Concept; Lobbying/Industry Representation; and Sustainability Measurement. Usedfully then reviewed each pilot concept for its maturity phase (i.e., R&D, pilot, scaling), status (i.e., inactive, not coordinated, or underway), future pilot scheme pillar (i.e., focus of scheme, R&D, education and awareness building, or policy), and how it overlapped or contributed to other pilot concepts. Alongside the interviews and workshops, Usedfully conducted a social media campaign aimed to raise public awareness of the TPSP.

Milestone 4 involved defining the pilot through several steps. Based on the pilot concepts identified in the workshops, Usedfully sent out a survey to interested stakeholders to choose the concepts that were of greatest importance or that they would like to take part in. Usedfully received 71 responses from stakeholders throughout the value chain, including retailers, funders, researchers, and stakeholders involved in reuse, repurposing and repair. Other stakeholders included educators, product manufacturers, special interest groups, textile consultants, sorters, landfill operators, and fiber/yarn/textile manufacturers. Of these responses, 78.9% were interested in playing an active role in the pilot through doing, consulting, making decisions, or being kept informed of the pilot progress.

The results of the survey identified 7 pilot concepts as having the greatest impacts for NZ and for the stakeholder organizations that responded. From these, Usedfully refined the short-list of pilot concepts based on the survey responses as well as guidelines provided by MfE for applying for voluntary accreditation of a PS scheme. Usedfully evaluated the final concepts

using criteria such as impact; necessary stakeholder commitment; scalability or replicability; financial sustainability; feasibility and achievability; and potential as an accredited voluntary scheme. This resulted in three pilot project ideas providing three pillars of a future scheme. The first project idea was considered a foundational pillar of the scheme as it involved aggregating, identifying, and segregating unwanted textiles to address current issues faced by charities and op shops who accept donated items. This option was considered an essential aspect of the scheme to increase reuse and repair and divert textiles from landfill. The second pilot concept was end-of-life consumer education and would fulfill the pillar of education and awareness building of a future scheme. The third concept included research and piloting of technical solutions for "problem" end-of-life textiles (e.g., blends, trims, finishes, etc.) and would comprise the R&D pillar of a future scheme. All three proposed concepts outlined relevant stakeholders and potential scopes for the pilot project.

The next step of Milestone 4 was for interested stakeholders to demonstrate their commitment to the proposed pilot concepts and to form Working Groups for each concept. For the pilot concept to move forward, three members (i.e., engaged and relevant stakeholders) were required to commit to researching and developing a pilot concept proposal to commence mid-2021. All three proposed pilot concepts received enough commitment from stakeholders to move forward to Working Group formation, with each Group facilitated by a Usedfully member. The pilot will provide learning opportunities for scaling, suitable textiles for the scheme, the volume and quality of textile returns, and how it can be funded. At the end of the pilot stage, Usedfully will apply for voluntary PS accreditation for the scheme they have developed. Finally, as part of Milestone 4, Usedfully will prepare a White Paper to deliver to the Ministry for the Environment, providing recommendations for how the government could help to support textile circularity in New Zealand.

To conclude, Usedfully is focused on providing a system to achieve a circular economy in New Zealand. They have taken a systems approach by engaging a wide range of stakeholders and are working towards circularity by developing pathways where textiles are reused directly when possible, cascading down to lower-value applications, and finally to end-of-life solutions. One Usedfully key informant commented that it is not about having a default solution at the end, where any and all textiles can be reprocessed into new material as that mentality encourages endless production; rather, by having a system in place that can better collect and sort textiles,

then the textile can be kept at its highest possible value for a longer period of time. As better solutions are developed and scaled for end-of-life textiles, these can be "plugged in" to the system and further advance the system towards circularity.

*Table 4.2: Stages and milestone activities and outcomes of the Textile Product Stewardship Project.*

| Stage | Milestone | Activities and Outcomes Involved Within the Stage |
|---|---|---|
| 1 | 1 | • Advisory Board formation<br>• Project planning and scoping |
| | 2 | • Mapping textile waste flows<br>• Priority stakeholder interviews<br>• Looking in the Mirror report (Casey & Johnston, 2020)<br>• Social media campaign |
| | 3 | • Workshops with interested stakeholders<br>• Identification of 16 pilot concepts<br>• Social media campaign |
| | 4 | • Survey on pilot concepts<br>• Short-list of 3 pilot concepts<br>• Working Group formation<br>• Development of pilot concept proposals<br>• White Paper to the Ministry for the Environment |
| 2 | - | • Pilot project concept(s) identified in Stage 1 |

*Table 4.3: Textile volumes manufactured, imported, and sent to landfill in New Zealand (data from Casey and Johnston, 2020).*

| **Textile Type** | **Fibre and Fabric Production** (tonnes/year) | **Textile Product Production** (tonnes/year) | **Fibre and Fabric Imports** (tonnes/year) | **Textile Product Imports** (tonnes/year) | **Sent to Landfill** (tonnes/year) |
|---|---|---|---|---|---|
| Apparel | - | 18,531 | - | 19,959[1] | 34,922 |
| Carpet | - | 86,935 | - | 76,231 | 148,341 |
| Other[2] | - | 18,531 | - | 22,680 | 37,466 |
| Total | 137,600 | 123,997 | 265,351 | 118,870 | 220,800 |

[1]Includes new and secondhand apparel

[2]Includes linens, towels, curtains, and home textiles

# CHAPTER 5: Interview and Survey Findings

This chapter presents the findings from participant interviews and survey responses to addressing research questions 2–5. I begin with the findings related to the types of textiles and waste that participants deal with, their control and influence over value chain activities, as well as survey participants' interest in getting involved in a PS program. Next, I present the findings regarding the motivations or drivers for product stewardship participation and the current strategies participants have implemented to address their environmental impacts. This is followed by the barriers for product stewardship and the enablers that would help address or overcome these barriers. Drivers, barriers, and enablers have been categorized in a similar manner to Ki et al. (2020), however some factors differ from that source in terms of whether the factor is considered internal, external, or internal/external to the organization. Lastly, I present the findings on how sustainability efforts of the companies and organizations represented in the study have been affected by the COVID-19 pandemic. When I refer to participants and have not specified either interview participants or survey respondents, then the finding relates to both interview and survey participants.

## 5.1 Textile Types and Waste

Interview and survey participants both deal with a variety of textile types, with interview participants primarily dealing with B2B or corporate textiles including workwear, uniforms, personal protective equipment, or textiles for food or hospitality industries (e.g., linens, towels, etc.) (I-201; I-501; I-701; I-702), while survey participants predominantly deal with fabric for apparel, new consumer apparel, and accessories and footwear (Figure 5.1). In terms of textile waste, interview participants' major concern was end-of-life textiles. Survey participants also dealt with end-of-life textiles but additional waste in the manufacturing or retailing stages such as fabric offcuts, defect or unsold product, and garment returns (Figure 5.2). When asked what is done with waste textiles, participants mentioned a number of methods for disposal including donation (I-201; I-401; I-701; I-702; S-01; S-02; S-03; S-04; S-07; S-10), repurposing into new garments or other textile products (I-401; S-01; S-03; S-06; S-09; S-13), using as rags (I-201; I-701; I-702; S-05; S-07; S-08), selling items at discounted prices (S-04; S-11), and direct or indirect landfill disposal (I-201; I-501; I-701; I-702; S-04; S-10). Regarding landfill disposal, one participant stated:

> What we're doing at the moment, we don't have a solution. We don't have an end solution. So, we are working with a couple of companies in terms of developing models for end-of-life of garments […] But in terms of garment waste, most of our, most of the people we supply to — [company name] or our direct customers — it goes into landfill when they're finished. We're trying to change that. (I-701)

As exemplified by the participant above, landfilling these items was seen as a last resort or due to necessity as no other options are currently available for ongoing textile disposal.

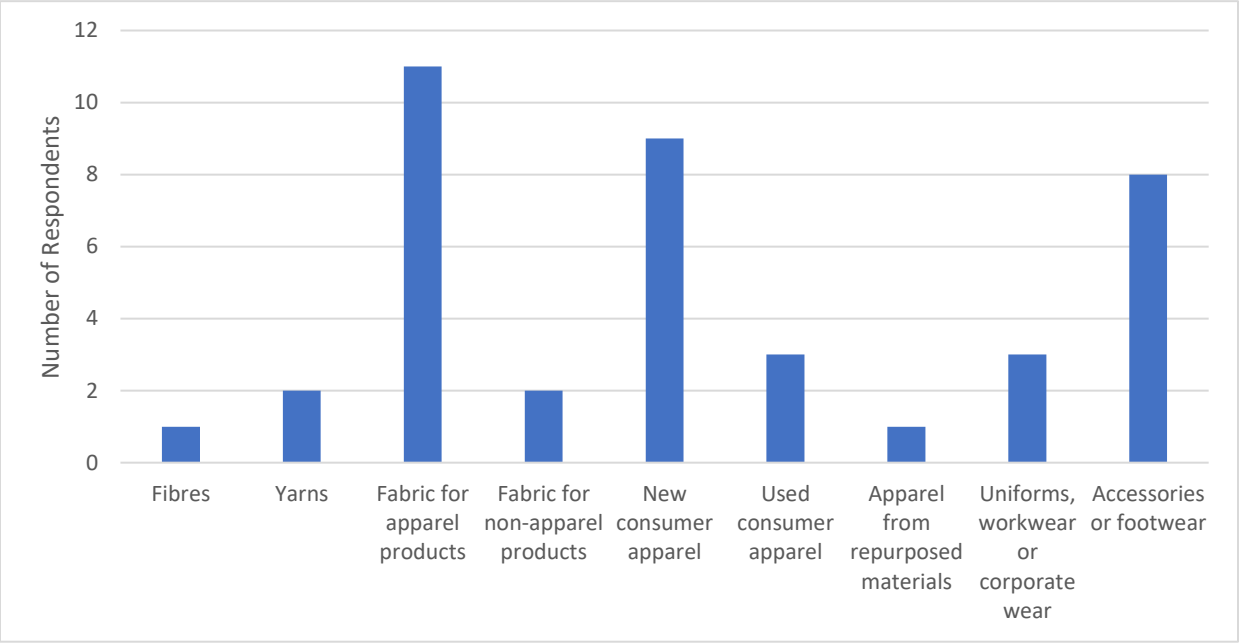


*Figure 5.1: Types of clothing or textile products survey respondents deal with (n=13).*

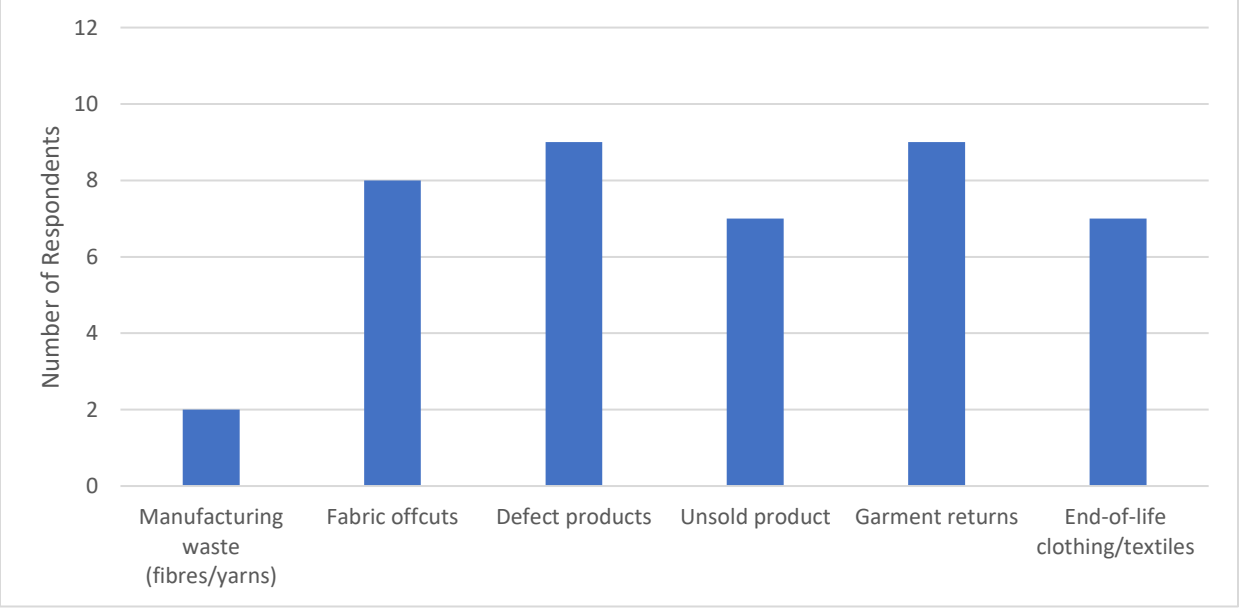


*Figure 5.2: Types of clothing or textile waste survey respondents deal with (n=13).*

## 5.2 Value Chain Control and Influence

Survey participants were asked about the stages of the clothing/textile life cycle they had control over versus the stages they could influence as this would provide some insight into their capacity to make changes directly within the value chain. As seen in Figure 5.3, participants had greater control over the upstream activities within the value chain which involved design/redesign, sourcing materials, manufacturing, distribution and logistics, and retail. However, they had less control (and greater influence) in downstream value chain activities such as laundering, maintenance/repair, disassembly/end-of-life solutions, and disposal, with slightly more control over reverse logistics or take-back services. In terms of influencing sustainability policy or government initiatives, participants felt that they had little to no sway over these types of decisions (Figure 5.4).

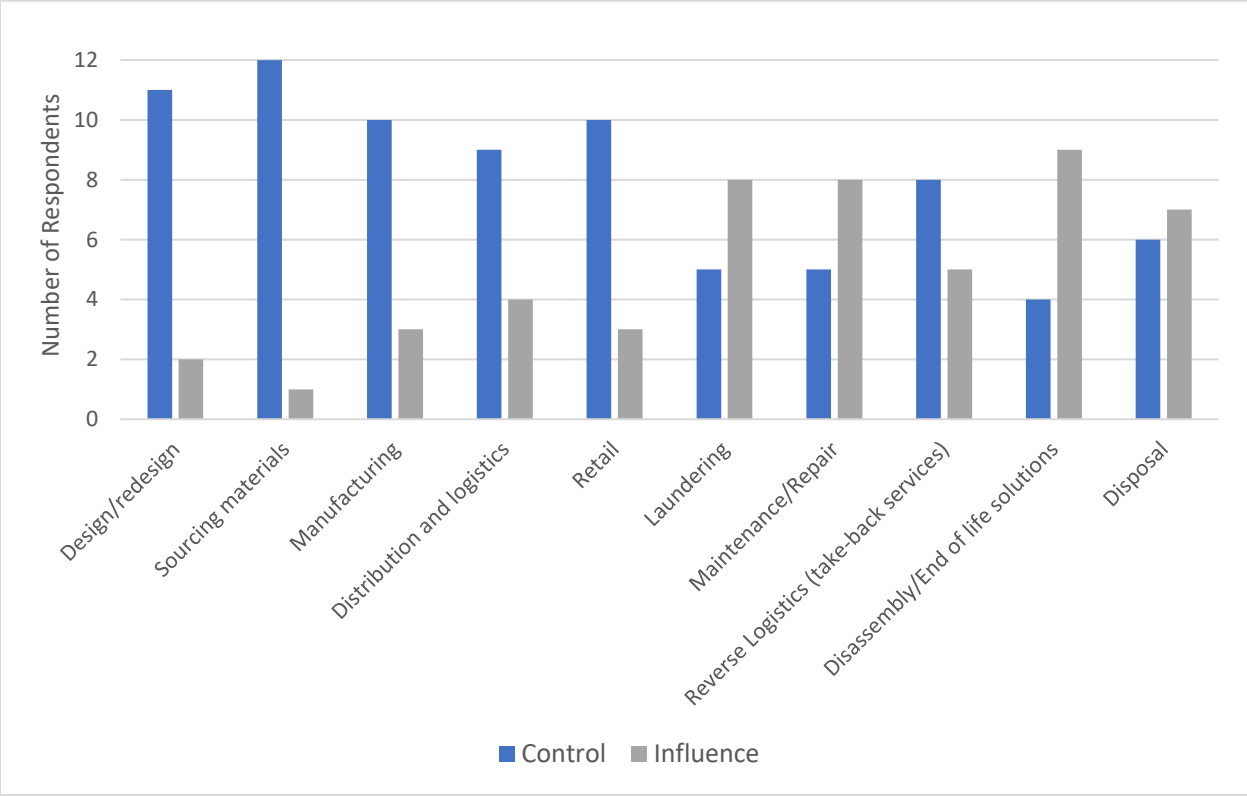


*Figure 5.3: Stages of the clothing/textile product life cycle survey respondents have control or influence over (n=13).*

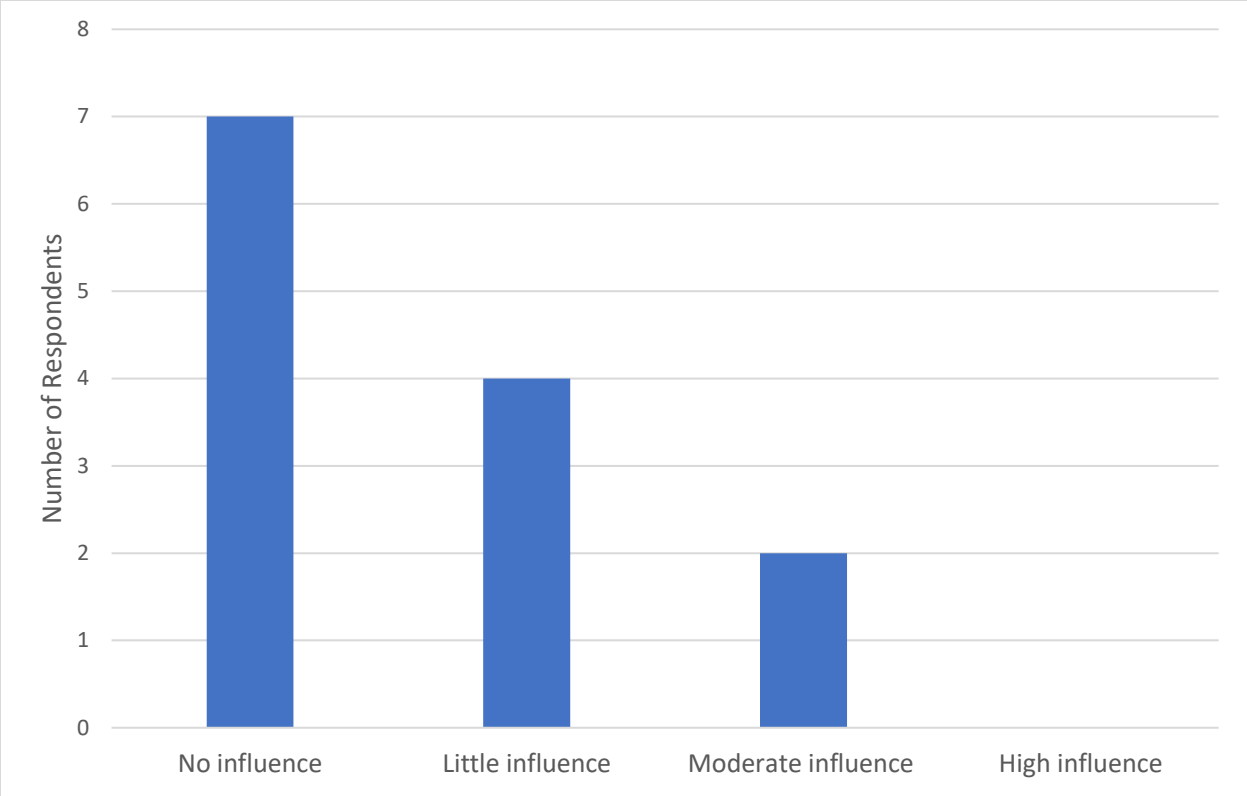


*Figure 5.4: Amount of influence respondents feel their company/organization has over sustainability-related policy or government decisions (n=13).*

### 5.3 Product Stewardship Involvement

Only five survey participants had heard about The Formary or the Textile Reuse Programme prior to the survey. Of those five participants, media (3), industry news (1), and through industry contacts (1) were listed as ways respondents had heard about them. When asked about their likelihood of joining an accredited, voluntary product stewardship program, eight participants were likely or highly likely to join, with some being unsure or unlikely to join (Table 5.1). Of the two respondents who were unlikely to join, one participant stated that the company was interested in PS programs "but haven't joined any at this stage due to a combination or cost and available resources (spare capacity of staff)" (S-04), while the other stated:

> We are currently very confident and comfortable with our sustainability, and have been so for a long time before that has become a corporate 'must be seen to do'. To be honest, we have been quite cynical at the lengths some companies now go to show they are saving the planet, when they aren't, and so we have continued not to focus too much on sustainability in our marketing, and therefore have not joined any programs. But we may do so in future. (S-11)

*Table 5.1: Survey respondent likelihood of joining an accredited, voluntary product stewardship program (n=13).*

| Likelihood of Joining | Number of Respondents |
|---|---|
| Highly likely | 5 |
| Likely | 3 |
| Unsure | 3 |
| Unlikely | 2 |
| Highly unlikely | 0 |

## 5.4 Drivers for Product Stewardship

Of those survey participants who indicated they were likely to join an accredited, voluntary PS program, they were motivated for several reasons. Industry participants represented in the interviews also stated various reasons for engaging in product stewardship. These drivers could come internally from the company/organization, for a reason external to the company, or a combination of internal and external drivers. Responses sometimes varied based on the type of company or organization (i.e., B2B or customer-facing) and where they operated within the value chain.

### *5.4.1 Internal Drivers*

Internal drivers refer to sustainability motivations that come from within the company or organization itself. For many industry participants, taking responsibility for their environmental impacts was seen as the "right thing" to do (I-201; I-501; S-01; S-03; S-04; S-06; S-07). In these instances, environmental concern is part of the company's purpose or mission, and decisions are made with environmental benefits or impacts in mind. Relatedly, a sense of responsibility to the environment motivated participants in their sustainability efforts (S-08; S09). One participant stated that they are "already looking for ways to reduce waste; it is and always has been, part of the company's DNA" (S-04). For these participants, sustainability and environmentalism play an integral role within the company. One interviewee stated:

> I think it's just mostly you've just got to be doing the right thing. And, you know, cost doesn't become the key driver if you know that the end goal was to eliminate waste and landfill, then you know? That's it, then you need to plan differently. (I-501)

These sentiments were echoed by consultant participants and Usedfully key informants in that, ideally, businesses should be internally motivated to be sustainable if their business model

has negative consequences for the environment. However, they recognized that not all companies will be intrinsically motivated to take responsibility for these impacts as there are no tangible reasons (i.e., legislation; costs) for doing so. As one Usedfully key informant stated:

> I think ideally […] businesses should be sustainable. Now, it's just that the system that we've been operating in hasn't forced that on them. So, as an example, [it hasn't] captured the true cost of the business practices. They haven't had any reason to be fully sustainable or circular – however you want to term it. So, ideally brands should just want that, you know. That would be the idealistic view. But the reality is that to have that happen, you've got to have other drivers because, obviously, if people are doing well economically, financially, and [not] having to have the true costs attributed to their business, they can carry on as they are. (I-101)

One consultant emphasized that product stewardship will be driven out of necessity, due to the current resource intensity of the industry:

> So, if your business is into selling clothes and you're dependent on crops and water and land use, then you better have a different business model. So, I think that's a massive driver […] I do think it's just multiple drivers now. But if you want your business to survive for the next 20 years, you have to change your business model. There's no question. (I-301)

According to this participant, businesses will be driven to product stewardship to better manage scarce resources.

Two survey participants responded that joining a product stewardship scheme could provide them with guidance on how they could implement changes to become more sustainable. Participant S-13 stated that "[having] a framework and tested/developed system to work from" would be their major reason for joining a PS scheme. Lastly, an internal incentive to address textile waste for companies or organizations such as those with rental models or involved in waste management was simply the volume of waste they had to deal with. These types of businesses are getting the immediate feedback of how much waste is being generated and are, therefore, motivated to engage because of these firsthand waste experiences.

### *5.4.2 External Drivers*

External drivers refer to motivators to improve sustainability that comes from outside the company or organization. The most common external motivator highlighted by industry participants to address environmental impacts was customer pressure (I-501; I-701; I-702; S-10). Participants discussed how their customers have inquired about what they are doing to improve sustainability in their business, with this being an incentive to change to suit what customers are

looking for. Usedfully informants talked about how this pressure is more likely to be on companies getting inquiries from customers regarding what they can do with their clothing at the end-of-use stage. The participant from the textile rental company agreed that, because the rental model is inherently more circular, the company was not getting as much pressure from its customers.

The increasing waste disposal levy discussed in section 4.2 was anticipated to be an incentive to find alternatives for landfill disposal of textiles; however, one participant pointed out that there are currently no alternatives for a lot of waste streams, including textiles. Instead, people may just have to pay more money to landfill their waste textiles unless alternative solutions for this waste are developed. This argument, however, could be used as leverage to join a PS scheme that has alternative disposal options if the cost of landfilling becomes more expensive than becoming a PS scheme member.

One organization interviewed relies on volunteers to repurpose donated clothing that cannot be sold in its current condition. Although textile waste was prevented in the process of repurposing, the purpose of the organization was to advocate for and upskill these volunteers. As the participant explains, “we’re advocating for people learning to sew so that they understand what it takes. And then they think twice about buying fast fashion. It skills them up” (I-401). Relatedly, another company represented in the survey was driven by advocacy and upskilling people by providing employment to women who are vulnerable or living in poverty, in addition to wanting to improve the environmental health of the planet. These two participants demonstrate that environmental motivation may not be the only factor driving sustainability initiatives but that the effects of their efforts can still have positive environmental impacts.

### *5.4.3 Internal/External Drivers*

Internal/external drivers refer to motivators that initially come from within the company or organization with the acknowledgement that it may appease external pressure from consumers. Participants shared how sustainability initiatives can function as a “good story” for the company or organization (1-101; 1-104; I-702; I-801). In other words, companies could use their environmental initiatives as a marketing story to attract customers while simultaneously improving or demonstrating their sustainability. Knowing that a “good story” will come out of a project was seen as an encouraging factor for engaging in a sustainability project. One participant who manufactures textile products explained how their own customers may be

motivated to invest in garments made from more sustainable fibres (e.g., recycled fibres or alternative biodegradable fibres) if they knew that the story, and resultant business, would be worth the initial financial investment.

While not as widely shared, other drivers for product stewardship included demonstrating brand leadership (I-102; I-103; I-201), to be held accountable to sustainability standards (S-02; S-06), and for company or organizational credibility (S-05). For brand leadership, companies were motivated to engage in product stewardship because it demonstrates how they are leaders in textile sustainability which may be a potential attractor for business. One participant discussed how his company has been demonstrating leadership for over a century:

> I think the Textile Reuse Programme is well worth our investment of time and energy and well worth keeping abreast of things that are going to make a difference. Our company has been around long enough to know that disrupters and change doesn't happen overnight, it's a gradual process that's ongoing and in order to get better as a business — and we want to be better — we've got to keep our eyes and minds open for change. And we're not scared of change. In New Zealand, our business has evolved over — it started in New Zealand in 1910, it started in America in about the 1880s — there's been a lot of change over those years and will probably continue to change. We want to be part of it. (I-201)

## 5.5 Strategies for Sustainability Improvement

There were several practices that participants engaged in to reduce their textile waste or to otherwise address their environmental impacts. These practices can be organized into the categories identified by Lewis (2016) as policy, design, procurement, or recovery strategies.

### *5.5.1 Policy Strategies*

Participant sustainability efforts can be formalized through a company or organizational sustainability policy. Four out of five companies represented in the interviews and seven survey participants reported that their company has a sustainability policy. Policies from survey respondents covered a range of initiatives to enhance their companies' social and environmental sustainability (Figure 5.5). Other areas addressed in policies that participant S-13 listed were reduction of plastic packaging, working with suppliers to align sustainable values, and community and charity work. Decisions about sustainability or waste reduction were mostly made by those in high level positions such as owners, managers, or directors, while some companies reported having a sustainability team or working group for these initiatives. Of those companies/organizations represented in the survey with a sustainability policy, most used the

company website or social media platforms to communicate these policies to the public (Table 5.2). Interview participants also communicated through their websites or through sustainability or Corporate Social Responsibility reports. Despite not all companies having an official environmental or sustainability policy, 11 of the 13 survey respondents had pages on their website dedicated to sustainability, traceability, or transparency. These websites also listed various certifications or standards that respondents' companies or products adhered to including Fairtrade, Responsible Down Standard, bluesign®, the Higg MSI, Global Organic Textile Standard, Oeko-Tex, ZQ wool certification, and 1% for the Planet where 1% of company sales is donated to environmental non-profit organizations. Furthermore, two companies who responded to the survey are members of Mindful Fashion NZ, which outlines a code of conduct for members to follow on issues related to labour standards, transparency and traceability, and environmental protection.

When it comes to monitoring environmental impacts, one interviewee discussed measuring their waste diversion practices holistically, while others did not currently monitor their textile waste generation. Survey participants monitored a variety of environmental impacts, with production/purchasing, waste volumes, and packaging materials at the top of the list (Figure 5.6). One interviewee described how his company had investigated carbon zero certification yet decided against it because it would only certify their onshore supply chain, while most of their manufacturing, and thus carbon emissions, occur offshore.

*Table 5.2: Ways survey respondents communicate their environmental or sustainability policies to the public. Totals are greater than 7 because respondents could have chosen multiple communication methods.*

| **Communication Method** | **Number of Respondents** |
|---|---|
| Company website | 7 |
| Social media | 5 |
| Direct inquiries | 2 |
| Printed catalogues | 1 |

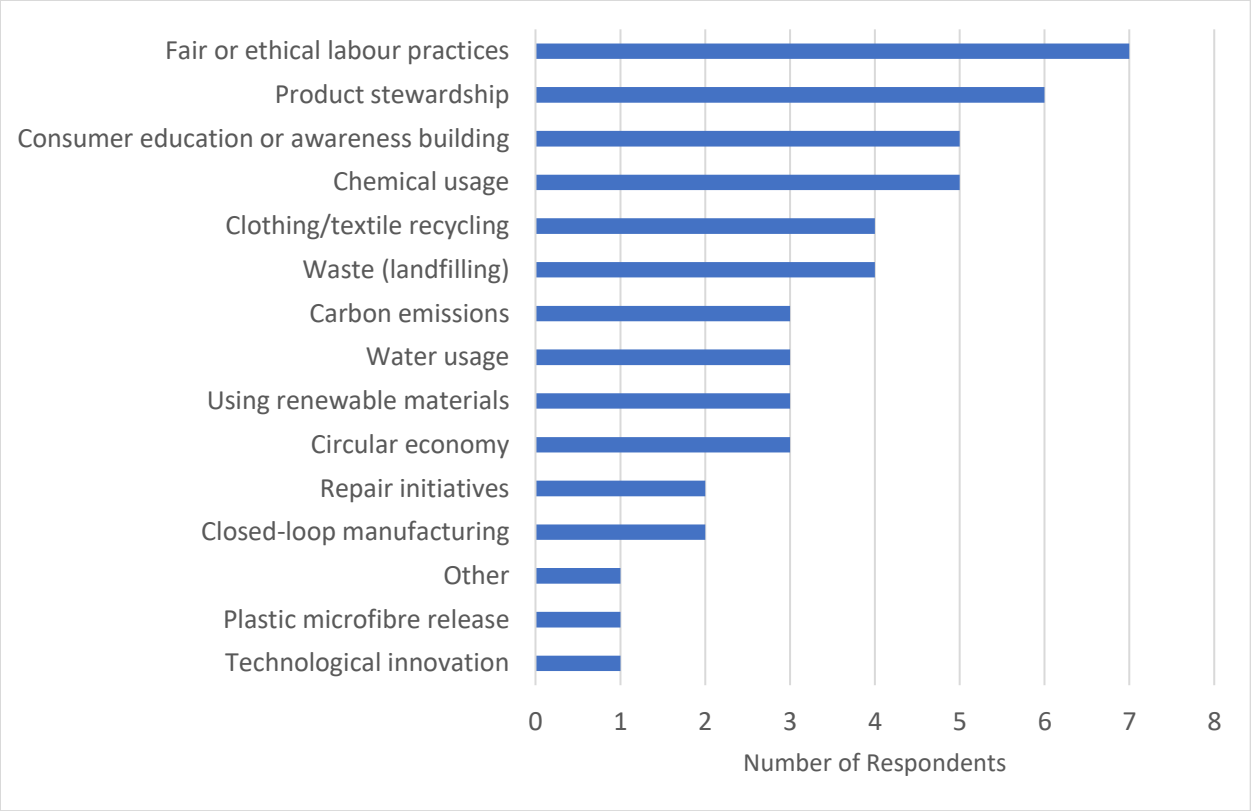


*Figure 5.5: Areas addressed by survey respondents' company/organizational environmental or sustainability policy (n=7).*

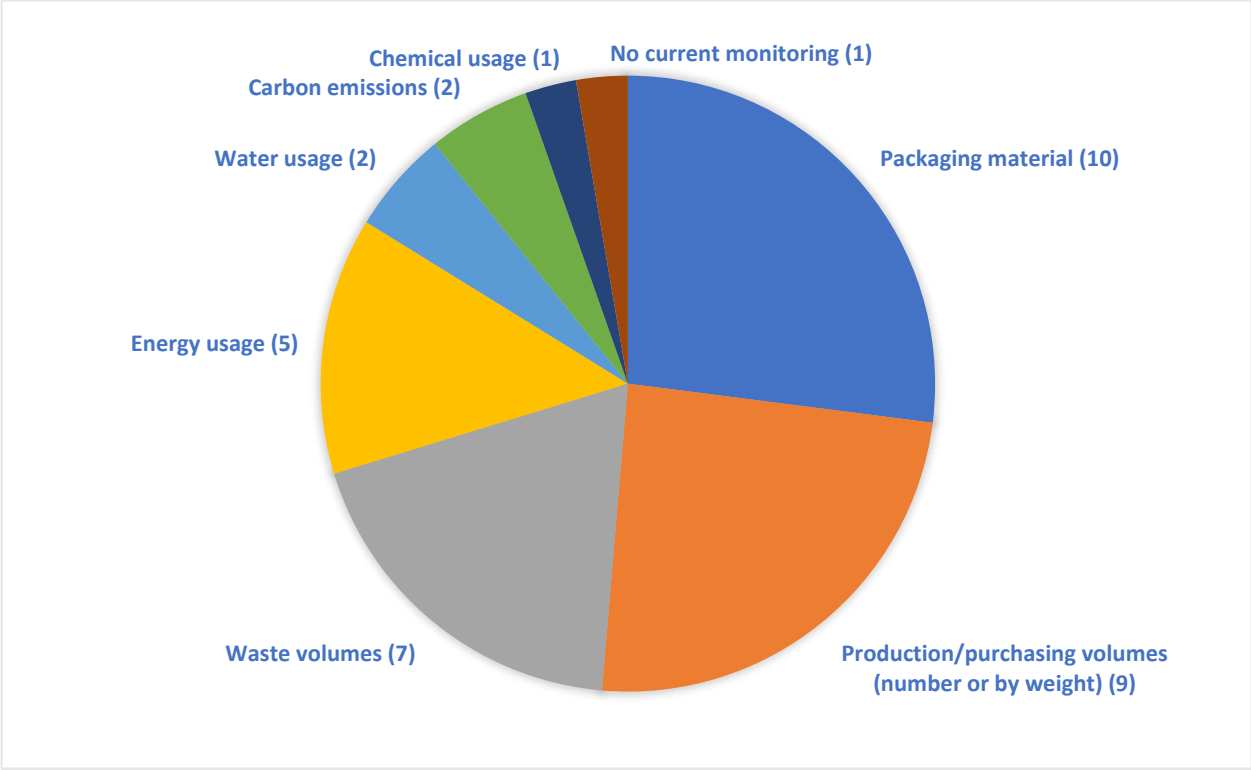


*Figure 5.6: Environmental impacts monitored by survey respondents (n=13).*

### *5.5.2 Design Strategies*

Many participants demonstrated life cycle thinking by considering the environmental impacts of their products from design to the disposal stage. Participants thought about the sustainability of the garments at the beginning of their life so that there are better options for the products at the disposal or end-of-life stage (I-501; I-701; I-702; S-07; S-10; S-11). This included creating durable products meant to last, "core styles" that could transcend seasons or trends, or making products intended to be recyclable. Not only does this thinking relate to the textile product itself, but the associated wastes that come along with it. For example, one participant stated:

> We are now on that journey of thinking – the whole life cycle. And where it can end up and that's right through from not only the garment but then to all the packaging and the ticketing and everything surrounding that product. (I-501)

In addition to life cycle thinking, companies responsible for their own design and manufacturing incorporated sustainable fibres such as recycled polyester or organic cotton into their product lines (I-701; I-702; S-02; S-07; S-12). Participants also discussed moving away from synthetic fibres, where possible, and replacing these with natural fibres. Similarly, participants who purchased their garments from outside manufacturers discussed how they sourced more sustainable textiles in the first place to improve their environmental impacts (I-501; I-801). Some participants who manufacture had implemented techniques to minimize textile waste at the garment production stage (S-09; S-10; S-13). These techniques included efficient fabric cutting or whole garment technology. One participant described how the company "use[s] practises to minimise waste like fabric cutting in the most economical way, even altering patterns to create less waste" (S-09).

### *5.5.3 Procurement Strategies*

Procurement strategies were not as widely utilized by industry participants, although some interview participants noted that ethical sourcing and finding suppliers with practices in alignment with sustainability policies was important. These participants, who purchase or supply corporate textiles, workwear, or uniforms were beginning to have discussions with their suppliers about what can be done with the textile products they have purchased at end-of-life and what these suppliers might plan to do in the future (I-201; I-501; I-801). One participant stated how her company plans to budget for end-of-life options at the procurement stage, once a viable

solution for waste textiles is in place. Another participant discussed how his company was planning for end-of-life options through procurement contacts. For example,

> We're just waiting for when we go to tender next and we'll actually put in stronger end-of-life controls and monitoring in the tender because, at the moment, it's based on the goodwill of our supplier. Whereas, when we go to the market next for uniforms we'll put in this, kind of, better end-of-life provisions. So, we're kind of gonna [*sic*] try and put the emphasis more on the supplier by actually incentivizing through the contract to do something about it. (I-801)

By starting these discussions and actively searching for ethical suppliers means that participants are planning for end-of-life at the procurement stage. Some of the responsibility for end-of-life textiles is then being shared with upstream suppliers.

### *5.5.4 Recovery Strategies*

Participants reported several current processes to divert textiles from landfill disposal. These included reuse options where textile products were donated to local or international charities, fashion schools, or sewing groups; given away to staff; sold as scraps; or sold at discounted rates. Through diversion efforts such as these, survey respondents stated that very few items were left over for landfilling. Two survey respondents offered repair services for their clothing, while 11 study participants discussed how they repurposed textile products. Repurposing efforts could refer to downcycling into rags, upcycling into one-of-a-kind or value-added products, or even reconstituting waste into hand-knitting yarn.

Participants also highlighted their efforts to address other areas of waste including recycling non-textile materials when possible and eliminating or switching from plastic packaging to paper-based or compostable packaging (I-701; I-702; S-05; S-08; S-09; S-13). One company discussed how they were also eliminating plastic tags from their clothing products. An additional area of sustainability that some participants' companies/organizations have addressed are reducing their transport emissions by electrification of transport fleets (I-201; I-801) or by allowing customers to pay to offset their carbon emissions when purchasing online (S-09).

In addition to survey participants' current sustainability efforts, they were asked what areas they feel they could address or improve upon (Figure 5.7). Reducing or eliminating packaging followed by providing fair or ethical labour opportunities were the two top areas survey respondents felt they could address. Participants discussed the possibility of offering take-back services for their garments to resell or repurpose (S-01; S-02; S-03; S-07; S-10; S-13) and

stated that they could look into existing reuse and recycling options within New Zealand for waste textiles (S-01; S-03; S-05; S-07; S-13).

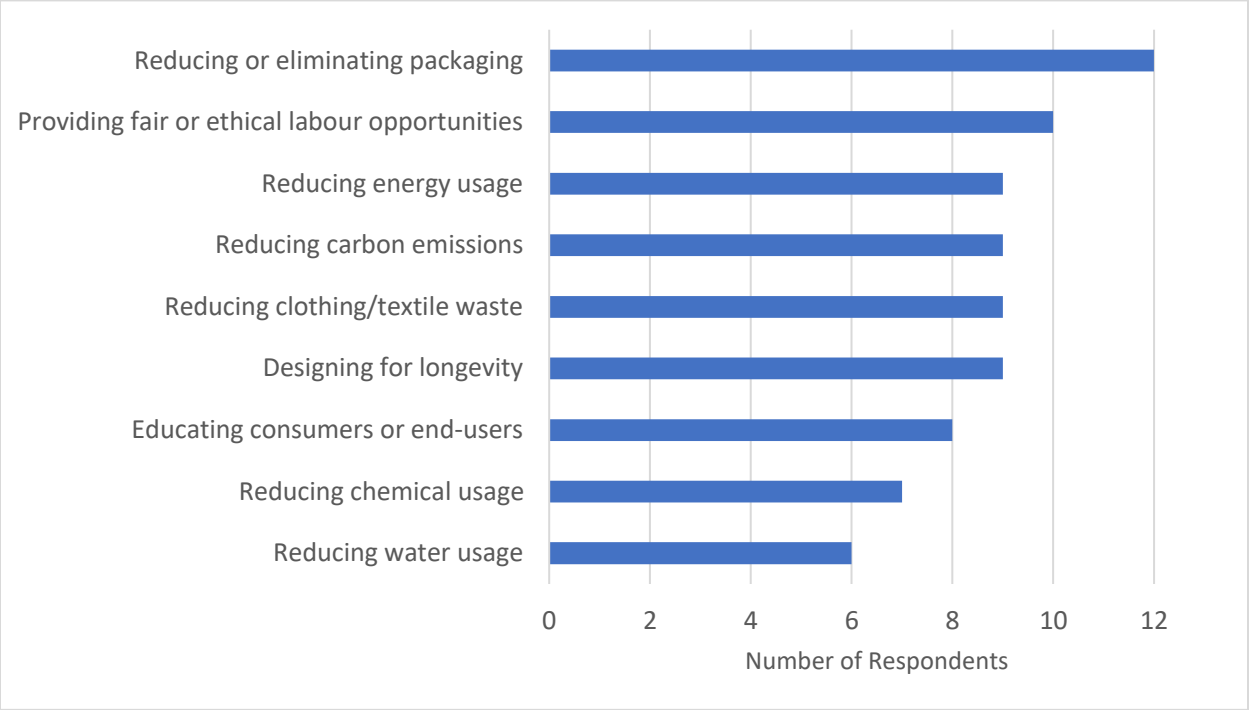


*Figure 5.7: Areas of sustainability survey respondents feel their company/organization could address (n=13).*

## 5.6 Barriers for Product Stewardship

Several barriers for engaging in product stewardship were identified from the perspectives of Usedfully informants developing the TPSP but also the wider challenges of industry stakeholders in addressing their environmental impacts.

### *5.6.1 System Development Barriers*

For the participants working on the TPSP, stakeholder engagement was a challenge for a few different reasons. Firstly, Usedfully informants discussed the challenges of communicating the PS pilot or TRP as a system rather than a concrete solution to textile waste. Participants discussed how their purpose within Usedfully is to create a system for textiles that solutions could be added to rather than trying to develop a circular solution. In this sense, members are investing in building a system before the solutions. Therefore, "selling the system" as opposed to a solution was seen as a barrier for stakeholder engagement. As one participant said:

> We've had that focus on not being — how do we explain we haven't got the solution? But what we add on offer is a system, not the solution, or we add one solution, but it's the

> selling of a system and the selling of the knowledge; the understanding that the system needs to change to provide the solution. (I-101)

Similarly, interviewees identified how some industry stakeholders are looking for instant solutions to their waste problems and are not necessarily willing to invest in a system or acknowledge that the system must be developed first (I-101; I-102; I-103; I-201). Instead, companies or organizations are interested in one-offs where they offload textile waste to charities or other organizations for reuse without attempts for this to be a systemic change in their business. One interviewee mentioned how corporates her company supplies inquired about garment end-of-life improvements, yet "unfortunately, the speed at which the world works at there is not a lot of appetite to say that we may have a solution in two years, you know, they wanted a solution in two months" (I-501).

Usedfully informants also noted that stakeholder engagement was a challenge in terms of building a circular movement. Although Usedfully hired service providers to help with a stakeholder engagement plan for Stage 1 of the project, they noted that building awareness of product stewardship and trying to get stakeholders on board before the project began by having a detailed engagement plan would have helped their efforts and given a sense of project interest. While each Working Group ended up getting enough stakeholder commitment to proceed, it was difficult for Usedfully informants to predict how much engagement they would get in building the pilot proposals.

Another challenge with developing the TPSP are waste priorities at a national level. As previously mentioned, six priority products had been announced by the Environment Minister. These priorities included plastic but not textiles, even though the majority of textiles are made from synthetic or plastic-based fibres and that these fibres have a demonstrated harmful impact when landfilled or through microfibre release. As one Usedfully informant describes: "within the government, they prioritize certain waste streams. And textiles is not one of their highest priorities" (I-101). Furthermore, it was highlighted that textiles are essentially two waste streams: organic waste for natural fibre textiles and plastic waste for synthetic textiles. Both organic waste and plastics are of high priority at a national level, yet textile products are excluded from these streams.

At a more practical level, textile sorting was seen as a challenge in developing a circular system due to the many fibre types and conditions of clothing at the end-of-use or end-of-life stages. Particularly, technologies for fibre identification and how "no one technology fits all

fibers" increase sorting complexities and pose challenges for efficient sorting. One participant summarized these challenges when he stated:

> So, a lot of the research that's going in is about separation of the base fibres and then reusing that base product. The poly-cotton separated into polyester and cotton. If you can find a use for the cotton, then you can find a use for the poly. But can we do this on a decent scale and then how do we deal with all of the other bits and pieces that would end up in any sort of process as feedstock, that won't be as pure as the poly? That healthcare uses, for example, that come from the fabric industry around curtains and matting and all those kinds of things. They're just different qualities and different fibres and the identification and separation of those, it seems to be taking up a lot of discussion with the Textile Reuse Programme because the feedstock will be such a varied range of product, it's pretty hard to imagine how it would all be separated out into various base form. (I-201)

The third pillar of the pilot scheme to address problem end-of-life textiles is intended to find options for these items as one Usedfully informant stated:

> It's very clear to us and the work we've done that a lot of the inability to create circularity in textiles is from a technology processing point of view. So, what are the options? So, what are the options at scale, as well? So, there's an element to any product stewardship scheme in this space, that there's going to be some R&D. (I-101)

### *5.6.2 Stakeholder Barriers*

Stakeholder barriers refer to the internal and external challenges that industry participants are faced with when it comes to joining a product stewardship scheme or otherwise addressing their environment impacts.

**5.6.2.1 Internal Barriers.** For industry participants, the most common barrier for product stewardship engagement was financial concerns (I-401; I-501; I-701; I-702; S-01; S-02; S-03; S-04; S-05; S-09; S-13). This included the costs of transitioning to the use of sustainable fibres, pressure of an ongoing financial commitment if one was to join a PS program, or costs for end-of-life solutions that had not been budgeted for in the procurement stage. When asked directly what barriers might prevent PS participation, one survey respondent (S-01) answered: "Financial concerns are probably top of the list. Garment manufacturing is very tough, and profits are slim, so initiatives need to be cheap and easy to initiate in order to get take up in the industry." For one interview participant, trying to encourage their customers to purchase more sustainable fibres (e.g., organic cotton or Better Cotton Initiative certified fibres) was difficult because of the added cost that customers would have to pay for. Relatedly, the cost of sustainable fibres versus conventional fibres was seen as a barrier for companies to stock more sustainable fibre lines.

Often discussed alongside financial concerns was labour or the necessary people to dedicate time and effort to program participation (I-401; S-10; S-13). Sufficient staff time or "dedicating time and human resources to something that doesn't have a direct financial gain" (S-13) was seen as a challenge.

Another barrier is the condition of textiles at the end-of-use or end-of-life phase which makes it difficult for any direct reuse option (I-401; I-501; I-801). On the commercial textiles side, this would be uniforms or other corporate wear that has been worn for activity that may result in physical damage or sweat, while fast fashion garments may be in poor condition due to the initial lower quality of the garment. Participants discussed how this condition posed challenges in terms of what options there were for the garments besides using as rags or landfilling. For example, one participant dealing with corporate textiles stated,

> […] whereas the postal and delivery uniforms are synthetics and heavily used so very heavily worn, sweat stained, etc., because of the use they get. So, you know, you have the corporate uniform, theoretically is easy to find an end-of-life solution for it, whereas the delivery uniform is very much low-grade textile at the end of its life, so a lot harder to find the solution for. So, we kind of had to treat the two quite differently in terms of what we could potentially do with it and what we'd end up with. (I-801)

Clothing condition also had implications for donated textiles in that instead of being able to sell these garments for another use, they had to be landfilled. This barrier relates to the issue of textile sorting as well since these "problem textiles" pose challenges for sorting processes.

Interviewees discussed how other areas of waste or sustainability were of higher priority within their business than textile waste (I-201; I-501; I-801). This could be due to volume of waste in relation to other waste streams, such as packaging, or because the nature of the business deals with other areas with higher impacts. For example,

> Our main focus really is decarbonisation. So, you know, getting our carbon emissions down. And I think when we were looking at uniforms, we were in a place where we were doing lots of tiny little projects everywhere, whereas over the last few years, we've worked really hard to spring everything in and just make some big differences in one or two environmental areas. And carbon is our number one thing to reduce. (I-801)

Textiles as a lower priority form of waste means that action to address textile waste could be delayed or put off by stakeholders.

**5.6.2.2 External Barriers**. An external barrier faced by many participants was a lack of governmental support for sustainability initiatives. All survey respondents stated that they received no direct support from government. Aside from the Waste Minimisation Fund,

participants received little support in the form of funding or through textile regulations. One participant noted that despite the government's goals to reduce emissions or other environmental impacts associated with climate change, there are no practical levers put into place to achieve these goals.

Lack of infrastructure in the form of local manufacturing, textile waste aggregation centres, or infrastructure to reprocess waste textiles was also highlighted as a barrier to product stewardship (I-201; I-601; S-07; S-11). As manufacturing has generally moved offshore, this has meant that using waste textiles as raw material for textile reprocessing is not currently a viable option within New Zealand. Furthermore, as New Zealand manufacturing is primarily limited to wool, physical infrastructure to deal with synthetic fibres is lacking.

**5.6.2.3 Internal/External Barriers.** Internal and external barriers refer to the challenges participants face within their company or organization that are beyond their control. Brand or company/organizational size was seen as a challenge as participants discussed how larger brands can more easily make sustainability changes within their business due to broader reach (i.e., larger supply chain and logistics networks) and scale (need or ability to place larger orders) (I-103; I-601; S-02). Furthermore, participant I-103 discussed how larger brands have a big enough scale to make more impactful changes and can use their size as leverage to make significant changes within the supply chain. In addition, brand size also had implications for which factories they could work with: "It is also challenging to find factories with certifications when our units are low because only bigger factories can afford them" (S-02).

A barrier for sustainability action shared by one survey participant was that they were unsure which sustainability initiatives to focus on because of the number of options available. In their words, "it can be challenging to know what is the best next step in sustainability (i.e., is it better to have organic cotton or WRAP certified factories?)" (S-02). As there are many options for guidelines and certifications, it can be challenging to know which one will have greatest impact and is the best fit for the company.

Another survey participant stated that "the current business structure and ways of working" (S-13) was in itself a challenge for sustainability. One interviewee also highlighted how the neoliberal consumption model that the fashion industry operates in has added significant complexity to the issue. The size of the industry, its fragmented supply chains, and the scale of its environmental impacts were all seen as a great challenge in integrating product stewardship

within the industry. Lastly, a survey participant, while in the minority, mentioned that they had not yet faced any barriers to address the environmental impacts of their products; rather, they argued that it was a matter of making an effort.

## 5.7 Product Stewardship Enablers

While the interview and survey participants identified numerous barriers for product stewardship, they also highlighted several factors that would better enable them to address their environmental impacts.

### *5.7.1 Internal Enablers*

Interview participants, particularly those involved with the TRP, demonstrated having a systems perspective in that they had moved away from "low hanging fruit" solutions (i.e., easily implemented solutions such as using recycled fibres) towards an understanding that a systems change is necessary (I-101; I-102; I-103; I-201; I-801). Participants talked about the need for long-term sustainability that is a result of creating a circular system with "linked-up thinking" and looking at the value chain holistically, rather than one-off or instant solutions. One interview participant who is working on the development of the TPSP stated how this "linked-up thinking" is needed and what they are striving for in the TPSP. In his words,

> […] the kind of the linked-up thinking is not happening so much here, yet. And I think that's where we're trying to, to engage. So, the Textile Reuse Programme already has partners, not just in the fashion retail space, but also in the uniform space and even in logistics. And this kind of linked-up thinking is really important to try to come up with a solution or identify the best options in the New Zealand context. (I-103)

Having a systems perspective was, therefore, seen as a valuable way of thinking to advance circular initiatives.

### *5.7.2 Internal/External Enablers*

Raising consumer awareness of the sustainability issues surrounding the industry was identified as one way to challenge the status quo and promote or advance PS and circularity (I-101; I-102; I-103; I-104; I-601). If consumers are educated on the impacts of their clothing purchases and behaviours, then they can start putting the pressure on companies, as well as government, to act. Interview participants noted they have seen an increasing awareness from consumers, especially young consumers who have just completed university, and that additional consumer education would help increase customer pressure.

Interview participants also highlighted the importance of monitoring textile flows, specifically textile waste, for understanding the scale of the problem (I-101; I-102; I-103; I-601). Despite the lack of textile waste monitoring at the national level, collecting waste diversion information is important to measure the effectiveness of sustainability efforts. This is important not only for individual companies but for providing baseline data for the TRP. As one participant described,

> Ultimately being able to measure it — if you can't measure it, you know, it's got no value. So, yeah, that measurement is really key. It's a key from our sponsors, from our funders, because they want to understand the impacts of our projects. And it's key from membership, because they want to be able to report what they're doing. (I-101)

Collaboration amongst stakeholders and having shared values with collaborators was highlighted as an important factor for successful sustainability efforts (I-101; I-102; I-103; 1-401; I-601). Due to the size of the C&T industry in New Zealand as well as the size of individual brands or retailers, collaboration was seen as critical for sustainability:

> I think that's why it's interesting to engage in the New Zealand space, where that's definitely the case, you know, there's only a couple of retailers that are really big in New Zealand in terms of fashion or clothing and footwear, and the uniforms market is quite big. And so yeah, the collaborative approach is essential, and it could be quite different from what a brand has been doing to try to do stuff in the space. (I-103)

As highlighted by this interviewee, bringing multiple organizations together means that there is enough scale in the form of financial and human resources as well as volumes of waste to begin to implement circular solutions. Another interviewee supported the importance of cross-industry collaboration when he stated:

> I think it goes back to that consciousness of what needs to happen is you can't solve it yourself. You know, you can make individual choices, of course. But if you're going to shift the system, you need to have collaboration across multiple parties, across your supply chain across, you know, whether it's government, local government, national government, uniform suppliers, consumers, re-makers. You know, together, the possibilities become evident. (I-101)

In addition, without having shared values, then collaborations are more likely to fail when companies or organizations have different goals and priorities.

### *5.7.2 External Enablers*

Participants also noted how increased government support would help their initiatives. All survey participants stated that they had no direct support from government, yet study participants acknowledged how policy (e.g., mandatory regulations for textiles) or financial

support through investment in infrastructure would help to accelerate industry sustainability as well as individualized efforts (I-103; I-701). Some participants (S-02; S-03; S-07; S-13) stated that they received support in the form of sustainability guidance from organizations such as the Sustainable Business Network, a membership-based social enterprise enabling circularity through collaboration, Mindful Fashion NZ, or WasteMinz, another membership-based organization focused on management related to waste reduction, resource recovery, and land contamination. Additionally, sustainability frameworks and guidance were provided through certifications like the B Corp Assessment Tool, Fairtrade International and Global Organic Textile Standard.

These factors would help to overcome some of the barriers or challenges highlighted by the research participants and more easily enable them to address their environmental impacts and work towards circularity.

## 5.8 COVID-19 Impacts

In addition to the impacts of COVID-19 on the research process and data collection, the pandemic also had implications for participants in terms of their operations and sustainability efforts.

### *5.8.1 Operational Impacts*

At the highest level of lockdown, several participants faced temporary or permanent store closures or were only able to supply or sell to those who could prove they were an essential business, even for online sales. For those with manufacturing facilities, workers were reduced to skeleton crews while those in offices transferred to working from home due to physical distancing measures. Nine participants referred to loss of sales with some stating that they do not anticipate sales to return to normal for a while. One participant attributed their being able to remain in business to the government's Wage Subsidy Scheme, which provided financial support to employers and workers during the pandemic (Employment New Zealand, 2021). Alongside reduced sales, five participants had to make staff redundant within their company.

Interestingly, once physical and online sales resumed, six participants discussed improvements with sales, some with revenues better than prior to COVID-19. Survey participants who elaborated on their increased sales stated that they believed it was due to more people shopping online and "deliberately supporting NZ made" (S-11). These sales increases

remained consistent for survey respondents of the follow-up survey in February 2021, although one participant stated that they were beginning to feel the effects of not having international tourists. Twelve companies represented in the interviews and surveys faced logistics challenges with delays and increased costs of freight, while supply and manufacturing were not as significantly affected.

### *5.8.2 Impacts on Sustainability Efforts*

In terms of sustainability efforts, participants faced one of three scenarios, although participants could have experienced all three scenarios throughout the research period. Some participants were in "survival mode" amid COVID-19 (I-201; I-701; S-04; S-08). Efforts diverged from sustainability and instead redirected to sustaining business operations. For most participants, their sustainability efforts were put on hold during the initial months of the pandemic, but they remained committed to their sustainability policies or initiatives. Participants talked about how their current sustainability efforts may have been stopped in the short-term to get operations up and running but that they were still dedicated to the initiatives they had put in place before COVID-19. During the follow-up interviews, industry participants were just starting to put sustainability discussions back on the agenda after being delayed through the initial lockdown periods.

Interestingly, the COVID-19 downturn allowed many survey participants the time to reset or refocus their sustainability efforts as well as highlighted the importance of sustainability in their business (S-02; S-03; S-04; S-07; S-08; S-08; S-09; S-10; S-12). One survey participant stated "our whole business is changing, and this is directly related to the enforced pause caused by the pandemic. We have leapt ahead in the advances we have made in the environmental area" (S-08). Improved sustainability efforts included making smaller collections, increased impact monitoring, planning for carbon neutrality, looking for onshore manufacturing opportunities, and research related to product stewardship. Interviewees also anticipated how the pandemic would affect waste solutions:

> Yeah, I think that will be one of the things about the pandemic it will drive the demand for onshore solutions because borders are closed. You know, even our recycling is no longer being processed. It's going to become important that the solutions are localized. (I-102)

In addition, interview participants discussed how COVID-19 may drive demand for onshore production due to production shutdowns in countries where textile products are sourced from. As participant I-101 stated:

> So, there's been a long period of time where there's been no flow of goods and inventory. So, the smaller brands, I think will look at how they de-risk it by having onshore production, and this will also help in building a circular economy. Because if you've got more production in New Zealand, you'll have more capability around reprocessing of garments but also, they can go back into the system here.

The implications of these varied impacts in relation to product stewardship will be discussed in the following section.

# CHAPTER 6: Discussion

The research findings suggest that several factors must be considered and addressed to move towards greater circularity within the C&T industry. The findings also emphasize the importance of context when it comes to product stewardship development. Just as brand level product stewardship initiatives depend on the scale and capacities of an individual brand, regional level PS also depends on the region's ability to collect, sort, and reprocess end-of-use or end-of-life textiles effectively and efficiently. An understanding of relevant stakeholder drivers, strategies, and barriers is also necessary to determine what is contributing to, and what is needed for, a systems change. In other words, it highlights the factors enabling or preventing stakeholders' sustainability efforts within the current linear system and what additional factors are needed for circularity.

In responding to the research questions, three main themes emerged from the data: (1) product stewardship within the current linear system; (2) factors preventing system circularity; and (3) closing the loop. The first theme relates to the parts of the system that currently exist to enable circularity. This includes PS development through Usedfully's previous and ongoing work, stakeholder drivers for PS, and stakeholders' current sustainable management practices that align with PS strategies. The second theme is about the necessary parts of the system that might be currently missing or otherwise preventing a circular transition, including the challenges or barriers that must be overcome. The third theme is related to addressing these barriers and changes to the surrounding context that would better enable PS, and thus circularity, as well as what needs to be considered in moving from the current system to an ideal circular system. This chapter will discuss the identified themes in relation to the case and draw connections between the study and the literature on product stewardship and the circular economy. The impacts of COVID-19 on participants' operations and sustainability efforts will be discussed within these three themes. The chapter will tie in recommendations for how changes can be made or practices that can be implemented amongst different stakeholders to better enable circularity through product stewardship.

## 6.1 Product Stewardship Within the Current Linear System

### *6.1.1 Usedfully*

In examining Usedfully's journey from The Formary, the Textile Reuse Programme, leading to the Textile Product Stewardship Project, it is evident that the context in which a PS scheme operates is an important influencing factor for what the scheme will ultimately entail. Contextual factors include the relative size of the C&T industry; manufacturing and reprocessing capabilities; size, types, and control of textile-related companies or organizations operating within the region; waste management practices; and government policies related to waste and product stewardship. Additional factors include external support from government, NGOs, or other companies (e.g., an organization like Usedfully to take the lead on scheme development); available technical and physical infrastructure; consumer awareness of C&T sustainability; and awareness of the scale of the waste problem through waste audits and continuous monitoring. These varied contextual factors support Martin's (2016) assertion that product stewardship implementation is not universal. However, consistency among approaches is helpful in increasing efficiency between schemes dealing with the same products (Martin, 2016). So, while adopting the approaches of other systems or regions is possible, it must come with an understanding of the specific regional circumstances the system is operating in (Martin, 2016).

Usedfully's Textile Product Stewardship Project demonstrates one possible approach for scheme development that is not mandated by government policy. Since there are few best practice examples for post-retail activities in the C&T industry (Kant Hvass, 2014), they have had to build a system from the ground up. The Formary and subsequently the TRP had gone through the journey of attempting to address individual corporates' textile waste and discovering that a systems change through product stewardship was needed to see any significant impacts. In this sense, Usedfully has gone through several levels of innovation to get to the point of product stewardship. Drawing on the work of Brezet and van Hemel (1997), Niinimäki (2015) outlines these levels of innovation for fashion sustainability as:

> (1) Incremental (small improvements for existing products)
> (2) Redesign (major redesign for existing products)
> (3) Product alternatives (new product or service concepts)
> (4) System innovation and design for a sustainable society (p. 4)

As current levels of innovation for sustainable fashion fall between the second and third levels (Niinimäki, 2015), it follows that few examples for system innovation are offered for product

stewardship development. This is evident through the available literature on post-retail activities focusing on take-back schemes or reverse logistics (e.g., Kant Hvass, 2014) that do not go beyond brand level service concepts. However, what the case study makes clear is that, in order for a systems change to occur, the responsibility must extend beyond take-back approaches to building a system that engages all relevant stakeholders in the solutions.

Since Usedfully is navigating through a novel process of product stewardship development, they have completed several projects that have built up different aspects of the system. These have included the fibre-to-fibre trials, fibre-to-roading trials, creation of the Usedfully digital platform, as well as the "one-off" projects in the early days of The Formary and TRP. The results of the study imply that other regions attempting to develop a voluntary PS scheme may have to go through similar trial and error processes for post-retail activities to find suitable solutions for end-of-life textiles (Kant Hvass, 2014). This supports statements made by the Ellen MacArthur Foundation (2017) that circularity requires a design-thinking approach, "bringing actors together from across the system to collaborate, prototype, learn, refine, and scale what works" (p. 26). Despite having a lack of guidance for scheme development, Stage 1 of Usedfully's TPSP followed three similar steps outlined by the Fuji Xerox Product Stewardship Roadmap. These steps included having an understanding product impacts, building solutions to address these impacts, and creating a business case and management team for the project (Shareef & Harding, 2018), demonstrating that this process is applicable to other products and beyond the individual business level.

To support a circular economy, Usedfully has chosen three pilot concepts, taking a pillared approach to the scheme. These three pillars are intended to support activities that will strengthen the effectiveness of the scheme over time and adhere to the guidelines set out by MfE for applying for product stewardship accreditation. Foundational to the scheme is the pilot concept to aggregate and sort textiles to address the fact that charities and other organizations that accept used, donated garments are the ones left to deal with the problem of textile waste. As noted by one participant in this sector, charities are seen as a free way to dispose of unwanted clothing, resulting in high volumes of textiles unsuitable for direct reuse. According to MfE (2020b), a product stewardship scheme must demonstrate effective waste diversion from landfill, which could be fulfilled by this pilot concept. Supporting pillars of the scheme are the pilot concepts related to consumer education and awareness and R&D for textile sorting processes. If

successful, these pilot concepts will help to address challenges involved in textile sorting and clothing condition, and fulfill enabling factors for circularity such as consumer awareness, collaboration, and infrastructure. In a similar manner, a portion of the collected fees from France's EPR scheme is dedicated to education initiatives and R&D for improved processes (Bukhari et al., 2018), indicating that these pillars are important for schemes to be effective and continuously improving. It also supports the previous comment that for PS to enable circularity, actions must go beyond take-back services to support changes at different stages of the value chain as well as changes by different stakeholders.

The types of textiles and textile waste that stakeholders deal with in a particular region are important for scoping a PS scheme. Participants in this study dealt with a variety of textile types from apparel fabric, new consumer apparel, corporate wear, to accessories and footwear. These textile types provide an indication of what future waste types will be comprised of if sold locally. As many survey participants also manufactured or sold textile accessories and footwear, future schemes should consider how these products could be implemented or if it is more appropriate to have separate schemes for these products. France's EPR scheme includes footwear (Bukhari et al., 2018), so additional analyses would be helpful in determining if footwear works well in the same system as textiles and linen products. The textile waste types that participants identified ranged from production waste to retail waste and end-of-life clothing/textiles, implying that participants deal with various qualities and conditions of waste that must be treated accordingly.

Furthermore, the areas of control versus influence will have implications for what a product stewardship scheme can cover as survey participants had greater control over upstream value chain activities. Stakeholders can extend their control over downstream activities by offering take-back services or otherwise communicating product end-of-use or end-of-life options with their customers. For future TRP members, this would include communicating their involvement in a PS scheme and the options customers have for those products once they are no longer wanted.

Some survey participants were unsure about joining a PS scheme, suggesting that more information about the benefits of involvement is needed and that membership expectations would need to be outlined for stakeholders to consider joining a voluntary scheme.

### *6.1.2 Drivers*

Product stewardship motivations were consistent with drivers previously identified in the circular economy literature (Jia et al., 2020; Ki et al., 2020) and have been categorized according to whether the company or organization had an intrinsic or internal motivation to address their environmental impacts, whether this motivation comes from external pressures, or both. These drivers have implications for how to best appeal to stakeholders to engage in PS systems. Furthermore, these motivations could indicate the speed or order in which stakeholders adopt or join a PS scheme. Many participants stated that they were motivated to do the "right thing" in that they were internally driven to improve their practices out of concern for the environment. This high internal motivation to address their environmental impacts could be explained by the study population in that those who agreed to participate are inherently interested in sustainability or are leaders in the space because of their current involvement with the TRP. This supports findings that stakeholders who implement circular practices are likely to be seen as sustainability leaders or innovators in the industry (Weber, 2019).

The maturity of a brand or company might nudge them in the direction of investment in a product stewardship scheme. Two companies represented in the interviews have been in business for over 100 years, while a third has been around for 88 years. Lahti et al. (2018) argue that established brands may struggle to transition toward circularity because of difficulty in forecasting their future without any previous experience or data to draw upon. However, the results of the study show that perhaps established companies have already been through the process of understanding that the "low hanging fruit" options are insufficient for achieving circularity. These companies' previous involvement with the TRP would likely have also contributed to the knowledge that a systems change is needed over easy, instant solutions. Future schemes should begin engagement with those who are willing to invest in a system development (i.e., those motivated internally by environmental concern). These stakeholders could be identified by their involvement in other circular or environmental initiatives.

Participants noted that, in an ideal world, stakeholders should be motivated to act if their activities or products knowingly contributed to environmental damage. If a scheme is voluntary, however, then there must be other reasons for stakeholders to join aside from environmental or social concern. Engaging stakeholders who are not motivated by environmentalism means demonstrating the benefits of product stewardship membership that will appeal to their priorities

or interests. For those motivated by external customer pressure, engaging in environmental practices could appease growing consumer demand for sustainable products and improve brand image (Sandvik & Stubbs, 2019). Olesen (2011) describes cause-related marketing, where collaborative campaigns are created between for-profit and non-profit organizations to address a mutual cause, as a growing strategy to enhance brand image. Collaborations between industry stakeholders and non-profits (e.g., charities or secondhand organizations who accept textile donations) through the vehicle of a PS scheme could appeal to those participants and alike stakeholders who are motivated to engage in sustainability initiatives by the opportunity of a "good story". This supports findings from Kant Hvass (2014) who found that participants in her study used storytelling to improve customer engagement and bring them back to the store.

The current system does not capture the true costs of products (e.g., the natural resources and labour that have gone into it) (Cataldi et al., 2013), so unless measures are put into place that would cause environmental impacts to be reflected in the price of a product, or unless brands experience increased resource scarcity or mandated EPR legislation, then laggards may not become engaged until they are forced to do so. However, due to uncertainties and logistical challenges associated with COVID-19, "companies must introduce new tools and strategies across the value chain to future-proof their business models" (Business of Fashion, 2020, p. 9). Product stewardship as a tool to build circular systems and resiliency in value chains could be another potential selling point as businesses look to secure their future in the industry.

### *6.1.3 Strategies*

As product stewardship accounts for more than just the disposal stage (Lewis, 2016), participants were asked about their sustainability efforts throughout the value chain and if attempts were made to minimize environmental impacts throughout the product life cycle. Encouragingly, all participants were engaged in sustainability initiatives in some form or another, although this engagement could be explained by the study sample being already interested in sustainability initiatives. Participant strategies aligned with those suggested by Ki et al. (2020) to slow, narrow, and close resource loops as well as those outlined in Lewis' (2016) product stewardship framework categorized as policy, design, procurement, and recovery strategies.

Many participants had environmental policies to guide their company or organization in a certain direction for sustainability. However, participants were not asked about the effectiveness

of these policies and whether they had a performance evaluation system for their initiatives, so the impacts of these policies are unknown. In addition to environmental policies, several participants' companies had certifications or standards they adhered to listed on their websites. Niinimäki (2015) argues that the use of standardized eco-labels is more reliable than a company's own environmental claims. However, the example given by a participant regarding his company's decision to forego carbon certification due to it only covering the carbon emissions of local manufacturing alludes to the challenges of sustainability claims within the global nature of the textile industry. This finding suggests that additional studies to compare eco-labels and various environmental metrics would be helpful for stakeholders trying to decide the certifications and measurements best suited to their production processes and products. The environmental standards or certifications that participants adhered to were focused on upstream value chain activities, supporting earlier research that there is a lack of certification for downstream activities such as waste collection and recycling (Clancy et al., 2015; Kazancoglu et al., 2020). While a PS certification could be developed for downstream value chain activities, there would be complexities with determining the criteria and enforcing this type of certification. A company in Morana and Seuring's (2007) study affixed a label to all products made of 100% polyester so that these items could be returned at the end-of-use, however a lack of communication between retailers and consumers about the ability to return these products prevented the scheme from being successful. Therefore, labels for textiles within a PS scheme could be an alternative to certification but still provide a way to differentiate these products from those not included in a voluntary scheme. A label could indicate the return options to end-users, but effective communication strategies would also be needed to make end-users aware of the scheme.

For design strategies, participants demonstrated life cycle thinking by creating durable products and using practices to minimize waste in the production process. Life cycle thinking has been found to contribute to the success of product stewardship schemes for other industries or products (Lewis, 2016), indicating that this perspective is critical for developing circular systems. Life cycle thinking provides greater coherence between different stages in the value chain or circular system by considering the product in relation to use and end-of-use activities, and how the product might be put back into manufacturing processes.

Procurement strategies were used to a lesser extent, although the examples highlighted in the findings suggest that procurement is an opportune stage to engage upstream manufacturers and suppliers. If these upstream stakeholders get more inquiries from brands or retailers as their customers, the same logic could follow that they may be willing to adjust their production techniques to align with customer preferences for sustainable offerings. In having these conversations at the procurement stage, it might spread awareness of product stewardship schemes and help to share responsibility for minimizing product impacts with upstream stakeholders. Clearly, integrating circular practices within the "take" and "make" stages of the linear system through policy, design and procurement are also vital for an overall systems transition (Brydges, 2021).

Survey participants claimed to send little waste to landfill, instead opting to donate, give away or repurpose where possible. Again, this could be explained by the types of companies and organizations represented in the study and their place in the value chain but also how current responsibility for end-of-use or end-of-life textiles is typically held by the end-user. Only one interview participant had a rental model, while only one other interviewee was involved in the waste management of textiles. These two participants highlighted the vast amounts of waste they had to send to landfill and one of the major reasons they were searching for end-of-life solutions. Therefore, recovery strategies were still largely linear in that items could be reused directly or in some downcycled manner, but eventually destined to be landfilled.

Stakeholders existing practices can be formalized through PS membership. In this sense, PS schemes can take advantage of what can be done within the current system to implement more efficient changes. It is clear that the transition to CE will not be immediate, so existing infrastructure and capabilities can be considered in order to achieve "quick wins" (Degenstein et al., 2021; Shareef & Harding, 2018, p. 7). Since the process of developing an industry-led PS scheme at a regional level is so novel, those implementing schemes should consider how to best capitalize on the resources that are already developed such as available environmental metrics, technologies, and stakeholders' existing knowledge and services (e.g., repair or rental services). As demonstrated through Usedfully's plan for their PS scheme, processes and solutions that have greater circularity (e.g., fibre-to-fibre recycling) can then be implemented into the system as they are developed and scaled.

Taken together, these findings reveal a contradictory scenario where PS schemes operating within the linear economy can only become so circular, yet PS is needed to move towards system circularity. Therefore, innovative steps need to be taken to begin the transition to circularity.

### 6.2 Factors Preventing System Circularity

The study findings highlight the complexities that companies and organizations are faced with when making decisions related to sustainability. Participants involved in the development of the Usedfully TRP and TPSP highlighted challenges in the project development process itself. As previously discussed, Usedfully had little examples to draw upon for determining the best process to approach scheme development. Other challenges related to textile sorting of products in varying conditions. Previous research has described challenges with closed-loop fibre recycling related to the scale of the technology, quality of fibres after recycling, as well as the issue of fibre blends, notions, and chemical additives (Durham et al., 2015; Filho et al., 2019; Weber, 2019). Coming from a systems perspective, however, another challenge is the practical issues of collecting, identifying, and sorting post-consumer waste (Lacy et al., 2020; Payne, 2015). Both the technical and practical challenges with end-of-life options for textiles were identified by study participants. Identifying fibre types via spectroscopy is one of the services offered by Usedfully through its work in the Textile Reuse Programme, however, to keep textile products in their highest level of value, labour intensive processes of manually sorting and judging product quality and condition are still needed (Heikkilä et al., 2019). Depending on the use of the textile item and its function, the condition of textile products will vary after use. Some may have only reached the end-of-use stage and are suitable for direct reuse, while others may have reached the end-of-life stage and need to be processed into another item or recycled in some way as exemplified by one participant's struggle to find different solutions for office wear versus delivery uniforms. The findings suggest that until automated processes for sorting clothing based on quality and condition are developed, trialed, and scaled, this stage within a PS scheme will remain labour intensive.

Waste priorities at both the national and business level was identified as another barrier as other waste streams tended to be put ahead of textiles due to greater volumes or perceived impacts. However, the findings imply a disconnect between government and waste management practices and their goals to address climate change. There is evidence to support the claims that

the clothing and textile industry is a major contributor of carbon emissions and consequently to climate change (EMF, 2017; McKinsey & GFA, 2020), yet few levers are in place to mitigate these impacts. This could relate to that fact that most textile manufacturing and thus carbon emissions take place offshore; however, climate change impacts are also associated with the use and disposal stage of textiles. Communicating the impacts of these stages with government and stakeholders and drawing connections between textile waste as essentially organic and plastic waste (which are both often addressed first) could help to prioritize textile products in waste streams. Survey respondents felt that they had little to no influence over government policies or decisions related to PS. However, collective recommendations on behalf of stakeholders (e.g., Usedfully's White Paper recommendations) could be more influential than individual companies approaching government on their own.

Unsurprisingly, costs or financial concerns were seen as a barrier for product stewardship participation and sustainability efforts in general. Even prior to COVID-19, businesses have had to balance financial profitability with sustainability efforts, where sustainability can often be considered an "add-on" but not the focus of business. Several researchers have reported on costs as a barrier to engaging in circular fashion practices (Franco, 2017; Kant Hvass & Pedersen, 2019; Kazancoglu et al., 2020; Ki et al., 2020; Sandvik & Stubbs, 2019; Weber, 2019). However, with anticipated increases to New Zealand's waste disposal levy, the costs of product stewardship participation may seem more accessible to stakeholders. For other EPR models, the costs of end-of-life processes can be passed along to the customer in the cost of the product (McKerlie et al., 2006), so PS schemes will have to consider the various funding models that will be accepted by stakeholders. In communicating the benefits of PS or "selling the system" and engaging industry stakeholders, emphasizing eventual cost savings by avoiding landfilling fees could help. Furthermore, new business models that arise from "tapping into current waste streams" (e.g., rental/leasing models, resale models, recycling) can be a potential selling point for stakeholders concerned about costs (Sandvik & Stubbs, 2019, p. 371).

For many participants, sustainability efforts were put on hold during the initial stages of the pandemic and there was uncertainty around when these efforts or conversations would return. Research has yet to determine what COVID-19 might mean for industry sustainability in the long-term; however, early reviews have suggested that overall industry sustainability has slowed (Brydges et al., 2020). Brydges et al. (2020) has encouraged brands to "not use COVID-19 as an

excuse to press the pause button on sustainability initiatives" but instead "use the time to reflect, retool, and rebuild a more inclusive, as well as environmentally and socially sustainable, industry" (p. 304; Business of Fashion, 2020). Indeed, this has been the case for some participants who have used the downtime during the pandemic to re-evaluate their sustainability strategies. This suggests that time and the ability to dedicate people to work on sustainability initiatives is not always available in the fast-paced, linear system. Having this downtime during COVID-19 to reset goals and refocus areas of importance demonstrates how time is an important factor for sustainability in addition to financial resources.

The above findings demonstrate that product stewardship can only go so far within the current linear economy, further highlighting "the difficulties of retro-fitting existing business models to become more sustainable" (Brydges, 2021, p. 6). Unless stakeholder barriers are addressed, circular systems cannot be achieved. The next section discusses some of the ways these barriers can be overcome.

### 6.3 Closing the Loop: Moving from the Current to Ideal System

Current challenges or barriers faced by stakeholders could be leveraged into opportunities for closing the loop on product stewardship systems. These enablers were consistent with those identified in the literature by Ki et al. (2020). While Usedfully's TPSP and related initiatives will help to address some of these barriers, changes outside of Usedfully's system are also required. Previous studies have identified limited consumer awareness regarding clothing environmental impacts as a challenge for sustainability (Kant Hvass, 2014; Morgan & Birtwistle, 2009). Although it was not discussed as a challenge in this study, consumer awareness was acknowledged as an important area to address as not only do business models and systems need to change to be more circular, but consumer mindsets as well. Consumer education and engagement have been suggested to equip the public with knowledge of textile sustainability to nudge the industry in the direction of change and provide consumers with information to improve their purchasing, use, or disposal practices (Bianchi & Birtwistle, 2011; Kant Hvass, 2014). It is clear that Usedfully understands the importance of consumer education through their On the Mend education series and by having a PS scheme education and awareness pillar. This research supports previous calls for consumer education, adding that information about product stewardship and consumer roles within it should be included in educational material. Retailers can act as an important point of communication between brands and customers (Morana &

Seuring, 2007); therefore, the benefits and opportunities offered by product stewardship should be communicated to all stakeholders within the value chain. Brands or PS members can draw upon open-source educational materials provided by NGOs such as the Ellen MacArthur Foundation, WRAP UK, or Fashion Takes Action.

Relatedly, the end-user or consumer will need to be considered in the development of PS schemes as they play an important role in the return of products and ultimately decide the disposal route. Transaction costs such as time, required knowledge or information, planning, and transportation must not be too high for the end-user for them to participate in reverse logistics services (Morana & Seuring, 2007; 2011). As different disposal methods for used clothing exist, the transaction costs for these different methods will vary (Morana & Seuring, 2007). For instance, throwing a garment away in the trash has a low transaction cost aside from potential psychological costs of knowing that it is not an environmentally friendly disposal option (Morana & Seuring, 2007). Closed-loop supply chain processes need to compete with alternative disposal routes with lower transaction costs (Morana & Seuring, 2007). Therefore, convenient means of product returns must be established (e.g., incorporated into existing disposal routes such as donation), or the end-user must be incentivized in other ways (e.g., knowledge of environmental savings; store vouchers; regulations) to account for potential higher transaction costs of take-back schemes or other reuse/resale activities. These considerations are important for consumer participation in product stewardship schemes.

The study has also highlighted the importance of collaboration for product stewardship development. Comparable to the participants in Franco's (2017) study, survey respondents identified brand size as a barrier to sustainability in that they had a lack of industry reach or scale. Searching for similarly sized manufacturers or suppliers with shared values of sustainability and subsequent relationship building could be a way to address this barrier (Franco, 2017). Lahti et al. (2018) suggest small- and medium-sized businesses create steering committees to overcome barriers associated with transitioning to a circular economy, such as contractual obligations and difficulty in forecasting how to design lucrative models. An advantage of these cross-collaborations or using third-party providers is that companies can rely on others' expertise regarding a specific process or product (e.g., reverse logistics; technology) rather than having to become experts in these areas themselves (Kant Hvass, 2014; Lahti et al., 2018). In a sense, the collaborative actions of the Textile Reuse Programme, TPSP Working

Groups, and the overall project in this study has acted as a joint steering committee by bringing stakeholders together to share knowledge and expertise. Collaborations may prove difficult due to the competitive nature of the industry but, for small companies, it may be one of the few ways for them to compete with large fast fashion players in the global system. Furthermore, the global pandemic has emphasized the importance of collaboration even between competitors (Business of Fashion, 2020). Industry stakeholders will "need to share data, strategies and insights on how to navigate the storm" (Business of Fashion, 2020, p. 8), and product stewardship schemes provide such an opportunity.

While global statistics are helpful to have an integrated picture of C&T environmental impacts, regional statistics are critical for addressing these impacts in a practical manner and developing a scheme that can deal with a specific scale of waste. At the same time, emissions, resource use, and other environmental impacts need to be associated with products to gain a greater understanding of diversion efforts. To support these monitoring efforts, individual companies and organizations could purposefully track their own textile flows and resource use to fill knowledge gaps. Usedfully has provided New Zealand's first aggregated estimates of national textile flows through their Looking in the Mirror Report (Casey & Johnston, 2020). However, ongoing monitoring by stakeholders is important to have up-to-date information on textile flows going forward and could also be helpful in supplementing textile waste diversion data.

Government support was identified in the study as an important enabler for product stewardship. In particular, regulatory measures have been proven to help textile diversion efforts in regions such as France and Markham, Ontario (Bukhari et al., 2018; Javed, 2017). The mandatory product stewardship principles outlined by the Product Stewardship Institute (2012) place many areas of responsibility on government, including enforcing the system rules, making a level playing field for all producers, and educating the public. In the absence of government regulation, areas of responsibility (e.g., enforcement and level playing field) would fall to other stakeholders who must voluntarily take on these roles. Usedfully demonstrates how product stewardship schemes can be initiated at a regional level if you have a willing facilitator to take the lead, which in other examples of regional or national product stewardship has been government regulation. The role of government in mandatory schemes is important for enforcing PS but perhaps its other role has been to bring stakeholders together when mandatory PS is

legislated. In this case, Usedfully has taken on this role by providing a platform for stakeholders, including government, to come together to build a network and find collaborative solutions for circularity. The New Zealand government has supported Usedfully's efforts through the Waste Minimisation Fund, suggesting that the public sector is interested in supporting product stewardship for clothing and textiles, even though they have not taken an active role in mandating it or declaring it a priority product. Aside from policy, government can still play a role by building public awareness and encouraging stakeholders to participate in product stewardship initiatives. Furthermore, governments can invest in infrastructure that makes local or onshore textile collection, sorting, and reprocessing more feasible.

Returning to the principles of the circular economy where waste and pollution are designed out, products and materials are kept in use, and natural systems are regenerated (EMF, 2013; 2017), the linear economy is just beginning a circular transition in New Zealand. Taking innovative steps by capitalizing on stakeholder drivers and sustainability strategies, working to overcome stakeholder barriers, and addressing the above enabling factors can facilitate circularity within the system (Figure 6.1).


*Figure 6.1: Enabling factors to close the loop between current product stewardship in New Zealand and the "ideal" circular system.*

The approach to product stewardship and circularity as used in the case study has implications for how we might conceptually view a circular system in the C&T industry. Brydges (2021) argues that our conceptualization of circularity is not attainable within the current state of the industry. Instead of viewing the circular economy as one giant circle encompassing the industry in its entirety (e.g., Figure 2.3), perhaps we view it as an overall circular system supporting various circular initiatives within it; a "systems within systems" approach (Figure 6.2). At a macro scale, overall industry circularity could be represented by the

blue circular arrow, with inner circular subsystems representing circularity at a national or regional level. These inner subsystems will vary based on size of the region or volumes of clothing and textiles being circulated within them, with the potential for subsystems to overlap or collaborate where appropriate (Kieren et al., 1984). Further within these inner circles could be smaller circular processes that are implemented as technology and logistics improve to reprocess various textile types. For example, value chains for different fibre-to-fibre recycling will vary based on the fibre type in question (e.g., different inputs needed to reprocess lyocell versus nylon recycling), yet stakeholders may utilize these different value chains within their products. In the field of systems engineering management, Choi and Shen (2016) and Choi et al. (2019) have demonstrated that the fashion supply chain can indeed be considered a system of systems (a large or complex system made up of smaller independent and interactional subsystems working toward a shared goal (Jamshidi, 2009)) and have applied a system of systems framework to sustainable fashion supply chain management. Future work can apply this conceptualization pictured below or system of systems theory to further explore this framework and how it relates to circularity.

*Figure 6.2: A proposed systems within systems conceptualization of the circular economy for clothing and textiles.*

A human ecology perspective is, thus, useful for this conceptualization in understanding the relationships between different parts of the system and how contextual factors within the stakeholder's macro and microenvironments affect, and are affected by, stakeholder actions. For instance, PS policy implementation by the government drives industry stakeholders to change

their practices to become more sustainable and circular; retailers who implement take-back schemes provide consumers with end-of-use disposal that could better align with their environmental concern; and designers who create garments for modularity or recyclability make end-of-life processes easier for sorters and recyclers. All parts of the system including activities within the value chain as well as stakeholders' values and priorities must change to align with circular principles. If we are not proactive in this change, then it will be forced upon us when already scarce resources are no longer available. As demonstrated by this research, systems cannot become circular if at least some parts remain linear.

Through this conceptualization, there is potential for smaller stakeholders to see their place in the overall picture. Furthermore, the challenge of moving from a linear to circular economy may not seem so daunting by breaking the transition down into smaller, replicable systems. It also illustrates that the process for achieving the "ideal" circular system through product stewardship need not be identical nor will the industry "experience a uniform transition to a more circular system" (Brydges, 2021, p. 7). This conceptualization may demonstrate a more manageable or practical view of circularity for the clothing and textile industry.

# CHAPTER 7: Conclusion

Greater understanding by industry, government, and consumers of the considerable environmental impacts of the clothing and textile industry has prompted the search for circular solutions. Of particular concern are the volumes of textile waste being discarded each year and the value and resources that are lost when textiles are landfilled without attempts for reuse. Although individualized initiatives at the consumer and brand level are important and needed, siloed efforts will not be sufficient for the systems level change that is needed for industry sustainability. Furthermore, it is not enough to change the behaviours or actions of individual stakeholders; we need to change the systems in which these stakeholders operate. The concepts of circularity and systems thinking is anything but new; however, we are just beginning to understand how we apply these concepts to our current levels of textile production, consumption, and disposal. This is an exceptionally complex task for industries such as the fashion or C&T industry, which has been intentionally developed to move rapidly from one trend to another without much thought to the environmental and social consequences of this linear model. Furthermore, the fragmented nature of the industry, the number of players in the system, along with large distances between sites of production and consumption create even greater complexities for sustainability efforts.

Product stewardship has been discussed as one possibility for producers to take responsibility for their textiles and minimize or eliminate waste throughout the product life cycle. Literature on the topic has offered examples of brand level product stewardship but has not fully examined how to initiate textile PS systems at a regional level without government regulation. This study has aimed to address this gap by providing insights into the process and nuanced considerations made by Usedfully in its journey of developing a product stewardship scheme in New Zealand. Although the pilot stage of the project was not included in this research, the process from Stage 1 of the TPSP has identified a potential approach that other organizations or regions can adopt to initiate a scheme that best fits varying contexts. Instead of trying to tackle the industry as a whole, this research aimed to demonstrate how small, replicable systems can be applied to other regions with an understanding of that region's context and capacities. The pilot concepts or end result of a scheme may be different in other regions as it depends on the current state of waste, onshore capabilities of reprocessing waste, and how engaged stakeholders are in

developing a scheme. However, this research has demonstrated practical steps that can be taken to initiate PS scheme development for clothing and textiles.

The study has identified several process learnings such as the need to engage stakeholders early and to raise awareness of the necessity of a systems change; the importance of understanding the current volumes of textile flows and waste in order to build systems to scale; the need to identify the PS concepts that are most important within the context and to the stakeholders involved; and the benefits of co-designing the scheme with those stakeholders who will be participating in it to enable effective engagement and solutions. This research has also highlighted the product stewardship drivers, strategies, and barriers from the perspectives of stakeholders both involved in the development of the TPSP and a sample of those external to the project. The study supplements research specific to clothing and textile product stewardship beyond the brand level which, so far, has been an underexplored area and provides a means for comparison for future studies.

The transition to a circular economy is a massive endeavour, especially considering the current state of the industry and its vast environmental impacts; however, we do not need a global system of everyone working in the same manner or implementing the same solutions to get there. This is unrealistic and as mentioned before, “one size fits all” solutions do not exist (Martin, 2016, p. xv). Instead, smaller systems that are context-specific can help the industry move towards circularity. Developing a PS scheme by co-designing it with relevant stakeholders and adapting it to local needs — such as the process identified in this case study — can increase both the efficiency of PS adoption and the effectiveness of the scheme. From a systems perspective, change at a smaller level (i.e., within a particular region) may be a better approach than striving for overall industry change. In this way, we can imagine small circular systems eventually evolving into broader industry circularity. These smaller systems can be adapted to local contexts and work with other circular systems by sharing knowledge and solutions. This approach comes with an understanding that different system set-ups or ways of transitioning to circularity can and need to exist if we are to incite change in the overall global textile system.

### 7.1 Study Limitations

A single-case study methodology was chosen for the research to explore an approach to product stewardship at the regional level. With this choice comes the acknowledgement of the limitations and vulnerabilities of single-case studies in terms of generalizability (Kant Hvass &

Pedersen, 2019; Yin, 2018). While statistical generalizations cannot be made from case studies, they can expand on theories and contribute to analytical generalizations (Yin, 2018). This study has shed light on the practical considerations for PS development and proposed an adapted visual conceptualization of the circular economy for the clothing and textile industry based on this process. This conceptualization can be used as a perspective to approach future studies.

The timing of the research also presents some limitations. The research only focused on Stage 1 of the TPSP which involved the planning and scoping of the pilot scheme and did not examine whether the PS scheme was effective in minimizing the environmental impacts of C&T in New Zealand. Although the additional questions related to COVID-19 provided some interesting insights into the impacts of a global pandemic on organizations, it limited the number of companies/organizations who had the time or resources to participate in the research.

This study also only included the perspectives of Usedfully key informants and industry stakeholders and did not account for all relevant stakeholders who might influence or be affected by product stewardship (i.e., government, consumers, and waste management). Finally, the research was conducted from Canada which may have impacted search engine results when looking for potential participants in New Zealand and relevant company information. These limitations provide opportunities for further research proposed in the next section.

### 7.2 Future Research

As we are just beginning to understand product stewardship within the contemporary context of the C&T industry, there are numerous avenues for further exploration. Additional research to understand the effectiveness or success of Usedfully's PS scheme after the pilot stage could provide insight into which solutions worked or not and why. Further studies are needed to determine the environmental savings of the project and whether the scheme was effective at minimizing or diverting textile waste from landfill. These studies could adopt quantitative methods to measure environmental performance of the PS initiatives and to estimate the costs of collection, recycling, and remanufacturing of waste textiles (Cai & Choi, 2021).

This research took a human ecological systems approach, but future research could consider product stewardship development through the lenses of stakeholder theory, risk management, policy, or system of systems theory. As previously mentioned, the perspectives of external stakeholders (e.g., consumers, waste management, government) on PS for clothing and textiles are needed as these actors play critical roles in the success of product stewardship. It

would also be worthwhile to examine the perspectives of industry stakeholders who are not internally driven by environmental concern (i.e., laggards) to understand how to effectively engage them in product stewardship. Specific research questions that arise from this study include:

- How can product stewardship be used as a risk management strategy within the clothing and textile industry?
- What policies, aside from mandatory extended producer responsibility, can best support textile waste diversion initiatives and voluntary product stewardship?
- What role can external stakeholders play in product stewardship schemes and how might they be engaged?

Further examination of product stewardship models in other contexts is needed, including those that are similar and dissimilar to New Zealand in terms of policy, manufacturing capabilities, and size, amongst other factors. For instance, a Canadian PS model would need to account for federal, provincial, and municipal government policies as well as a large geographic spread which would have implications for transportation and emissions if an implemented system was nation-wide. Therefore, additional models and examples of PS at a regional level are needed to determine best practices. With the European Commission's announcement that by 2025, European Union member states must separately collect textile waste and divert it from landfill and incineration (European Environment Agency, 2019), there will be ample opportunities to study emerging models for textile end-of-life processes. Finally, as sustainability includes social and economic pillars in addition to the environment, research considering the social and economic impacts of product stewardship and circular initiatives on garment workers and business profitability are also avenues worthy of further study.

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Appendix A: Information and Consent Form

**Interview Information and Consent Form**

**Study Title: Integration of a product stewardship model into the Canadian textile waste stream: A New Zealand case study**

**Researchers:**

Lauren Degenstein
University of Alberta
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Dr. Rachel McQueen
University of Alberta
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Dr. Lisa McNeill
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**Background**

You are being asked to participate in a research study that explores current solutions to address clothing and textile waste. You have been identified as a potential participant either by your affiliation with the Textile Reuse Programme or by your company/organisation's relevance to the research. Results of the study will provide insights into ways product stewardship can be effectively implemented to reduce clothing and textile waste.

**Purpose**

The purpose of this study is to gain an understanding of the factors that lead to successful product stewardship models and to identify the potential challenges and strategies for integrating a product stewardship policy for clothing and textiles. This data is being collected for graduate thesis research.

**Methods**

Participation in this study involves an initial 30–60-minute interview as well as a follow-up interview where you will be asked questions regarding your company's/organisation's involvement with the Textile Reuse Programme or product stewardship related to clothing or textiles and how this has been impacted by COVID-19 over time. Prior to the interview, you will be asked to complete a brief online survey of your company's/organisation's size and structure. The interview will take place via video conference (e.g., Zoom, Google Hangouts Meet, Skype) at a time that is convenient for you. The interview will be audio or video recorded, transcribed, and analysed for similarities between stakeholders within the clothing and textiles industry in both New Zealand and Canada.

Zoom Privacy Policy: https://zoom.us/privacy
Google Hangouts Meet Privacy Policy: https://policies.google.com/privacy?hl=en-US
Skype Privacy Policy: https://www.skype.com/en/legal/

**Confidentiality & Anonymity**

You will not be personally identified in the results of this study. Only the principal investigator and research supervisors will have access to the data. The results will be used for a master's thesis, a paper for peer-reviewed publication, and research report. In these papers and report, individual data will not be presented, only data analysed at the group level will be presented in aggregate form. Anonymity cannot be guaranteed because some personal information (name, company/organisation, role) will be collected at the beginning of the interview. This information

will be removed from the raw data and coded but there is a risk of re-identification of participants.

The research investigators will not personally identify participants in the dissemination of the research unless otherwise requested by the interviewee. Only the name of the company or organisation that you represent may be included in the research findings. No identifiable information will be retained as the lists with confidential information (names, email addresses and telephone numbers) are destroyed at the end of the study.

Data in paper from this study will be kept in a secure place (a locked cabinet) for 5 years following completion of the research project. Electronic data will be password protected to ensure privacy and confidentiality and will be appropriately destroyed after 5 years following completion of the research project.

**Benefits**
There will not be any direct benefits to you for participating in this research. The research from this study will provide insights into the motivations and challenges for engaging stakeholders in product stewardship programmes in New Zealand and Canada. Findings of the study can help to improve existing or future product stewardship programmes related to clothing and textiles.

**Risks**
There are no foreseeable risks associated with participating in this study.

**Voluntary participation**
You are under no obligation to participate in this study. Your participation is completely voluntary. Even if you agree to be in the study, you can change your mind and withdraw at any time. You are asked to let us know you no longer want to participate in the interview through email.

The data will be transcribed and analysed after all interviews have taken place. You have until one week after the interviews have been transcribed to withdraw your data. As the information you provide will be used in a graduate thesis, peer-reviewed publication and research report, withdrawal of data will not be possible after one week of the time of the interview.

**Questions or concerns**
If you have any questions about your participation in the study, you can email Lauren (principal investigator) at [email removed]. If you would like to contact the research supervisors, you can contact Dr. Rachel McQueen at [email removed] or Dr. Lisa McNeill at [email removed]. The plan for this study has been reviewed for its adherence to ethical guidelines by the University of Alberta's Research Ethics Board 1 (Study ID: Pro00097937). For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at [phone removed]. This office has no affiliation with the study investigators.

# Survey Information Sheet

**Researchers**

Lauren Degenstein
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Edmonton, AB, Canada

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University of Alberta
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Dr. Lisa McNeill
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**Background**

You are being asked to participate in a research study that explores current solutions to address clothing and textile waste. You have been identified as a potential participant by your company/organisation's relevance to the research. Results of the study will provide insights into ways product stewardship can be effectively implemented to reduce clothing and textile waste.

**Purpose**

The purpose of this study is to gain an understanding of the factors that lead to successful product stewardship models and to identify the potential challenges and strategies for integrating a product stewardship programme. This data is being collected for graduate thesis research.

**Methods**

Participation in this study involves the completion of a survey where you will be asked questions regarding your company's/organisation's involvement with product stewardship/sustainability related to clothing or textiles and how this has been impacted by COVID-19. The survey will take approximately 30 minutes to complete. The completed survey will be analysed for similarities between stakeholders within the clothing and textiles industry in New Zealand.

**Confidentiality & Anonymity**

You will not be personally identified in the results of this study. Only the principal investigator and research supervisors will have access to the data. The results will be used for a master's thesis, a paper for peer-reviewed publication, and a research report. In these papers and report, individual data will not be presented, only data analysed at the group level will be presented in aggregate form. Anonymity cannot be guaranteed because some personal information (company/organisation; email address for recruitment) will be collected at the beginning of the survey. This information will be removed from the raw data and coded but there is a risk of re-identification of participants.

The research investigators will not personally identify participants or your company/organisation in the dissemination of the research unless otherwise requested by the participant. No identifiable information will be retained as the lists with confidential information (names, email addresses and telephone numbers) are destroyed at the end of the study.

Data in paper from this study will be kept in a secure place (a locked cabinet) for 5 years following the completion of the research project. Electronic data will be password protected to ensure privacy and confidentiality and will be appropriately destroyed after 5 years following completion of the research project.

**Benefits**
There will not be any direct benefits to you for participating in this research. The research from this study will provide insights into the motivations and challenges for engaging stakeholders in product stewardship programmes. Findings of the study can help to improve existing or future product stewardship programmes related to clothing and textiles. You will have access to the completed master's thesis and research report which will summarise the key findings.

**Risks**
There are no foreseeable risks associated with participating in this study.

**Voluntary participation**
You are under no obligation to participate in this study. Your participation is completely voluntary. You can decline to participate in the study at any time before you submit any responses and close the webpage at any time. However, once you have submitted the survey you will not be able to withdraw your responses as they will be made anonymous and mixed with other participants' responses.

**Questions or concerns**
If you have any questions about your participation in the study, you can email Lauren (principal investigator) at [email removed]. If you would like to contact the research supervisors, you can contact Dr. Rachel McQueen at [email removed] or Dr. Lisa McNeill at [email removed]. The plan for this study has been reviewed for its adherence to ethical guidelines by the University of Alberta’s Research Ethics Board (Study ID: Pro00097937). For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at [phone removed]. This office has no affiliation with the study investigators.

If you consent to participate in this study, then please click the "Next" button below to proceed with the survey. If you DO NOT consent to participate in the survey, then please close your browser.

# Appendix B: Company/Organizational Survey

The purpose of this survey is to provide context for the interview/survey findings by characterizing the types of companies and organizations participating in the study.

Name of company or organization: _____

Head office location: _____

Number of years in operation: _____

Enterprise type: Simple enterprise (one operating entity) Complex enterprise (multiple operating entities)

Business organization:

Sole proprietorship Partnership Corporation Limited Liability Company Cooperative

Size of company/organization based on number of employees:

Small: Non-employing 1-4 5-9 10-19 20-49 50-99

Medium: 100-199 200-499

Large: 500+

Industry (check all that apply):

- ☐ Clothing/textile design
- ☐ Raw materials production
- ☐ Textile materials production
- ☐ Apparel manufacturing
- ☐ Non-apparel manufacturing
- ☐ Retail
- ☐ Supply chain management
- ☐ Technology & innovation
- ☐ Consulting
- ☐ Waste management
- ☐ District, city or regional council
- ☐ Recreation or tourism services
- ☐ Other services_____

Current involvement with the Textile Reuse Programme:

Member Collaborator Considering membership/collaboration Non-member

Appendix C: Interview Guides

## Interview Guide for Usedfully

1. How does Usedfully work towards reducing textile waste in New Zealand?
2. How did the Textile Reuse Programme (TRP) start?
    a. What motivated you to begin the TRP?
3. How does the Usedfully TRP relate to product stewardship?
4. What types of clothing and/or textile waste does the TRP/Usedfully focus on?
    a. How might this expand in the future?
5. How were the companies or organizations involved in the TRP/Usedfully chosen?
6. What are the different levels of membership or involvement in the programme?
7. According to your website, the programme was launched "following two years of investigation, auditing, system design and feasibility studies" (http://www.theformary.com/our-work/). Can you take me through each of these steps and what they entailed?
8. What are the next steps for the programme/project?
    a. Do you plan to apply for product stewardship accreditation? Why or why not?
9. How do you measure success within the programme?
10. What are some of the current challenges Usedfully is facing in relation to the programme/project?
11. What are some of the barriers for expanding the programme? (e.g., stakeholder engagement, government or policy support, financial concerns)
12. What support do you get from outside organizations? What about government support?
13. How has policy legislation or regulation helped the development of Usedfully-TRP?
14. How could policy help the long-term sustainability or growth of Usedfully-TRP?
15. What strategies have you used to engage stakeholders?
16. To what extent do you see the programme expanding, nationally? (e.g., more members, different types of clothing/textile waste accepted)
17. How has the COVID-19 outbreak impacted your day-to-day operations?
18. How have your sustainability efforts changed with the COVID-19 outbreak?
19. How have other aspects of your business/organization have been prioritized over sustainability?
20. Looking forward, how do you anticipate your decisions or environmental policies changing as a response to COVID-19?
21. How do you envision the future of the Usedfully Textile Reuse Programme?
22. Is there anything else you'd like to add before we end the interview?

**Interview Guide for Current/Former Members of the Textile Reuse Programme**

1. In what ways do you deal with, or are responsible for, clothing and/or textile waste? What types of textile waste does your company deal with?
2. How are clothing/textiles collected and sorted?
3. How did you get involved with the Textile Reuse Programme?
4. For what reasons were you (or your company) interested in the programme/reducing your textile waste?
    a. Prompt: Was it customer pressure, general criticism of the negative externalities of your product, saving money?
5. How was the decision to join made within your company?
6. How does (did) your company benefit by being involved in the programme?
7. How do you feel your involvement with the TRP sets you apart from your competitors?
8. Does your company have an environmental policy? If so, who was responsible for the creation of the policy?
9. How does your organization communicate its environmental policy(ies) to the public?
10. How does (did) your partnership in the Textile Reuse Programme align with your company's mission or ethos?
11. How do (did) you measure the effectiveness of the TRP or your involvement with the TRP?
12. What are some of the current challenges your company faces in relation to the programme / reducing your textile waste?
13. What are some of the barriers for expanding the programme or your participation in it? (e.g., stakeholder engagement, government or policy support, financial concerns)
    a. Former members: What were some of the barriers for continued participation in the programme?
14. What support does your company get from outside organizations or government support?
15. How has policy legislation or regulation helped your involvement the TRP?
16. How could policy help the long-term sustainability of the TRP or your company's participation in it?
17. To what extent do you see your involvement in the programme expanding?
18. How has the COVID-19 outbreak impacted your day-to-day operations?
    a. Production, distribution, sales?
19. Can you give me a general explanation of your supply chain and how this has been impacted by COVID-19?
20. How have your sustainability efforts changed with the COVID-19 outbreak?
21. How have other aspects of your business/organization have been prioritized over sustainability?
22. Looking forward, how do you anticipate your decisions or environmental policies changing as a response to COVID-19?
    a. Prompts: More resilient supply chains?
        Incentive to move towards circular supply chains?
        Production onshore or purchasing from New Zealand manufacturers?
23. How do you envision the future of the Textile Reuse Programme?
24. Is there anything else you'd like to add before we end the interview?

**Interview Guide for Interested or Non-Members of the Textile Reuse Programme**

1. In what ways do you deal with, or are responsible for, clothing and/or textile waste?
    a. What types of textile waste does your company deal with?
2. What does your company currently do with unwanted, unwearable, or damaged clothing/textiles?
3. Does your company have an environmental policy?
    a. If so, who was responsible for the creation of the policy?
    b. What prompted your company/organization to develop this policy or initiative? (customer pressure, general criticism of the negative externalities of your product, saving money?)
    c. How does your organization communicate its environmental policy(ies) to the public?
4. For what reasons might your company/organization be interested in a product stewardship program/reducing your textile waste?
5. How are decisions regarding sustainability or waste reduction made within your company?
6. What are some of the current challenges your company faces in regard to reducing clothing/textile waste?
7. What, if any, strategies have you used to reduce the clothing/textile waste produced by your company?
    a. Are there strategies you have been meaning to try?
8. What are some of the barriers for participating in a product stewardship program? (e.g., stakeholder engagement, perceived or real lack of access, government or policy support, financial concerns).
    a. Is this even a potential option for your company?
    b. What possible sources of funding would your organization have for participating in a product stewardship program?
9. What support does your company get from outside organizations or government support for sustainability or waste reduction initiatives?
    a. What about policies?
10. How has the COVID-19 outbreak impacted your day-to-day operations?
    a. Production, distribution, sales?
11. Can you give me a general explanation of your supply chain and how this has been impacted by COVID-19?
12. How have your sustainability efforts changed with the COVID-19 outbreak?
13. How have other aspects of your business/organization have been prioritized over sustainability?
14. Looking forward, how do you anticipate your decisions or environmental policies changing as a response to COVID-19?
    a. Prompts: More resilient supply chains?
        Incentive to move towards circular supply chains?
        Production onshore or purchasing from New Zealand manufacturers?
15. Is there anything else you'd like to add before we end the interview?

# Appendix D: Survey Questions

As a representative of your company/organisation, we are interested in your current experience with clothing or textile waste and your thoughts on product stewardship programmes for clothing/textiles. In case you are unfamiliar with the term, product stewardship refers to “an environmental management strategy that means whoever designs, produces, sells, or uses a product takes responsibility for minimising the product's environmental impact throughout all stages of the products' life cycle, including end of life management” (Northwest Product Stewardship Council, n.d., para. 1). You may respond to questions in bullet point form. Questions with a red asterisk (*) are mandatory. For questions that do not apply to your company/organisation, please type "N/A".

Have you heard of the The Formary or the Textile Reuse Programme before? *

- Yes
- No

If you replied "Yes" to the previous question, how did you hear about the The Formary or the Textile Reuse Programme?

What specific clothing and/or textile products do you deal with? (check all that apply) *

- Fibres
- Yarns
- Fabric for apparel products
- Fabric for non-apparel products
- New consumer apparel
- Used consumer apparel
- Accessories or footwear
- Uniforms, workwear or corporate wear
- Other: _____

What types of clothing/textile waste does your company/organisation deal with? (check all that apply) *

- Manufacturing waste (fibres/yarns)
- Fabric offcuts
- Defect products
- Unsold product
- Garment returns
- End-of-life clothing/textiles
- Other: _____

What does your company/organisation currently do with unwanted, unsellable, unwearable or damaged clothing/textiles? *

Which of the following environmental impacts does your company/organisation currently monitor, if any? (check all that apply) *

- No current monitoring

- Production/purchasing volumes (number or by weight)
- Carbon emissions
- Energy usage
- Water usage
- Chemical usage
- Waste volumes
- Packaging material
- Other: _____

What is the likelihood of your company/organisation joining an accredited, voluntary product stewardship programme? (1=very unlikely; 2=unlikely; 3=unsure; 4=likely; 5=highly likely) *

For what reasons might your company/organisation be interested or motivated in joining a product stewardship programme or otherwise addressing your environmental impact? *

What are some of the current challenges your company/organisation faces in regard to reducing clothing/textile waste or other environmental impacts? *

What, if any, strategies have you used to reduce your clothing/textile waste or environmental impact? *

What, if any, opportunities are there for your company to address your clothing textile/waste or other environmental impacts in New Zealand? (e.g., existing reuse or recycling programmes; take-back services, etc.) *

What are some of the barriers for participating in a product stewardship programme? (e.g., stakeholder engagement, government or policy support, financial concerns) *

What support do you get from outside organisations or government for sustainability or waste reduction initiatives, if any? (e.g., funding; guidelines for product stewardship) *

How much power do you feel your company has in influencing policy or government decisions related to sustainability? *

- High influence
- Moderate influence
- Little influence
- No influence

In what areas of sustainability do you feel your company can reduce negative impacts? (check all that apply) *

- Designing for longevity
- Providing fair or ethical labour opportunities
- Reducing clothing/textile waste
- Reducing carbon emissions
- Reducing water usage
- Reducing chemical usage

- □ Reducing energy usage
- □ Educating consumers or end-users
- □ Reducing or eliminating packaging
- □ Other: _____

Which of the following stages of the product life cycle does your company have control over? Which do you have influence over? (check one per row) *

| | Control | Influence |
|---|---|---|
| Design/redesign | □ | □ |
| Sourcing materials | □ | □ |
| Manufacturing | □ | □ |
| Distribution and logistics | □ | □ |
| Retail | □ | □ |
| Laundering | □ | □ |
| Maintenance/Repair | □ | □ |
| Reverse Logistics (take-back services) | □ | □ |
| Disassembly/End of life solutions | □ | □ |
| Disposal | □ | □ |

How are decisions regarding sustainability or waste reduction made within your company/organisation? *

Does your company/organisation have an environmental or sustainability policy? *

- □ Yes
- □ No (skip to the next section)

What areas of sustainability does your policy address? (check all that apply)

- □ Circular economy
- □ Product stewardship
- □ Using renewable materials
- □ Fair or ethical labour practices
- □ Closed-loop manufacturing
- □ Technological innovation
- □ Water usage
- □ Chemical usage
- □ Carbon emissions
- □ Plastic microfibre release
- □ Repair initiatives
- □ Clothing/textile recycling
- □ Waste (landfilling)
- □ Consumer education or awareness building
- □ Other: _____

What prompted your company/organisation to develop this policy or initiative? (e.g., customer pressure; general criticism of the negative externalities of your product; etc.)

How does your company/organisation communicate its environmental policies to the public? (check all that apply)

- Company website
- Social media
- Direct inquiries from public
- Education campaigns
- Workshops
- Policies are not communicated with the public
- Other: _____

In what ways has your company/organisation been impacted by COVID-19 up until this point? *

How have your sustainability efforts changed with the COVID-19 pandemic, if at all? *

Looking forward, how do you anticipate your decisions or environmental policies changing as a response to COVID-19? *

Are you interested in participating in a brief follow up survey? The survey will be related to if/how your company or organisation has been changed by COVID-19 since participating in this survey. *

- Yes
- No

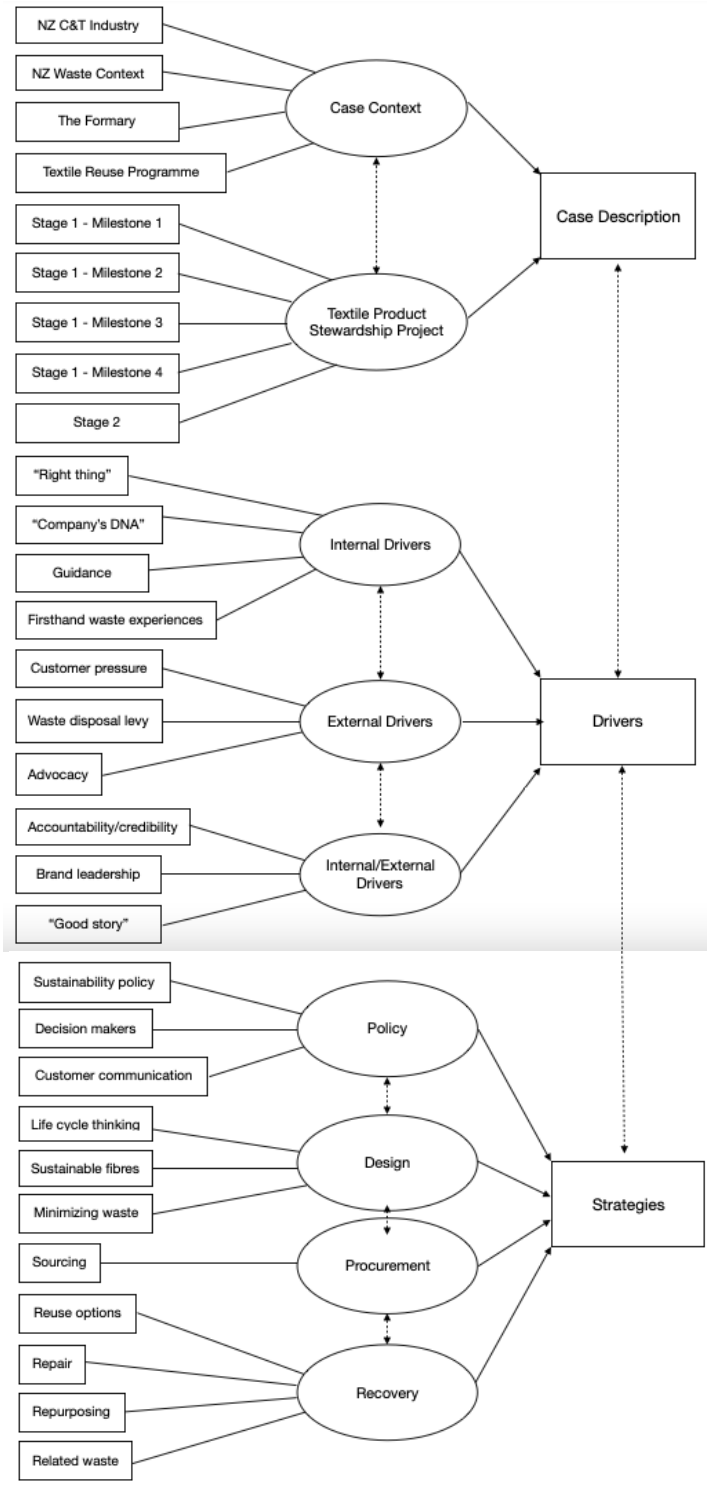
Please use this space to add any additional comments. Thank you for your participation!

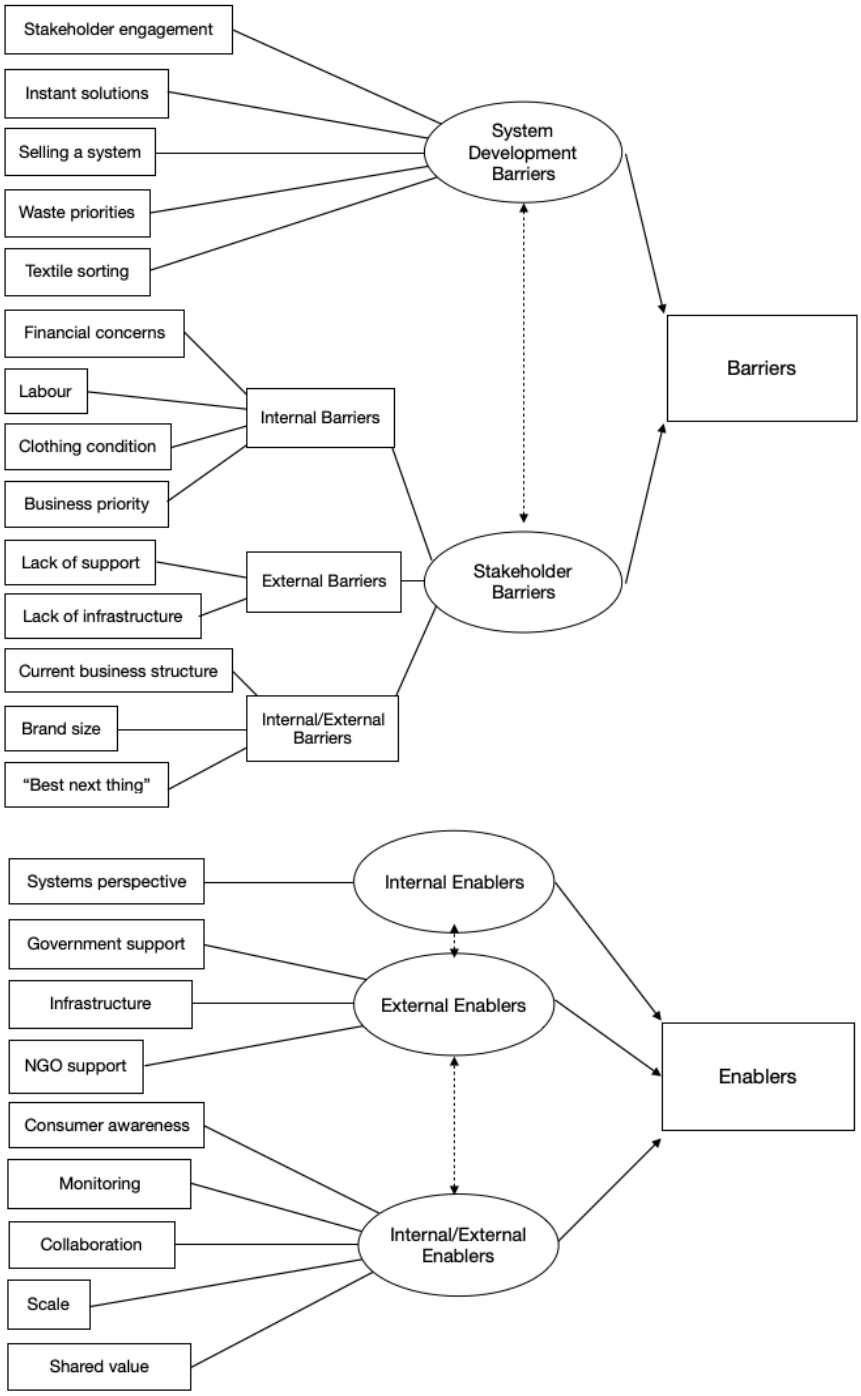
# Appendix E: Follow Up Interview Guide and Survey Questions

1. How has the COVID-19 outbreak impacted your day-to-day operations since we last spoke?
    a. Prompt: Production, distribution, sales?
    b. Improvements?
2. How have the impacts on your supply chain changed since then?
3. Up until this point, how have your sustainability efforts changed with the COVID-19 outbreak?
4. How have other aspects of your business/organization have been prioritized over sustainability?
5. Looking forward, how do you anticipate your decisions or environmental policies changing as a response to COVID-19?
    a. What about changes to these decisions or policies once the crisis is over?

Appendix F: Mapping Codes to Categories to Themes

Adapted from Saldaña, 2016, p. 14




Stakeholder engagement
Instant solutions
Selling a system
Waste priorities
Textile sorting
System Development Barriers
Financial concerns
Labour
Clothing condition
Business priority
Internal Barriers
Lack of support
Lack of infrastructure
External Barriers
Current business structure
Brand size
"Best next thing"
Internal/External Barriers
Stakeholder Barriers
Barriers
Systems perspective
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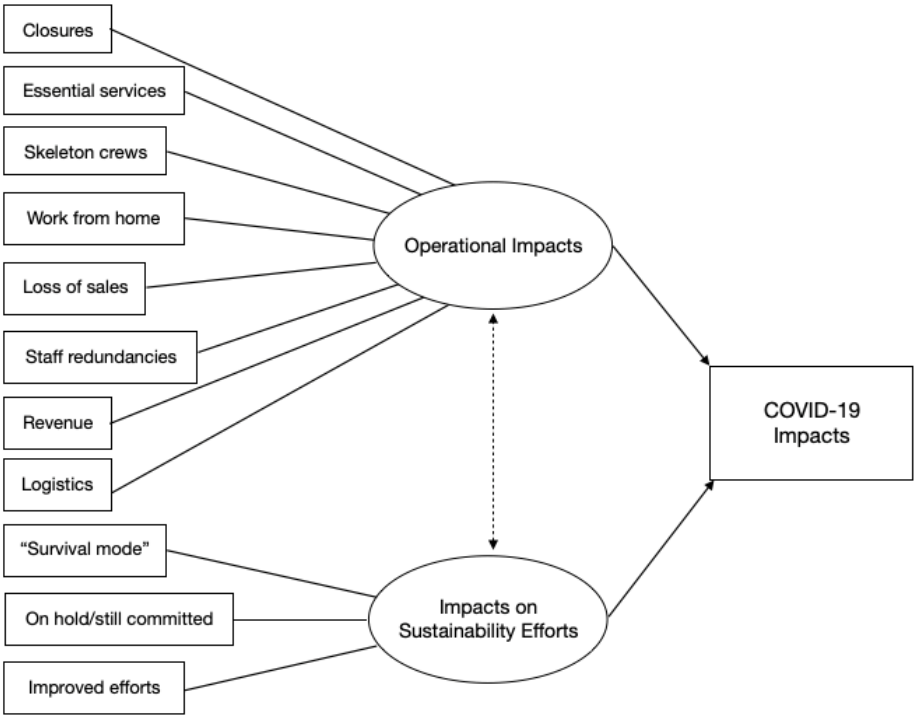
Infrastructure
NGO support
Consumer awareness
Monitoring
Collaboration
Scale
Shared value
Internal Enablers
External Enablers
Internal/External Enablers
Enablers


Closures
Essential services
Skeleton crews
Work from home
Loss of sales
Staff redundancies
Revenue
Logistics
"Survival mode"
On hold/still committed
Improved efforts
Operational Impacts
Impacts on Sustainability Efforts
COVID-19 Impacts