Unravelling the Problem of Apparel Waste in the Greater Vancouver Area

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Foreword

Better Together – The Importance of Collaboration

> "A diversity of opinions is likely to invite conflict, but if stakeholders are given the correct tools, participants can use the tension as an opportunity for learning and growth."[1]
>
> —Myrna Lewis, co-founder of the Lewis Method of Deep Democracy

The apparel industry, from production of fibres through to the management of apparel waste, is a complex, multi-stakeholder system. Complex systems can leave individual stakeholders feeling stuck when faced with solving the problem on their own. Therefore, stakeholders from both but apparel industry and waste management industry together to solve their shared challenge of apparel waste.

This report was initiated as key next step identified among participants in the Leverage Lab for Textiles Waste. Participant were all local actors involved directly with or connected to the various parts of the apparel industry in the greater Vancouver area. During the workshop-style Leverage Lab sessions, participants agreed that a common understanding of the existing state of apparel waste was a key first step in making strides towards eliminating it.

To go beyond simply scratching the surface of the apparel waste challenge, the collaborative process aimed at helping participants discover leverage points. In this report, these leverage points are revealed as opportunities for action.

More details on how the problem of apparel was explored through the Leverage Lab process can be found in Appendix 1.

[1] Paraphrased from Myrna Lewis. "Mining the Gold of Conflict," *TEDx Cape Town* 2015. https://www.youtube.com/watch?v=FsFz1H447kk

Acknowledgements

The authors thank the many organizations in the greater Vancouver area that participated in Leverage Lab Collaborative for Textiles workshops to contribute their knowledge of the industry, their own practices, and their ideas for reducing apparel waste in the region.

A special thank you to Sara Blenkhorn, of the Leverage Lab. Undaunted by the complexity of the challenge, she set out to reduce apparel waste in the greater Vancouver area. It was her that brought us all together to discuss and workshop the basis of this report. And it is her dedication to the challenge, vision and leadership that inspired us to write this report.

Convener and Facilitator - Leverage Lab

As the convener and facilitator, Leverage Lab created a safe space for these competitors to work together around their common challenges and guided the chosen direction of the lab while integrating the perspectives and needs of participants. The lab brought in a new methodology that builds relationships, creates trust and utilizes prototyping to solve our city's most complex challenges. The lab focused on understanding the challenge first, which led Leverage Lab to explore external factors such as regional and global trends, research best practices from other jurisdictions, enlist high-level expertise, and seek regulatory insight.

For more on Leverage Lab, its process and supporters, please visit Appendix 1.

Co-Conveners

During the Leverage Lab Collaborative for Textiles workshops, co-conveners listed below played a key advisory and research role between workshops. Beyond the workshops, co-conveners continued to play a key advisory role to the writers for the development of this report. The authors would like to thank the following organizations for taking on this important leadership role.

Metro Vancouver

Metro Vancouver's sustainability principles provide guidance for the regional solid waste plan, which was approved by the Province of BC in 2011. Goals include reducing the waste we each generate and aspiring to recycle 80% of the region's waste by 2020. With this aim, Metro Vancouver co-convened the Leverage Lab Collaborative for Textiles to better understand how new programs and policies can encourage the apparel and recycling industries to divert apparel waste from disposal.

City of Vancouver

The City of Vancouver has an ambitious Greenest City 2020 target of reducing waste disposed to landfills and incinerators by 50% compared to 2008, and ultimately a goal of zero waste by 2040. As additional steps are taken in support of this target and goal, it is necessary to understand why apparel waste ends up in the garbage, and how reduction, reuse, and recycling options can be supported. By partnering with the Leverage Lab Collaborative for Textiles and its participants, the City is better equipped to understand the barriers and opportunities related to reducing apparel waste in Vancouver.

Vancouver Economic Commission

The Vancouver Economic Commission (VEC) works to position Vancouver as a globally recognized city for innovative, creative, and sustainable business by strengthening our technology, digital entertainment, and green economy sectors through strategic programs and initiatives. The VEC engaged in the Leverage Lab Collaborative for Textiles to support Vancouver businesses operating in the apparel industry, with the goal of helping the local industry reduce its ecological footprint through collaborative efforts.

The VEC advocates for the continuation of manufacturing and production in the heart of the city. By helping businesses become more resilient and identifying business development opportunities that are becoming possible—due to climate change and businesses' increasing accountability for their role in the take-make-waste pattern of consumption—the VEC is helping drive the green economy in Vancouver and beyond.

Debrand

No company wants to see their products or assets going to landfill, especially with their name attached. Debrand solves both of these problems through secure disposal. Debrand specializes in disposal of all kinds of non-saleable or obsolete goods. Whether it's uniforms, event equipment, or customer product returns, security, brand protection, and the environment are paramount. Through Debrand's services, company assets are repurposed or recycled by the most environmentally friendly means possible without the company's brand name attached.

EcoFashion Week

Established in Vancouver, in 2010, Eco Fashion Week (EFW) has successfully showcased 11 editions featuring over 150 of designers and stylists from around the globe. As a not-for-profit organization, EFW aims to present the solutions and innovations working to develop a more responsible fashion industry. The sustainable fashion spectrum is diverse and multi-faceted, as it considers the environment, the working conditions, and the supply chain as well as responsible consumption practices. EFW calls this the "Eco Recipe". In short, an "Eco Recipe" is individualistic and speaks to the ways companies, brands, and individuals practice sustainability.

FABCYCLE

FABCYCLE (and Frameworq) is on a mission to convert fabric waste into resource. FABCYCLE provides a convenient pickup service for fabric scraps. Then FABCYCLE connects the scraps with the creative community to facilitate the reuse of fabric that otherwise would have ended up in the landfill. FABCYCLE provides creative waste diversion solutions (reuse and recycling) for materials that are difficult to recover.

The idea for FABCYCLE came from the Leverage Lab Collaborative for Textiles, where the need for a different kind of service to divert textile waste was identified. The Leverage Lab was a catalyst for forming the unique business model in which FABCYCLE operates—when bridging between the creative community and businesses that are seeking to close the loop on textile waste.

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Leverage Lab Collaborative for Textiles

Facilitator/Convener
- Leverage Lab: Sara Blenkhorn

Fashion Show
- EcoFASHION: Week: Myriam Laroche, Natalie Farrell

Designers/Brands
- Gentle Fawn (The Family Business Distribution): Sarah Cumming, Carla Hogg
- Lululemon: Julie Strilesky
- Lunapads: Madeleine Shaw
- Nicole Bridger Design: Nicole Bridger
- H&M: Jessica Stasskewitsch

Fabric Finishing and Supply
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- KenDor Textiles: Paul King, Sybille Kissling
- Our Social Fabric: Toby Russell

Collectors, Sorter-Graders, and Resellers
- Canadian Diabetes: Beata Tymoszejko
- Debrand: Wes Baker, Amelia Ufford
- Recycling Alternative: Louise Schwarz
- Salvation Army: Dan Kinsey
- Trans-Continental Textile Recycling: Patricia Penrose, Gurpreet Preety
- Urban Impact Recycling: Nicole Stefenelli
- Value Village / Savers: Tracie Soyka
- FABCYCLE and Frameworq: Irina Molohovsky McKenzie

Government
- City of Vancouver: Andrea McKenzie, Chris Underwood
- Metro Vancouver: Karen Storry
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National Zero Waste Council, Circular Economy Working Group

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1 Introduction

This report takes the first step towards the transition from a linear (Figure 1) to a circular system (Figure 2) by defining the problem of apparel waste, explaining the existing system of apparel waste generation and management in the greater Vancouver area, and presenting key opportunities that need to be realized by the industry, waste management and government stakeholders in order to make the transition to circular fashion.

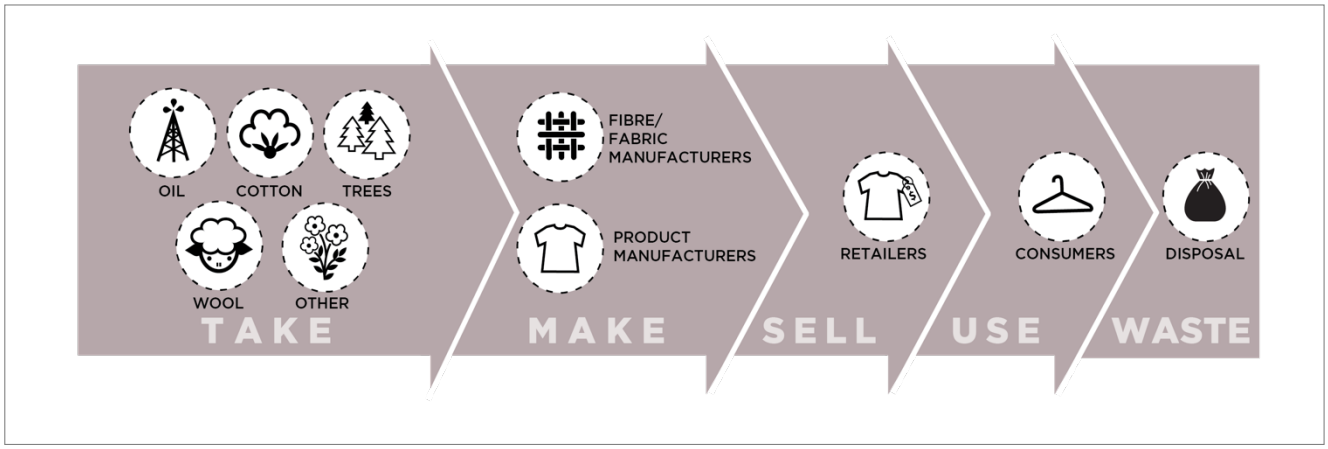

Figure 1 Linear Apparel System

The report details that while there is an existing system to manage apparel waste, it is not circular and it doesn't capture all the waste that is created. To move the industry forward, we need to innovate and find ways to capture more material, and we need to move from a linear to a circular system—to "circular fashion."

For many, circular fashion is an entirely new concept. Therefore, it is important to first establish a common understanding of how to apply the principles of a circular economy to the fashion industry. Starting with what is meant by circular fashion. Circular fashion is a systems level approach to minimizing waste and environmental impacts while maximising profits. Apparel circulating through the circular fashion system is designed so that it becomes a resource (asset) instead of a waste (liability) at the end of its life. In practice, this translates to products that are designed to last; and products that are designed to be recycled or returned to the biological cycle at the end of their useful life. Circular fashion employs the following circular business models to maximize the profits from the each garment in circulation: repair and maintenance, rent and resell, recertify and reimagine, and closed-loop recycling. Despite the benefits of a circular fashion: minimizing apparel waste, reducing environmental impact and improving profitability; circular-fashion business models are uncommon. This report aims to help change that by illuminating the opportunities for the greater Vancouver area fashion industry.

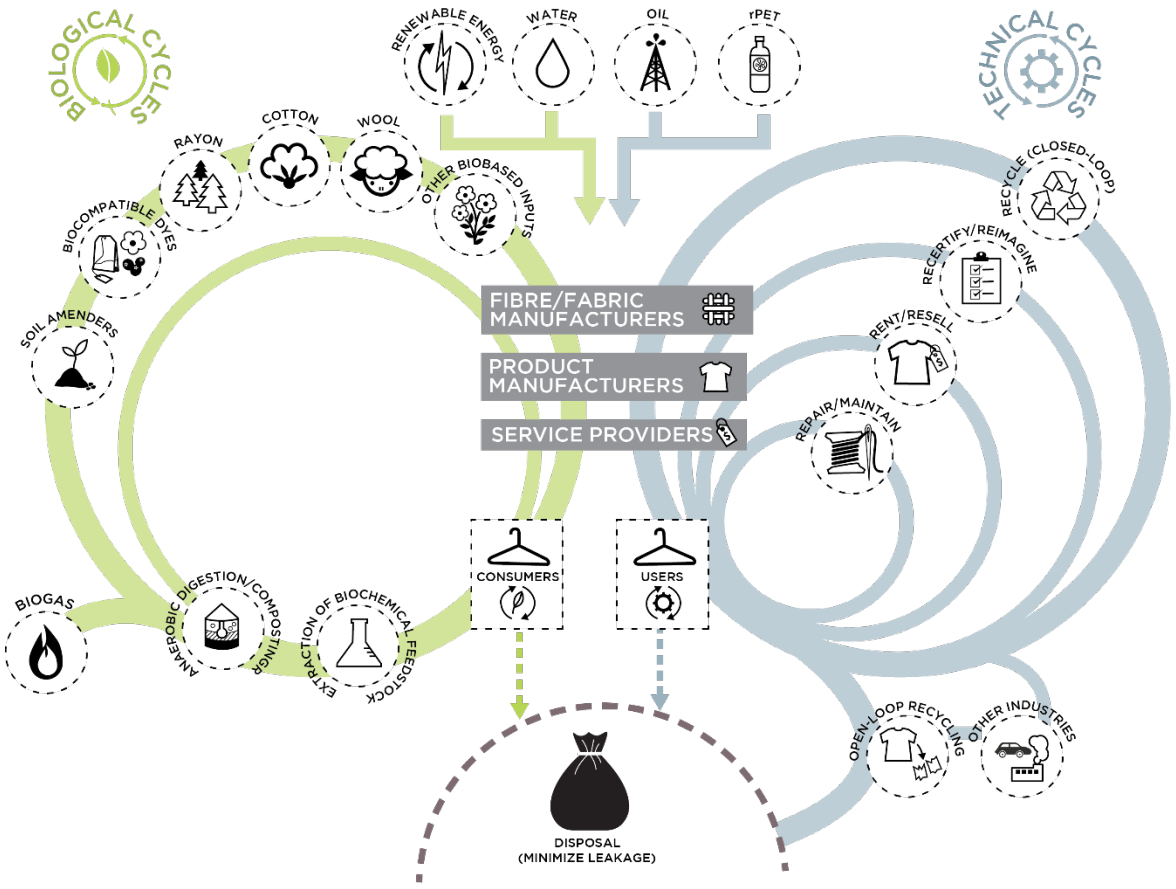

Figure 2 Circular Economy Butterfly Diagram for Apparel[2]

Circular fashion presents an opportunity not only to reduce waste; but also to address growing consumer concerns. A lack of action towards circular fashion is fueling a growing concern about what to do with textile waste arising from the manufacturing and consumption of apparel, which is referred to in this report as apparel waste. Consumers are starting to take note of the impacts of the linear take-make-dispose model. Documentaries, such as RiverBlue and The True Cost, are providing consumers with unvarnished truths about the real cost of the clothes hanging in their closets, including the environmental impacts of producing cheap clothing. Here in the greater Vancouver area, mounting attention on waste in the apparel sector—as demonstrated by public art and advocacy projects such as Value Village's "I Give a Sh!rt" installation[3] (Figure 3).

[2] Adapted from Elllen MacArthur Foundation with original drawing from Braungart &McDonough Cradel to Cradle. "Circular Economy System Diagram" https://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram

[3] Lauren Sundstrom, "Vancouver Aquarium art installation takes aim at clothing waste," *Daily Hive*, August 18, 2016, http://dailyhive.com/vancouver/vancouver-aquarium-value-village-give-a-shirt-2016.

Figure 3 Value Village's demonstration of how much water is wasted in producing new clothes (over 2,600 litres for one cotton t-shirt). Credit: Value Village

While this report focuses capturing what happens in the greater Vancouver area and opportunities to move towards reduction of apprel waste in the greater Vancouver area, the greater Vancouver area is just a small piece of a much larger system which operates in very similar ways in developed countries around the world. Therefore, the contents of this report are widely applicable.

2 Defining the Problem

Why does the disposal of apparel matter?

Impacts

Clothing plays an important role modern society. We can't do away with it. But we can educate ourselves as to the impacts of take-make-waste clothing and find innovative ways to produce clothing to reduce the impacts.

It is time to ask: How might we dress ourselves without the following negative impacts?

Waste Volume

Apparel waste is estimated to be one of the fastest growing waste streams in the world.[4] The Boston Consulting Group estimates that 83.5 million tonnes of apparel waste goes to disposal annually and that by 2030, annual apparel waste to disposal will increase by 62% to 134.3 million tonnes due to an increase in consumption.[5] In Canada, an estimated 500,000 tonnes of apparel waste goes to disposal annually. In the greater Vancouver area, approximately 20,000 tonnes of apparel (2.3% of the total garbage)[6] goes to disposal annually (Figure 4).

Apparel prices started to decrease in 2000, when China entered the World Trade Organization, and prices have not yet recovered.[7] Relatively low prices for clothing, consumer confusion about what to donate, rapidly changing trends, and lack of commercially viable closed-loop recycling is resulting in an increasing amount of apparel going to disposal.

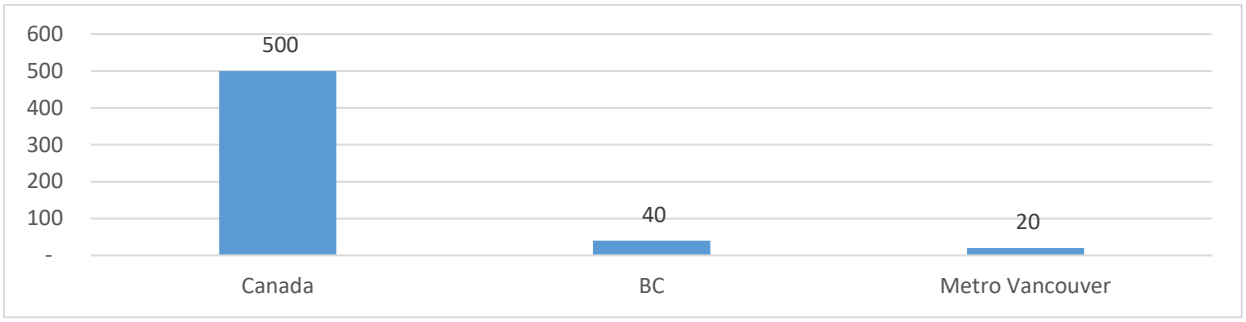

Figure 4 Apparel Waste to Disposal, 2015 (thousand tonnes).

[4] Kirsi Niinimaki and Lotta Hassi, "Emerging design strategies in sustainable production and consumption of textiles and clothing," Journal of Cleaner Production 19 (2011): 1876–1883.

[5] Boston Consulting Group and Global Fashion Agenda, *Pulse of the Fashion Industry*, Global fashion Agenda & The Boston Consulting Group, 2017, https://static1.squarespace.com/static/5810348d59cc68e529b7d9ba/t/596454f715d5db35061ea63e/1499747644232/Pulse-of-the-Fashion-Industry_2017.pdf.

[6] Tetra Tech EBA Inc., *2016 Waste Composition Monitoring Program* (Burnaby, BC: Metro Vancouver, 2016).

[7] Cascadia Consulting Group, *King County Linkup Program 2016 Textiles Market Research Memorandum (revised*) (King County, WA: King County Department of Natural Resources and Parks, 2017).

In 2015, global fashion waste equaled greater than 90% of the estimated global fashion fibre production (Figure 5).

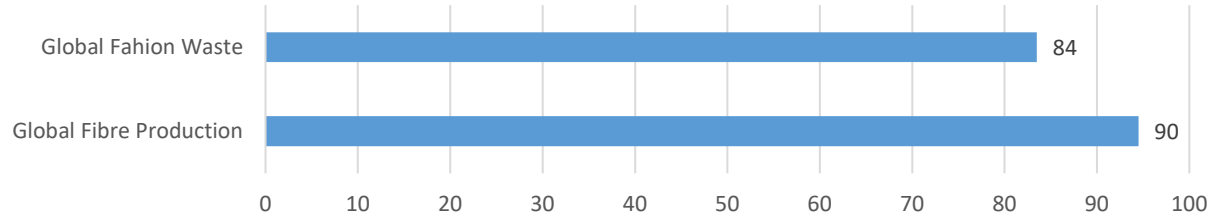

Figure 5 Global Fibre Production Compared to Global Fashion Waste, 2015 (million tonnes). [8,9]

Increased awareness of the impacts of take-make-waste fashion is needed to prevent further strains on our limited solid waste capacity and expedite the transition from linear to circular fashion.

Plastics Clothing and Microplastics

Synthetic fibres, such as polyester and acrylic, comprised 55% of the global fibre market in 2016.[10] This poses a challenge for waste diversion, as such fibres are difficult to recycle. Teijin, in Japan, is the only one commercial closed-loop recycling plant that accepts used polyester garments. It operates using a take-back program model, accepting only garments from partner brands that have been designed for recycling. Most mainstream polyester garments have no closed-loop recycling option at end-of-life. In addition they are less desirable in open-loop recycling options such as wiper rags and insulation.

Apparel made from synthetic fibres sheds some of this fibre through regular wear and washing, resulting in the accumulation of microplastics in the environment. Too small to be filtered out by washing machines and sewage plants, microplastics in laundry wastewater end up in rivers, lakes, and oceans where they are ingested by aquatic life—and eventually make their way up the food chain.[11] Local researchers found that there are 3,000-4,000 microfibres per cubic meter of water in the Georgia Straight.[12]

Without a change to how we make and care for our garments, synthetic fibres will continue to pollute aquatic environments with microplastics.

[8] Textile Exchange, *Preferred Fiber & Materials Market Report 2017*, 2017. To download the report: http://textileexchange.org/downloads/2017-preferred-fiber-materials-market-report/.

[9] Boston Consulting Group and Global Fashion Agenda, *Pulse of the Fashion Industry*.

[10] Calculated from data provide by Textile Exchange, *Preferred Fiber & Materials Market Report 2017*.

[11] Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN. 43pp.

[12] Desforges et al. "Widespread distribution of microplastics in subsurface seawater in the NE Pacific Ocean," *Marine Pollution Bulletin* Page, 79 (2014) 94–99.

Toxic Dyes and Finishing Processes

Chemical coatings, dyes, softeners, and additives can not only be toxic to consumers,[13] but also reduce the recyclability of apparel as they are a significant percent of a garment's weight (5%–15%).[14]

The bulk of the environmental damage and health impacts of chemicals used in mainstream apparel production occur before garments reach the consumers. Chemicals used to create mainstream fashions are a major source of water pollution. Though methods are used to treat this wastewater in developed countries, in developing countries, which produce much of the world's textiles, wastewater treatment methods are rarely used.[15]

Innovation around chemicals used in mainstream textiles is needed to protect the environment and improve the recyclability of clothing.

Risks to Business Profitability of the Take-Make-Waste Model

Companies are feeling the strains of resource scarcity and price volatility from the current take-make-waste model that dominates textile production.[16] By 2030, if companies across the globe stay on their current paths, there could be a seven billion tonne gap between supply and demand of natural resources.[17]

Fierce competition and fast fashion have created consumer expectation for low-cost apparel. To keep costs low, brands need a steady supply of raw material (e.g., oil and cotton) and cheap labour. Tighter regulations coupled with increasing costs for raw material, water, labour, and energy are driving interest in cleaner and leaner production.

Loss of customer base is the other risk for profitability, for businesses that lag behind their customers. Organizations that take no action to prevent or minimize apparel waste impacts could see their market share decrease as consumer awareness increases, and progressive customers actively switch to transparent brands with practices that align with their values.

> "Based on conservative projections, fashion brands' profitability levels are at risk of at least 3 percentage points if they don't act determinedly, and soon."[18]
>
> – Global Fashion Agenda & Boston Consulting Group

[13] Giovanna Luongo, "Chemicals in textiles: a potential source for human exposure and environmental pollution" (PhD diss., Stockholm University, 2015) http://urn.kb.se/resolve?urn=urn:nbn:se:su:diva-120010.

[14] Oakdene Hollins, *Apparel and Footwear Recycling Innovation* (Sustainable Apparel Coalition, 2014).

[15] Muhammad Imran, David Crowley, Azeem Khalid, Sabir Hussain, Muhammad Waseem Mumtaz, and Muhammad Arshad, "Microbial biotechnology for decolorization of textile wastewaters," *Reviews In Environmental Science & Biotechnology* 14/1 (2015): 73–92.

[16] National Zero Waste Council, *Circular Economy Business Toolkit* (National Zero Waste Council, 2016) http://www.nzwc.ca/Documents/CircularEconomyBusinessToolkit.pdf.

[17] Peter Lacy and Jakob Rutvsit, *Waste to Wealth: Creating Advantage in a Circular Economy*, (Palgrave Macmillan, 2015).

[18] Boston Consulting Group and Global Fashion Agenda, *Pulse of the Fashion Industry*.

Lost Economic Opportunity

Globally, only 0.1% of collected textile waste is made into new garments.[19] The current take-make-waste model does not allow fashion brands to maximize the value of the resources (e.g., water, energy, oil, cotton) that go into the creation of garments.

Work is underway internationally to help the fashion industry better understand the business case for circular fashion. Circular fashion business models could help improve brand loyalty by encouraging longer term relationships with customer through lease and maintenance. In addition, circular fashion could help meet increasing demands for sustainable fashion.

> "More than 65% of the emerging market consumers actively seek sustainable fashion versus 32% or less in mature markets."[20]
>
> – McKinsey & Company

Circle Economy, a circular economy "do and think tank" from the Netherlands, collaborated with forward-thinking fashion brands and found[21] that consumers would pay a 12.5% premium for recycled denim compared to virgin equivalents; and that use of recycled fibres resulted in savings from reduced water and energy consumption and reduced CO_2 emissions (Table 1).

Table 1 Savings from use of Recycled Fibres in Clothing (2015-2016)[22], [23]

Company	Description	Reduced Consumptions and Emissions (%)		
		Water	Energy	CO_2
G-STAR	30% recycled denim fibre	9.8%	4.2%	3.8%
REBLEND	100% recycled yarn from post- consumer clothing	62%	33%	18%

While the early adoption of circular fibres by some forward-thinking companies is promising, adoption of circular fibres across the industry is needed to prevent apparel waste.

Regulatory Risk

There is growing pressure for regulators to enact policies that reduce the volume of apparel going to disposal in order to meet their waste reduction and recycling goals. Such policies and programs are being contemplated and implemented at both senior and local levels of government. Recently, the City

[19] "Post-Consumer Textiles Collection Is Step One, But Then What?" Circle-Economy, last modified April 6, 2017, https://www.circle-economy.com/post-consumer-textile-collection-fibersort/#.WgjtlbYZNds.

[20] McKinsey & Company, *The State of Fashion 2017*, (McKinsey & Company, 2016), https://www.mckinsey.com/~/media/McKinsey/Industries/Retail/Our%20Insights/The%20state%20of%20fashion/The-state-of-fashion-2017-McK-BoF-report.ashx

[21] "Post-Consumer Textiles Collection Is Step One, But Then What?" Circle-Economy, last modified April 6, 2017, https://www.circle-economy.com/post-consumer-textile-collection-fibersort/#.WgjtlbYZNds.

[22] Circle Economy. Reblend Life Cycle Assessment Results. https://www.circle-economy.com/wp-content/uploads/2017/01/Reblend-Life-Cycle-Assessment-Results.pdf

[23] Circle Economy. G-Star Closed Loop Denim Business Case & Environmental Impact Assessment. https://www.circle-economy.com/wp-content/uploads/2017/01/V3-Publishable-G-STAR-Casestudy-1.pdf.

of Markham banned textiles from garbage collected through its curbside program, while Nova Scotia encouraged all second-hand apparel collectors to participate—as one group—to identify locations where donations can be dropped off.

In October 2009, the Canadian Council of Ministers of the Environment identified textiles and carpet as a "phase 2" priority product category as part of its Canada-wide Action Plan for Extended Producer Responsibility. The aim of the action plan was to have the phase 2 category addressed by 2017. To date, no provinces have implemented extended producer responsibility for textiles or carpet. However, since these products are part of the action plan, it is expected that provincial governments will consider how EPR for these products could be addressed in the future.

It is advisable for industry to take measures to reduce waste before regulators intervene.

3 Economic Insights

Though economic data specific to the greater Vancouver area is not readily available, the global and provincial economics of the apparel industry provide important insights into the leverage points for reducing apparel waste and the role of actors in the greater Vancouver area:

- Apparel manufacturing is an economically important manufacturing subsector in the greater Vancouver area. Clothing manufacturing is the fourth-largest manufacturing subsector in BC at 8.5% of manufacturing sales, following food and beverage (21.0%), value-added wood (19.8%), and paper (10.3%), and in 2015 represented $3.7 billion in annual sales.[24] BC has 184 clothing manufacturing businesses,[25] and over 80% of them are located in the Lower Mainland.

- On a global scale, the greater Vancouver area plays a small role in garment manufacturing. Apparel production in the greater Vancouver area is in the $3 billion to $4 billion range while global clothing exports and imports are worth $445–500 billion USD (Figure 6).

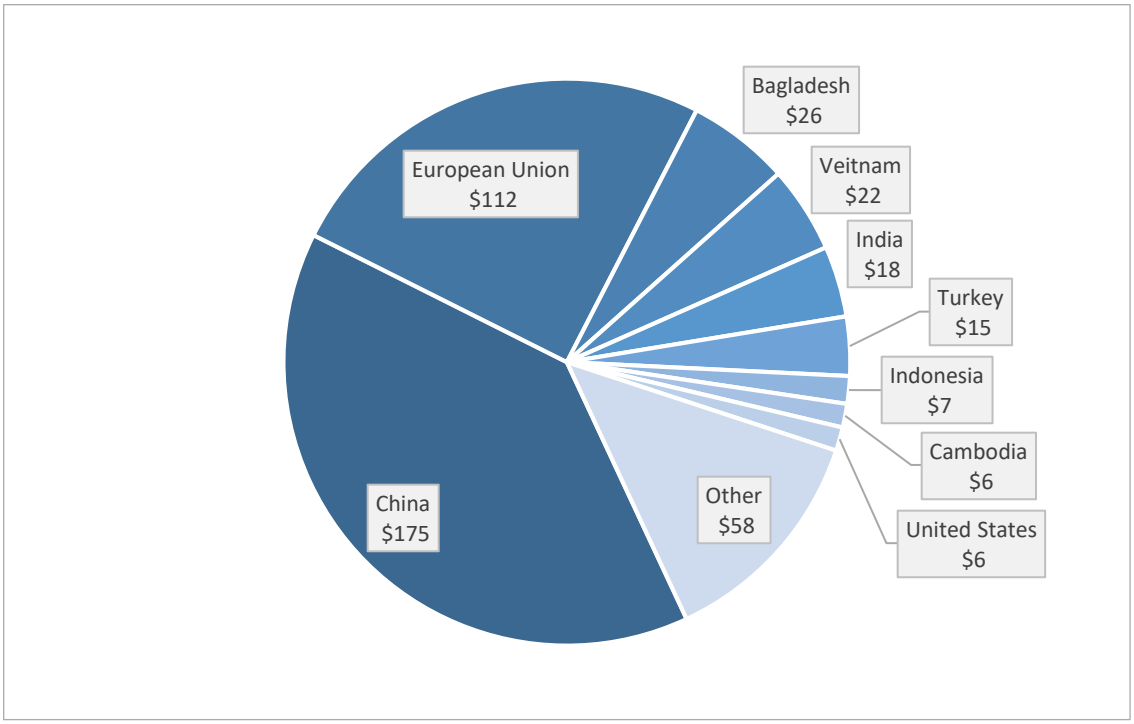

Figure 6 Top Exporters of Clothing, 2015. (All dollar values in billions, USD)

[24] British Columbia Alliance for Manufacturing, BC apparel Industry Labour Market Partnership, Labour Market Information Report. September 2016. https://www.workbc.ca/getmedia/41be12dd-ce11-472c-903f-1d44341fb3c9/Manufacturing_BC_Apparel_LMP_Phase_2_Final_Sept_16.pdf.aspx

[25] Statistics Canada, CANSIM Table 304-0015, Manufacturing Shipments by Industry NAICS, Apparel Industry Employer Survey 2016.

- Consumption of apparel is a key activity in the greater Vancouver area. The wholesale and retail apparel business (selling of new products) in the greater Vancouver area represents an estimated $740 million USD in annual revenue.[26] Overall, Canada is one of the top importers of new clothing in the world (Figure 7).

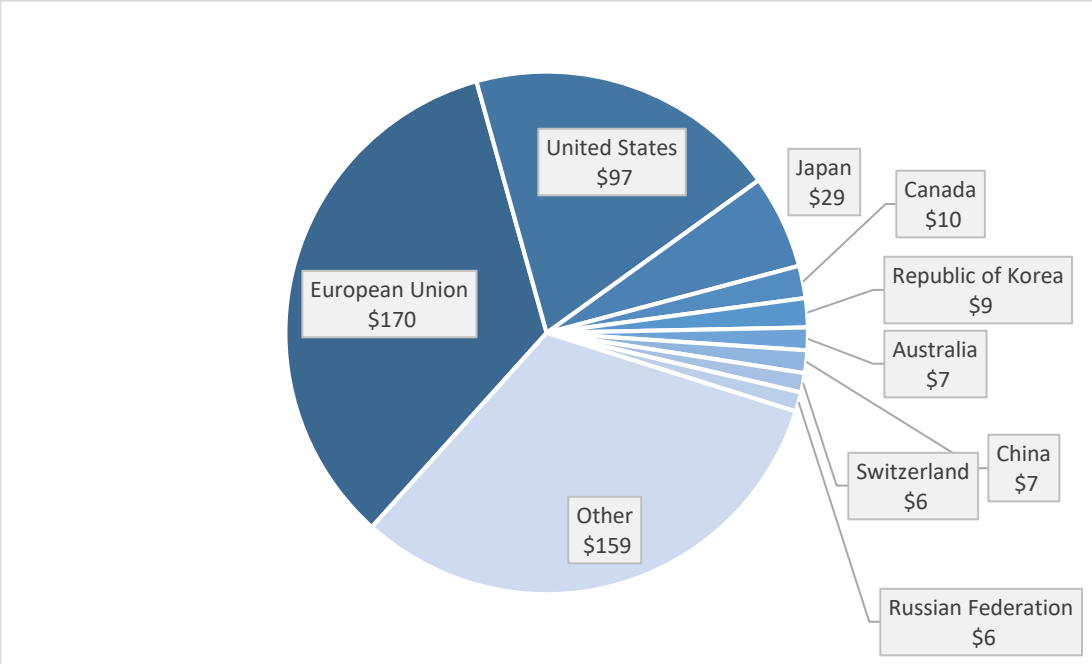

Figure 7 Top Importers of Clothing, 2015.[27] (All dollar values in billions, USD)

- Repair and maintenance of apparel could be an early growth area in a transition towards a circular economy for the fashion industry (Table 2).

Table 2 2016 Greater Vancouver Area Repair Summary[28]

Description	**Number of Businesses**	**Number of Jobs**	**Revenue ($ million USD)**
Shoe and Leather Repair Services	55	127	$3.3
Apparel Repair and Maintenance	54	126	$9.7

[26] Hoovers Business Database, "All Metro Vancouver Businesses," accessed January 2017.

[27] World Trade Organization, "Statistical Tables, Table A23 Top 10 Exporters and Importers of Clothing, 2015," *World Trade Statistical Review*, 2016, https://www.wto.org/english/res_e/statis_e/wts2016_e/WTO_Chapter_09_tables_e.pdf.

[28] Hoovers Business Database, "All Metro Vancouver Businesses." accessed January 2017.

- Women are a key target audience for apparel waste generation. On average, women in Canada spend almost twice as much money on apparel as do men. Fast fashion and disposable clothing has been prevalent in the women's wear sector, and it is increasing in menswear.[29]

- Apparel waste diversion creates green jobs. On a per tonne bases, diverting textile waste creates seven times more jobs than sending textiles to disposal.[30]

[29] Marketline, *Apparel Retail in Canada* (Marketline, 2016). Accessed by subscription.

[30]: Morrison Hershfield, Assessment of Economic and Environmental Impacts of Extended Producer Responsibility Programs in BC (Victoria, BC: Ministry of Environment, 2014), http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/AssessementEconEnvImpactsEPRPrograms-Feb2014.pdf.

4 Current State of Apparel Waste Generation and Management

Understanding the current system for the generation and management of apparel waste is key to identifying opportunities to innovate. This chapter presents the baseline research of where apparel waste is generated and the key challenges identified during the Leverage Lab Collaborative for Textiles process.

Overview

The system by which apparel waste is generated and managed can be understood by following three categories of material: new apparel, diverted apparel, and wasted apparel. These material categories are further subdivided into six key activities (Figure 8). Although the system operates at a global scale, the following sections pay special attention to activities and stakeholders located in the greater Vancouver area.

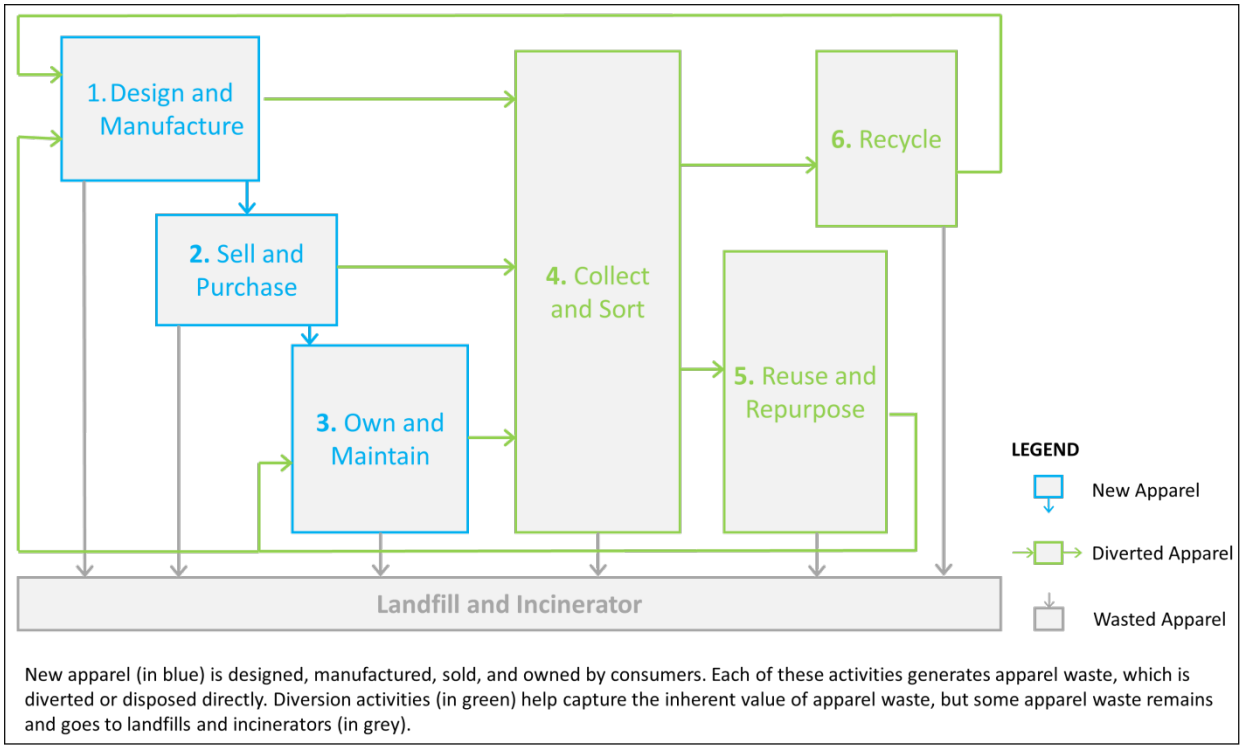

Figure 8 System of Apparel Waste Generation and Management: Six Key Activities.[31]

The new apparel category follows the creation of new clothing from designers and manufacturers (Activity 1) through retailers (Activity 2) to consumers (Activity 3). These activities describe a primarily linear business model that has a great deal of impact through the consumption of virgin resources. Apparel waste is generated in each activity in this category, and is either diverted or disposed.

[31] This figure is a derivative of "Apparel and Apparel Waste Flows in the Greater Vancouver Area (October 27, 2017 revision)" by City of Vancouver in collaboration with Leverage Lab Collaborative for Textiles, used under a Creative Commons Attribution 4.0 International License. Refer to Figure A3.1 in Appendix 3.

Terminology used to describe apparel waste comes from the waste management industry. The waste management industry categorizes waste based on when it is generated and who discards it (the sector). First, waste generated before reaching the end user is called pre-consumer waste, and waste generated by the end user is called post-consumer waste. Next, waste is discarded by either residents (e.g., from houses and apartments), or businesses, institutions and other organizations. These are referred to as the residential sector, and the industrial, commercial and institutional (ICI) sector, respectively. Table 3 summarizes how the different types of apparel waste generated by Activities 1 to 3 are categorized by the waste management industry.

Table 3 Categories of Apparel Waste Generated by "New Apparel" Activities

	Design and Manufacture	**Sell and Purchase**	**Own and Maintain**	
	Industrial, Commercial, Institutional			**Residential**
Pre-consumer waste	-designer samples -fabric samples -manufacturing off-cuts -fabric bolts and roll-ends -defective and damaged apparel -excess inventory	-designer samples -defective and damaged apparel -excess inventory -recalled inventory -other unsellable apparel (e.g., championship merchandise printed with losing team's logo)	n/a	n/a
Post-consumer waste	n/a	-consumer returns -recalled inventory	-uniforms -apparel branded with organizational logos (e.g., promotional t-shirts) -other industry apparel waste (e.g., fabric and costumes used for film and television) -fabric scraps from repair and alterations completed by a business	-unwanted consumer apparel -damaged or worn-out consumer apparel -fabric scraps from repair and alterations completed by consumers

The diverted apparel category shows how some of this apparel waste is diverted from disposal. Diverted apparel must be collected and sorted (Activity 4) before it can be directed towards reuse and repurposing (Activity 5), or recycling (Activity 6). Diverted apparel flows back to consumers, apparel designers, apparel manufacturers, or other industries entirely (not shown in Figure 8). However, not all

apparel in this category is successfully shifted from waste to resource, and some apparel waste is generated by collecting, sorting, reuse and recycling activities.

The wasted apparel category identifies flows of apparel waste from all activities to disposal.

Each activity is discussed in the sections that follow.

New Apparel

Activity 1: Design and Manufacture

Generation of Apparel Waste

Regional stakeholders that generate apparel waste from design and manufacturing activities include specialized designers and design offices as well as cut-and-sew (manufacturing) businesses.

Design

From specialized designers and design offices, apparel waste includes design samples, leftover fabric bolts and roll-ends, and various scraps. Included in these materials are technical fabrics with special coatings. Apparel brands order single or limited numbers of design samples, which are no longer needed after they have been field tested or marketed to retailers. Waste is also created from excess inventory as well as fabrics and apparel that arrive damaged (whether from manufacturing or shipping). The volume of design waste varies throughout the development process and is typically disposed as garbage.

Due to the use of proprietary fabric and the sensitivities around next season's designs being made public before they are released, design waste can be difficult to divert. Some larger brands in the region report sending this material for secure sorting and certified destruction through local service providers such as Debrand and various sorter-graders (see Activity 4)**.** However, the relatively higher cost of these services compared with disposal can be prohibitive for smaller operations.

Manufacture

The apparel waste generated by cut-and-sew businesses primarily consists of off-cuts and fabric scraps from the cutting table. These materials are small, irregular-shaped pieces of fabric that are not easily reincorporated into conventional manufacturing processes and are understood to be an undesirable resource for reuse or sale. This waste is typically swept into a bin at the end of the day, resulting in a mix of fabric types and colours co-mingled with pattern paper. Leftover fabric and factory-defect fabric make up the remainder of manufacturing waste. Some designers using natural fibres report there is a market for their cut-and-sew scraps, but many manufacturers do not know what to do with this waste other than dispose it as garbage.

A compounding factor in the generation of apparel waste from design and manufacturing is the rise of fast fashion. More garments are produced, as cheaply as possible, using lower-quality fabrics.

Challenges

The following challenges impede the diversion of design and manufacturing waste from disposal:

- **Design for end-of-life:** There is a lack of awareness and motivation for apparel companies to consider what happens to their product after its useful life. Designers are often unaware of which fibres have recycling end markets.
- **Diversion cost:** Diverting apparel waste from disposal is a potential cost to businesses, requiring time, human resources, and infrastructure.
- **Business models:** Business models that require continuous consumption to be profitable feed continuous waste streams; resistance to change from linear to circular business models exists.
- **Supply chain transparency:** The textile industry as a whole is not required to report about many aspects of supply chain and manufacturing, including the management of textile waste.
- **Responsibility:** In conventional business models, designers have little or no control over what happens to apparel they design and manufacture, even if designed with reuse and recyclability in mind.
- **Fast fashion seasons:** The quantity of apparel is consumed annually is increasing, while the quality of materials used is decreasing.

Activity 2: Sell and Purchase

Generation of Apparel Waste

In the course of doing business, apparel retailers end up with pre-consumer waste in the form of excess inventory, damaged and defective inventory, samples, and post-consumer waste in the form of products returned by customers that cannot be resold.

The nature of the damage or defect determines exactly how brands and retailers handle the material, but in many cases, it is deemed unsellable and too expensive to repair or more cost-effective to dispose. Some brands and retailers prefer disposal over discounting or donation to prevent defective products from tarnishing their reputation or less-expensive items from competing with their new stock.

Decisions made by retailers that sell apparel and by the customers that purchase it affect the quantity of post-consumer waste generated at the "own and maintain" stage (Activity 3). Fast fashion, which uses cheaper materials and labour, floods the market with inexpensive apparel that is typically disposed sooner than apparel designed with longevity in mind (often described as "slow fashion."[32] Intended to be made in a more sustainable way,[33] slow fashion has higher production costs for materials and labour, which requires consumers to make a more significant investment in its purchase. The aim of the slow fashion movement is to create high quality, well-made garments that will hold emotional and material

[32] Vanessa Richmond. "In search of ethical gladrags." The Tyee, March 17, 2006, https://thetyee.ca/Life/2006/03/17/EthicalGladrags/). The term "slow clothes movement" is thought to be of local origin, and has been credited to a 2004 article (https://www.straight.com/article/just-how-slow-can-you-go) written by Angela Murills, a fashion writer for the Vancouver news magazine, The Georgia Straight.

[33] Hazel Clark. "SLOW + FASHION-an Oxymoron-or a Promise for the Future…?" Fashion Theory 12/4 (2008): 427-446.; and Kate Fletcher. "Slow Fashion: An Invitation for Systems Change." *Fashion Practice* 2/2 (2010): 259-265). Sustainable production practices associated with "slow fashion" include: use of organic, recycled and repurposed materials; hand-made products; small-scale production; local production and use of local resources; more direct relationships between producers and consumers; fair wages; increased agency of stakeholders across value chain, especially women; and transparent production systems.

value to the wearer, ultimately increasing consumers' motivation to keep, and eventually pass on their clothes.[34,35]

Businesses and institutions purchase apparel such as uniforms and promotional apparel. Because these items are typically branded, commercial and institutional customers prefer sending excess and damaged inventory to secure disposal, which ensures these items do not find their way to outsiders or to international markets (where the reputational risk and business security risk of an outsider wearing their apparel is very low but still of concern). Some items carry a security risk (e.g., police uniforms) and should be securely handled to prevent impersonation of police officers, first responders or other official agents.

Sporting events such as the Super Bowl provide an interesting example of commercial apparel waste resulting from purchasing practices that prioritize profit over waste reduction. Event organizers order two sets of branded merchandise in advance of the game (one set for each contending team) in order to capitalize on sales immediately after the game when merchandise featuring the game winners is in high demand. But this practice automatically creates waste: only one set will be merchandise worth selling; the other will be considered waste before it even hits the market.

Challenges

The following challenges illustrate why apparel waste from retail activities ends up as waste:

- **Responsibility:** Brands and retailers are disconnected from the end fate of the garments they produce and experience little control of what happens to the apparel they sell.
- **Low cost of fast fashion:** Low-cost, mass-produced apparel encourages the continual purchase of new items with short lifespans.
- **High cost of slow fashion:** With competition from fast fashion, more-expensive slow fashion may not have the demand necessary to sustain businesses using this production model.
- **Consumer behaviour:** Inexpensive fast fashion helps to fuel consumer demand for the latest trend, and this demand creates a market for fast fashion.
- **Consumer awareness:** Consumers lack knowledge about the impacts of their fashion consumption habits (e.g., polluting microplastics are generated from washing plastic clothing).
- **Consumer apathy:** The average consumer is typically more concerned with being "on trend" and saving money than with the social and environmental impacts of apparel production, whether those impacts occur locally or far from home.
- **Transparency of business practices:** Consumers rely on brands and retailers for product information, but these businesses may not reveal the negative impacts of their business practices.
- **Low awareness:** Apparel companies may lack an understanding of the impacts of waste and the role that the design phase plays in waste outcomes.
- **Convenience:** Finding alternative solutions to dealing with damaged and excess product—rather than simply putting it in the garbage bin at the back of the store—is perceived as complex and costly.

[34] Clark, "SLOW + FASHION-an Oxymoron-or a Promise for the Future…?," 427-446.

[35] Fletcher, "Slow Fashion: An Invitation for Systems Change," 259-265.

- **Lack of accessibility to affordable and sustainable fashion alternatives:** Most mainstream retail establishments lack substantial selections of sustainable clothing, and such alternatives are often expensive.

Activity 3: Own and Maintain

Generation of Apparel Waste

The number of garments purchased each year by the average consumer has increased by 60% from 2000 to 2014. According to a survey of two thousand women in the UK, the average clothing item was only worn an average of seven times before being discarded.[36] A separate study found one third of British women considered clothing "old" after only three wears.[37] These figures show the trend towards buying new apparel rather than maintaining the garments we already have. The shift towards fast fashion drives this trend since low-quality garments more quickly become damaged and worn out, and it is often cheaper to purchase new clothing rather than repair or alter the clothing we already own. The issue is compounded by the loss of sewing and other apparel maintenance skills by consumers.[38, 39]

To address this issue, some forward-thinking retailers offer a range of repair services to customers—from a voucher for the nearest drycleaner/repair shop to in-store service. Unfortunately, turnaround time for repair can sometimes be longer than customers are willing or able to wait (e.g., a customer may not want to go a week or more without a rain jacket in November). Therefore, for warranty and product defect returns, customers often opt for on-the-spot replacement products over repair. In these cases, if the defect is minor, forward-thinking companies donate the returned garment to a local charity or sell it to a staff member at a discount. Some companies, such as Patagonia, also provide guides explaining how customers can repair garments themselves.

In addition to individual consumers, other significant apparel consumers are businesses, institutions, and other organizations that purchase uniforms and other garments for staff, employees, volunteers, promotion, and so forth. These items are often branded with an organization's logo. Their care and maintenance may be arranged by the organization (e.g., through a linen and uniform service company).

Challenges

The following issues contribute to higher volumes of post-consumer apparel waste:

- **Increased consumption:** Consumers buy more and own it for less time, enabled by the shift towards fast fashion business models.
- **Skill and knowledge:** Most consumers do not have the sewing skills and knowledge of apparel care to repair their clothing.

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[36] **"**Style that's sustainable: A new fast-fashion formula," McKinsey & Company (Nathalie Remy, Eveline Speelman, and Steven Swartz), accessed November 2017, https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/style-thats-sustainable-a-new-fast-fashion-formula.

[37] "Once worn, thrice shy – British women's wardrobe habits exposed!" Bernardos Retail, last modified June 11, 2015, http://www.barnardos.org.uk/news/press_releases.htm?ref=105244.

[38] Anneli Palmsköld, "Reusing Textiles: On Material and Cultural Wear and Tear," *Culture Unbound: Journal of Current Cultural Research* 7 (2015): 31-43.

[39] Pamela A. Norum, "Examination of Apparel Maintenance Skills and Practices: Implications for Sustainable Clothing Consumption," *Family and Consumer Sciences Research Journal* 42/2 (2013): 124–137.

- **Relative cost and inconvenience of maintenance and repair:** As a result of fast fashion, the overall quality and therefore the lifespan of apparel has decreased significantly in the last decade. Fast fashion encourages consumers to throw out damaged apparel and buy new low-cost items instead of investing in the maintenance and repair of their wardrobes. The net result is a higher volume of low-quality materials in the used apparel system and being sent for disposal.

Diverted Apparel

Activity 4: Collect and Sort

This activity is characterized by successive processes of sorting apparel, each of which is an opportunity for extending the useful life of apparel items or extracting value from their constituent materials.

A well-developed network of collecting and sorting infrastructure already handles many types of apparel waste generated by "new apparel" activities 1, 2 and 3.

Residential (Post-consumer) Apparel Waste

When it comes to post-consumer apparel from the residential sector, the first sort is conducted by consumers as they decide how to get rid of unwanted clothing: by repurposing it, giving it to family or friends, donating it, selling it, or throwing it in the garbage.[40, 41] Consumers have several options for discarding their unwanted apparel (Table 4).

Part of the reason valuable apparel goes to disposal is that consumers do not have the expertise required to identify the value of unwanted apparel, and differences between what various collecting organizations accept make it difficult for the average consumer to properly select which items are suitable for donation. For example, a shrunken cashmere sweater with several holes in it is of higher value to a sorter-grader than a polyester-cotton blend t-shirt in perfect condition. There is inherent value left in these discarded textiles; approximately 95% of apparel disposed as garbage is reusable or recyclable.[42]

Despite the many options for unwanted apparel, residents in the greater Vancouver area are throwing away 5–9 kg of clothing per capita per year (Figure 9). Researchers in Ontario found that 92% of surveyed consumers knew where to donate their clothing, but reported disposing 38–50% of their unwanted clothing.[43]

[40] Sally A. Hibbert, Suzanne Horne, and Stephen Tagg. "Charity retailers in competition for merchandise: examining how consumers dispose of used goods." Journal of Business Research 58 (2005): 819-828.

[41] Palmsköld, "Reusing Textiles: On Material and Cultural Wear and Tear," 31-43.

[42] Cascadia Consulting Group, *Post-Consumer Textiles: King County Linkup Research Summary Report* (King County, WA: King County Department of Natural Resources and Parks, 2015).

[43] Sabine Weber, Jennifer Lynes, and Steven B. Young, "Fashion interest as a driver for consumer textile waste management: reuse, recycle or disposal," *International Journal of Consumer Studies* 41/2 (2017): 207–215.

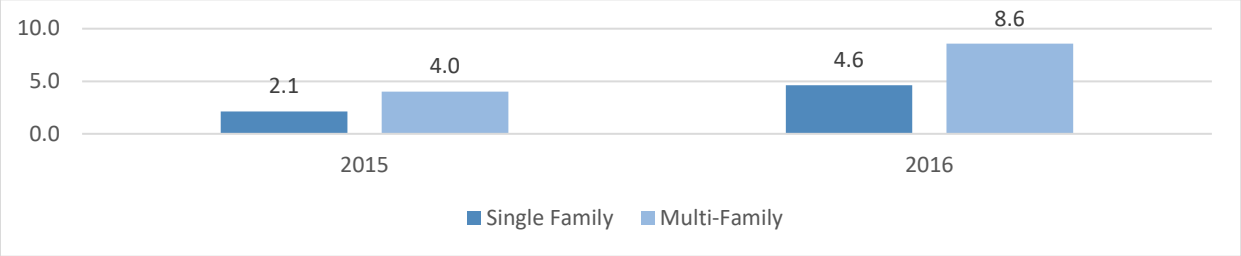

Figure 9 Per Capita Annual Disposal of Clothing in the Greater Vancouver Area (kg/person) [44, 45]

Several factors affect which method consumers use to divert clothing from disposal. Both convenience and familiarity with each option influence whether consumers swap, sell or donate, and which charities or businesses they choose to support.[46]

Many consumers also desire that their unwanted apparel go to someone in need, or in some way help the wider community. One study concludes that this desire is partly driven by feelings of guilt associated with discarding usable apparel.[47] Trust therefore becomes an important factor when donating apparel, and consumers tend to choose organizations who they believe will fulfill their promises to help needful people and communities.[48] As a result, many charities are involved (through a variety of partnership arrangements) in collecting post-consumer apparel. This trust is especially important because consumers typically do not fully understand what happens to their donated items. Apprehension about donating items is likely due to unfamiliarity with the complicated nature of collection and sorting activities, but also conflicting accounts about the social and environmental impacts of exporting used apparel.[49]

[44] Tetra Tech EBA Inc., *2015 Waste Composition Monitoring Program* (Burnaby, BC: Metro Vancouver, 2016).

[45] Tetra Tech EBA Inc., *2016 Waste Composition Monitoring Program* (Burnaby, BC: Metro Vancouver, 2016).

[46] Kathryn Koch and Tanya Domina, "Consumer Textile Recycling as a Means of Solid Waste Reduction," *Family and Consumer Sciences Research Journal* 28/1 (1999): 3–17.

[47] Palmsköld, "Reusing Textiles: On Material and Cultural Wear and Tear," 31-43.

[48] Palmsköld, "Reusing Textiles: On Material and Cultural Wear and Tear," 31-43.

[49] For conflicting accounts, see: Eleanor Goldberg, "These African Countries Don't Want Your Used Clothing Anymore," *Huffington Post*, September 19, 2016, http://www.huffingtonpost.ca/entry/these-african-countries-dont-want-your-used-clothing-anymore_us_57cf19bce4b06a74c9f10dd6; Lily Kuo, "To Stop Relying on Western Hand-me-downs, African Countries Are Importing Chinese Textile Companies," *Quartz Africa*, November 28, 2016, https://qz.com/661463/a-chinese-garment-factory-is-helping-rwanda-wean-itself-from-western-hand-me-downs/; Kylie Kiunguyu, "Rwanda Will Proceed with the Ban on Used Clothes Despite Threats by the United States," *This Is Africa*, July 6, 2017, https://thisisafrica.me/rwanda-will-proceed-ban-used-clothes-despite-threats-united-states/.

Table 4 Options for Discarding Post-consumer Apparel Waste

Option		**Description**
Repurposing		Using unwanted clothes as household cleaning rags or for other consumer uses
Handing down or swapping	Consumer to consumer	Passing on garments to family, friends, and others, sometimes facilitated by social media (e.g., Facebook groups)
Selling		Selling garments directly to other consumers, often facilitated by online platforms such as Facebook or Craigslist
	Resell or consignment store	Taking items to a second-hand store that purchases clothing directly from consumers for resale, or sells items on a consignment basis (includes some e-commerce platforms)
Donating	Donation bin	Placing garments in donation bins located throughout the region, operated by bulk collectors, thrift stores or sorter-graders
	Residential pickup	Scheduling a time with a bulk collector, thrift store, sorter-grader or clothing-provider charity to pick up items directly from residences
	Clothing drive	Dropping garments off at a specially organized event for collecting clothing
	Thrift store	Taking items directly to second-hand stores that resell them, often as a charitable enterprise
	Take-back program	Bringing garments back to retailers who take back their own brands and/or other brands
	Clothing-provider charities	Charities that collect specific items of apparel to distribute directly to individuals in need
Disposing		Placing apparel in garbage containers

Managing Residential (Post-consumer) Apparel Waste

What happens to post-consumer apparel after it is sold or donated is not well understood by consumers, or even by many apparel industry stakeholders. Figure 10 reveals that the diversion options available to consumers follow an ordered sequence of material flows.

Resell and consignment stores commonly donate unsold inventory to clothing-provider charities, thrift stores or bulk collectors. Donation bins are used by bulk collectors, sorter-graders and thrift stores to collect items. Bulk collectors operate by selling what they collect to thrift stores or sorter-graders. Thrift stores donate some unsold inventory to clothing-provider charities and/or sell it to sorter-graders. Along the way, some of this material is disposed to landfills and incinerators.

The majority of discarded post-consumer apparel, however, makes its way to sorter-graders. From there, apparel is sold on global reuse, repurpose, and recycling markets. If no end-market can be found

for materials, then sorter-graders dispose them as garbage. Each of these stakeholders is described in further detail below.

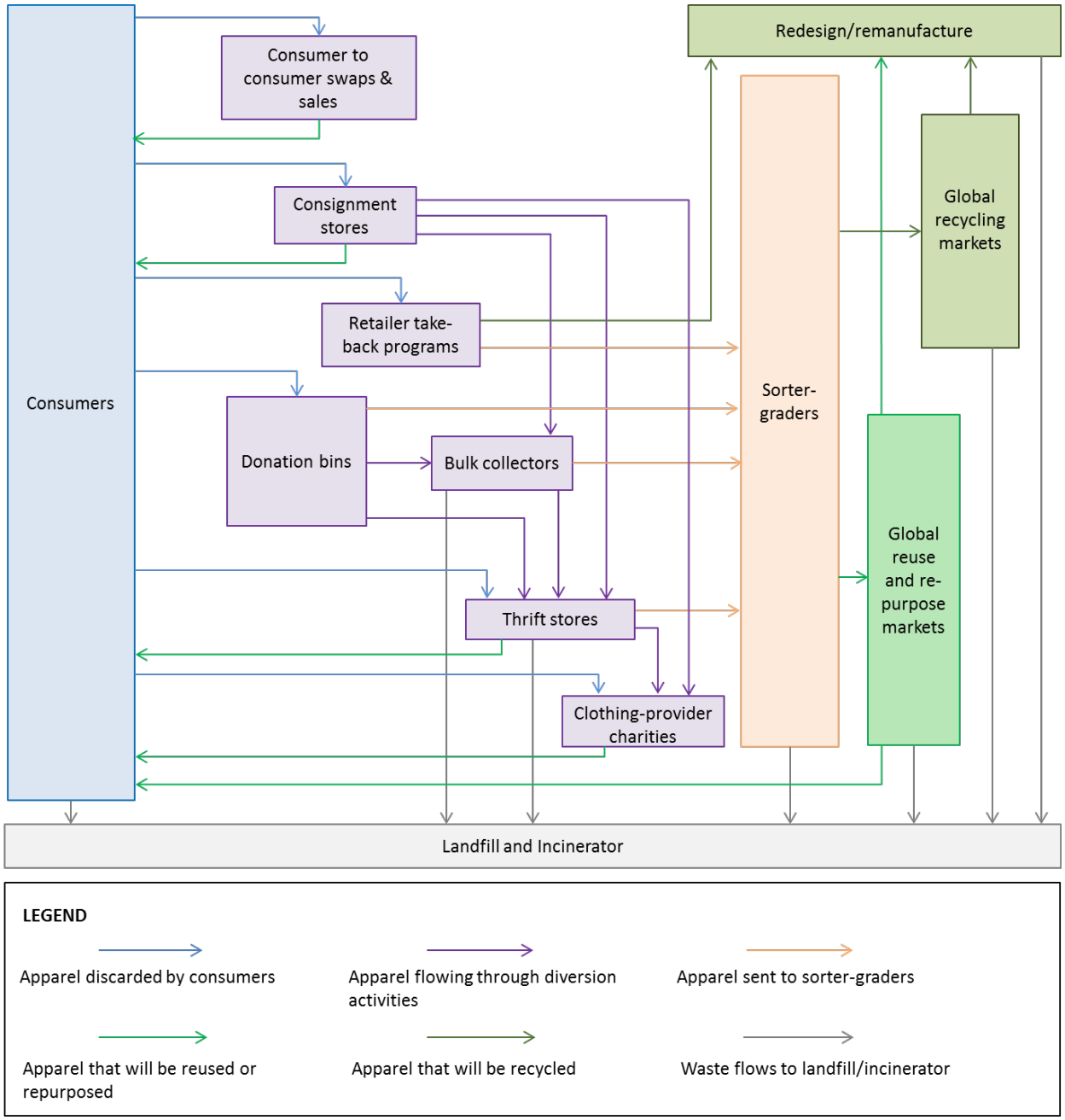

Figure 10 Flows of Post-consumer Apparel Waste[50]

[50] This figure is a derivative of "Apparel and Apparel Waste Flows in the Greater Vancouver Area (October 27, 2017 revision)" by City of Vancouver in collaboration with Leverage Lab Collaborative for Textiles, used under a Creative Commons Attribution 4.0 International License. Refer to Figure A3.1 in Appendix 3.

Resell and Consignment

Resell and consignment stores are often very selective when sorting materials and not all items consumers bring in may be accepted. Since consignment stores are very selective about what they accept in the first place, unsold materials are assumed to be of a high quality and in good condition. Unsold items are typically offered back to the consignee (who has to make a new decision about what to do with them) or donated to clothing-provider charities, thrift stores, or bulk collectors.

E-Commerce

Many online businesses allow customers to buy and sell post-consumer apparel online. Thredup.com and Swap.com are examples of resell and consignment that exist entirely online, but brick-and-mortar consignment and thrift stores increasingly offer online shopping as well.[51] Some e-commerce only facilitates consumer-to-consumer swaps and sales (e.g., Facebook Marketplace, Craigslist, Kijiji).

Donation Bins

Bulk collectors, thrift stores and sorter-graders all operate donation bins as a way to collect post-consumer apparel. Donation bins can be a convenient option for donating clothing, but also present several issues. There is mounting pressure on local and regional governments, from bin operators and the public, to play an active role in addressing these issues. Donation bins are placed, sometimes without authorization, on both private and public property. Bin placement and maintenance can be challenging: the bin may block the use or function of street infrastructure, such as bus stops, parking spaces, and sidewalks; collectors may find their bins damaged or inaccessible; and considerable competition exists between bin operators for locations, especially in the more affluent neighborhoods in the region. Local governments are receiving an increasing number of complaints about donation bins, including frequent incidents of illegal dumping near bins.

Bulk Collection

Bulk collectors do not further sort collected materials, but sell their inventory by weight to thrift stores and sorter-graders. Bulk collectors report having to dispose materials if they get wet or contaminated as well as any items dumped outside donation bins that they are unable to sell. Many bulk collectors also offer scheduled residential pick-ups to collect materials, but report this collection method can be prohibitively expensive.[52] Bulk collection of apparel (and other household goods) is commonly used to raise funds for charity.

Thrift Stores

Thrift stores, including both non-profit and for-profit organizations, sort collected materials according to what they will display for sale in-store. Thrift stores in the region estimate that 30% of collected materials are put out for sale, and of that, between 25% and 35% is actually sold to customers.[53] Some thrift stores allow individuals in need to obtain clothing for free. A small portion of materials is sent to disposal, typically if items are wet, stained, or visibly dirty. Clothing deemed not suitable for the sales rack and unsold clothing are handled differently depending on the store. They may be donated to

[51] Brenda Parker and Rachel Weber, "Second-Hand Spaces: Restructuring Retail Geographies in an Era of E-Commerce," *Urban Geography* 34/8 (2013): 1096–1118.

[52] Surveys completed by Leverage Lab Collaborative for Textiles participants, January 18, 2017; and follow-up interviews conducted by City of Vancouver, January to February 2017.

[53] Surveys and interviews conducted by Metro Vancouver and City of Vancouver, October 2016 to August 2017.

clothing-provider charities, sold to sorter-graders (both regional and overseas), or sent to disposal. Some businesses operating thrift stores sell their unsold materials directly to reuse and recycling markets located overseas.

Clothing-Provider Charities

Clothing-provider charities collect apparel to distribute directly to individuals in need, and tend to accept only specific items according to their charitable mandate (e.g., warm outerwear, interview outfits, prom dresses, etc.). Some thrift stores serve a similar function as clothing-provider charities and donate some inventory directly to individuals in need (e.g. through a voucher program). It should be noted that none of the participants in Leverage Lab Collaborative for Textiles were solely a clothing-provider charity. Further research is needed to understand how these stakeholders collect materials, and whether they generate any apparel waste.

Other Charities

Numerous charities are supported by funds raised through the sale of post-consumer apparel. In the greater Vancouver area, bulk collectors, sorter-graders and thrift stores are known to partner with at least 45 different registered charities. Bulk collectors, sorter-graders and thrift stores may be non-profit or for-profit entities, or hold charitable status themselves, and a wide variety of partnership arrangements determine who is responsible for collection, where materials end up, and how the charity will benefit from the arrangement. Unfortunately, some collectors have been reported to falsely advertise themselves as charities, or advertise partnership with fabricated charities. This deception can create distrust among consumers and impede participation in legitimate donation programs.[54]

Retailer Take-back Programs

Some retailers offer take-back programs for apparel, which often are open to apparel from all brands, not just those they sell. There are many ways to design these take-back programs, but one operating model is to sell collected materials to a sorter-grader, located either in the greater Vancouver area or overseas. Other take-back programs may repair and resell items from brands they sell or may recycle collected materials to manufacture new products to be sold in their stores.

I:CO runs a worldwide network for the collection and processing of used apparel for reuse and recycling, and it manages take-back programs for 40 retail partners globally,[55] including several large retailers with stores in the greater Vancouver area (e.g., H&M, American Eagle Outfitters, and The North Face; however, not all stores in the greater Vancouver area have implemented the program). These programs accept apparel from any brand, in any condition. Apparel collected through these programs within the greater Vancouver area may be sold by I:CO to regional sorter-graders or transported out of the greater Vancouver area for processing elsewhere.

Sorter-Graders

Sorters and graders (sorter-graders) conduct a detailed process to sell materials to reuse and recycling markets. They consolidate much of the apparel diverted within the region and sort items into approximately 400 different categories according to type, condition, fibre blend, and other criteria—depending on which end markets have contracts with the sorter-grader. Since each sorter-grader has

[54] Personal communications with Dr. Calvin Lakhan, July 12, 2017.

[55] "Creating the future," I:CO, accessed November 14, 2017, http://www.ico-spirit.com/en/homepage/mission/.

contracts for different end markets, the specifications to which they sort materials vary, and as a result, regional sorter-graders also buy and sell materials between themselves. Materials are ultimately sold to be reused as apparel, or repurposed or recycled to make new products, primarily to overseas markets in Europe, Asia, Central America, and Africa.[56] Materials for which there is no end market are disposed as garbage.

The greater Vancouver area is unique, compared to many parts of North America, in that there are sorter-graders located in the region. As an industry hub for used apparel collection, the greater Vancouver area is an importer of used clothing, receiving materials from as far away as Manitoba and Northern California. An estimated 25% of the clothing processed by regional sorter-graders comes from outside Canada (mainly the US).[57] Collectively, the six largest sorter-graders in the greater Vancouver area estimate that they sell approximately 50% of their total inflows to global reuse markets, repurpose 20% as wiping rags, sell 20% to textile recycling markets, and send 10% to disposal (Figure 11).[58]

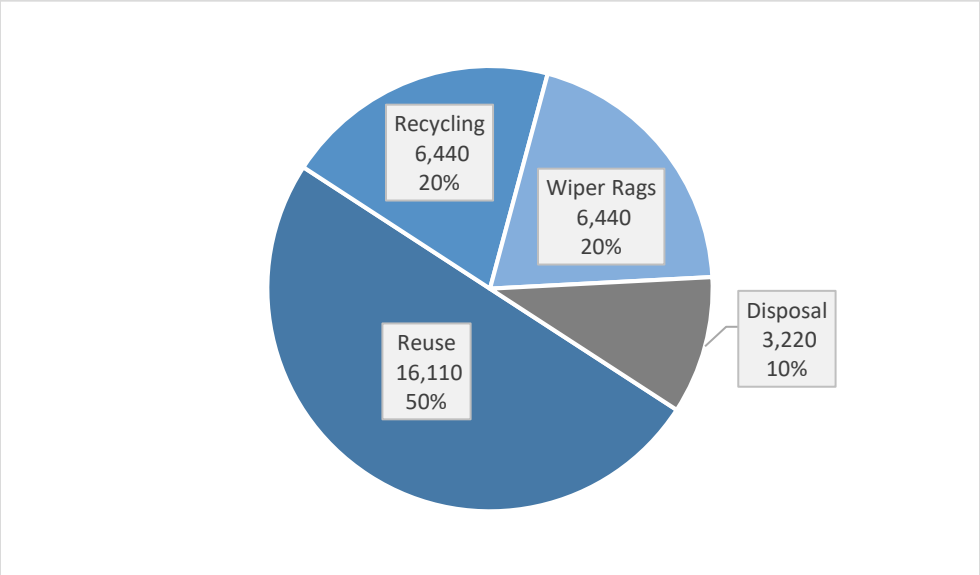

Figure 11 Greater Vancouver Area Sorter-Grader Secondary Markets, 2016 (in tonnes, percent of total tonnes). The reuse and repurpose of apparel waste from the greater Vancouver area occurs both inside the region and across the globe.

Sorter-graders in the greater Vancouver area report that the rise of fast fashion and disposable clothing has lowered the quality of collected materials.[59] This is a disturbing trend for the used apparel industry because sorter-graders rely on the sale of a small portion of high-value materials to stay profitable. High-value materials include couture clothing and accessories, trendy vintage items, and luxury fibres for new yarn production.[60] For example, sorter-graders in the US have sold vintage Levi's jeans for $10,000–

[56] SORT BC survey, June 22, 2017.

[57] SORT BC survey, June 22, 2017.

[58] SORT BC survey, June 22, 2017.

[59] Personal communications with SORT BC members, March 24, 2017.

[60] Jana M. Hawley, "Digging for Diamonds: A Conceptual Framework for Understanding Reclaimed Textile Products," *Clothing and Textiles Research Journal* 24/3 (2006): 262–275.

$20,000 (USD).[61] These "diamonds" represent only 1%–2% of the total volume of collected materials, but their sale permits sorter-graders to continue the less profitable operations that divert huge volumes of textiles from disposal.[62] A net devaluing of used apparel streams threatens the ability of sorter-graders to stay in business and in turn jeopardizes the operations model of the numerous businesses and charities that rely on these companies for a reliable revenue stream.

Competition for Materials

Collecting and sorting activity in the region is a complex mix of non-profit and for-profit organizations. For-profit businesses, including sorter-graders and thrift stores such as Value Village, purchase much of their inventory by weight from non-profit entities, including many bulk collectors. The benefit to for-profit businesses is the ability to supplement or fully meet their supply requirements. The benefit to non-profits is the ability to raise money for their charitable causes. In addition, many for-profit entities in the greater Vancouver area are aligned with a non-profit organization whereby the charity receives a portion of revenues generated from donated materials, even without conducting collection activities themselves.

Ultimately, all types of post-consumer apparel collectors compete with one another for materials; however, some collectors assert that non-profit and charitable programs should be given priority over for-profit entities. In contrast, for-profit businesses assert that they are able to support small local charities that do not have sufficient funding to run a donation bin program. Bulk collectors that operate with the purpose of supporting a specific charity also reported partnering with short-term local fundraising efforts, such as raising funds for youth soccer team jerseys.

Challenges

Current practices in collecting, sorting, and grading reveal a variety of challenges to reducing apparel waste:

- **Voluntary participation:** Donating or otherwise diverting textiles from disposal is voluntary.
- **Consumer motivation:** The extra work required—real and perceived—combined with apathy or a lack of awareness about the need to divert textiles from disposal prevents consumers from diverting unwanted apparel.
- **Inconsistent messaging:** There is conflicting information about what materials should be donated and where (e.g., only gently used apparel versus apparel in any condition).
- **Value identification:** Most consumers are not able to identify the value of materials or ensure that they reach organizations with the means to sort materials according to their best and highest value.
- **Social value:** Consumers are hesitant to donate materials when they do not feel confident that their donations will benefit the communities they go to.
- **Global impact:** Reports about the social and environmental impacts of global reuse and recycling markets for used apparel are conflicting. Some consumers are reluctant to donate for fear of negatively impacting developing countries.
- **Industry data:** Data on quantity and quality of the material collected is not readily available.

[61] Jana M. Hawley, "Digging for Diamonds: A Conceptual Framework for Understanding Reclaimed Textile Products," *Clothing and Textiles Research Journal* 24/3 (2006): 262–275.

[62] Jana M. Hawley, "Digging for Diamonds: A Conceptual Framework for Understanding Reclaimed Textile Products," *Clothing and Textiles Research Journal* 24/3 (2006): 262–275.

- **Market fluctuations:** Sorter-graders are vulnerable to fluctuations in market prices—both the purchase price from inflow sources and sale price to overseas markets—as well as shipping costs. Fluctuations of only a few cents make the difference between being profitable or not.
- **High-volume business model:** Sorter-graders need to acquire enough high-value materials to compensate for the cost of sorting and processing the low-value materials. Inundation of this market with a high volume of low-quality textiles, such as from fast fashion, throws this business model out of balance. Sorter-graders are driven to be more selective about what materials they purchase.

Industrial, Commercial, and Institutional Apparel Waste

Industrial, Commercial, and Institutional (ICI) apparel waste refers to the pre- and post-consumer waste generated by industry (e.g., manufacturing off-cuts, samples, unused fabric bolts, roll-ends), commercial business (e.g., excess inventory, defective and damaged apparel, apparel branded with business logos), and institutions (e.g., uniforms, apparel branded with institutional logos). (The generation of these waste streams are described in Activities 1, 2, and 3.) Some ICI apparel waste may be managed using the same processes as post-consumer apparel waste, but dedicated collection and sorting infrastructure that can address the unique characteristics of this waste stream is lacking.

Most local pre-consumer ICI waste is generated during manufacturing (e.g., local cut-and-sew) and is considered more desirable for closed-loop recycling markets if it is clean and in large quantities. However, one cannot underestimate the challenge of sorting manufacturing off-cuts from a factory that processes a range of fabrics of different fibre types, or the challenge of consistently collecting a large enough volume of this material to make it valuable to processors. Subsequently, reports of what happens to this material vary from brand to brand. For example, one brand that uses almost exclusively cotton reported that their cut-and-sew contractors had a recycling market for the off-cuts, which they participated in to save money on disposal. In contrast, a brand with small quantities of mixed fabric off-cuts was unable to find an economical recycling solution. In general, it seems that most brands are unaware of what their cut-and-sew contractors do with this material, or what they could do to divert it.

Brands and retailers, along with some institutions and corporations, often prefer destruction via incineration, or seek specialized processing, if the material has any of the follow characteristics:

- **Proprietary information:** Apparel brands need to protect their investment in trademarked fibre blends, customized finishing treatments, and more, therefore requiring assurance that materials will not be acquired by potential competitors.
- **Brand value:** The symbolic status and subsequent market value of certain apparel brands is in part communicated through sales channels, and therefore some apparel brands have strict requirements for how their products are made available to consumers.
- **Public image:** The potential for negative consumer attention should an apparel brand or retailer be connected to wasteful practices prompts these organizations to seek secure disposal methods for branded products.
- **Security risk:** Certain institutional wear carries a security risk, and it is in the public interest to ensure it is not available outside secure channels. For example, police, military or firefighter uniforms acquired from unsecure disposal methods may allow these professionals to be impersonated.

Institutions and corporations with branded apparel have excess inventory and worn, non-reusable garments such as uniforms, special event t-shirts, or any other apparel carrying their logos. Unbranded apparel is often consolidated with this waste stream, such as unbranded pants worn as part of a uniform with a branded shirt. These materials end up being thrown out as garbage, donated to various charities, or sent to sorter-graders. Alternatively, such materials are managed by specialized sorter-grader operations that do secure sorting and certified destruction.

Table 5 summarizes the ways in which ICI apparel waste is currently managed.

Table 5 Industrial, Commercial, Institutional Apparel Waste Management Options

Option	**Description**
Discount retail	Selling unsold or damaged/defective apparel or fabric to a discounter (e.g., fabric jobber, auctioneer, liquidator, off-price retailer), who will attempt to sell to consumers at a lower price than the brand or full-price retailer, or via sample and warehouse sales
Sorter-grader	Selling apparel, unused fabric, and off-cuts to a business that will sort and grade materials for local or overseas markets
Secure sorting and certified destruction	Hiring a business to sort and grade unwanted branded apparel and proprietary fabric for pre-approved local or overseas markets; or destruction
Donation	Donating unsold or damaged/defective apparel and fabric to a bulk collector, thrift store, clothing-provider charity, education institute or other organization
Disposal	Placing apparel, unused fabric, and off-cuts in garbage containers

Managing Industrial, Commercial, and Institutional Apparel Waste

Discount Retail

To deal with excess and damaged or defective inventory, manufacturers, apparel brands, and retailers can hold sample sales or warehouse sales. Alternatively, excess inventory and unused fabric can be sold to auctioneers, liquidators, or off-price retailers who sell at below retail prices. Discounted materials that remain unsold may be sold to sorter-graders and eventually go to global reuse or recycling markets, or may be thrown out as garbage.

Secure Sorting and Certified Destruction

Secure sorting and certified destruction businesses process materials for reuse, repurposing, or recycling like a regular sorter-grader, but guarantee their customers' materials will only be sold to pre-approved end markets. This allows apparel brands, retailers, and institutions to ensure their textile waste is diverted from disposal while still addressing concerns about proprietary information, brand image, and security risks. A variety of options are available. For example, customers of these businesses may approve their materials to be shredded for recycling but not to be sold for reuse overseas. Debrand is a regional example of a company dedicated to this service. Debrand estimates that 95% of materials received for secure sorting and certified destruction go towards textiles recycling markets, and 5% go to disposal.[63]

Donation

Instead of trying to sell excess or damaged inventory, manufacturers, brands, and retailers may choose to donate. Fabric bolts and roll-ends may be donated to young designers and educational institutions such as Kwantlen Polytechnic University for its fashion and technical apparel design programs. In Vancouver, the non-profit organization, Our Social Fabric, accepts donations of unused fabric for resell to consumers and small business. Apparel may be donated to clothing-provider charities such as Dress for Success or Brands for Canada, which distribute items directly to low-income and other needful communities. A limitation of these donation options is their capacity to process and store large volumes of material. Donation to bulk collectors and thrift stores is also an option, though concerns around brand value and proprietary information make this less common. Some apparel brands donate with the condition that the garments must be sold overseas, or that their logos must be removed.

Challenges

- **Business Sensitivity:** As detailed above in ICI apparel waste challenges such as proprietary fabrics or designs, brand value, public image, and security risk (for uniforms) result in some businesses choosing secure destruction over reuse.
- **Storage and processing:** Waste materials require people to sort them and space to be stored until they can be redistributed to various end markets.
  Awareness: Apparel brands and retailers may be unaware of the diversion options for their apparel waste.

Activity 5: Reuse and Repurpose

Reuse of apparel refers to clothing being worn again as clothing (after being discarded by the original owner). Repurposing apparel means using clothing for something other than its original intended use. Repurposing includes altering clothing to make new products, but differs from recycling in that clothing is not broken down to its previous state (fibre) first.

Global Reuse

The majority of used apparel from the greater Vancouver area is sold outside of the region. Sorter-graders currently sell an estimated 50% of their collected materials to global reuse markets in Africa, Asia, Central America, and Europe.[64] The majority of used clothing sold overseas goes to developing countries.

[63] Personal communications with Debrand, September 22, 2017.

[64] SORT BC survey, June 22, 2017.

There is demand for used apparel in developed nations, although the demand is mainly for vintage and higher-quality items. Some second-hand stores (both non-profit and for-profit), and especially collectible and vintage retailers, source a portion of their inventory from sorter-graders. Less than 1% of regional sorter-graders' inventory is sold for this kind of niche resell, and goes primarily to North America, the UK, and Japan.[65]

While global reuse markets are a critical path for diverting materials from disposal, there is little information on the ultimate end fate of these materials. Sorter-graders in the greater Vancouver area report that the apparel they acquire has to be of saleable quality or they will quickly go out of business, as the markets in developing countries will stop buying from them.

A common argument against the export of clothing to developing countries is that it has a negative impact on the domestic textile industry, specifically in Africa, where most of the second-hand clothing is sold. However, research from the Nordic Council of Ministers on the exports of used textiles found that the issue is much more complex and cannot simply be attributed to used textiles flooding the market. There is evidence that aging infrastructure and inefficient industry made it difficult for new textile manufactures in Africa to compete with cheap new clothing imports from Asia when the trade barriers were removed the late 1990s and early 2000s.[66]

The used clothing market provides jobs to tens of thousands in the formal retail sector and large informal retail sector in the receiving countries.[67]

> "In many African countries, over 80% of the population dress themselves in second-hand clothing."[68]
> – Bureau of International Recycling

Long-term stability of the global reuse market is uncertain. India already restricts the import of second-hand clothing to mutilated garments (recycled into low-cost blankets), or requires importers to acquire a licence on the condition that they will re-export 100% of wearable second-hand garments.[69] Several East African countries are also seeking to impose a complete ban on the import of second-hand clothing, asserting that it compromises both citizens' dignity and efforts to develop local manufacturing.[70]

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[65] SORT BC survey, June 22, 2017.

[66] David Watson and David Palm, "Exports of Nordic Used Textiles: Fate, benefits and impacts" (Denmark: Nordic Council of Ministers, 2016).

[67] Watson and Palm, "Exports of Nordic Used Textiles: Fate, benefits and impacts."

[68] Bureau of International Recycling. "Textiles." http://www.bir.org/industry/textiles/?locale=en_US

[69] Namrata Acharya, "India emerges top importer of used clothes," *Business Standard*, last modified October 10, 2015, http://www.business-standard.com/article/current-affairs/india-emerges-top-importer-of-used-clothes-115100800540_1.html.

[70] Kimiko de Freytas-Tamura, "For Dignity and Development, East Africa Curbs Used Clothes Imports," *New York Times*, October 12, 2017, https://mobile.nytimes.com/2017/10/12/world/africa/east-africa-rwanda-used-clothing.html?referer=https://t.co/tqQ31Ffbx5?t=1&cn=ZmxleGlibGVfcmVjc18y&refsrc=email&iid=6efea2e2a6a3487b862800c6f9d22bad&uid=3163864677&nid=244+272699399.

Regional Reuse

In the greater Vancouver area, consumers can purchase used apparel through local consumer-to-consumer forums (e.g., Craigslist, clothing swaps), second-hand resell or consignment stores, and second-hand thrift stores. Used apparel also enters and exits the region via out-of-region transactions, especially aided by e-commerce platforms, such as eBay.

The resale of fabric is less common, but consumers can find fabric bolts and yardage at Our Social Fabric and occasionally at thrift stores. Our Social Fabric is a non-profit organization that diverts textiles from disposal by reselling donated fabric to consumers. It is able to process a continuous flow of fabric bolts and roll-ends but must turn away particularly large donations to not exceed its available storage capacity.

Repurpose

The manufacture of wiping rags from used apparel is one option for damaged, unwearable, or unmarketable cotton textiles. Wiping rags are used in many industries for all manner of cleaning tasks (e.g., cleaning and polishing cars, machine parts, equipment, facilities, etc.). A small amount of this kind of apparel waste repurposing takes place within the greater Vancouver area. Sorter-grader Trans-Continental Textile Recycling cuts up apparel waste (cotton, primarily)—for which there is no reuse or recycling market—to make wiping rags at its facility in the greater Vancouver area. Other sorter-graders in the greater Vancouver area send cotton fibre–based inventory that cannot be sold for reuse or recycling to Trans-Continental Textiles Recycling, or send the material to out-of-province or overseas facilities to be cut into wiping rags. Sorter-graders in the greater Vancouver area currently sell an estimated 20% of their materials for wiping rags. [71]

Another example of repurposing is to develop new garments or products with apparel waste and other textile waste. For example, some clothing designers alter used apparel—vintage, especially—to make new clothing, which is sometimes referred to as “reworked vintage.” Some businesses, such as Looptworks, tonlé, and Offcut Caps™, use textile waste from a variety of industries to make new garments and accessories.

On a local scale, one of the Leverage Lab Collaborative for Textiles participants started a new business called FABCYCLE, which aims at tackling textile waste by connecting local designers and crafters with material destined for disposal, such as manufacturing off-cuts. The priority for FABCYCLE is to find repurpose options for the scraps by engaging the creative community. Scraps that cannot be repurposed are recycled, and those that cannot be recycled are sent to the local waste-to-energy facility.

Challenges

Current practices in reuse and repurpose reveal a variety of challenges to reducing disposal of apparel waste:

- **Global trade restrictions:** Diverting used apparel for other uses across global markets is obstructed by import and export restrictions in developing countries (e.g., India), which are typically the biggest marketplaces for used apparel.
- **Tracking:** Collecting data on how much material goes to different reuse end markets is difficult.

[71] SORT BC survey, June 22, 2017.

- **Consumer perception:** Some consumers associate second-hand apparel with lower socioeconomic status or fear that garments are unclean. Some find it inconvenient to look for a certain style at second-hand apparel stores.
- **Low cost of fast fashion:** Low-cost, mass-produced apparel discourages the purchase of used items that may be marketed at a similar price.
- **Demand and storage:** Organizations lack the space to store apparel and fabric until they are in demand (based on trends and seasonality).

Activity 6: Recycle

Textile and apparel recycling refers to processes that produce new fabric and yarn (closed-loop recycling) as well as processes that shred apparel to make insulation or fill products (open-loop recycling, or down-cycling). The viability of the recycling method depends on a variety of factors: the fibre blend, the quality of the material, the presence of notions (e.g. trims, zippers and threads), the use of dyes and chemicals, and the availability of end markets. Availability of end markets depends on the cost of the virgin commodities, such as the price of oil compared to the price of recycled material.

Globally, only a limited amount of apparel is recycled. The US Environmental Protection Agency estimates that nearly seven times more apparel and footwear waste generated in the US was put into landfills and incinerators than recycled in 2013.[72] Sorter-graders in the greater Vancouver area currently sell an estimated 20% of their materials for recycling. [73]

Table 6 - Summary of Global Closed-Loop and Open-Loop Recycling Options by Fibre Type, 2016

Fibre	**% of World Fibres[74]**	**High-Value Closed-Loop Recycling**	**Medium-Value Open-Loop Recycling**	**Low-Value Open-Loop Recycling**
Polyester	55%	Limited Chemical Recycling		• emergency blankets • insulation • geosynthetics
Cotton	22%	Respinning	• denim • “t-shirt cotton”	
Wool	1.3%	Respinning		
Other Plastic	13.3%	Limited		
Other Natural	6%	N/A		

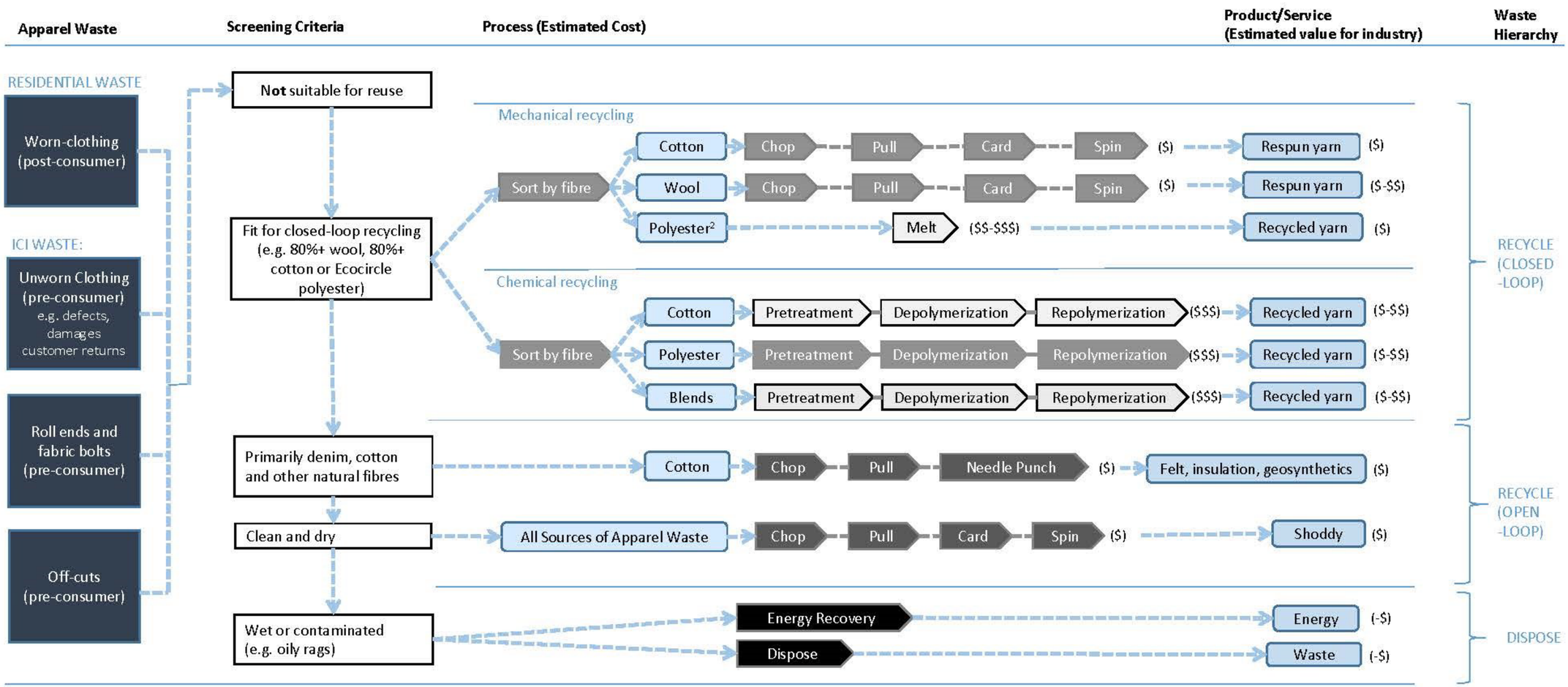
[72] United States Environmental Protection Agency, *Advancing Sustainable Materials Management: Facts and Figures 2013* (June 2015), 71, https://www.epa.gov/sites/production/files/2015-09/documents/2013_advncng_smm_rpt.pdf. Only 1.6 million tonnes of apparel and footwear waste generated in the US in 2013 was recovered through recycling (in the US or through global markets), compared with 11.1 million tonnes sent to landfills and incinerators. Recovery data does not include materials that were reused or repurposed.

[73] SORT BC survey, June 22, 2017.

[74] Textiles Exchange. Preferred Fibre and Materials Market Report 2017. 2017

Closed-Loop Recycling

Closed-loop recycling, where pre-consumer manufacturing scraps and post-consumer apparel are made into new garments, is done through either chemical or mechanical recycling processes (Figure 12). In the absence of company or government policies that require recycled content, the economic feasibility as well as the technical feasibility must be considered when reviewing the feasibility of closed-loop recycling. In a market driven system, the cost of the recycled input generally need to be lower than the cost of the virgin alternative to make the recycling viable. Very few companies are willing to pay a premium for recycled materials. In contrast, they will likely expect a discount.



LEGEND

Process commercialization

- Commercialized and high volume
- Commercialized but currently low volume
- Not commercialized for apparel waste

Process (Average Cost):

($) = less than mainstream product production
($$) = same as mainstream product production
($$$) = more than mainstream product production

Product/Service (Estimated value for fashion industry):

(-$) = negative value
($) = less than mainstream clothing
($$) = same as mainstream clothing
($$$) = more than mainstream clothing

Figure 12 Secondary Markets for Post-Consumer and Post-Industrial Apparel Waste

No closed-loop apparel recycling takes place inside the greater Vancouver area.

There is a disconnect between the design and manufacturing of apparel and the recycling potential of apparel. Current fibre choices for clothing are driven by cost, hand-feel, garment function, and availability. Recyclability of the garment is not a key consideration for most mainstream brands. The most popular fibre, polyester (55% of global fibre production), does not have commercially viable close-loop recycling options for most mainstream material. Teijin, the only commercial-scale polyester chemical recycling in the world, accepts only material from their Eco-Circle members.[75]

High-quality wool apparel (1.3% of global fibre production) is collected and shipped primarily to Prato, Italy, where a cottage industry of wool recycling re-spins the wool into high-quality yarn.

Cotton apparel (22% of global fibre production) can be re-spun into new fibres. The closest re-spinning operations to the greater Vancouver area are in the United States. While the mills accept some post-consumer cotton apparel for re-spinning, most focus on the re-spinning of post-industrial cotton waste sources, such as off-cuts from apparel manufacturing.

Open-Loop Recycling

Apparel made from low-value blended fibres goes either to disposal or mechanical recycling (typically in the form of pulling and carding) to make shoddy for use in fill products (e.g., punching bags, gymnasium mats, automotive insulation, geosynthetics). Such open-loop recycling or "down-cycling" greatly reduces the possibility of recycling these materials again when these products reach the end of their lifespans. Very few end markets exist for down-cycled textiles in North America.[76]

Challenges

Current practices in recycling reveal a variety of challenges to reducing apparel waste to disposal:

- **Synthetic and blended materials:** Consumers and designers like these fabrics for their look, hand-feel, and easy maintenance, but they are difficult to recycle. Few recyclers will take blended materials, and blended materials are reduced in value to the lowest component.
- **Recycling technologies and infrastructure:** Full-circle recycling is not available for most fibres. For fibres that have recycling options, such recycling processes are usually more expensive than disposal due to logistics and processing costs.
- **Tracking:** Collecting data on how much material goes to recycling markets is difficult.
- **Fibre end markets:** Without profitable markets, businesses will not manufacture recycled textile products nor invest in the research and development of new recycling technologies.
- **Global industry:** The majority of textile producers are located overseas. It is difficult to create a level playing field globally with only local and regional influence.

[76] Anthony Shackleton, Trans Continental Textiles Recycling, interview, June 2017.

- **Changing requirements:** The market for open- and closed-loop recycling demands flexibility on the part of sorter-graders to adapt to the changing requirements of mills.
- **Fibre identification:** Limited technologies are available or installed for identifying and sorting clothing by fibre type for closed-loop recycling.

5 Towards Reduction and Diversion of Apparel Waste

For the fashion industry, maintaining a status quo approach to apparel waste generation and management will result in:

- increased disposal of apparel waste
- increased microplastics in aquatic environments
- increased toxic dyes and finishing chemicals in waterways
- increased harm to the planet and humans due to excessive consumption of resources
- increased risk of economic loss; and
- increased risk of stricter regulatory control.

It is for these reasons that some of the key players in the fashion industry are strong advocates for reducing apparel waste to going to disposal. Such a shift towards an industry that is both profitable and sustainable, will take bold leadership, creative thinking and extensive collaboration.

What Might a Future Without Apparel Waste Look Like?

Leverage Lab Collaborative for Textiles participants imagined a future in which regulatory frameworks encourage more diversion of apparel to higher-value end products through improved reverse logistics. For example, the coordination and planning of how to get products back from consumers; extracting the maximum value of collected products through reselling; recertifying (repair); or recycling the returned products into new products.

Action Checklist

The following checklist presents the elements of that desired future. Organizations can use these questions to easily identify actions they can take towards the reduction of apparel waste. The desired future is one where all apparel companies check all the boxes below.

- ☐ **Policy** – Does your organization have an internal policy that promotes the use of circular fibres and circular business practices?
- ☐ **Design –** Does your organization create products designed for the environment and waste diversion? (Are your products durable, repairable, and recyclable?)
- ☐ **Business case** – Does your organization consider the value of apparel end-of-life in the business model and product design brief?
- ☐ **Transparency** – Does your organization share information about how your apparel is manufactured, including chemicals, certifications, and end-of-life recycling options?
- ☐ **Internal education –** Does your organization make sure that your leaders, designers, and marketers understand the core concepts of circular fibres and circular business models to reduce apparel waste?
- ☐ **Collaboration** – Does your organization participate in events or meetings that include representation from across the entire supply chain, including the reverse logistics?
    - E.g., Leverage Lab, Eco-fashion Week, Global Fashion Agenda, Fashion Takes Action, Sustainable Apparel Coalition
- ☐ **Consumer education** – Do your customers know what to do with the apparel they purchase when they are done with it?

- **Investment in circular products and business** – Does your organization invest in development of circular fibres and reverse logistics infrastructure?
  - E.g., Closed Loop Partners, H&M Global Change Award
- **Reverse-logistics** – Does your organization consider one or more of the following reverse-logistics options:
  - Extend life for customers:
    - Library lend/rent/or lease models for apparel?
      - E.g., Rent-frock-Repeat, Flaunt Fashion Library
    - Repair and refurbishment?
      - E.g., Contracts with local drycleaners/alternations shops or in-house repair
      - E.g., Renewal Workshop
  - Collect for local and global reuse:
    - Partnerships with worn apparel collectors?
      - E.g., bulk collectors, sorter-graders, or clothing-provider charities
    - Return-to-retail, including incentives for customers?
      - E.g., Store discount for using return-to-retail bins
  - Recover fibre for use in new garments:
    - Closed-loop recycling?
      - E.g., Evrnu, Teijin, Re:newcell
- **Manufacturing waste** – Does your organization actively seek recycling markets for your off-cuts and design sample waste streams? Does your organization consider methods of production that minimize waste, such as digital markers to reduce unused fabric, or additive manufacturing (e.g., 3-D knitting and printing)?
- **Regulation** – Is your organization prepared for future regulation that may require diversion of apparel from disposal?

Places to Intervene in the Current System of Apparel Waste Generation

Five key opportunity areas for change have emerged based on feedback from the Leverage Lab Collaborative for Textiles, the detailed mapping of the current system, and additional research contributed by the lab co-conveners:

1. Collaboration: Increase industry collaboration in collection, sorting, recycling, and design for circularity.
2. Investment: Invest in the development of circular fibres, recycling technology, and collection infrastructure.
3. Education: Educate consumers, designers, and brands about their role in zero-waste fashion.
4. Policy: Use policy to set a level playing field that supports the reduction of apparel waste.
5. Business Model: Make circular fashion business models the mainstream practice.

These opportunity areas describe actions to decrease generation and disposal of apparel waste. They also identify some potential actors. Determining who is best positioned to take action is an important part of the future work towards the reduction of apparel waste. Some opportunities—such as collaboration, education, and starting to invest in research and development of recycling technologies—could be realized in the short term. Creating supporting policies and shifting towards circular fashion as a mainstream approach will take longer to implement.

Opportunity 1: Collaboration

Increase Industry Collaboration in Collection, Sorting, Recycling, and Design for Circularity

There are benefits to individual organizations making their operations more efficient to reduce their apparel waste going to disposal, but the biggest potential to reduce apparel waste can only be realized through collaboration and system-wide implementation. Opportunities such as implementing circular fibres and having universal access to repair networks will require input and coordination of companies along the entire value chain. Some brands have a level of vertical integration of their value chain; however, most companies only operate with in their area of expertise. As witnessed during the Textiles Leverage Lab, having experts across the value chain discussing options for reducing apparel waste to disposal leads to better understanding of the challenges and fosters innovative partnerships.

One of the biggest gaps in collaboration in the current system (described in section 4) is between the generation of apparel (activities 1–3) and the diversion of apparel (activities 4–6). There is little communication or coordination between the apparel products being designed and the facilities that divert apparel waste. Bridging this gap is critical for reducing apparel waste. The ability for the existing system of collection, sorting, and recycling to continue to divert textiles depends heavily on the inputs they get from the generation of new apparel.

Taking Action

Design and Manufacturing (or Remanufacturing)

Timeframe	**Actions (Potential Actors)**
Short Term	• Arrange tours or produce videos to help apparel designers better understand the impacts of the waste generated from their designs and what happens to the various components that they specify. (Academia, Industry) • Translate the systems map into a visual infographic so that it is easier for stakeholders on the map to see where they fit into the complicated system. (Collaboration Labs, Associations)
Short to Medium Term	• Create industry guidelines for how to identify preferred circular fibres at end-of-life and include them in the design of every garment so that recycling facilities can identify and recirculate the fibres to the appropriate brands/facilities as inputs. (Government, Industry, Academia, Associations) • Collaborate with cut-and-sew manufacturer's to minimize wasted fabric and find markets for off-cuts. (Entrepreneurs, Academia, Industry)

Sell and Purchase

Timeframe	**Actions (Potential Actors)**
Short Term	• Connect retailers with charity collectors to increase collection of worn apparel. (Industry, Government)

Own and Maintain

Timeframe	Actions (Potential Actors)
Medium Term	• Make connections between apparel companies and thrift stores. Thrift stores could work with local repair service providers to refurbish donated, returned, and exchanged apparel so it can be resold locally in stores. (Industry, Government)

Collect and Sort

Timeframe	Actions (Potential Actors)
Short Term	• Work with donation points and sorter-graders to develop a standardized system of determining how to get the most value of donated apparel, through repairing, reselling, repurposing, and/or recycling. (Industry)
Medium Term	• Set up an association of textile diversion stakeholders (sorter-graders, thrift stores, worn apparel collectors) to share knowledge and resources with the goals of: o delivering consistent messaging to consumers about how to dispose of unwanted apparel o informing producers of ICI apparel waste about material purchasing and processing costs o pursuing/developing new markets for recycled textiles, especially within the region (Industry) • Organize and publicize annual or semi-annual events where apparel brands and manufacturers can share their scraps (e.g., a scrap round-up). (Associations, Industry)

Reuse and Repurpose

Timeframe	Actions (Potential Actors)
Medium Term	• Investigate what happens to used apparel in countries that import it and determine what infrastructure is needed to make sure end-of-life clothing is managed responsibly around the globe. (Industry, Government) • Work with the non-profit sector to help fund needed collection infrastructure in countries that import worn apparel (e.g., 1% for the Planet). (Industry)

Recycle

Timeframe	Actions (Potential Actors)
Medium Term	• Create a green fashion fund dedicated to funding recycling research and financing new recycling facilities so that the costs of investment in recycling research and development and infrastructure is distributed fairly between companies. (Associations, Industry)

Opportunity 2: Investment

Invest in the Development of Circular Fibres, Recycling Technology, and Collection Infrastructure

During the Leverage Lab Collaborative for Textiles, participants identified several challenging flows of material—which do not have local markets for diversion. While gently used apparel is commonly donated, well-used apparel and off-cuts from cut-and-sew shops in the greater Vancouver area less likely to be diverted from disposal. One brand reported the cost of recycling their off-cuts to be more than three times the cost of garbage.[77] Fierce competition and the lack of regulation to level the playing field makes doing the responsible thing—recycling—a very difficult business decision for brand owners. In order to improve the business case for recycling well-worn apparel and cut-and-sew manufacturing scraps, investment in more efficient reverse logistics and more affordable processing technologies is needed.

Within the greater Vancouver area there is an exciting opportunity to invest in new ideas, technology, and infrastructure that will create local green jobs and attract international attention.

Taking Action

Design and Manufacturing (or Remanufacturing)

Timeframe	Actions (Potential Actors)
Short Term	• Invest in innovation for design and manufacturing, such as zero-waste manufacturing and additive manufacturing. (Industry, Government).

Sell and Purchase

Timeframe	Actions (Potential Actors)
Short Term	• Invest in additional collection points to increase collection of worn apparel for repair, reuse, and recycling. (Industry, Government) • Set up retailer take-back programs and encourage return of apparel to retailers (through existing channels) to increase feedstock available for recycling technologies. (Industry, Government)
Medium Term	• Establish purchasing policies that encourage the use of fibre-to-fibre recycled content. For example, “minimum 10% recycled cotton fibre” or other evaluation criteria encourage supplier proposals that include recycled content. (Industry)
Long Term	• Invest in innovation for design and manufacturing, such as zero-waste manufacturing and additive manufacturing. (Industry, Government, Academia)

[77] Personal communications with Leverage Lab Collaborative for Textiles participants, 2017.

Own and Maintain

Timeframe	Actions (Potential Actors)
Short Term	• Invest in innovation for design and manufacturing, such as zero waste manufacturing and additive manufacturing. (Industry, Government, Academia) • Invest in additional collection points to increase collection of worn-apparel for reuse, repair and recycling. (Industry, Government) • Set up retailer take-back programs and encourage return of apparel to retailers (through existing channels) to increase feedstock available for recycling technologies. (Industry, Government) • Invest in infrastructure for repair, such as darning machines for denim.
Medium Term	• Fund innovation to facilitate customer repairs through web applications that educate consumers on repair options and nearest repair facilities. (Industry) • Facilitate renting or lending of apparel. (Industry, Government) • Include warranties as well as access to repair and alteration services with the purchase of new apparel. (Industry)
Long Term	• Incentivize consumers to choose to repair their clothes over discarding and buying new items. (Industry)

Collect and Sort

Timeframe	Actions (Potential Actors)
Short Term	• Fund innovation in fibre identification and sorting to get apparel to the right recycling end markets. (Industry, Government)
Medium Term	• Invest in, or partner with, businesses that provide collection solutions to designers and enable manufacturers to recycle cut-and-sew scraps. (Industry, Government) • Expand secure sorting and corporate destruction services and develop other infrastructure specifically targeting ICI apparel waste (e.g., manufacturing off-cuts). (Industry, Government)

Reuse and Repurpose

Timeframe	Actions (Potential Actors)
Short Term	• Invest in, or partner with, businesses to increase local reuse and repurposing of worn apparel. (Industry, Government) • Divert unbranded institutional wear to reuse markets. (Industry) • Divert unwanted fabric for reuse. (Industry)

Recycle

Timeframe	Actions (Potential Actors)
Short Term	• Fund research to advance recycling of blended textiles. (Industry, Government) • Invest in pre-processing technologies to prepare collected clothing to be sold directly to international recycling markets (e.g., for insulative uses, fill, and geosynthetics). (Industry, Government) • Attract open-loop recycling facilities to the Pacific Northwest to improve access to recycling markets for unwearable clothing. (Industry, Government)
Medium Term	• Develop commercially viable recycling technology that allows currently hard-to-recycle materials, such as polyester, blends, and chemically treated clothing, to be recycled into new apparel. (Industry)
Long Term	• Support the development of regional and North American markets for products made with recycled fibres. (Industry, Government) • Create local recycling facilities, particularly for high-volume products. (Industry, Government)

Opportunity 3: Education

Educate Consumers, Designers, and Brands About Their Role in Zero-Waste Fashion

A key challenge identified by participants in the Leverage Lab Collaborative for Textiles was the lack of knowledge and understanding of where apparel waste is generated in the current system, the options for diversion, and which fibres are most suitable for circular fashion business models. While this report addresses this challenge in Chapter 4 by sharing the current state of apparel waste generation and management, further work is needed to spread this information to a broader audience and inform stakeholders system-wide about what they can do to reduce their apparel waste.

Taking Action

Design and Manufacturing (or Remanufacturing)

Timeframe	Actions (Potential Actors)
Short Term	• Create guidelines and maintain supplier lists so designers and manufacturers can easily learn which fibres and fabrics can be recycled. (Industry, Government)
Medium Term	• Embed circular design and manufacturing into local fashion design school curriculums. (Government, Industry, Academia, Associations)

Sell and Purchase

Timeframe	Actions (Potential Actors)
Short Term	• Spread awareness of the impacts of apparel waste. (Industry, Academia, Government, Associations) • Inform retailers of options for managing their apparel waste, including donation and secure sorting and certified destruction services. Educate retailers on repair, reuse, and recycling options for unsold, defective, or damaged items. (Industry, Government)
Medium Term	• Educate consumers about apparel suitable for reuse and recycling and encourage the purchase of used clothing. (Government, Industry, Academia, Associations)
Long Term	• Promote circular business models to retailers and manufacturers. (Government, Industry, Academia, Associations)

Own and Maintain

Timeframe	Actions (Potential Actors)
Short Term	• Educate consumers about garment maintenance and repair to extend usable life, and promote buying for quality over quantity. (Industry, Academia, Government, Associations) • Provide care and repair instructions online. (Industry)
Short – Medium Term	• Educate consumers about the hierarchy of apparel waste: o 1st choose long-lasting items and wear them for as long as possible o 2nd repair, give/return for someone else to wear o 3rd recycle, o 4th dispose (Government, Industry)
Medium Term	• Educate consumers about apparel suitable for reuse and recycling and encourage the purchase of used clothing. (Government, Industry, Academia, Associations)

Collect and Sort

Timeframe	Actions (Potential Actors)
Short Term	• Develop a web platform to help residents find the nearest donation location. (Government, Industry, Academia, Associations) • Increase awareness of the many options consumers have to donate worn apparel, such as clothing drives, donation bins, and pickup services. (Government, Industry, Academia, Associations)

Reuse and Repurpose

Timeframe	Actions (Potential Actors)
Short Term	• Support marketing campaigns that aim to clarify what is accepted for donation at thrift shops and donation bins. (Government, Industry)

Recycle

Timeframe	Actions (Potential Actors)
Short Term	• Develop trusted closed-loop certifications and marketing campaigns to create demand for recycled materials. (Associations, Industry)

Opportunity 4: Policy

Use Policy to Set a Level Playing Field That Supports the Reduction of Apparel Waste

Forward-thinking apparel brands are already getting ahead of the game and working towards the reduction of apparel waste. But in order to encourage more businesses to follow suit, regulators need to create policies that encourage companies to implement circular approaches in their business supply chains. Without the support of policy makers, forward-thinking apparel companies may struggle to remain competitive with companies that do not account for the full cost of apparel waste.

Taking Action

Design and Manufacturing (or Remanufacturing)

Timeframe	Actions (Potential Actors)
Medium Term	• Provide designers and manufacturers with financial incentives for reducing or diverting their textile waste. (Government, Industry, Associations) • Provide brands and manufactures with financial incentives for continual improvement towards reduction of apparel waste. (Government, Industry, Associations)

Sell and Purchase

Timeframe	Actions (Potential Actors)
Medium Term	• Support existing reuse diversion markets by engaging developing countries (e.g., have discussions aimed at reducing threats of second-hand clothing tariff increases and second-hand clothing import bans). (Government) • Provide retailers with financial incentives for reducing or diverting their apparel waste. (Government) • Implement policies that require increased transparency, such as disclosure of recycled content and chemicals, on garment tags. (Government)
Long Term	• Monitor the use of harmful chemicals and, if warranted, create import restrictions and tariffs on unsustainable fabrics and apparel that negatively impact human health and the environment, as under the Canadian Environmental Protection Act[78]. (Government, Industry, Associations)

Own and Maintain

Timeframe	Actions (Potential Actors)
Medium Term	• Adjust or remove sales tax from repair services to encourage consumers to have garments repaired rather than buy new garments. (Government)

[78] E.g., the European Union banned imports of textiles with azo dyes in 2002, whereas Canada recently lessened reporting requirements for products using azo dyes.

Collect and Sort

Timeframe	Actions (Potential Actors)
Short Term	• Encourage the placement of donation bins in multi-unit residential buildings. (Government)
Medium Term	• Provide tax incentives for retailers with take-back programs (Government) • Enact a residential disposal ban on apparel in garbage carts at the municipal level. (Government) • Develop a strategy and implement policies to improve convenience of collection locations of the greater Vancouver area. (Government, Associations, Industry) • Enact a regional textile disposal ban once adequate infrastructure is in place to support such a ban. (Government) • Maintain a list of verified collectors or develop a municipal-branded program to increase public confidence that donated clothes are being managed responsibly. (Government, Associations, Industry) • Invest in data to make informed decisions (e.g., conduct waste composition studies for all sectors and other like studies that increase the understanding of what happens to end-of-life apparel). (Government, Industry, Associations)

Reuse and Repurpose

Timeframe	Actions (Potential Actors)
Short Term	• Encourage the placement of donation bins in multi-unit residential buildings. (Government)
Medium Term	• Require the reporting of data to help make informed decisions and measure progress. (Government, Associations)

Recycle

Timeframe	Actions (Potential Actors)
Short Term	• Encourage investment in recycling infrastructure development. (Government) • Encourage investment in recycling technology development. (Government)
Medium Term	• Created clear guidelines and eventually policies that encourage design for recycling. (Government, Associations, Industry)
Long Term	• Support Extended Producer Responsibility (EPR) policies at the provincial level. (Government, Industry, Associations)

Opportunity 5: Business Model

Make Circular Fashion Business Models the Mainstream Practice

Rethinking the current take-make-waste fashion business model with a circular lens has huge potential to not only reduce apparel waste, but also drive green business innovation. This will, in turn, create local jobs and put the greater Vancouver area on the map as a leader in sustainable apparel.

In a circular system, materials are viewed as components of a cyclical supply chain: raw materials that are harvested and manufactured eventually make their way back to being component material for another round of manufacturing. This eliminates or reduces the need for continued harvesting, and limits the impacts of resource extraction and manufacturing processes. Circular systems focus on

keeping a high standard of material while minimizing both waste and pollution. Therefore, fibres and textiles are sourced based on sustainable options, such as traceability, recyclability, soil- and forest-friendly practices, organic certification, non-toxicity, and fair trade. Certification organizations verify and track materials and processes.

A key part of the development of circular business models will require products that are designed for such models. Designers need to consider durability, repair, and recyclability as well as functionality. This type of design may require "thinking outside the box," such as getting inspiration from nature through a concept of circular design innovation called biomimicry. Additional savings and waste reduction may be possible though redesigning not only the product but the process by which it is made. Additive manufacturing such as 3D printing and knitting could create savings through more efficient use of fibres in the production of apparel.

Until recently, proof-of-concept was a key barrier to circular fashion. But leaders such as CROP have successfully created a 100% organic cotton recyclable collection using 3D knitting to minimize manufacturing waste. (See Appendix 4 for a curated list of industry leaders in this and other areas.)

Rethinking design will enable businesses to extract value from the resale or repair of functional and durable apparel. Once repair is no longer possible, businesses can extract value from the collection and recycling of their apparel. A circular business model increases the security of supply and improves price stability.

Taking Action

Design and Manufacturing (and Remanufacturing)

Timeframe	**Actions (Potential Actors)**
Short Term	• Set a vision and strategy for circular business practices. (Industry) • Design for durability, not obsolescence. (Industry)
Medium Term	• Identify and use materials suitable for closed-loop recycling. (Industry, Associations) • Develop and use new tools for industry to assess the business case for embedding circular fashion models. (Industry, Associations) • Utilize zero-waste patternmaking techniques, digital markers, and additive manufacturing to reduce waste from the production of garments. (Industry, Associations)
Long Term	• Utilize new circular fibres and production processes to increase recyclability (e.g., reduce toxic dyes and coatings that reduce recyclability; use 100% single-fibre) (Industry)

Sell and Purchase

Timeframe	**Actions (Potential Actors)**
Short Term	• Offer second-hand and recertified (repaired) clothing alongside new apparel within traditional retail spaces and online. (Industry)
Medium Term	• Consider the business case for alternatives to traditional retail models for apparel, such as leasing and renting. (Industry)
Long Term	• Deliver access to clothing as a service. (Industry)

Own and Maintain

Timeframe	Actions (Potential Actors)
Short Term	• Partner with local repair shops to offer timely repair to customers. (Industry)
Medium Term	• Locate repair and alteration services within retail establishments, such as in second-hand clothing stores (consignment stores and thrift stores) to overcome perceived barriers to shopping second-hand. (Industry)
Long Term	• Maintain ownership of apparel through a leasing program to build customer loyalty and meet demand for sustainable apparel. (Industry)

Collect and Sort

Timeframe	Actions (Potential Actors)
Medium Term	• Develop a reverse-logistics strategy to recapture the value of worn apparel. (Industry)

Reuse and Repurpose

Timeframe	Actions (Potential Actors)
Medium Term	• Develop textile washing infrastructure to prepare second-hand and returned apparel for resale. (Industry) • Collaborate with specialty collectors and zero-waste garment manufacturers to make limited-edition pieces from factory scraps (e.g., tonlé, Offcut Caps™,). (Industry)

Recycle

Timeframe	Actions (Potential Actors)
Medium Term	• Support apparel made from 100% recycled content. (Industry)

6 Conclusion

The greater Vancouver area, like many North American and European cities, has an existing infrastructure for the collection and reuse of clothing. After conducting detailed research and mapping out how the current system works, it is apparent that expanding and optimizing this system will help divert additional apparel from disposal; but it will not lead to desired systems level change of realising a circular fashion industry. Radical change is required to shift the fashion industry towards a circular fashion system that minimizes apparel waste.

Circular fashion ultimately means new business models. Which means that the bulk of the change falls on the fashion industry. However, government and consumers will play a key role in supporting the fashion industry towards new business models. Governments can accelerate the transition by implementing supportive policies that help move industry towards circular fashion. Consumers also have a role in radically changing their purchasing habits to support businesses that are moving in the direction of circular fashion.

Addressing the Recycling Gap:
A key first step in transitioning from a linear to circular fashion system is addressing the gap in recycling technology for clothing. An assessment to determine the feasibility of building local apparel recycling capacity would be a good place to start. Understanding what additional infrastructure is needed at a local level as well as the costs, logistics and social impacts of local recycling capacity will help move the conversation on how best to address the gap in recycling forward. It will also provide insights into the recyclability of different fibres and could help designers address recyclability during the design stage so that their clothing doesn't ultimately become waste.

Reducing Apparel Waste Using Existing Options:
Beyond recycling, there are many established circular fashion business models that could be implemented in advance of recycling technology and recycling capacity installation. Design for durability, repair/maintain, rent/resell, and recertify/reimagine are all existing circular models that can be adopted into mainstream fashion industry using today's technologies. Even closed-loop (fibre-to-fibre) recycling is possible for certain fibres. For example, cotton and wool are recyclable using mechanical closed-loop recycling technologies. Appendix 4: Industry Innovators, of this report, provides concrete examples of bold leadership, creative thinking and extensive collaboration that is reducing the almost 100 million tonnes of apparel waste going to disposal each year.

New Consumer Mindset:
While there is some evidence that consumers are starting to demand sustainable fashion, price-sensitive and trend-driven consumers expect fashion on-demand at a low cost. Therefore, in order for circular fashion to be realised, consumers need to radically change their approach to fashion. For fashion brands, a key strategy in transitioning to circular fashion will be shifting consumer mindset from buy new and dispose to lease/rent or buy for longevity.

The Need for Supportive Regulation:
It is uncertain if the fashion industry will address the recycling gap and implement circular models in the absence of government policies. Fierce competition between brands and price sensitive consumers make it difficult for fashion brands to make the leap from linear to circular business models. Some

forward thinking fashion brands are taking the leap early to stay ahead of commodity price volatility and potential future regulation. But mainstream brands are focused on responding to what consumers demand and will need radical change in consumer mindsets, or new government policies and programs, in order for them to make the leap.

Some local governments are already taking action by facilitating collection of materials to existing diversion system through programs such as curbside collection, education campaigns and "where to donate apps". This is a good first steps. But in order to make circular fashion mainstream, government needs to consider new programs and policies that not only bolster current collection systems, but also support brands in transitioning to the circular fashion business models.

Call to Action:

Currently too much apparel waste end up in disposal. Industry, government and consumers need to take action to transition to circular fashion. Systemic changes and multi-stakeholder collaboration are required to re-shape the fashion industry, such as implementing ecological tax reform to incentivize circular models. In order for these bold objectives to achieved, each stakeholder, each one of us, must actively seek to change business models; change marketing and manufacturing practices; and change purchasing patterns that put the fashion industry on the circular path.

Glossary

apparel: all products designed to be worn (e.g. clothing, shoes, and accessories). This report focuses on the clothing and largely leave shoes and accessories out of scope.

additive manufacturing: a manufacturing process that elimiates waste through a near one hundred percent efficient use of fibres in the production of apparel (e.g., 3D printing and knitting).

biomimicry: using nature's blueprints in order to unlock circular design innovation.

bulk collector: organizations (both non-profit and for profit) that collect clothing through various collection methods; such as donation bins, scheduled residential pick-ups, and clothing drives; in order to generate revenue through the sale of apparel to organizations such as second hand store or sorter-graders that sort and sell the clothing to various local and global end markets.

circular business model: integration of product design and business strategy which results in a dramatic reduction in resource consumption through delivery of products to customers using methods which maximize the duration that the product is in use by one or more user.

circular economy: a framework for commerce which looks to minimize impacts to the environment while maximizing profits by using resources more effectively through the employment of circular product design and circular business models (e.g. product-as-a-service, repair, or lease).

circular fibre: a fibre for clothing that can be mechanically or chemically recycled into a fibre which can be used to make clothing from the recycled fibres.

circular fashion: a framework for delivering fashion to consumer which looks to minimize the impacts to the environment while maximising profits by using resources more effectively by employing integrated product design and business models (e.g. rent, repair, reimagine and close-loop recycling).

closed-loop recycling: processes that produce new yarn and fabric suitable for garment production.

clothing provider charity: charitable organizations that distribute collected apparel directly to persons in need, typically at no cost to the recipient. Clothing provider charities may only accept specific items to support their charitable mission (e.g. winter coats, professional work wear, prom dresses).

corporate sorting and certified destruction: a sorting and destruction process whereby branded and proprietary products, including those that pose a security risk, are disposed securely.

fashion seasons: the number of new collections a brand produces annually.

fast fashion: the supply of clothing based on lowest production cost and fastest production time often resulting in low-quality mass-produced apparel with short lifespans.

Industrial, commercial, institutional waste: waste generated from the industry, commercial establishments or institutions that is managed by way of collection and delivery to a facility that handles municipal solid waste (also see municipal solid waste definition).

municipal solid waste: municipal solid waste (MSW) includes refuse that originates from residential, commercial, institutional, demolition, land clearing or construction sources as outlined in the Environmental Management Act.

open-loop recycling (or down-cycling): processes by which textiles are deconstructed, shredded or otherwise processed and used as inputs for the manufacture of lower value products, such as insulation or fill.

pre-consumer waste: waste arising from industrial, commercial or institutional establishments that does not reach a consumer (e.g. offcuts).

post-consumer waste: waste arising from products that have reached the consumer.

recycle: the action of taking a product or material and breaking it down so that it can be made into the a more valuable (upcycling), same value (recycling) or lower value (down cycling) material.

residential waste: waste arising from buildings where people live (e.g. single-family homes, and apartments).

reverse logistics: the coordination n and planning of how to get products back from consumers in order to extract the maximum value of collected products, through reselling, recertifying (repair), or recycling the returned products into new products.

sorter-grader: a common name for a company that purchases large quantities of used clothing or unwanted clothing and sorts them into various categories based on demand from global second hand clothing and recycling markets. They differ from second-hand clothing retailers because they sell clothing by the bail not by the individual item. Sometimes referred to as a used-clothing broker.

slow fashion: high-quality, well-made apparel, which often carries a higher price tag but typically extends wearability; apparel designed with longevity in mind.

take-make-waste (linear economy): a resource-intensive mainstream approach to commerce popularized in 1950s through the economic theory of planned obsolescence which aims to maximize profits by minimizing the amount of time between consumer purchase of new goods.

zero-waste manufacturing: the artful use of patterns which use almost all materials or additive manufacturing which results in almost 100% of the raw material used the manufacturing of the product to go into the product itself resulting in little to no residual material.

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Appendix 1: Leverage Lab Collaborative Approach

How Did We Explore This Problem?

Figure 13 Leverage Lab Collaborative for Textiles workshop 1

In recognition of the complexity of the problem and the many stakeholders involved, the authors used a collaborative process, supplemented by additional data gathering, to explore the challenge of diverting apparel waste and to seek a way forward.

The apparel businesses that participated in the process were concerned about the possibility of an upcoming regional textile disposal ban. Government participants were curious about the industry's perspective and what the waste material could be used for once it is diverted. Face-to-face interactions helped these stakeholders build trust and ultimately share ownership of the issue.

The Leverage Lab Collaborative for Textiles was formed to bring apparel industry participants and government participants together for a series of three workshops focusing specifically on apparel waste management in the greater Vancouver area. The workshops were designed with a backcasting approach, intending to establish an common desired future for the region from an apparel industry perspective and from there working back to identify the next steps and actions needed to reduce apparel waste going to landfills and incinerators.

Workshop #1 activities included:

- identifying the common challenge of apparel waste management
- identifying each participant's role in the apparel industry and how participants might help each other

Outcome: Participants determined a lack of adequate collective knowledge of the baseline system needed to figure out the next steps for better waste management. Participants understood their own waste contributions but not the larger regional system. Collective knowledge of the system was deemed a necessary first step before participants could take action to decrease disposal of apparel waste.

Between workshops, the co-conveners researched possible actions and methods for reuse and recycling of diverted material. Information was drawn from a variety of sources:

- surveys with workshop participants and other regional stakeholders, used to identify stakeholders' material inflows and outflows, discover the challenges to diverting their apparel waste from disposal, and get their initial comments on the feasibility and impact of a regional textile disposal ban
- interviews with other regions and municipalities, conducted to gather information on their initiatives, rationales, and experiences
- desktop study of reuse and recycling in the textile sector globally and in the greater Vancouver area, undertaken to uncover available methods, locations, new research, and impacts

The co-convenors also began to map the regional system of material flows. Refer to Appendix 3 for the methodology used to create the systems map.

Workshop #2 activities included:

- sharing the baseline system map and co-convenor research on recycling options
- identifying a desired future
- determining what participants thought was their greatest means to leverage these findings: a report describing the regional system's baseline and opportunities for reducing disposal of apparel waste

Outcome: Once a baseline understanding was established and a desired future explored, participants decided that writing a report was the best way to capture industry research on apparel waste and share that knowledge with other industry stakeholders

Workshop #3 activities included:

- collaborating with participants to fill informational gaps in the report outline
- confirming the updated baseline system map
- articulating the system's strengths, weakness, opportunities, and threats
- sharing co-convenor research on what other industry players are doing outside of the greater Vancouver area to reduce apparel waste
- identifying possible actions within stakeholder groups that could reduce disposal of apparel waste

Outcome: Participants drew from their new baseline knowledge and best-practice examples to identify actions that could reduce disposal of apparel waste within the constraints of available technology.

The Lab process would not have been possible without the Partners and Sponsors that supported the Leverage Lab.

Partners:

Vancity

VANCOUVER ECONOMIC COMMISSION

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Appendix 2: Table of Municipal Solid Waste Composition by Region

Region	Population[79]	Total Waste (2015, in tonnes)	Total Waste kg /capita	Estimated Textiles Waste (tonnes)	Textiles Waste (%)	Clothing Waste (%)	Year of Study	Waste Composition Study Type
Metro Vancouver	2,513,856	830,461	330	40,000	4.8%	2.3%	2016	Tetra Tech Study (waste sort)
Capital Regional District	378,232	135,000	357	8,018	5.9%	2.2%	2016	Tetra Tech Study (waste sort)
Regional District of Nanaimo	154,546	53,319	314	3,006	5.6%	-	2012	Maura Walker and Associates and MJ Waste Solutions (waste sort)
Fraser Valley	296,429	125,982	425	3,452	2.7%	1.5%	2015	TRI Study (waste sort)
Central Okanagan	195,466	126,857	649	3,250	3%	-	2013	In-house by RDCO
Thompson–Nicola	133,256	120,306	539	4,812	4%	-	2006	Sperling Hansen Study
Fraser–Fort George	91,299	76,052	833	3,803	5%	-	-	N/A
North Okanagan	84,587	39,671	469	1,984	5%	-	-	N/A
Cowichan Valley	82,786	24,174	292	1,740	7.2%	-	2015	Tetra Tech Study (waste sort)
Okanagan–Similkameen	81,898	45,044	550	1,802	4%	-	2008	
Comox Valley–Strathcona	110,102	61,437	558	3,072	5%	-	-	
East Kootenay	70,204	39,455	562	1,973	5%	-	-	
Peace River	63,897	58,913	922	3,535	6%	-	2008	Visual Estimate Only
Cariboo	62,252	44,448	714	1,778	4%	-	1991 – 2009	Estimated based on other waste compositions from Canada (Sperling Hansen)
Central Kootenay	60,102	29,029	483	1,451	5%	-	-	
Squamish Lillooet	55,603	30,526	549	1,221	4%	-	2012	Estimated based on other waste compositions from Canada (Gartner Lee)

LEGEND	
	No data available; estimated to be 5% based on rest of BC, or estimated using data from similar region.

[79] "Municipal Solid Waste Disposal in B.C. (1990–2015)," BC Ministry of Environment, accessed May 2017, http://www.env.gov.bc.ca/soe/indicators/sustainability/municipal-solid-waste.html.

Region	Population	Total Waste (2015, in tonnes)	Total Waste kg /capita	Estimated Textiles Waste (tonnes)	Textiles Waste (%)	Clothing Waste (%)	Year of Study	Waste Composition Study Type
Columbia–Shuswap	51,379	30,673	597	1,104	4%	-	2013	TRI Study[80]
Buckley Nechako	40,059	25,838	645	517	2%		2008	AECOM Study
Kitmat–Stikine	38,517	28,888	750	1,444	5%	-	-	
Alberni–Clayoquot	30,106	22,820	758	1,141	5%	-	-	
Kootenay Boundary	29,349	16,817	573	841	5%	-	-	
Sunshine Coast	29,177	12,371	424	1,249	10%		2015	Dillon Study
Powell River	19,481	8,922	458	446	5%	-	-	
Skeena–Queen Charlotte	17,531	12,079	689	604	5%	-	-	
Mount Waddington	11,368	6,184	544	309	5%	-	-	
Northern Rockies	5,963	2,844	477	142	5%	-	-	
Central Coast	3,239	1,458	450	73	5%	-	-	
ALL OF BC	**4,710,684**	**2,009,569**	**427**	**92,767**	**5%**	**2%**		

LEGEND	
	No data available, estimated to be 5% based on rest of BC, or estimated using data from similar region.

[80] Includes all non-compostable organics category (1.6%) as textiles were not separated.

Appendix 3: Regional Apparel Systems Map

To understand the challenges and opportunities for action, Leverage Lab Collaborative for Textiles participants identified a need to map the flow of material between stakeholders (Figure A3.1). The map was created using the following methodology:

1. Participants in Leverage Lab Collaborative for Textiles were surveyed about where they receive and send apparel and apparel waste. Refer to Table A3.1.

Table A3.1. Material Flow Survey Questions

1.	Organization name
2.	Your name
3.	What quantity of textiles do you receive? (tonnes per month or year, lbs is fine. Please include units)
4.	Which of the following sources do you receive materials from? (check all that apply) a) Public donation bins owned by you b) Public donation bins owned by others c) Residential pick-up programs (apartments) d) Residential pick-up programs (single-family homes) e) Thrift stores f) Retailers (unsellable old stock) g) Retailers (unsellable factory defects) h) Retailers (take back programs) i) Corporate (uniforms/event shirts) j) Manufacture (off cuts mixed with paper) k) Manufacture (roll ends) l) Other: _____
5.	Names of organizations where you get materials from
6.	How much are you able to sell? (tonnes per month or year, lbs is fine. Please include units)
7.	Include breakdown of where it goes if available (i.e. used clothes, used shoes, rags or shoddy. Please include units)
8.	How much material do you have trouble finding a market for (tonnes per month or year, lbs is fine. Please include units)? What happens to the material you cannot find a market for?

2. Each participant was classified as a stakeholder type to develop a set of nodes (i.e. the rectangular boxes on Figure A3.1), with each node identified as being located inside or outside of the greater Vancouver area (or both).
3. Based on survey answers, flows between nodes were drawn (i.e. the arrows on Figure A3.1, representing the flow of materials between stakeholders), including where flows cross regional boundaries.

4. The draft version of the map and a definition list of stakeholder types were presented to participants, who were asked to verify the flows of apparel and apparel waste through their organizations. All corrections and feedback were documented in worksheets. See Table A3.2.

Table A3.2. Material Flow Diagram Verification Questions

1.	Your name
2.	Your organization
3.	Which node represents your organization?
4.	The definition provided for this node accurately describes my organization. a) Yes b) No
5.	If no, please explain why not.
6.	If no, please write a better definition. (Note: if you circled yes, but feel the definition could be improved or clarified, please also write it here).
7.	a) Look at all the arrows pointing **towards your node**, and which nodes they are coming from. These are your **sources of inflow** materials according to our surveys and research. Make a list of these nodes on the following lines. b) For each of these inflow sources, please confirm whether you actually do receive materials from these sources by circling 'Yes' or 'No' for each item.
8.	a) Look at all the arrows pointing **away from your node**, and which nodes they are going to. These are the **destinations for your outflow** materials according to our surveys and research. Make a list of these nodes on the following lines. b) For each of these outflow destinations, please confirm whether you actually do send materials to these places by circling 'Yes' or 'No' for each item.
9.	Are there any flows missing from or to your node? For example, does the map correctly show what happens to the following types of flows? a) All the materials/products you sell b) Any materials/products you donate c) What happens to damaged items d) What happens to defective items e) What happens to samples f) What happens to items that don't sell g) What happens to off-cuts, roll-ends h) Materials that go to landfill or incinerator
10.	If you circled no for any of the above, please describe what you do with those materials. If anything else is missing, please describe here.
11.	Are there any unique situations that have arisen in your organization where you sent or received materials from a person or organization you don't routinely partner with? If yes, please describe here.

5. The map (Figure A3.1) was revised using feedback and corrections from participants, and phone interviews were used to further clarify feedback.
6. Stakeholder nodes were categorized into six activities describing the flow of new, diverted and wasted apparel: design and manufacture (Activity 1); sell and purchase (Activity 2); own and

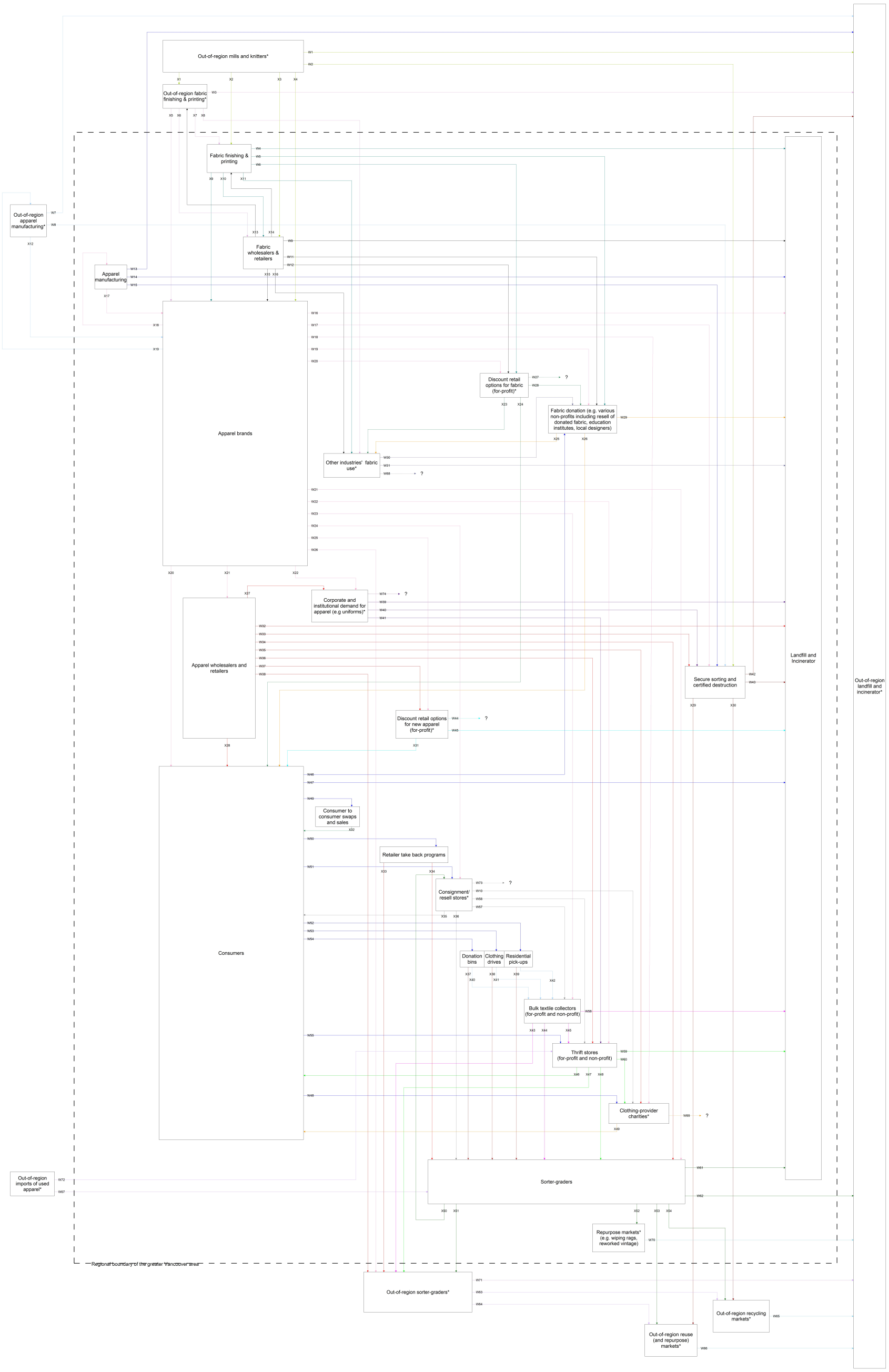
maintain (Activity 3); collect and sort (Activity 4); reuse and repurpose (Activity 5); and recycle (Activity 6). Flows were re-drawn between the six activity nodes to create a simplified map of global apparel flows. Figure A3.2 identifies which stakeholder nodes belong to each of the six activities.

Apparel and Apparel Waste Flows in the Greater Vancouver Area

City of Vancouver in collaboration with Leverage Lab COLLABORATIVE for Textiles

Revision date: November 30, 2017

This diagram was developed using information provided by participants in Leverage Lab COLLABORATIVE for Textiles, convened October 2016 to April 2017 in Vancouver, BC. The information in this diagram is subject to change.
Updated information, feedback and questions may be directed to apparelwaste@vancouver.ca



LEGEND

- Stakeholders and activities
- Flows of apparel and apparel waste between stakeholders and activities
- Regional boundary of the greater Vancouver area
- X## / W## — Unique identifiers for each flow to/from stakeholders and activities
- ∗ These stakeholders were not participants in Leverage Lab COLLABORATIVE for Textiles. Their material flows have not been verified by a stakeholder representative
- → ? Material flows to/from this stakeholder have not been verified by a stakeholder representative

Figure A3.1. Apparel and Apparel Waste Flows in the Greater Vancouver Area (November 30, 2017 revision), City of Vancouver in collaboration with Leverage Lab COLLABORATIVE for Textiles, 2017, https://commons.wikimedia.org/wiki/File:Apparel_and_Apparel_Waste_Flows_in_the_Greater_Vancouver_Area_(Nov_30,_2017_revision).pdf.

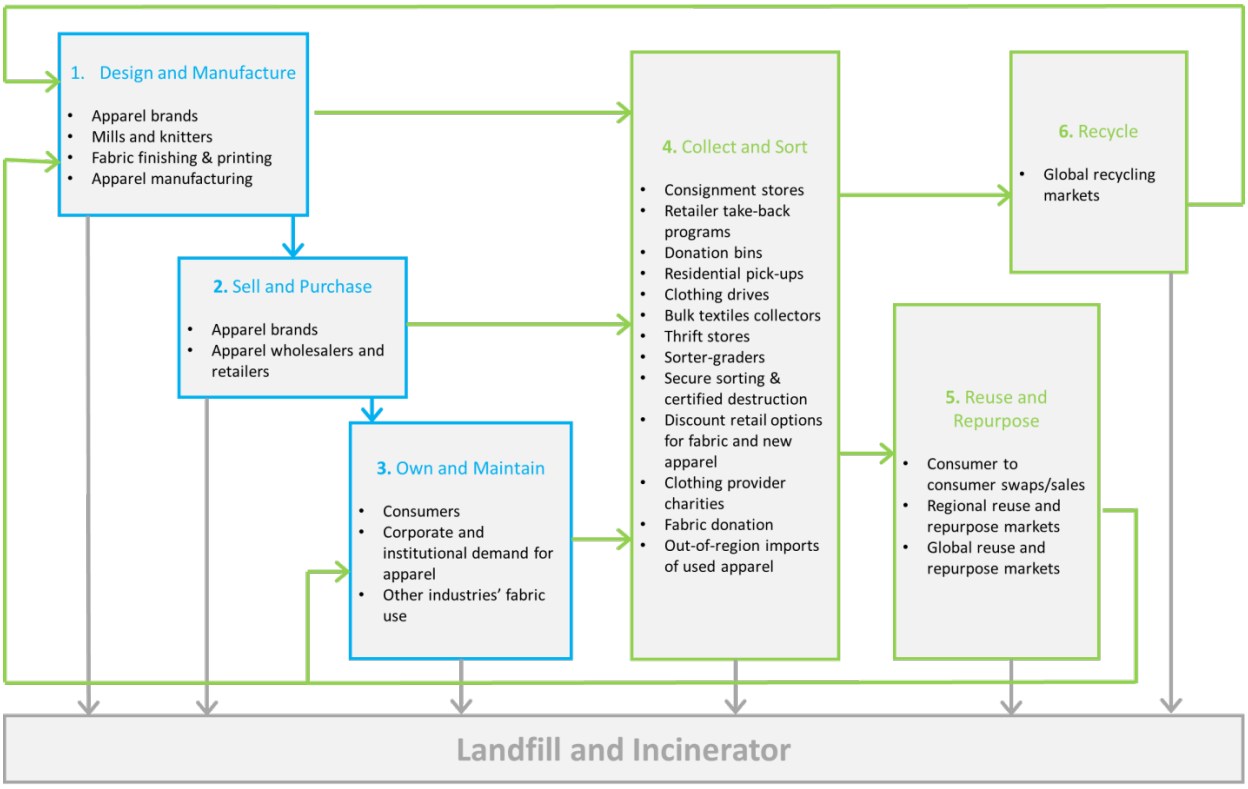


Figure A3.2. System of Apparel Waste Generation and Management: Six Key Activities with Detail of Categorized Stakeholder Nodes.[81]

[81] This figure is a derivative of "Apparel and Apparel Waste Flows in the Greater Vancouver Area (October 27, 2017 revision)" by City of Vancouver in collaboration with Leverage Lab Collaborative for Textiles, used under a Creative Commons Attribution 4.0 International License. Refer to Figure A3.1 in Appendix 3.

Appendix 4: Industry Innovators

Opportunity 1 – Collaboration

Collaboration: Increase industry collaboration in collection, sorting, recycling, and design for circularity.

Canadian Collaborations		
Location	**Organization(s)**	**About**
Vancouver, BC Canada	Leverage Lab - http://www.theleveragelab.com	Leverage Lab is a six-month program that facilitates cross-sector collaboration in order to address shared industry challenges and improve social and environmental impact, productivity, and brand. With the intent to continue to pilot and created industry solutions to reduce apparel waste.
Toronto, ON Canada	Fashion Takes Action https://fashiontakesaction.com/ Sustainable Strategies http://sustainablestrategiesandsolutions.ca	Textiles Diversion Lab is just the beginning. It is an intensive two day workshop sessions to start the conversation around what industry can do towards reducing apparel waste with the intent to build momentum to continue cross-sector collaboration beyond the initial two workshops sessions.
San Francisco, USA	Sustainable Apparel Coalition https://apparelcoalition.org/	Manufacturers, brands, and retailers are joining together to identify and measure their sustainability impacts on an industrial scale like never before. Working on the Higg Index for common industry benchmarking
Global (Includes Canada and USA)	Textiles Exchange http://textileexchange.org/	A global non-for-profit which works on collaborating with industry towards better fibre choices (e.g. organic cotton) and use of integrity standards (e.g. Global Recycled Standard).
United Kingdom	Wrap UK - Sustainable Clothing Action Plan http://www.wrap.org.uk/sustainable-textiles/SCAP/signatories	Recruiting UK businesses to commit to the SCAP 2020 Commitment aimed at reduction carbon, water and water though resource efficient business models, design for extending clothing life, better fibre and fabric selection, changing consumer behaviour, reuse and recycling.
United Kingdom	Ellen McArthur Foundation. - Circular Fibres Initiative https://www.ellenmacarthurfoundation.org/programmes/systemic-initiatives/circular-fibres-initiative	Brings key industry leaders and stakeholders together to collaborate and innovate towards a new textiles economy based on the principles of a circular economy.
Copenhagen, Denmark	Global Fashion Agenda http://www.globalfashionagenda.com	Call to action for industry to make a commitment to take the necessary steps to transition to a circular fashion system.

Opportunity 2 – Investment

Funders		
Location	**Organization(s)**	**About**
BC, Canada	BC Solid Waste Research Collaborative https://bcswrc.ca/projects/project-current/textiles	BC Solid Waste Research Collaborative aims to unite researchers, government and industry to solve municipal solid waste management challenges. Within the Canadian context, several funds are available for research on municipal solid waste such as textiles. The BC Solid Waste Research Collaborative maintains a list of research funders: • Environmental Research & Education Foundation • Engage and Connect Grants from national Science and Engineering Research Council (NSERC) • TD Friends of the Environment Foundation • EcoAction Community Funding Program • Max Bell Foundation - Senior Fellows Program • Canada Foundation for Innovation – Major Sciences Initiatives Fund • Canada Foundation for Innovation – Innovations Fund • The Sustainable Development Fund • Federation of Canadian Municipalities - Green Municipal Fund
USA	Closed Loop Partners www.closedlooppartners	An investment fund focused on investing on sustainable consumer goods, advanced recycling technology and the development of the circular economy. Investments include advancement of fibre-to-fibre recycling technology (evRnu) and new repair business models for apparel (The Renewal Workshop).
Europe	Fashion for Good fashionforgood.com	With over 20 partners, Fashion for Good aims to build a coalition of brands, producers, retailers, suppliers, non-profits, innovators and funders to make all fashion good. The program includes an accelerator program aimed to find and fund technology and business models that can transform the industry. As well as a scaling programme to help existing good fashion increase their scale and impact.
Europe	European Clothing Action Plan www.ecap.eu.com Delivered by: WRAP, MADE-BY, Rijkswaterstaat, Danish Fashion Institute, and Long Waste and Recycling Board	A 3.5 year project ending in March 2019 funded by EU LIFE fund. It looks to reduce apparel waste and embed a circular economy approach to the fashion industry.

Funders		
Location	**Location**	**Location**
Global	H&M Foundation - Global Change Awards globalchangeaward.com	An annual award totalling €1,000,000 to incentivise innovators to find circular fashion solutions. Past winners include Unspun: a machines that spins custom fitted clothes and then unspins them again and grape leather: using leftovers from winemaking to create fully vegetal leather.
Global	C&A Foundation www.candafoundation.org	Fund initiatives that have the potential to change the fashion industry. Funding recipients include Fashion for Good, Circle Economy Textiles Programme, Fabric of Change challenge in partnership with Ashoka.

Opportunity 3 – Education

Education: Educate consumers, designers, and brands about their role in zero-waste fashion.

Government Initiated Education Programs		
Location	**Organization(s)**	**About**
NS, Canada	Assocation for Textiles Recycling AFTeR http://afterwear.ca/wp/	Nova Scotia Environment initiated the formation of AFTeR, an association of six charitable organization that collect textiles. The association helps provide consistent messaging and a single platform to find the nearest donation drop-off location.
ON, Canada	City of Markham www.markham.ca	Partnered with charities to create Markham branded donation bins with clear consistent messaging on what is accepted. The bins are located on municipal property and in high rise apartment buildings.
NY, USA	RefashionNYC http://www1.nyc.gov/assets/dsny/zerowaste/residents/re-fashionyc.shtml	RefashionNYC is partnership between the New York Bureau of Sanitation and Housing Works. It is a 100% non-profit and charitable services which promotes local drop off location and provides city branded collection bins to eligible apartment building, office buildings and textiles businesses.
WA, USA	King County http://kingcounty.gov Seattle Public Utilities http://www.seattle.gov/util/	Threadcycle is a public education campaign and partnership between King County and Seattle Public Utilities. The aim of the program is to encourage the public to donate all textiles including damaged clothes and linens in any condition except wet. The campaign explains why, what, where to donate and what happens to donated clothing. http://your.kingcounty.gov/solidwaste/ecoconsumer/threadcycle.asp

Government Initiated Education Programs		
Location	**Location**	**Location**
CA, USA	San Francisco sfenvironment.org/textiles	Encourages residents to donate their clothing https://www.recyclewhere.org/ for reuse. And collects clean, dry fabric such as single socks and clothes with rips and holes in clear bags in their blue bin collection system https://sfrecycles.org/.
UK	Love Your Clothes (UK) www.loveyourclothes.org.uk	Love Your Clothes was developed in collaboration with industry to help change the way UK consumers buy, use and dispose of their clothing. It includes tips on buying new clothes, care and repair, refashioning and upcycling, as well as what to do with unwanted clothes.

Post-Secondary Education Programs		
Location	**Location**	**About**
ON, Canada	Seneca College www.senecacollege.ca	Offers various sustainable fashion courses including a course titled Product Development for the Circular Fashion System. The Seneca School of Fashion hosted a Textiles Waste Diversion at the Newnham Campus.
ON, Canada	George Brown College www.georgebrown.ca	Started a stainable fashion production grad program in April 2017.
BC, Canada	LaSalle College Vancouver www.lasallecollegevancouver.com	LaSalle participates with EcoFashion week in their annual chic Sheets bed linen Challenge http://ecofashion-week.com/index.php/participants/vancouver/participantschicsheets/
BC, Canada	VCAD http://www.vcad.ca/programs/fashion-design/	VCAD a require course for sustainable fashion to help students understand their impact including environmental impacts, human rights and waste generation in the industry. They have also participated in past Value Village sponsored 81lbs challenge at Eco Fashion Week. During this challenge the students reimagine clothing destine for disposal.
BC, Canada	Kwantlen Polytechnic University www.kpu.ca	KPU students work on various zero fashion waste projects such as Thrive Zero Waste pattern making, recycling fishing nets into industrial design products; and upcycled collections to celebrate earth day.

Opportunity 4 – Policy

Policy: Use policy to set a level playing field that supports the reduction of apparel waste.

1. Business Model: Make circular fashion business models the mainstream practice.

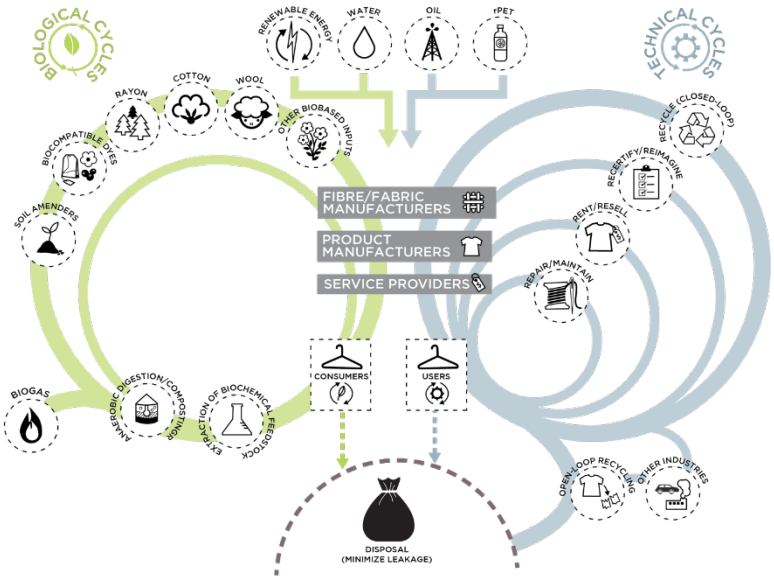
Forward thinking regulators and businesses are implementing policies which help keep textiles out of waste.

Government Policies and Programs		
Location	**Organization(s)**	**About**
ON, Canada	City of Markham www.markham.ca	Program: See Education Policy: In April 2017 City of Markham banned textiles from city curbside collection program. City of Markham residents must set out garbage in a clear bag with a limit of up to 4 privacy bags. Bags containing textiles won't be picked up.
NY, USA	New York Department of Sanitation http://www1.nyc.gov/assets/dsny/zerowaste/residents/re-fashionyc.shtml	Program: See Education Policy: If textiles make up more than 10% of business waste during any month, businesses are required to separate and recycling all waste textiles including fabric scraps, clothing, belts, bags and shoes. https://www1.nyc.gov/assets/dsny/docs/commercial-recycling-notice-english.pdf
Sweden, EU	Swedish government	Cut VAT on repairs to various items including clothes and shoes from 25% to 12%.
Francs, EU	French government	All clothing, linens and footwear that enter the French market are subject to a tariff that is then re-invested into end of life management, R&D into textile recycling, and communication campaigns. Eco TLC is accredited by the French government to manage this program. Companies can also choose to set their own internal collecting and recycling program

Voluntary Business Policies		
Location	**Organization(s)**	**About**
CA, USA	Everlane www.everlane.com/factories	Implemented policy towards radical transparency of where their clothes are made and the cost to produce them.
Global	Various Third Party Certifications	Bluesign: oncludes evaluation of inputs (fibres, chemicals, dyes, energy, water) and analysis of production processes regarding resource efficiency https://www.bluesign.com/ Cradle to Cradle Certified: considers end-of-life for certified products www.c2ccertified.org Nordic Ecolabel: requires that 90% of production waste to be recycled. www.ecolabelindex.com/ecolabel/nordic-ecolabel-or-swan B Corp: Includes waste reduction in certification evaluation. https://www.bcorporation.net/

Opportunity 5 – Business Model

Industry leaders are already working on transitioning from the current take-make-waste model to a circular fashion model. It is important to remember that the most gains are to be had by keeping the material in the inside loops. With that in mind, the following innovators are listed in order of "loop priority".



1st Loop (User/Consumer to User/Consumer) Keep using it. Design for durability and Repair		
Location	**Organization(s)**	**About**
Originally Vancouver, BC Canada now Finland, EU	ARC'TERYX www.arcteryx.com	"Arc'teryx proudly guarantees the quality and performance of all our products. Items with defects in materials or workmanship will be replaced or repaired at the discretion of Arc'teryx for the practical lifetime of the product. Product damaged through wear and tear, misuse, or neglect may be repaired at a nominal charge"
VT, USA	Darn Tough Socks https://darntough.com/	"If you were able to wear out a pair of Darn Tough socks, we'll replace them. At any time."
NV/CA, USA	Patagonia http://www.patagonia.com/ironclad-guarantee.html	"We guarantee everything we make. If you are not satisfied with one of our products at the time you receive it, or if one of our products does not perform to your satisfaction, return it to the store you bought it from or to Patagonia for a repair, replacement or refund. Damage due to wear and tear will be repaired at a reasonable charge."
UK	Tom Cridland www.tomcridland.com	"The 30 Year T-Shirt is built to last a lifetime but also backed with 3 decades of free mending. If anything happens to it over the next 30 years, send it to us and we will mend it and send it back to you. That means the cost of repair and return postage is on us."

2nd Loop – Repair and Maintain		
Location	**Organization(s)**	**About**
ON, Canada	Doctor Denim doctordenim.ca	Offers invisible repair for jeans.
ON, Canada	Dye it Black www.dyeitblack.com	Re-dyes faded and stained clothing black as an alternative to re-buying/disposal.
CO, USA	Tersus Solutions www.tersussolutions.com	Water-free textiles cleaning. Using C02.
NV/CA, USA	Patigonia	Patigonia's wornwear program includes garment care instructions, DIY repair instructions, buy back of old clothing and repair services.
Sweden, EU	Houdini www.houdinisportswear.com/en/sustainability	Offer a variety of circular fashion options including repair, resell, rent and design for environment. Ninety-one percent of their line is made from recycled, recyclable, biodegradable or bluesign certified fabrics.
CA, USA	ifixit www.ifixit.com/Device/Clothing	An online resource with DIY repair advice for several products including clothing.

3rd Loop – Rent/Resell		
Location	**Organization(s)**	**About**
BC, Canada	Our Social Fabric https://oursocialfabric.wordpress.com/	A not-for-profit company that accepts unused fabrics and sewing supplies for donations and sells them at reduced prices to hobbyist and creative professionals in order to help divert textiles waste from disposal.
BC, Canada	Flaunt Fashion Library flauntfashionlibrary.com	An on-line lending platform where consumers can lend an item from their closet for a commission, or borrow from the library for a fraction of the price of buying new.
ON, Canada	Rent-frock-Repeat	On-line special occasion dress rental company that provides consumers with access to designer dresses for the evening out on the town at a fraction of the retail cost.
USA	ThredUp (US) https://www.thredup.com/	One of the largest on-line thrift stores. Allowing savvy shoppers to filter and sort through their e-commerce platform as an alternative to the traditional brick and mortar thrift store.
USA	Coyuchi www.coyuchi.com	Subscription service for linens for a duration of 6, 12, or 24 months. Returned linens are renewed, upcycled or recycled.
Netherlands, EU	Mud Jeans http://www.mudjeans.eu/	Product-as-service subscription model which gives consumers access to jeans for a small monthly fee. Consumers have the option to keep or switch them at the end of 12 months. Returned jeans are upcycled or recycled through MUD jeans closed-loop recycling process.

4th Loop – Recertify/Reimagine (Upcycle)		
Location	**Location**	**About**
Metro Vancouver, BC, Canada	FABCYCLE https://fabcycle.ca/	Collects fabric scraps from local design offices and cut-and-sew facilities. Scraps are then made available to the creative community for reuse, recycled if possible or sent to energy recovery.
New York, NY USA	Fabscrap fabscrap.org	Collects fabric scraps from local design offices and cut-and-sew facilities. Scraps are then made available to the creative community for reuse or diverted to recycling such as insulation for automobiles.
Portland, OR USA	Looptworks www.looptworks.com	Partners with large brands which have large quantities of textiles waste and creatively produces high quality, unique, one-time only products such as designer leather bags from old airplane seats or laptop cases made for excess wetsuit neoprene.
OR, USA	The Renewal Workshop (US) https://renewalworkshop.com/en/home	Partners with fashion brands to transform returns, unsellable, or excess inventory into upcycled garments which are co-branded and available for sale on the renewal workshop website.
Seattle/New York, USA	Eileen Fisher RENEW https://www.eileenfisherrenew.com/	Online platform to purchase slightly used Eileen Fisher Clothing. Since 2009 the program has taken back over 800,000 pieces of clothing. The renew program uses a variety of renewal techniques to get the garments ready for sale: clean, overdye (to hid minor flaws or stains), mend, resew, felt, research on new fibres to help realize fibre-to-fibre reyclcing.
New Zealand	Offcut Caps https://offcutcaps.com/	Rescues off-cuts from New Zealand's textiles industry and makes them into unique caps which are exclusively available through limited time only "drops".
Cambodia	Tonle https://tonle.com/pages/zero-waste	Creatively sews new garments out of remnant materials from "heaping piles of factory scrap material". Their signature scrap style takes unusable scraps from large manufactures and cuts them into strips to be made into garments or their own handsewn "yarn" to be made into woven apparel.

5th Loop – Recycle (Closed-Loop)		
Technology Innovators		
Location	**Location**	**About**
Canada	Victor Group Quebec http://fabric.victorgroup.com/t/Eco%20Intelligence	Victor Innovatex is primarily an ulphostry fabric company. Their approach to investing in cradle-to-cradle certified fabrics is proof-of-concept that can be recycled such as their ECO Intelligent Wool and their Eco Intelligent Polyester that when companies invest in the R&D with recycling in mind the industry can reduce textiles waste.
UK	Worn Again http://wornagain.info/	Started in 2005 as an upcycling company and has since evolved into circular textiles-to-textiles recycling company. Work Again is working on a technology to separate polyester and cotton from low-value clothing to produce cost-competitive clothing without compromising on quality.
Hong Kong	Kong Research Institute for Textiles and Apparel https://about.hm.com/en/media/news/general-2017/Successful-method-found-for-recycling-blend-textiles-into-new-fibres.html	A partnership between H&M and the Hong Kong Research Institute of Textiles and Apparel to find commercial viable recycling solutions for textiles. They recently announced a breakthrough in recycling blended textiles in to fabrics and yarns without any quality loss through a hydrothermal chemical process.
Finland, EU	IONCELL. http://ioncell.fi/ Initiated by researchers at: Aalto University, and University of Helsinki	An innovative process that uses an ionic liquid to separate the polyester from the cotton. The technology is able to make new fibres out of cardboard, paper and old clothing. The researchers are also looking into ways to recover the dyes used from the old clothing. They plan to open their pilot plant by 2019 and hope to be fully commercialized by 2025.
USA	EvRnu www.evrnu.com	A new technology provider. EvRnu is changing the industry by creating technology that converts apparel waste into a liquid then transforms it into a new pure fibre. The production reduces water and greenhouse emissions compared to tradition polyester production.
Sweden, EU	Swerea Swedish Research	Hosts a textiles recycling research lab to help academia and industry advance textiles recycling. http://www.swerea.se/en/areas-of-expertise/materials-sciences-raw-materials/textiles/textile-recycling
Netherlands, EU	FeyeCon and DyeCoo	Water free $C0_2$ dying technology that reduces the environmental impacts of the textiles dying process. Liquidized $C0_2$ can also be used in reverse to strip the dye colour from existing polyester garments. Solving a key challenge with recycling of polyester.

Technology Innovators		
Location	**Location**	**Location**
Sweden, EU	Renewcell http://renewcell.se/about/business-concept/	Developed a process to take high-cellulose (cotton and viscose) used clothing and recycling them. Their process includes shredding, removing non-fibre elements, de-colouring and making a slurry. Once the clothing is make into a slurry the non-cellulosic portion is removed and remaining slurry is dried to produce a pulp which can be sold as an input to new garments.
Commercialized Technologies		
Location	**Location**	**About**
Quebec, CA	Chroma (Quebec) https://chrrroma.ca/	Open-loop mechanical recycling for old clothes. Chroma makes felt from old clothes collected in the Montreal area. The felt is made from 80% old clothes and 20% polyester.
AZ, USA	Bonded Logic and Pheonix Fibres	Open-loop mechanical recycling for cotton (denim). Makes insulation products for the various industries out of old denim http://www.bondedlogic.com/ultratouch-denim-insulation/
Various USA	Martex Fibres	Closed loop mechanical recycling. Creates recycles reclaimed fibre and recycled fibre yarn (Jimtex) out of cut-and-sew scraps and old clothing.
Japan	Teijin	Closed loop chemical recycling. Collects polyester uniforms and apparel from EcoCircle members and chemically recycles them in new polyester fibres.
Near Prato, Italy, EU	ReVerSo	Closed loop mechanical recycling for wool. Takes worn wool garments and respins them into high-end wool yarns.
Sweden, EU	OrganoTex® http://organoclick.com/products/performance-textiles-nonwoven/organotex/	Innovation using biomimicy. Inspired by the lotus leaf, OrganoTex® is a fluorocarbon free waterproofing that provides durable protection against water and stains.
Egypt	Transformation Textiles https://transformationtextiles.ihubapp.ca/stories/157	Minimizes waste by filling in blank areas product markers with underwear and sanitary pad patterns to create sanitary products for women in developing countries.
UK	TamiCare Cosyflex http://www.tamicare.com/cosyflex	Creates garments using 3D additive manufacturing with results in zero cutting waste.