HEY FASHION

TEXTILES EDITION

FASHION'S WASTE CRISIS AND HOW TO SOLVE IT

PREPARED FOR

EILEEN FISHER FOUNDATION BY PENTATONIC®

About this report

The Eileen Fisher Foundation commissioned this report to support the apparel industry to confront the climate crisis. Authored by Pentatonic, it focuses on the issue of textile waste and how circularity can be leveraged to effectively address it.

The report functions as a survey of the most recent, credible data and elevates the topic of textile waste by bringing together a diverse set of stakeholder voices actively working on the issue, translating these findings into tangible recommendations to propel the movement forward.

A key principle of the circular economy focuses on eliminating waste and keeping materials in circulation at their highest value. Offered within this report are a suite of priority actions for realizing circularity for the fashion industry at the necessary scale, ensuring they unlock the intended environmental and socio-economic advantages.

This report does not specifically address social issues; however, it does cover how the environmental degradation of textile production and waste directly impacts communities around the world.

EILEEN FISHER FOUNDATION

The Eileen Fisher Foundation inspires possibility by bringing people together to transform global systems for a better world.

PENTATONIC®

Pentatonic is a design and technology consultancy powering sustainable transformation for the world's leading brands. Their end-to-end expertise in the circular economy and sustainable innovation enables them to create holistic strategies rooted in firsthand experience to deliver lasting change in a range of industries.

A big thank you to the Eileen Fisher Foundation for making this report possible, the EILEEN FISHER, Inc. team for their continued enthusiasm and dedication to making a difference in the fashion industry, and all of our interviewees and contributors for taking the time to share your extremely valuable insights. Special recognition to Eileen Fisher for having the vision and courage to undertake this project and to Amy Hall for contributing her expertise in sustainable fashion.

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HEY FASHION

HEY FASHION!, founded by the Eileen Fisher Foundation, is a platform dedicated to elevating the issue of textile waste in the fashion industry. HEY FASHION! unpacks the following pages and presents them in an approachable, memorable way by translating the report into an achievable action plan designed for everyone. Join us and let's create a global movement to solve one of fashion's biggest challenges!

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As the leader of an apparel company, I feel an urgency to address the challenges the industry faces regarding textile waste, overconsumption, and circular design. By inviting Pentatonic to research the current state of circularity, my intention is to facilitate meaningful collective action that moves the industry forward.

Eileen Fisher, Founder

EILEEN FISHER FOUNDATION & EILEEN FISHER, INC.

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THIS REPORT IS INTERACTIVE

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Executive summary

Accelerating the transition to a circular economy in fashion requires substantial and urgent action from all stakeholders. It is no longer a question of *if* the industry will adopt circular strategies but *how*.

Human-induced climate change is already endangering billions of people. The latest IPCC Report, the starkest yet, warns that without *immediate* and *deep* emissions reductions across all sectors in the next 3 years, limiting global warming to 1.5°C is beyond reach. [1]

The quantity of clothing entering the market has expanded rapidly over the last decade with 150 billion new clothing items produced annually. [2] Currently, **the volume of clothing produced and discarded is growing at a faster rate than recycling facilities can process.** In addition, highly recyclable or compostable materials only represent a nominal share of the overall market. Textile waste is a global issue, with the negative environmental and socio-economic consequences of overproduction and consumption already widespread.

Beyond textile waste, the industry is also struggling to keep its emissions in check. Notably, the fashion industry is the third highest producer of greenhouse gas emissions globally. [3] Quantis estimates that apparel makes up 6.7% of the world's greenhouse gas emissions, rising to 8% when footwear is included, which is almost four times the estimated emissions from the airline sector. [4]

The fashion industry is failing to meet the 1.5˚C target outlined in the United Nations Paris Agreement by a staggering 50%, placing the industry on a 3˚C trajectory. [5] Swift, impactful change is essential to decarbonize the industry for the well-being of both people and the planet.

Businesses that embrace circularity will benefit from consumer support and government regulations alike and will be seen as more resilient and attractive for investments in capital markets. To alleviate pressure on already stressed natural resources, and improve lives and livelihoods of those in the global textiles system, integrating circularity into every level of the value chain will bring wider benefits if it is pursued in tandem with a rapid, global transition to renewable energy. The textile waste problem remains intertwined with a host of other systemic issues which needs to be addressed holistically.

Moving forward, how can circularity succeed in fashion? A key principle of the circular economy focuses on eliminating waste and keeping materials in circulation at their highest value. By promoting existing infrastructure, rapidly upscaling emerging technologies and pushing for circular business models that genuinely reduce consumption, stakeholders can drive forward collective change. Based on the research collected from over 50 interviews with prominent cross-sector stakeholders and a comprehensive literature review, this report seeks to uncover common barriers inhibiting progress and propose tangible, actionable recommendations specific to each group.

The following eight points represent the most important overarching actions to promote a systemic transformation in the fashion industry to tackle the growing problem of textile waste.

All eight priority actions must be pursued simultaneously in order to achieve the monumental change required to pivot the industry from linear business models to circular systems and collectively reach net-zero emissions in time.

01

SCALE COLLECTION & SORTING INFRASTRUCTURE

As more brands maneuver to find opportunities within the circular economy, investment in textile-to-textile recycling will become essential to create sufficient capacity and drive forward improved procurement practices. To unlock the huge potential of textile-to-textile recycling, large-scale investment is needed globally throughout the value chain, but particularly in collection and sorting. Funding and optimizing these operations enables all other technologies to scale at the necessary rate and benefits all levels of a functioning circular economy from resale, repair and recycling. Private investment plays a central role to deliver the scale of investment required. Government legislation can help expand current capabilities, create demand for high-quality feedstock and require brands to contribute, while incentivizing citizen participation.

To achieve a step change in sustainability through innovation by 2030, the fashion industry needs $20 billion to $30 billion of financing per year to develop and commercialize disruptive solutions and business models that will meet shifting consumer preferences and regulatory pressures. [7]

02

INVEST IN RECYCLING INFRASTRUCTURE

To mitigate future textile waste from entering the landfill or incinerator, fashion players need to concentrate their efforts on supporting both existing and emerging recycling facilities. Enabling textile recyclers to rapidly scale proven technologies from pilot stage to commercial scale will help minimize global textile waste from entering the landfill or becoming a product of lesser value. Equally supporting all types of recycling, from well-established mechanical recycling to emerging technologies, and considering all generated waste from post-industrial to post-consumer, will help promote a resilient circular economy for textiles. Private investment again plays a central role to deliver the scale of investment required.

To stay within a 1.5-degree pathway as recommended by The Intergovernmental Panel on Climate Change (IPCC), the fashion industry needs to bring the share of mechanically recycled (or equivalent) fiber or filament within the polyester market from 14% to 90% by 2030. [8]

03

REDUCE PRODUCTION & CONSUMPTION

The current pace of production is not sustainable. The current system is broken leaving behind environmental destruction and suffering communities in its wake. The next decade will define the fashion industry as brands decide if they will take action and uphold their commitments to a circular transition to mitigate their impact or if they will fail to meet the new global expectations. Brands need to scrutinize their current global footprint or risk financial and reputational decline. Citizens also have a part to play in shifting to circular systems and ways of engaging with fashion. Reducing consumption will help companies break free from conventional approaches to fashion and embrace new circular revenue streams.

Should growth continue as expected, total clothing sales will reach 160 million tonnes by 2050 — more than three times today's amount. [9]

Today, the average consumer buys 60% more pieces of clothing than 15 years ago. Each item is only kept for half as long. [10]

04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION

Cultivating robust, mutually beneficial relationships across the fashion value chain is essential to mobilize action. Achieving circularity will be beyond any one stakeholder — rather, it will require fashion businesses, suppliers, investors, governments, citizens and all other participants to work together to deliver well-functioning systems. A broad range of perspectives must be heard to ensure a balanced discourse delivering solutions that work on a global scale for both people and planet. Few brands have started to incorporate circular initiatives; however, these remain marginal parts of a linear system. Looking ahead, as citizens become more active in demanding circularity and policy evolves to favor those businesses, brands will need to rapidly launch circular models aimed at recapturing and reusing existing products and materials.

Our interviews with 51 prominent stakeholders revealed that 76% of all interviewees cited the importance of collaboration in achieving circularity.

05 DESIGN FOR DURABILITY & RECYCLING

Creating products within a circular economy requires a new, holistic approach to design. Longevity and recyclability are key. Quality garments built to last as long as possible need to be produced with materials capable of longer life spans, constructed in ways suited to repair if appropriate and ultimately in ways that make recycling or composting viable when the garment reaches its end-of-life. Encouraging a new generation of designers to work with these considerations front of mind offers an opportunity for collectors, sorters and recyclers to transform textile waste into new revenue streams or valuable materials. This process will require equal involvement from all stakeholders. Governments can kick-start this process through mandatory product warranties or repair services, extended producer responsibility (EPR) schemes which require companies to pay for the collection, sorting, and recycling of clothing they put on the market, and subsidizing preferred fibers.

Utilizing current textile-to-textile recycling technologies can deliver a 75% increase to circularity in the industry. [11]

Less than 1% of material used to produce clothing is recycled into new clothing. [12]

06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS

Governmental legislation can help regulate industry standards for investors and consumers to easily navigate and compare brand efforts. This will ensure brand accountability and diminish the probability of greenwashing. Without universal definitions and standards, brand commitments remain unchecked — proving to be misleading to the public. For brands leading the way in circular initiatives, standardization will provide a unique opportunity to publicly demonstrate their encouraging progress. Standardization will provide enhanced motivation for brands due to the potential risk of losing informed customers willing to make alternative choices. It could also foster smoother cross-sector collaboration with all stakeholders working from the same criteria and universal terminology.

When it comes to sustainability, about one third of the fashion industry has yet to take action at all. [13]

07 DIVEST FROM FOSSIL FUELS

Many sectors rely on fossil fuel and the fashion industry is no exception. Approximately 90% of companies' greenhouse gas (GHG) emissions come from their supply chain (coal-powered manufacturing and thermal coal, fossil fuel and fracked fabrics and shipping). [14] Divesting from fossil fuel is essential for the fashion industry to achieve net-zero emissions and a net positive circular economy. Brands that do so will have a competitive advantage in the mid and long term, and positively impact many of the other critical aspects of circularity. Brands with outsourced supply chains must support their partners' transition to renewable energy while reflecting on procurement practices which bring their goods to market. Furthermore, scrutinizing fossil fuel fibers used within their products and packaging, seeking appropriate alternatives or investing in solutions to handle synthetic textile waste will help mitigate the impacts of their use.

The industry in 2018 "produced 2.1 billion tonnes CO2eq. This represents 4% of global carbon emissions — an emissions' share larger than that of France, Germany and the UK combined." [15]

08 CHANGE THE METRICS OF SUCCESS

A circular economy is regenerative by design. Defining its success will need to be framed not only through financial metrics but by the improved health of communities and the ecosystems — measured through triple bottom line accounting. By valuing waste as a resource, calculating materials' true environmental and social costs and decoupling growth from resource consumption, companies should expect a complete overhaul of their business operations. Bold commitments with clear implementation strategies will help businesses, governments and investors navigate new ESG goals.

A report published by the European Regional Development Fund explained that from the "47 targets set in 2017 by brands for 2020, merely 11% of them were achieved by July 2019." [16]

Circularity when viewed as a whole has the potential to revolutionize the fashion industry and create impactful, positive change for people, planet and profit. Everyone has a role to play when it comes to minimizing and better utilizing textile waste. From brands to citizens, investors to governments, the final destination of textile waste needs to evolve beyond the landfill. Companies committed to embracing circularity will become leaders in the industry and demonstrate that sustainability can be more than just a marketing buzzword.

Original content from 50+ industry interviews

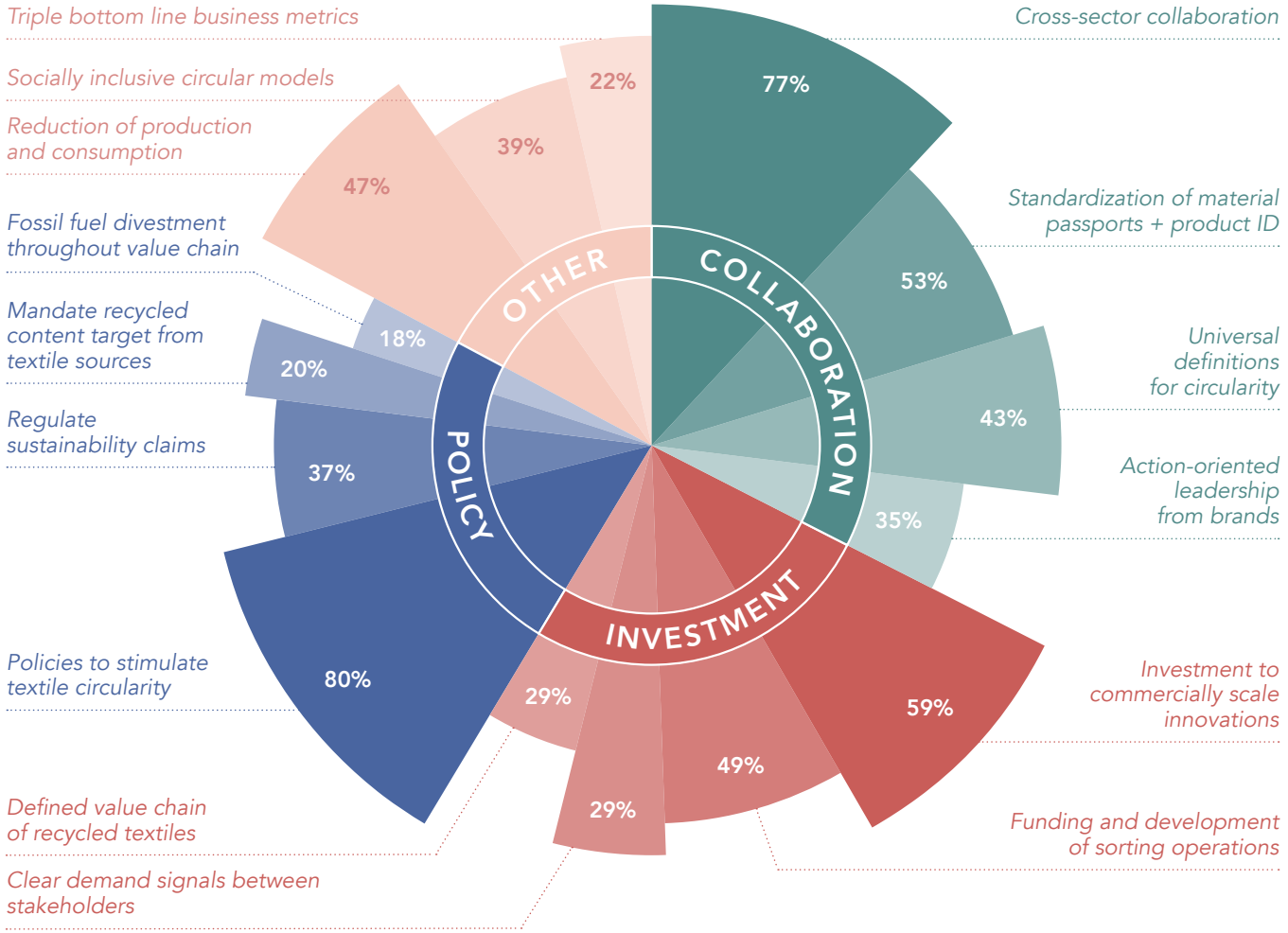
The following diagram represents the key themes identified by interviewees as needed to achieve circularity.

Interviewees were carefully selected across all spheres of influence, with an emphasis on supply chain, to provide expert insights on the topic of textile waste (for a full list of contributors see Research Methodology). They represent nonprofits, businesses, investors, policymakers, academia and other actors from across the fashion ecosystem.

The categories of collaboration, investment, policy and other encapsulate the main subtopics raised.

Sustainability initiatives can often create silos of information and knowledge preventing widespread collective action. By gathering all stakeholders from across the supply chain, the industry can work together to effectively combat the textile waste problem together.

FIGURE 1: CONTENT FROM INDUSTRY INTERVIEWS



Research methodology

THE RESEARCH WAS FRAMED AROUND THE QUESTION

What are the most tangible ways to increase global recycling from fashion industry waste?

SCOPE

This research captures the scale of fashion's waste crisis and how circularity can be leveraged to effectively address it. It explores the key strategies, infrastructure, regulations and financing needed to make a serious impact on the volume of textiles being produced and wasted.

Understanding the interconnected nature of circularity and the complex system of textile waste required expert insights from a broad range of perspectives. Prominent stakeholders were contacted from the entire fashion ecosystem including fiber-to-fiber recyclers, collectors, sorters and preprocessors, resellers, software providers, brands, government officials, independent scientists, investors and NGOs. Those contacted for an interview or a questionnaire provided key industry insights within the existing and emerging infrastructure, in addition to sharing their experience within the complex system of textile waste. All types of textile waste were considered within the scope of this report.

RESEARCH METHODS

1. Literature review
2. Industry analysis
   - Brands
   - Supply chain
3. Stakeholder outreach
   - Questionnaire
   - Interviews

LITERATURE REVIEW

A comprehensive literature review was conducted to capture the main topics of global textile waste and recycling. This included the most recent and credible white papers and reports, technical papers and academic journals, legislative reports, news sources and documentaries.

INDUSTRY ANALYSIS

This research was supplemented by a meta-analysis of brands' sustainability data and pledges, to contextualize the key themes within the current industry landscape and discourse around circularity.

BRAND SELECTION AND ANALYSIS

Phase 01

Over 200 brands were identified to provide an overall representation of the industry. The following factors were considered during this initial selection:

- All market levels across the following categories: luxury, fast fashion, mid-market and sports/outdoor
- Location of headquarters, ensuring a diverse range of geographic locations, with an emphasis on N. America and Europe
- Current market presence and brand equity
- Department stores were not included
- Group companies' complete brand portfolios were initially included

Phase 02

A further selection process then took place. Brands focused on circular initiatives, with the most publicly available data on their operations, and/or with largest revenues were prioritized.

32 brands were selected for deeper analysis:

Adidas, Allbirds, Arc'teryx, ASOS, Burberry, C&A, Chanel, Columbia, Forever21, GAP, Gucci, H&M, Hermes, Icebreaker, Levi's, Louis Vuitton, Lululemon, Mammut, New Balance, Nike, Pangaia, Patagonia, Primark, REI, Stella McCartney, Timberland, TJ Maxx, Under Armour, Uniqlo, Urban Outfitters, Zalando SE, ZARA

Sustainability reports (or equivalent) were analyzed to determine if the brands included specific targets and data on the following key topics: raw material usage, textile waste and circularity. For example, if brands offered year-round take-back or repair services, these were considered to be circular initiatives.

Brands' participation in industry working groups, standards or certifications were recorded. Additionally, any financial investments into textile recycling infrastructure or other circularity enabling businesses were recorded. Other publicly available rating systems were leveraged to further inform the current state of brands' sustainability performance. Brands were then evaluated based on: data transparency, data quality and specificity and measurable targets with associated timelines.

Collectively, this data provided important context on how the issue of textile waste is understood, communicated and strategized by brands.

SUPPLY CHAIN ANALYSIS

Detailed analysis of the global textile recycling supply chain was conducted, considering both existing and emerging infrastructure. Technologies specifically targeting recycling fractions were the focus, but all enabling service providers within textile circularity were considered. This covered:

- Collection / sorting
- Repair / resale
- Pre-processing / disassembly
- Downcycling
- Recycling (all types)
- Machinery providers
- Raw material processors / manufacturers

Over 250 suppliers were collated from a combination of Open Source databases, Pentatonic's expertise, reports and industry news. Their core service offering, material focus, operational location and, where available, processing capacity were recorded.

STAKEHOLDER OUTREACH*

ACADEMIA & RESEARCH
QUT
Circuvate
Mistra Future Fashion
The Footwearists

BRANDS
Another Tomorrow
Bestseller
EILEEN FISHER, Inc.
H&M Group
Nudie Jeans
Zalando

COLLECTORS & SORTERS
RE TEXTIL
Recuprenda
Salvation Army
Soge International
Texaid
Wear2Go

DIGITAL SERVICES**
Adnas
Avery Dennison
Clo Virtual Fashion
EON / Adetexs
Material Exchange
Reverse Resources
Sellalong
The Movement
Waste2Wear

GOVERNMENT
Dutch Environment Directorate
City of Austin, USA

INVESTORS
Alante Capital
Veronica Chou

NGO
Accelerating Circularity
Circle Economy
Circular Berlin
Fashion Revolution
STAND.earth
The Or Foundation
The Revival

RAW MATERIAL
Lenzing group
Noosa

RENTAL
Gemme Collective
POOL / Beat The Heat UG
Rotaro

RESALE
Archive Resale
KeptSKU
KIABZA
Lizee
Recurate
ThredUp

RECYCLERS
AITEX
BlockTexx
Circ
CuRe Technology
Evrnu
FastFeetGrinded
Giotex
Infinited Fiber Company
Jiangsu Yongyin Chemical Fibre
OSOMTEX®
PurFi
PWO Industries SDN BHD
ReBlend
Refresh
Renewcell
Säntis Textiles
Sateri
Södra / Once More
Spinnova
The New Denim Project, Iris Textiles
Triturats La Canya
Worn Again

MACHINERY
TOMRA Recycling

STANDARDS & CERTIFICATIONS
Cradle2Cradle
Textile Exchange

QUESTIONNAIRE

Five business areas were identified to target key stakeholders with the circular fashion supply chain and a bespoke questionnaire created for each. The questions featured multiple choice, short answer and long answer responses. The identified business areas were:

1. Sorting, repair and resale services
2. Rental or subscription services
3. Recycling operators
4. Machinery providers
5. Digital services*

To note: *While firsthand opinions help illustrate the collective thinking from stakeholder groups, they remain the views of the individual and do not necessarily represent the views of the publishing parties.*
** some contributors opted to remain anonymous and are therefore not included in this list.*
*** platforms facilitating resale but not physically handling clothing were categorized as digital services.*

INTERVIEWS

Interviewees were individually selected across all spheres of influence, with an emphasis on supply chain, to provide detailed insights on the textile waste crisis during a 60-minute interview. Over 51 interviews took place over the course of two months with many of the most influential businesses and senior fashion executives contributing from all over the world. Recyclers, sorters, non-governmental organizations, government officials, investors, industry associations and independent scientists all participated in interviews answering specific pre-set questions. The questions altered depending on the participant; however, the core themes remained the same — areas of progress, information gaps, areas of need and specific barriers being faced, with the ultimate aim of identifying where the biggest areas for impact lie.

RATIONALE

The literature review provided the background information necessary to identify key stakeholders and understand the current fashion industry landscape. Questionnaires and interviews helped reinforce findings from the literature review in addition to revealing specific challenges being faced by different groups. Featuring influential business professionals from each group helped provide a holistic and realistic view of textile waste and available solutions and collate expert insights.

EXAMPLES OF VARIOUS SOURCES USED AS PART OF THE LITERATURE REVIEW

B Lab (Certified B Corporations)
Ellen MacArthur Foundation
Fashion Pact
Fashion Transparency Index 2020
Global Recycled Standard (GRS)
Sustainable Apparel Coalition (SAC)
Sustainable Clothing Action Plan (SCAP)
STAND.earth fossil-free rating
STAND.earth materials grade
UN Fashion Industry Charter for Climate Action
2025 Sustainable Cotton Challenge (Textile Exchange)
2025 Recycled Polyester Challenge (Textile Exchange)

HOW TO READ

This report acts as a resource to guide readers through the complexities and opportunities of textile waste in fashion as well as supporting the industry itself and other critical groups on best practices moving forward.

For easy navigation, this report is divided into chapters covering the main stakeholder groups and topics. Each chapter begins with a quick overview of the contents and ends with a summary of the key themes, with specific recommendations linked to the eight overarching priority actions. These eight action areas were identified from the research collected across the main categories impacting the fashion industry: materials, supply chain, brands, citizens, governments and investors.

Whether you are on a brand's procurement team and tasked to source sustainable materials, an investor looking to capitalize on the growing recycled textiles market or a citizen looking to play your part, this paper seeks to support and provide you with information for your journey towards circular fashion.

Terminology

CIRCULAR ECONOMY	A framework designed to decouple economic activity from the consumption of finite resources, focusing on positive societal and environmental impacts. Its core principles are: • Eliminate waste and pollution • Circulate products and materials at their highest value • Regenerate nature • Transition to renewable energy and materials
DECARBONIZE	Refers to all measures through which an organization reduces their carbon footprint, primarily GHG emissions, in order to reduce impact on the climate.
DOWNCYCLING	To recycle in such a way that the resulting product is of a lower value than the original (e.g., shredding clothing into insulation).
ESG	Environmental and social governance (ESG) criteria are a set of standards beyond the typical financial factors that help companies make informed investment decisions. Investors are increasingly using this data and metrics to screen potential investments.
FAST FASHION	Inexpensive clothing produced by mass-market retailers, characterized by rapid speed to market, fast changing trends.
FEEDSTOCK	The specific raw material used to supply an industrial process — in this case, textile recycling. Source can vary but would likely be one of the three wastes explained below.
GHG EMISSIONS	Greenhouse gases are carbon dioxide (CO_2) and methane (CH_4) emitted from human activities which trap heat in the atmosphere resulting in global warming.
GREENWASHING	Marketing which misrepresents environmental impacts or benefits, leading people to believe that a company's products or policies are better than they are.
IPCC	The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.
MATERIAL CIRCULARITY	Refers to a material's ability to be circulated i.e., recycled multiple times. According to Fashion Positive, "circular" materials must have some content from existing recycled sources, such as pre- or post-consumer textiles, packaging or industrial byproducts. [17]

MMCF	Man-made cellulosic-fibers are conventionally derived from wood or sometimes other plant matter like bamboo. Wood is mechanically shredded before undergoing intense chemical processing to create cellulosic pulp which is dissolved to form a viscose solution then extruded into fibers.
NET-ZERO	Reaching net-zero emissions and becoming carbon neutral. Many companies across all industries have publicly declared targets to become carbon neutral by 2050.
PET	Polyethylene terephthalate, a fossil fuel derived polymer referred to as polyester when converted into textiles.
POST-CONSUMER WASTE	Used (textile) products generated by individuals or by commercial, industrial and institutional facilities in their role as end-users of the product. A highly mixed and complicated waste.
POST-INDUSTRIAL WASTE	The (textile) waste generated from manufacturing processes that can be directly used in the same process or by other producers and industries. Typically very clean, uncontaminated waste.
PRE-CONSUMER WASTE	Unused (textile) materials or finished products which have not reached the intended market, typically due to defects, damages, unsold stock, mismanagement of production or changing trends.
RECYCLING	The process of converting waste into commercially reusable raw materials.
SUPPLY CHAIN	All stakeholders involved in the process of producing and selling commercial products, from supply and processing of raw materials, product manufacturing, distribution and sale to end user.
SUSTAINABILITY	Meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, concerns for social equity and economic development are considered.
TEXTILE RECYCLING	The process of converting waste textiles back into different stages of raw material for reuse in textile materials. (See Chapter III).
TONNES VS TONS	Metric tonnes is a different form of measurement to tons. A ton is equivalent to 2,000 lbs, while a tonne is equivalent to 1000 kg
TRANSPARENCY	Fashion Revolution defines this as "the public discourse of credible, comprehensive and comparable data and information about fashion's supply chains, business practices and the impacts of these practices on workers, communities and the environment." [18]
TRIPLE BOTTOM LINE	A sustainability framework that measures a business's success in three key areas: people, planet and profit.
VALUE CHAIN	The process in which companies add value to raw materials to produce products eventually sold to consumers.
WASTE HIERARCHY	A waste management framework prioritizing efficient use of resources and reduction of environmental harm. Reduce → Reuse → Repair → Share → Recycle

CHAPTER I

Fashion industry landscape

From status quo to system transformation

- Current state of affairs
- Tackling consumption
- Leading producers and consumers of textiles and clothing
- Textile waste as a valuable resource
- Understanding the impacts of textile production
- Fashion and climate

Current state of affairs

Fashion is a multi-trillion-dollar global industry focused on newness and aspiration. Clothing production and consumption are at an all-time high, resulting in significant environmental damage evident throughout the complex global supply chain. [19]

Overall, the industry globally has made minimal efforts to address the mounting textile waste crisis with the urgency and scale required.

A complete transformation of the fashion industry will take substantial, urgent and collective action. Moving forward, if brands wish to remain competitive and meet the rising demands, investing in circularity must become a central strategy. The circular economy aims to minimize overconsumption, prevent waste, restore fragile ecosystems and rebuild an economy with a focus on people and the planet before profit.

Investing in circular opportunities and supporting innovative technologies remain fundamental for global transformation in addition to collaboration and profound behavioral change.

TOP-LEVEL FASHION INDUSTRY STATISTICS

CLIMATE HEADLINES

1.5°C

Fashion industry is failing to meet the 1.5°C pathway outlined in the UN Paris Agreement [20]

TEXTILE WASTE OPPORTUNITY

~80%

of all secondhand clothing is downcycled, exported or landfilled [21]

CLIMATE HEADLINES

THE FASHION INDUSTRY'S 2030 EMISSIONS REDUCTION TARGETS WILL BE

MISSED BY 50%

ON THE CURRENT TRAJECTORY [22]

PRODUCTION & CONSUMPTION

$500b

of value lost every year due to lack of recycling and clothes thrown into landfills before ever being sold [23]

160m

tonnes (estimated) of clothing sales reached in 2050 — more than three times the amount today [24]

60%

increase in the amount of clothes the average consumer buys compared to **15 years ago** [25]

TEXTILE WASTE OPPORTUNITY

14% › 90%

2022 2030

The fashion industry needs to increase the market share of mechanically recycled (or equivalent) polyester fiber or filament from 14% to 90% by 2030, to achieve the 1.5°C global warming pathway [26]

TEXTILE WASTE OPPORTUNITY

$4 billion

estimated cost in the United States in 2020 to collect and dispose of textile waste [27]

CLIMATE HEADLINES

UTILIZING TEXTILE WASTE HAS THE POTENTIAL TO DRIVE FORWARD CIRCULARITY AND HELP SCALE TEXTILE RECYCLING TO CREATE A

$10-20 billion

MARKET [28]

Tackling consumption

Over the last two decades, the fashion industry has changed drastically. Clothing was more expensive but lasted longer, resulting in fewer purchases and less waste sent to landfill. Globalization brought fashion to new corners of the globe and made affordable clothes accessible to more people.

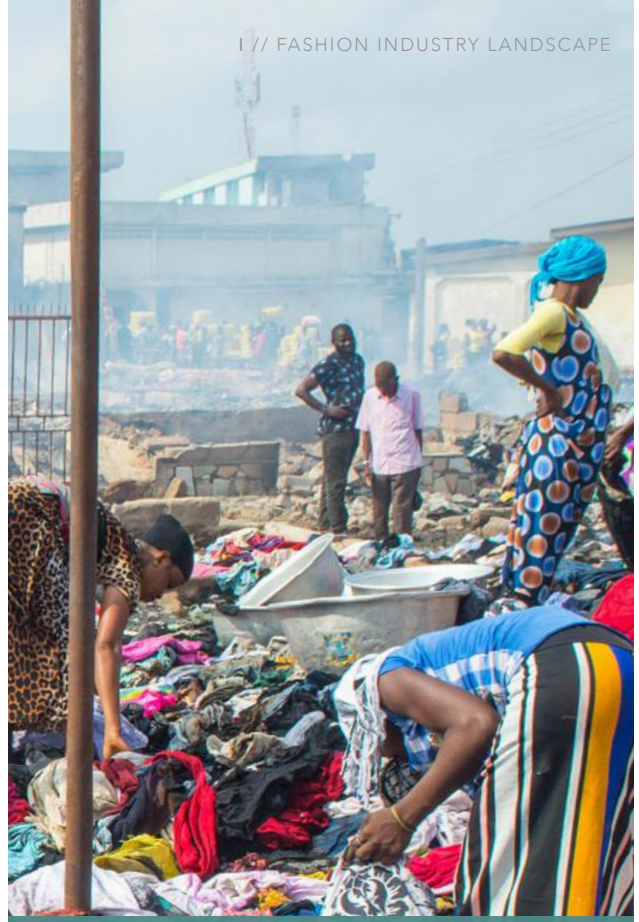
Today, many brands have developed models based on producing cheap, low-quality garments as fast as possible to maximize profits. The average consumer now buys 60% more pieces of clothing than 15 years ago and keeps each item for half as long. [29] The constant pressure to produce cheaply, coupled with globalization, has allowed brands to outsource production to factories scattered across the globe to utilize the cheapest workers. This has resulted in highly complex and fragmented global supply chains.

The fashion industry is **"valued at around $2.4 trillion and employs over 75 million people worldwide,"** [30] demonstrating its massive influence and financial power. However, it simultaneously **"loses about $500 billion of value every year due to the lack of recycling and clothes that are thrown into landfills before ever being sold."** [31] Emerging markets in Asia, Africa and South America will continue to drive demand putting pressure on the industry to adapt quickly.

> **"Should growth continue as expected, total clothing sales would reach 160 million tonnes in 2050 – more than three times today's amount."** [32]

To prevent further environmental damage and mitigate reputational risk, it is essential to move away from a take-make-waste model and shift to a circular system focused on keeping materials in use at their highest value for as many cycles as possible. The Ellen MacArthur Foundation estimates that **"less than 1% of material used to produce clothing is recycled into new clothing.** [33] **Additionally, approximately 12% of fibers are discarded on factory floors, while 25% of garments remain unsold."** [34] This indicates an opportunity for the fashion industry to innovate and combine efforts to minimize waste, circulate products and recycle textiles at their end-of-life. New technology, coupled with systematic change, can help pave the way to achieve the necessary changes needed to overcome the growing problem of textile waste.

This global emergency requires drastic change from all stakeholders.



<1% OF MATERIALS USED TO PRODUCE CLOTHING IS RECYCLED INTO NEW CLOTHING

12% OF FIBERS ARE DISCARDED ON FACTORY FLOORS

25% OF GARMENTS REMAIN UNSOLD

LEADING PRODUCERS AND CONSUMERS OF TEXTILES AND CLOTHING

- Globally, the United States, Germany, France and the United Kingdom were the largest importers of textiles, while China exported the highest number of textiles and clothing. [35]
- **In 2018, China exported almost 38% of worldwide textiles and 32% of all clothing.** [36]
- China generated 44 million tonnes of synthetic fiber or 70% of the world total in 2014. [37]
- The EU exported the second highest number of textiles and clothing. [38]

More frequently and in increasing volumes, textile waste is moving from high-income countries to low-income countries.

TOP EXPORTERS OF USED CLOTHING 2019 [39]

#1	USA	$720m
#2	UK	$496m
#3	GERMANY	$379m
#4	CHINA	$372m
#5	SOUTH KOREA	$312m

TOP IMPORTERS OF USED CLOTHING 2019 [40]

#1	UKRAINE	$203m
#2	PAKISTAN	$189m
#3	GHANA	$168m
#4	KENYA	$165m
#5	UAE	$151m

Monetary value represents the value of the goods entering or exiting the country.

Textile waste as a valuable resource

Textile waste is one of the biggest challenges facing the fashion industry today. Nevertheless, this challenge brings significant opportunity to transform previously wasted products into new resources and drive progress towards net zero.

A report published by the Global Fashion Agenda and McKinsey & Company found that **"existing recycling technologies have the potential to drive 80% circularity in the fashion industry if fully scaled."** [41] Scaling textile recycling can create a 10 to 20 billion USD market. [42] Processing textile waste results in positive environmental benefits and economic growth via investment opportunities and job creation. The good news is that accelerating circularity in the fashion industry is achievable by scaling preexisting technologies, and the race to reduce waste has already begun.

CURRENT PATH FOR TEXTILE WASTE

- In 2015, the Ellen MacArthur Foundation reported that globally, 73% of textile waste is sent to the landfill or incinerated. [43]
- In the United States, 85% of textile waste ends up in a landfill or incinerator. [44] It was estimated to cost approximately 4 billion USD in 2020 to collect and dispose of textile waste. [45] The remaining 15% of textile waste was collected for reuse and recovery. [46]
- Approximately 10-30% of donations given to charities in the UK, US and Canada end up being resold in the country of origin. [47]
- Clothes that cannot be resold again due to poor quality are usually downcycled into lower quality blankets and insulation or sent to the landfill. [48]

The United States sent **16.9 million tons of post consumer textiles** to the landfill in 2017, [49] while annually in North-West Europe (NWE) about 5.2 million tons of textile waste was discarded. [50] **Textile waste is expected to increase by 63% by 2030** due to the growing global population and an expanding middle class. [51] Implementing circular textile strategies on a global scale, while simultaneously building large-scale infrastructure to handle the growing volume of textile waste, is essential to driving change. Instead of sending more and more clothing to landfills or incineration, the industry needs to recognize that textiles are not "waste" but rather a resource — bringing both environmental and financial benefits, while increasing competitive advantage.

CASE STUDY

INDIA

Trucks carry bales of unsorted clothing from the port town of Kandla to the city of Panipat in northern India. Used clothing from the UK and US make up the majority of clothing items sent to India. [52] Panipat offers a range of services including options for sorting, bleaching, producing fiber, yarn and/or carpet for international export. This demonstrates the global scale of the textile waste value chain and reveals the high transportation emissions produced by the fashion industry.

CASE STUDY

GHANA, KANTAMANTO MARKET

The Kantamanto Market in Accra, Ghana is the largest second hand clothing market in the world, seeing approximately 15 million garments weekly in a country of just over 30 million people. [53] Kantamanto successfully recirculates a minimum of 25 million garments monthly through resale, repair and remanufacture. Still, Kantamanto cannot recommodify everything it receives. Roughly 40% of the average clothing bale opened there leaves as waste. [54] According to The Or Foundation, a not-for-profit working with the Kantamanto Market ecosystem to catalyze a "justice-led circular economy," clothing waste from the Kantamanto Market alone made up 20% of the planned capacity of the local (Kpone) landfill before it overflowed and exploded in 2019. With no sanitary landfill remaining, much of this waste is handled informally, burned out in the open or swept out to sea. [55] Moving clothing to landfills across the world does not make it disappear, it only transfers pollution to a different country – one not responsible for its creation in the first place.

> **"Most people working in this second trade market do not know the system that they're a part of, they've never been privileged to be a part of any conversation about circularity."**
>
> Liz Ricketts, Co-Founder & Director
> THE OR FOUNDATION

Not only are low-income countries forced to deal with the environmental repercussions of textile waste from higher-income countries, but imports often devastate the domestic clothing industry. [56] The Ghanaian government attempted an import ban of items such as secondhand undergarments in 1994 but regulating this on the receiving side is not feasible. [57]

According to The Or Foundation, the rising cost of secondhand clothing bales is an important factor impacting the Ghanaian community. Kantamanto Market retailers pay $120-1000 USD to purchase 55kg bales containing anywhere from 50-800 pieces of clothing. [58] Retailers are forced to take a financial risk with each bale as they cannot return mouldy, stained, or unsellable merchandise yet viewing the contents beforehand is not allowed. This results in many retailers taking out loans and The Or Foundation found that less than 18% of retailers return a profit on the average bale.

Yayra Agbofah, founder of THE REVIVAL, an upcycling non-profit organization in Ghana, shared his perspective on the quality of clothing entering the market. In his experience, containers sometimes include bales of winter clothing, which are largely unusable for resale in a warm climate, or extremely large sizes when most of the demographic is slender. **"From year to year, the clothes that come [to the Kantamanto market] are getting worse and worse in terms of the quality. And it's mostly from the fast fashion brands like H&M, Zara and Topshop. They are in really bad condition."** For Yayra, the problem is based on ignorance; "People from the Global North, giving clothing to charity shops think that they are doing something good and think that it's going to somebody who really needs it. That is not what is actually happening."

CASE STUDY

CHILE

African countries are not the only ones receiving waste from high-income countries. In Latin America, "Chile has long been a hub of secondhand and unsold clothing, made in China or Bangladesh and passing through Europe, Asia or the United States before arriving in Chile." [59] Some **59,000 tonnes** of clothing arrive each year at the Iquique port in the Alto Hospicio free zone in northern Chile." [60] Of the initial 59,000 tonnes of clothing arriving in Chile, about 39,000 tonnes are directly dumped in the desert because municipal landfills will not accept them due to the chemical composition and lack of biodegradability. [61]

High-income countries shipping their waste overseas not only perpetuates the problem of textile waste but separates the high-income consumer from understanding the impacts of their actions. Looking forward, citizens of emerging economies will be able to afford new items and not rely on secondhand options, escalating the problem further.

Understanding the impacts of textile production

FIGURE 2: THREE-TIER SUPPLY CHAIN MODEL AND GHG EMISSIONS PER TIER

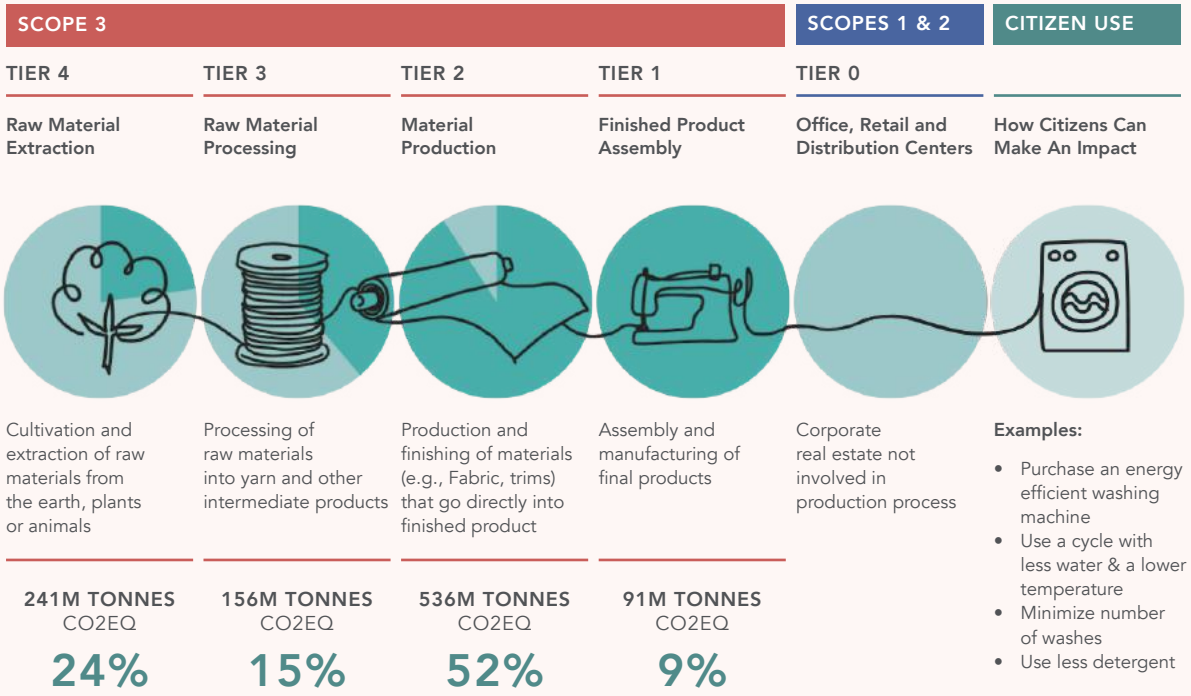


Figure 2 splits GHG emissions across each of the tiers of the supply chain. Clearly, the two biggest sources of emissions lie in Tier 4 — raw material extraction and Tier 2 — material production. As such, many of the solutions to reduce emissions presented in this report focus on these tiers.

Textile waste is only one piece of the puzzle when it comes to the environmental damage caused by the fashion industry.

Each step within the supply chain carries significant impact. Producing textiles and garments requires huge amounts of energy, water and toxic chemicals, directly harming the environment and human health.

This section outlines the key impacts, reinforcing the importance of valuing and circulating textiles within a climate of intensifying demand for declining resources.

1.3lbs (0.6KG) CO2EQ WASHED AT 86°F (30°C), DRIED ON THE LINE [62]

5.3lbs (2.4KG) CO2EQ WASHED AT 104°F (40°C), TUMBLE DRIED IN A VENTED DRYER [63]

GHG EMISSIONS

Stakeholders throughout the fashion value chain need to drastically reduce greenhouse gas emissions by 2030.

- The industry needs to reduce emissions by **1.1 billion tonnes of CO2 by 2030.** To put this in perspective, the industry produced 2.1 billion tonnes CO2EQ in 2018. The 1.5 degree target will be missed by 50% if drastic changes are not implemented immediately. [64]
- On average, **96% of emissions stem from Scope 3** (all supply chain operations), as illustrated by fashion brands following approved science based targets (SBTs). SBTs do not allow for carbon offsetting and give a truer picture of companies' emmissions. Scope 3 emissions often go unmeasured and unreported. [65]
- Within Scope 3 emissions, over **78% come from upstream emissions** — purchasing materials, goods and services, with the remaining **22% from downstream emissions.** [66]

WATER CONSUMPTION & POLLUTION

The fashion industry is highly dependent on water to produce textiles.

Responsible water management and reducing overall water consumption are important steps to protect people and the planet.

- **Cotton production directly contaminates water** systems from the runoff of pesticides, fertilizers and minerals negatively impacting biodiversity and human health. [67]
- Water consumption for crop cultivation differs regionally — **rain fed crops naturally consume less water** compared to conventional industrialized watering. [68]
- Discharging untreated production **wastewater from textiles** carries the polluted water directly into local rivers used for fishing, drinking or bathing. [69]
- Textile production requires dyeing and finishing processes, which generate significant amounts of toxic pollutants. Some estimates show that it can take up to **200 tons of fresh water per ton of dyed fabric.** [70]

It is important to note that it is incredibly difficult to manage chemicals due to the fashion industry's highly fragmented global supply chain. This represents problems for brands to effectively monitor and track chemicals within their products, and recyclers to safely and effectively circulate these products into new materials.

MICROPLASTICS

Microfibers are small plastic fibers shed from synthetic clothing and textiles during production, consumer use or end-of-life, which end up as pollution in the environment. [71]

Microplastics found in oceans, rivers and lakes are not only dangerous to human health but negatively impact entire ecosystems. The industry is being slow to measure and take action on this growing problem.

- **Textiles are now the largest source of global microplastic pollution** and have even been detected in the deepest parts of the ocean. [72]
- **17 of 22 blood samples from healthy adult donors contained plastic particles.** "Half the samples contained polyethylene terephthalate (PET) plastic, which is commonly used in drink bottles AND polyester textiles." [73]
- **Microplastics can take up to 450 years to disintegrate**, persisting in the environment and food chains long into the future. [74]

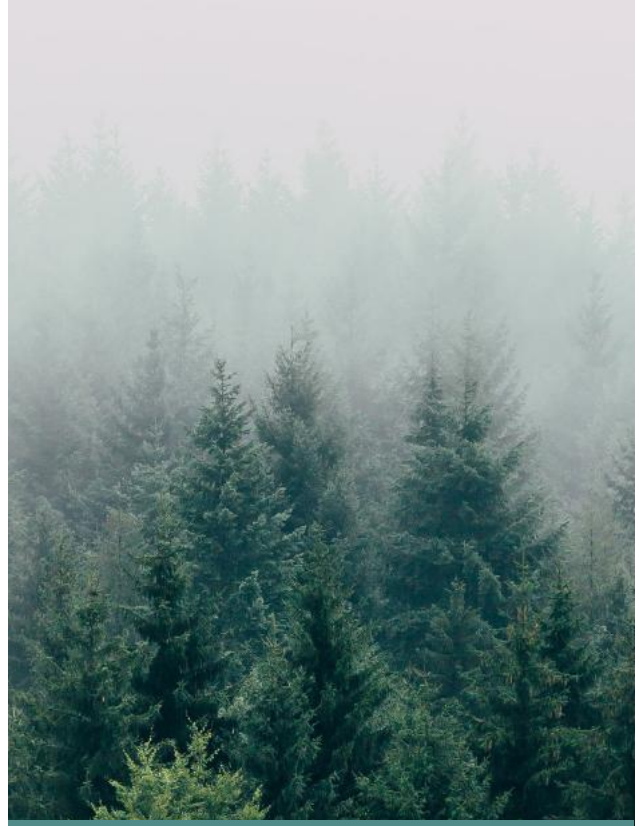
FOSSIL FUELS

Many sectors rely on fossil fuel to make products, and the fashion industry is no exception.

- Fossil fuel is the most common form of energy used to produce clothing. However, there is an increased interest and commitment to renewable energy sources such as solar, wind and nuclear energy. [75]
- Fossil fuels are used for mining, harvesting and processing secondary raw materials.
- Synthetic raw materials (i.e., polyester, nylon and acrylic) are directly petroleum based and require energy to transform the material into pellets, which are then melted down into fiber.
- Materials like cotton rely on fossil fuel based energy for the planting and harvesting of the crop, bleaching and dyeing textiles and the wet processing stage. [76]

> **Big brands will be forced to separate themselves from fossil fuels. I think the social license for brands to continue to have heavy reliance on fossil fuels is only going in one direction. Either you need to disconnect yourself from that, or you're going to lose your customers.**

Gary Cook, Global Climate Campaigns Director
STAND.EARTH



DEFORESTATION

Huge areas of land are cleared to cultivate raw materials for textile production. [77]

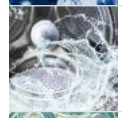
- More than 200 million trees are logged every year and turned into cellulosic fabric. If placed end-to-end, those trees would circle the Earth seven times. [78]
- Deforestation has wider consequences beyond harming wildlife and negatively impacting ecosystems — it reduces how many trees can absorb CO2, can lead to flooding, erosion, disrupt weather patterns and even impact the macro climate. [79]

CHEMICALS

Certain dyes and additives are released into the environment when clothing is produced, incinerated or landfilled. While controlling hazardous chemical inputs and outputs in manufacturing is increasingly difficult, keeping materials in the loop can offer a solution to minimizing the release of chemicals into the environment.

The list of chemicals below provides an overview of the type of chemicals found and where they are used within the fashion supply chain. [80]

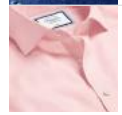
Lead
Used in the dyeing process



Nonylphenol ethoxylates (NPE)
Used in industrial washing

Phthalates
Used in printing

Perfluorinated compounds (PFC)
Used in water-repellent coating



Formaldehyde
Used in wrinkle-resistance treatment

KEY FACTS

- EPA Resource Conservation and Recovery Act labels textile manufacturing facilities as hazardous waste generators. [81]
- In China, 72 different toxic chemicals in polluted waters came from textile dyeing, of which 30 chemicals cannot be removed through wastewater treatment. [82]

Fashion and climate

CLIMATE CHANGE IMPACTING THE INDUSTRY

The fashion industry has already profoundly impacted ecosystems, resources and emissions globally and is projected to grow considerably in the coming decades. These impacts, while incredibly damaging to the health of communities and the natural environment, will also directly impact the industry's ability to cultivate, produce and distribute textiles. The Deloitte Climate Check survey indicated that nearly 30% of executives say their organizations **are already feeling the operational impacts of climate-related disasters and more than a quarter are facing a scarcity of resources due to climate change**. [83]

Production facilities have been outsourced to countries with higher risks of climate disasters such as fires, droughts, floods and hurricanes which will become more frequent and severe over time. With a finite amount of land and a growing global population, more land will be needed to cultivate food crops, deprioritizing textile crops like cotton. As water too becomes scarcer and more expensive, its use within the fashion industry will become more heavily scrutinized.

As stated unequivocally in the 2022 IPCC Report, the fashion industry, along with all over sectors, must make *immediate* and *deep* cuts to its emissions *within the next 3 years* to limit catastrophic global warming and future proof itself in this changing climate.

ENVIRONMENTAL IMPACTS OF TEXTILE PRODUCTION STATISTICS

WATER CONSUMPTION AND POLLUTION

1900+ chemicals used during the production of clothing were identified by The Swedish Chemicals Agency. 165 of these are classified as hazardous to health or the environment in the EU [84]

GHG EMISSIONS

26% of the carbon budget associated with a 2˚C pathway could be used up by 2050 if the industry continues on its current path [85]

MICROPLASTICS

ONLY **20%** of brands have published information on microplastics [86]

MICROPLASTICS

90% of the microplastics found in ocean surface waters on the west coast of Sweden consisted of synthetic textile fiber [87]

WATER CONSUMPTION AND POLLUTION

20% of the world's wastewater is generated by the fashion industry — the second-biggest consumer of water [88]

GHG EMISSIONS

90% of fashion companies' GHG emissions are from their supply chain [89]

DEFORESTATION

200m+ trees are logged every year and turned into cellulosic fabric. If placed end-to-end, those trees would circle the Earth seven times [90]

CONCLUSION

Fashion industry landscape

Building the case for circularity

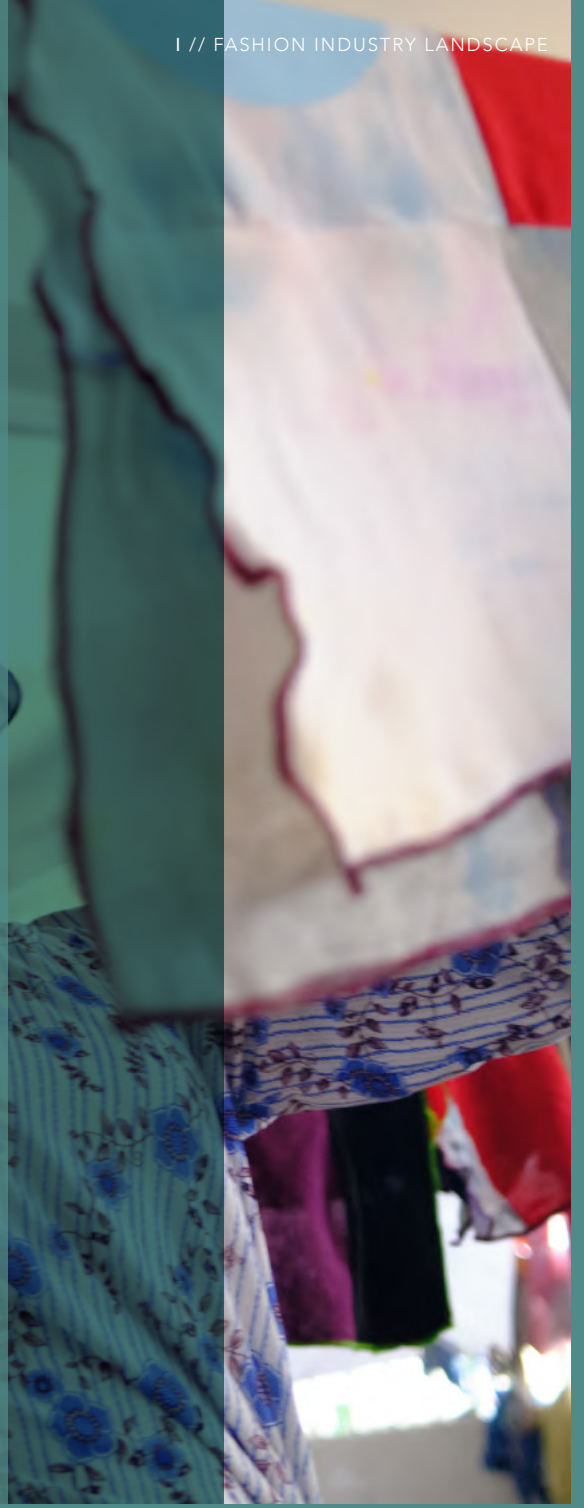
The next decade will define the next century of fashion. The timeline to achieve a complete overhaul of traditional businesses and switch to fully circular models is ambitious but possible.

Making fashion circular will not only improve the environment but drive economic growth and help secure the creation of new jobs around the world. Beyond the moral and environmental responsibility of transitioning to circularity, companies actively moving away from business as usual will protect themselves against the vulnerability of a failing fashion system and leap ahead of the competition. Brands that invest and act decisively on opportunities like textile-to-textile recycling will have access to abundant, affordable recycled materials and establish themselves as leaders in sustainable fashion. Those not taking meaningful action will be locked out of this new era of fashion and will struggle against incoming legislation and rising consumer demands.

The challenge of transitioning to a circular fashion system is daunting but the opportunities to succeed have been identified — the question is how everyone will play their part in moving the industry forward.

RECAP

- *Current levels of production and consumption of clothing are not sustainable*
- *<1% of materials used to produce clothing is recycled into new clothing*
- *The majority of textile waste is either landfilled, incinerated or illegally dumped in nature*
- *Downcycling of textiles into low value materials still represents the majority of textile recycling capacity globally*
- *High-income countries are exporting the problem of textile waste and the subsequent pollution to lower-income countries*
- *China produces and exports the most textiles, while the United States imports the highest number of textiles*
- *The current collective action by brands to reduce textile waste is falling drastically short of requirements to mitigate climate change*
- *Substantial commitments and urgent action are critical to achieve the safe 1.5˚C pathway set by the IPCC*



CHAPTER II

Material dilemmas

Where we are now and where we need to go

- Material matters
- Clothing composition
- Prevalence of polyester
- Recycled fibers
- Material obstacles
- Fiber commitments
- Emerging fiber technologies

Globally, 109 million tonnes of fiber were produced in 2020, compared to the 58 million tonnes in 2000. [91] Driven by the rise of fast fashion, it is projected that **within the next 10 years, global fiber production will increase by 34%**. [92] The fashion industry intends to "double its use of polyester by 2030." [93] The action to continue sourcing polyester allows the fashion industry to continue with "business as usual" despite the limited global capacity to recycle polyester clothing. Materials are a central unlock for circularity and their selection needs careful consideration alongside the technologies and infrastructure available to handle them. Brands investing in textile-to-textile recycling will have unique access to innovative recycled materials and gain important competitive advantages.

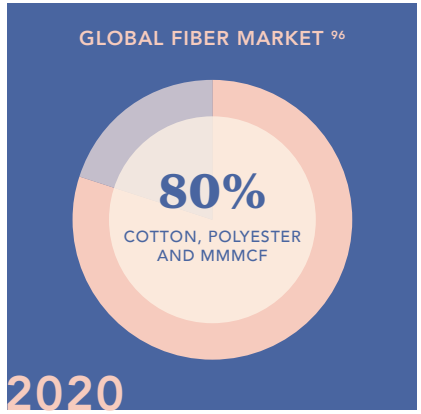
This chapter outlines the most common materials used to make clothing, where the industry is headed and the commitments brands can enact now to improve their raw material inputs. Each market segment in the fashion industry is dependent on certain materials that make up the majority of their textiles. The following table displays the most popular fibers used within different market levels.

TABLE 1: MATERIAL PREFERENCES ACROSS MARKET LEVELS

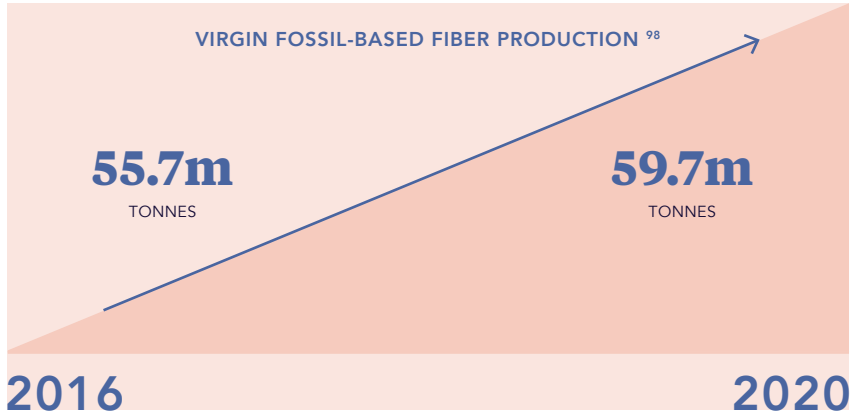
SPORTSWEAR	Polyester, nylon, elastane
FAST FASHION	Polyester, cotton, elastane
MID MARKET	Cotton, MMCF, polyester
LUXURY	Leather, wool, other animal fibers

In an effort to reduce GHG emissions, the Textile Exchange launched a climate strategy in 2020 to encourage brands and other actors in the textile supply chain network to commit to a **reduction goal of 45% by 2030 in the pre-spinning phase** of textile fiber and materials production. [94] This announcement also hoped to focus the fashion industry's efforts on tackling issues interconnected with climate such as water biodiversity and soil health. [95]

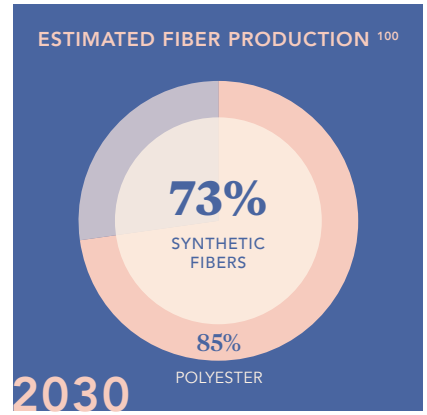
Material matters



Polyester and cotton are globally the most common fibers used to produce clothing and have been projected to remain in high demand into 2030 [97]



The production of synthetic fibers currently accounts for 1.35% of global oil consumption, which exceeds the annual oil consumption of Spain [99]



Clothing composition

Cotton

Cotton is the most profitable non-food crop globally. China, US and India produce the highest quantities of cotton available on the global market. [101] China accounts for almost 26% of the total exported cotton globally. [102] Areas used to grow cotton will become increasingly more vulnerable to climate change related events like droughts, which are predicted to increase not only in volume but in severity. [103] The US is already a water stressed region and the cultivation of cotton is expected to be severely impacted.

Cotton fiber is selected for clothing due to its breathable, comfortable and dye absorbent properties. [104] Cotton wrinkles easily and mixing polyester with cotton helps solve this specific problem, in addition to driving down cost. [105]

A natural fiber like cotton comes with its own negative environmental impacts due to the current conventional farming methods which rely heavily on fertilizers, pesticides, high water use and land use. [106] In India, particularly, most farmers participate in residue burning to prepare the field for the next crop rotation. [107]

Smoke from burning crop residues kills two people per minute, releasing twice as much CO2 as aviation. [108]

Polyester

Continuing to use polyester in fabric perpetuates the need for fossil fuel and large quantities of energy use necessary for extraction. Virgin polyester has many environmental disadvantages like generating three times more CO2 emissions than cotton. [109] However, a few advantages include a lower water footprint when compared to fibers like cotton. Polyester requires a lower temperature when washed, dries quickly and requires limited care resulting in lower overall energy consumption. Chemically, polyester can be recycled into pellets and then made into new polyester fibers without reducing the quality of the product over time. [110] Polyester negatively impacts the environment through the release of microplastics into the water system during the cleaning phase.

> **"There's a connection between the boom in fracking in many parts of the world and the production of polyester."**
>
> Muhannad Malas, Senior Climate Campaigner
> STAND.EARTH

Manmade Cellulosic Fibers (MMCFs)

MMCFs originate from dissolved wood pulp from trees. MMCFs represent about 6% of the total global market share, with 6.5 million tonnes of fiber produced. [111] Viscose holds the largest share of MMCFs with 80% of the share compared to acetate with only 13% of the market. [112] Lyocell, modal and cupro make up the remainder. Certifications for socially responsible forestry like FSC or PEFC made up 55-60% of all MMCFs in 2020. [113] Research and development to recycle MMCFs is ongoing but is expected to increase rapidly in the near future.

WHY ARE FIBER BLENDS COMMON?

Material blends are typically used to enhance the appearance or improve the durability of textiles, while offering an opportunity to cut costs.

Blending cotton (or any other fiber) with polyester reduces the overall price of the garment, but significantly complicates the end-of-life options for biodegradability and recycling.

The higher the number of fibers blended, the lower the probability that any of them will be recovered.

FIGURE 3: GLOBAL FIBER PRODUCTION PROJECTION FROM THE TEXTILE EXCHANGE

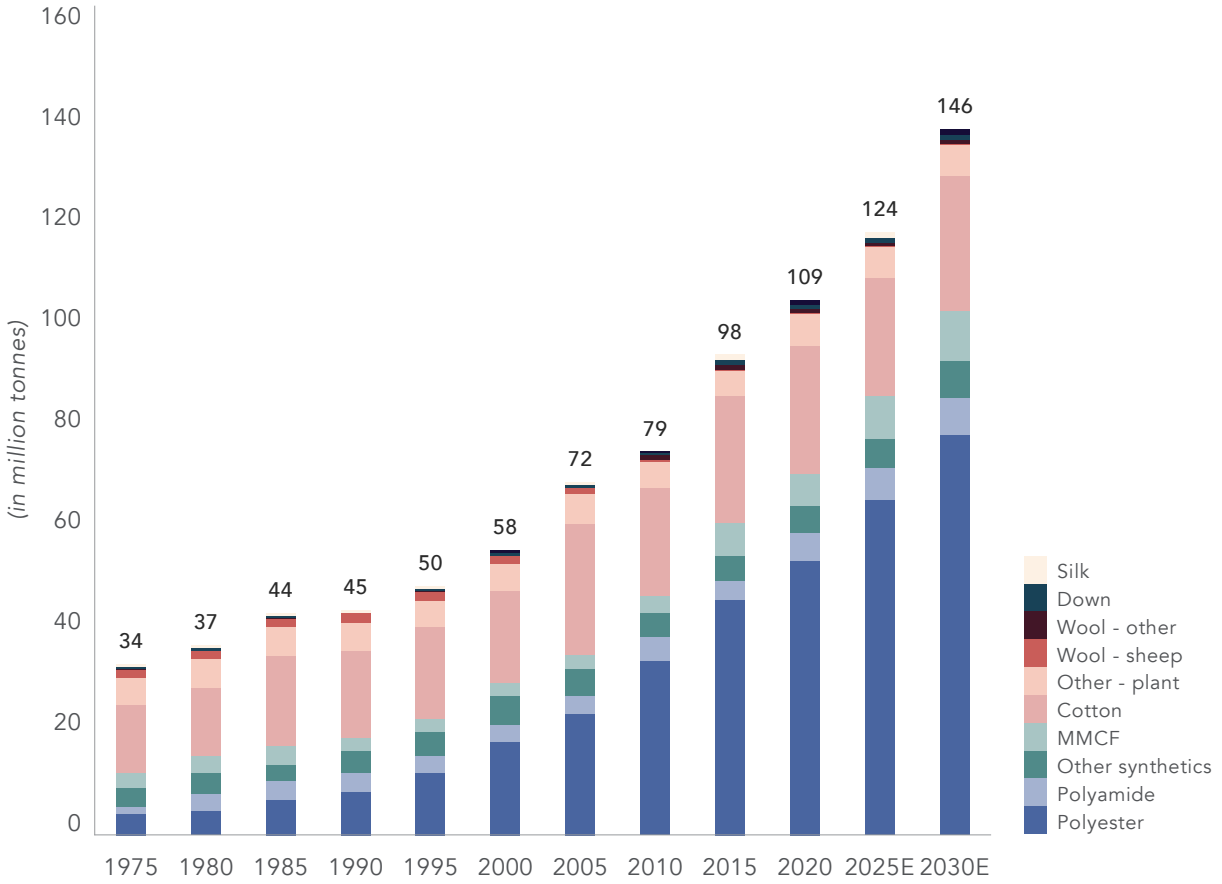
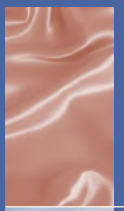


TABLE 2: MOST COMMON FIBERS ON THE MARKET [114]

Synthetic fibers	Polyester, polyamide, polypropylene, acrylics and elastane	**Animal fibers**	Wool, down and silk
MMCF	Viscose, acetate, lyocell, modal and cupro	**Plant fibers**	Cotton, linen, hemp and jute

CLOTHING COMPOSITION

Polyester and cotton, the most common fibers used to produce clothing, are here to stay for the foreseeable future. *How we manage them is key.*



Polyester in 2020 [115]

52% *of the global fiber market*

57m *tonnes of production volume*

Cotton in 2020 [116]

30% *of the global fiber market*

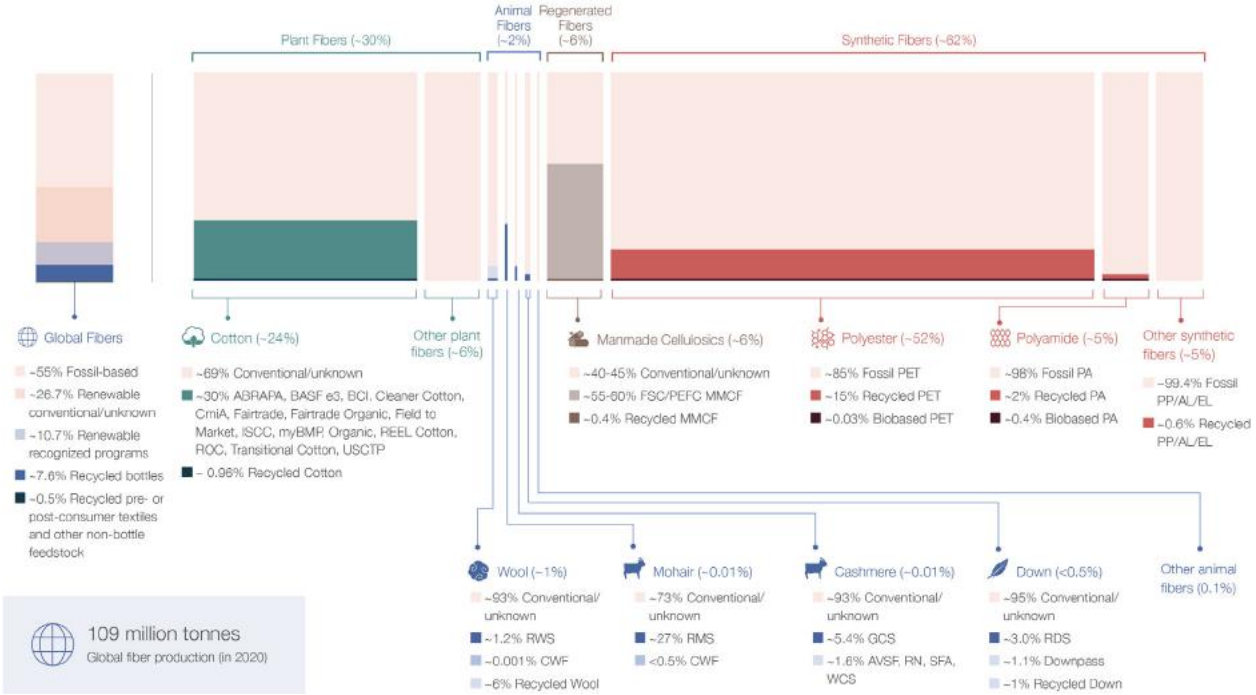
26.2m *tonnes of production volume*

Fashion Revolution, a nonprofit campaigning for a clean, safe, fair, transparent and accountable fashion industry, created a campaign called **#whatsinmyclothes**. [117] This seemingly simple question highlighted the fact that even brands themselves are not always certain about the chemical or material composition of their clothing. Without a clear understanding of the material composition of clothing, it is difficult for recyclers to accept many garments as feedstock for their process.

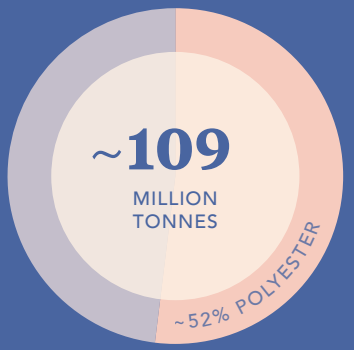
Prevalence of polyester

Although many brands have introduced circular initiatives to address materials in their clothing, the overwhelming majority rely on virgin fossil fuel based materials.

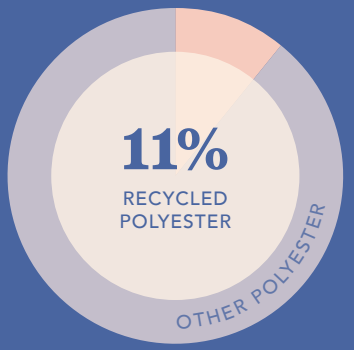
FIGURE 4: GLOBAL FIBER PRODUCTION IN 2020 FROM THE TEXTILE EXCHANGE



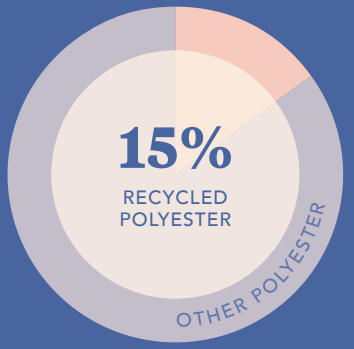
GLOBAL FIBER PRODUCTION 2020 [118]



MARKET SHARE OF RECYCLED POLYESTER 2010 [119]



MARKET SHARE OF RECYCLED POLYESTER 2020 [120]



> This is one of the greatest design challenges of our century. How do we take the things that are currently going to landfills or incinerators and turn them into useful, beautiful products?

Stacy Flynn, Co-Founder and CEO // EVRNU

Recycled fibers

Brands and investors that utilize and invest in recycled fibers will stamp out the competition and accelerate the transition to circularity. According to the Textile Exchange, recycled fibers are considered to be "preferred fibers" due to the environmental benefits of recycled content compared to extracting virgin fibers. **Recycled fibers represent only one fifth of the global fiber market**; however, the demand for recycled fibers is increasing in popularity. [121] Significant effort is required to ramp up efforts to incorporate more recycled content from textiles. This represents a massive opportunity for brands to break away from the competition and deliver superior materials.

The market share of recycled fibers increased from 6.9% in 2016 to 8.1% in 2020. [122] This increase in recycled fibers can be mainly attributed to recycled PET bottles which made up the majority of the recycled feedstock.

With less than 0.5% of the global fiber market from pre- and post-consumer recycled textiles in 2020, there is a clear gap in the recycled feedstock from sources other than recycled PET bottles. The fashion industry needs to procure recycled textile feedstock and support the necessary infrastructure to produce recycled content.

Dr. Ashley Holding, Founder of Circuvate, explained that the fashion industry needs to understand the importance of recycled content in clothing. Dr. Holding explained that "most brands with recycled polyester targets are achieving this target through utilising packaging waste or PET bottle waste." He stressed that this approach "doesn't really stimulate fiber to fiber recycling and it doesn't encourage any investment in the supply chain to actually recycle the textiles after they've been made."

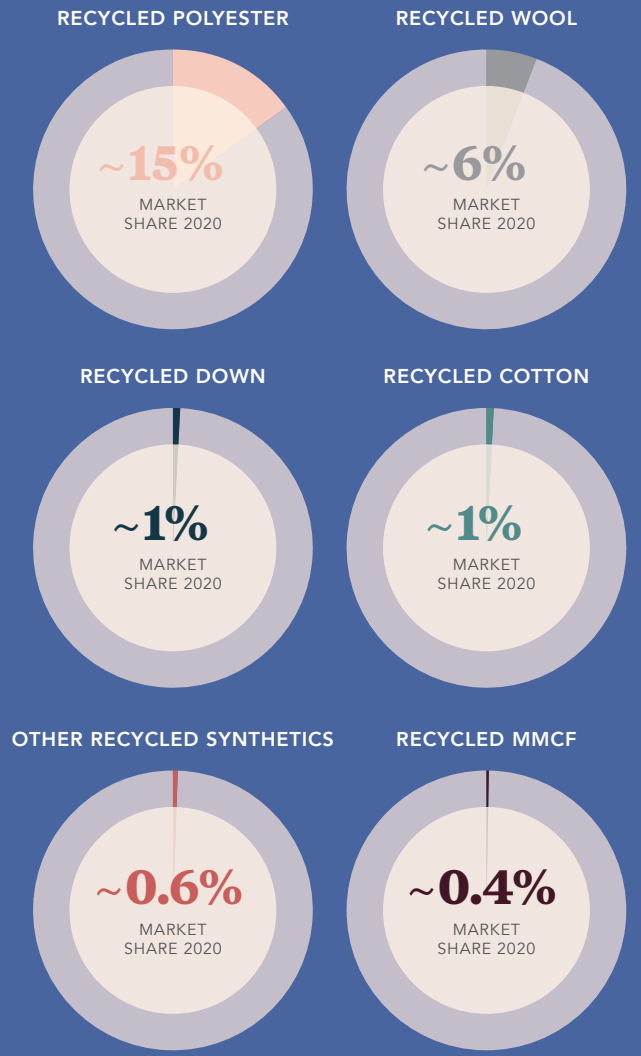
Recycled polyester

Recycled polyester is the most common type of recycled fiber with approximately 8.4 million tonnes produced for textiles. [123]

To increase the production of recycled polyester, the Textile Exchange and the UN Fashion Industry Charter for Climate Action created a "2025 Recycled Polyester Challenge" in 2021 to help stimulate the recycled polyester market. [124] Over 100 brands and suppliers (including subsidiaries) signed the challenge, signaling a widespread interest from brands to show citizens that they are committed to incorporating recycled polyester into their products; however, brands often did not stipulate the source of their recycled polyester.

Based on the research found in the Textile Exchange, recycled PET bottles represent the main source of recycled polyester.

DATA FROM THE TEXTILE EXCHANGE PREFERRED FIBER & MATERIALS MARKET REPORT



The goal of the "2025 Recycled Polyester Challenge" is to increase the share of recycled polyester to 45% by 2025, which is an ambitious goal considering that recycled polyester only made up 14.7% of the market share in 2020. [125] Ideally, brands should not directly compete with the packaging industry but instead, procure recycled content from textiles.

Using recycled PET bottles as a fiber source is a problematic and short-term solution. The fashion industry uses recycled PET bottles because it is a high-quality form of PET, which does not contain dye and has the potential to reduce overall greenhouse gas emissions. However, taking PET bottles away from the plastic industry to make textiles does not solve the growing problem of textile waste. It also allows the fashion industry to promote sustainability without taking responsibility for its own waste.

Recently, many fashion brands have produced public relations campaigns demonstrating a commitment to reducing plastics by using ocean plastic as textile feedstock. [126] Although removing ocean plastic is a noble endeavor, it fails to address the fashion industry's role in contributing to plastic waste in the ocean.

IPCC recommends a 1.5˚C-degree pathway to prevent irreversible and devastating changes to the health of the planet.

To stay within this target, the fashion industry needs to bring the share of mechanically recycled (or equivalent) fiber or filament within the polyester market from 14% to 90% by 2030. [127]

Brands have a significant opportunity to differentiate themselves from competitors. Brands that source textile-to-textile recycled polyester, compared to PET bottles, will be unique in the fashion industry and mitigate future material risks.

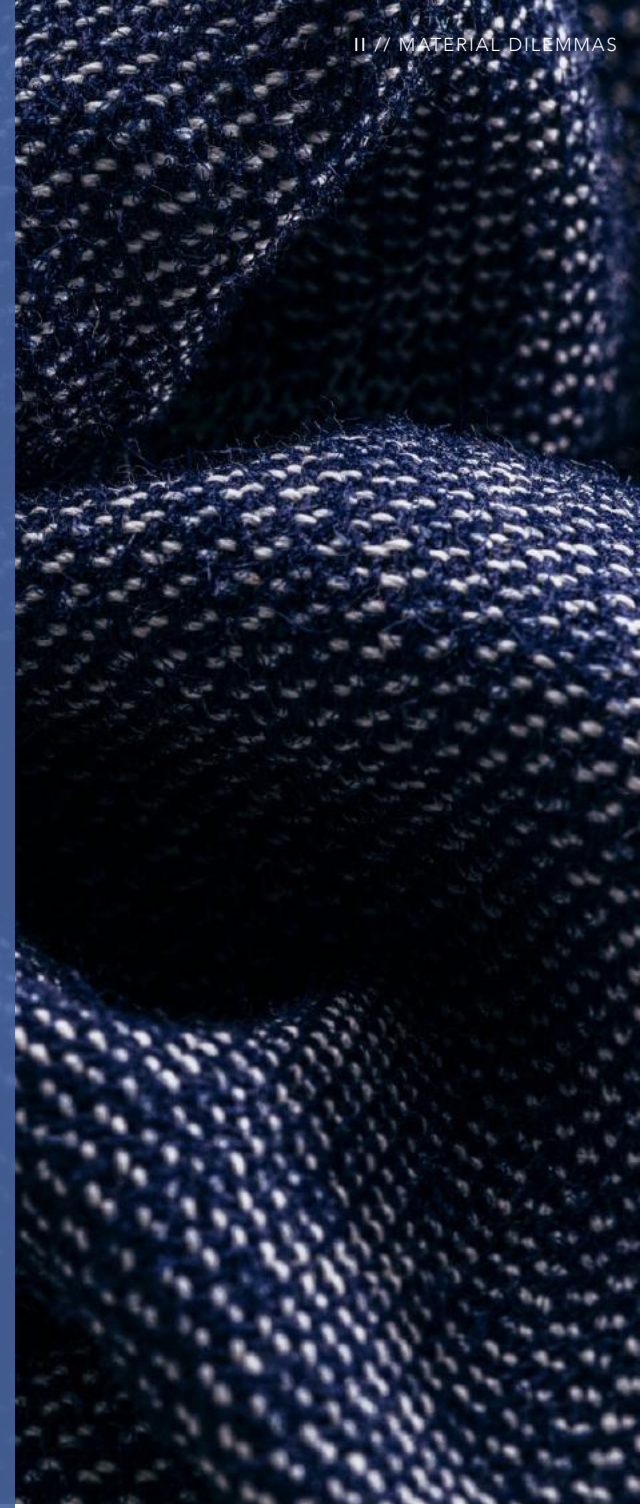
Recycled cotton

Recycled cotton accounts for about 0.96% of the total cotton production in 2020, with 255,000 tonnes produced in 2020. [128] With 99% of the global cotton market in 2020 comprising virgin cotton, there is significant opportunity to expand production of recycled cotton.

Recycled cotton refers to the process of mechanical recycling, not to be confused with chemical recycling of cotton, where it is transformed into an MMCF.

Recycled wool

The production volume of recycled wool is estimated at 70,000 tonnes and holds 6% of the wool market share. [129] Recycling wool has been a century old practice in Prato, Italy with a well-established value chain and consumer market. In Prato alone, 22,000 tonnes of wool are recycled annually. [130] India and China are also increasing their recycled wool capacity. [131]



Material obstacles

LACK OF TRANSPARENCY

Highly fragmented supply chains with suppliers spread around the world can make it difficult to create transparency from raw material to final product.

Transparency appears to be most challenging within the fast fashion context. The combination of large product ranges with increased speed to market complicates the process of accurately recording the exact content of each item. For example, Shein pushes 6,000 new items online daily, [132] and Zalando produces more than 150,000 products per season. [133]

Furthermore, while chemicals are monitored through restricted substance lists and regulated through national and regional laws, capturing comprehensive data on exactly which chemicals are used in all processing phases is a bigger challenge. A 2021 study conducted by The University of Toronto tested clothing from fast fashion retailers Shein, AliExpress and Zaful. [134] After evaluating 38 samples, the research found that the clothing contained elevated levels of potentially hazardous chemicals. In particular, **a children's jacket by Shein had almost 20 times more lead than is considered to be safe for children,** according to Canada's health agency standards. Chemist and environmental professor at the University of Toronto, Miriam Diamond commented: **"People should be shocked. This is hazardous waste."** [135]

Josse Kunst, Chief Commercial Officer at textile recycler CuRe Technology, expressed that:

> **"There is often inadequate or inaccurate information for the bill of materials for clothing. With food you need to indicate exactly what's in it. But with clothing, you can get away with mentioning something totally incorrect. That needs to change."**

Current legal requirements for product labeling are not sufficient to support a circular economy for fashion, demonstrating the importance of regulations to drive change, such as the new mandatory digital product passports from the EU legislation on the Ecodesign for Sustainable Products Regulation and review of the EU Textile Labeling Regulations (see Chapter VI).

To counteract a lack of transparency, standards and certifications can provide a credible and traceable solution. For example, organically produced textiles must adhere to much stricter criteria to be verified as organic (GOTS, Global Organic Textile Standard). Certified organic textiles have restrictions throughout the production stages including wet processing, often the most chemically intense. [136] GOTS approved inputs come with an assurance of being free from hazardous substances, meeting environmental criteria, as well as low toxicity and high biodegradability. This can be beneficial within a circular economy to more safely recycle organically produced textiles. Transparency and traceability for all textiles would raise the playing field and create more reliable foundations for textile circularity.

Many companies have emerged offering technologies supporting transparency and traceability (see page 48). Equipping suppliers and brands with tools to authenticate and track goods from the raw material to production through to end-of-life phase, coupled with policies promoting widespread standardized labeling, will empower all stakeholder groups to better manage clothing and textiles through a circular value chain.

Universal definitions

BRAND FIBER COMMITMENTS

The following quotes are from five anonymous brands. However, many more brand sustainability reports feature similar language when addressing their material targets.

"Currently developing apparel collections using **environmentally friendly materials.**"

"Products made from recycled or **more sustainable materials** by 2030."

"By 2030, we aim for 100% of our materials to be either **recycled or sourced in a more sustainable way**, including our new goal of 30% recycled materials by 2025 — to further accelerate use of recycled fibers."

"In 2023, 100% of our cotton and cellulosic fibers will be sustainable, as well as linen and polyester will be **sustainable or recycled** in 2025."

"Our clothes will be made from **recycled or more sustainably sourced materials** by 2030."

It should be noted that many brand websites and sustainability reports do not include definitions allowing the reader to understand what the company defines as "more sustainable" or "environmentally friendly." To solve this problem, brands need to include definitions for terms like "recycled" or describe specific materials that will be phased out to meet their targets.

> **"We need to move to textile-to-textile recycling. Full stop."**
>
> Josse Kunst, Chief Commercial Officer
> CURE TECHNOLOGY

H&M launched a "Conscious Collection," which is supposed to promote recycled material use and contain a minimum of 50% recycled content. However, "a Conscious Collection dress contained 'Polyester 52%, Polyamide 20%, Viscose 15%, Cotton 10%, Wool 3%.' Overall, with 72% of the garment made from synthetics and a fiber mix extremely difficult to separate in recycling, it is questionable why it has been identified as a part of the "Conscious Collection." Yet another item in the "Conscious Collection" includes a pair of trousers made of 100% polyester, **none of which is recycled**, demonstrating the need for fact-checking and scientific evidence to back up sustainability claims. [137]

TEXTILE EXCHANGE FIBER COMMITMENTS

During COP26, a UN Climate Change Conference, the Textile Exchange made a request to all governments at the conference. The request stated that over 50 companies and organizations supported the use of trading mechanisms to promote the production of environmentally preferred materials in textiles. [138] The signatories indicated that cost was one of the key challenges in transitioning to preferred materials and with a trade policy in place, companies would have the financial incentive to source environmentally preferred materials. [139] This public commitment to support the Textile Exchange and help them reach their goal of a 45% reduction in GHG emissions in the pre-spinning phase of textile fiber and material production by 2030 indicates the growing interest from brands to improve their material composition.

Emerging fiber technologies

Decarbonizing textiles will need to go beyond recycling of the current dominant fibers.

Sustainability centric textile engineering is a burgeoning market, promising innovative alternatives to diversify from cotton and polyester. This table provides a snapshot of next generation materials being developed and commercialized, with lower environmental impacts, utilizing different waste streams or renewable sources, and optimized for circularity from the outset.

FIGURE 5: PROJECTION OF GROWTH OF THE NEXT-GEN MATERIALS GLOBAL WHOLESALE MARKET

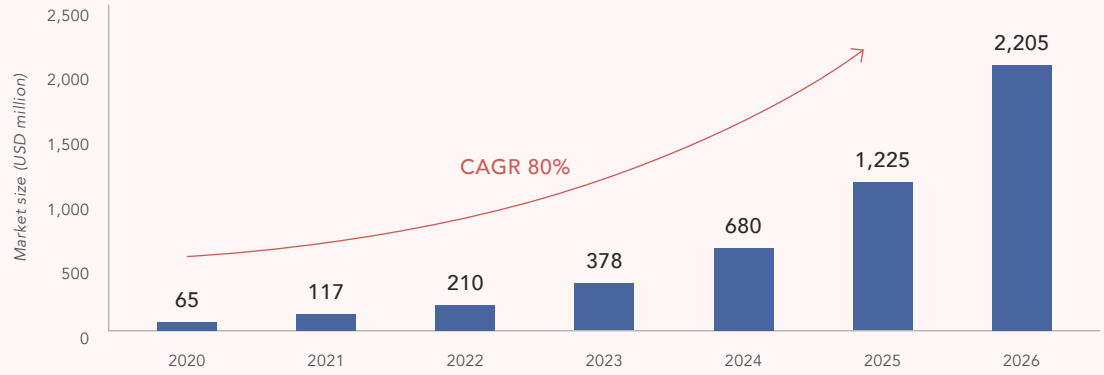


TABLE 2: EMERGING FIBER TECHNOLOGIES

COMPANY	CORE MATERIAL	RENEWABLE	WASTE FEEDSTOCK	COMPOSTABLE	CIRCULAR	ABOUT
Spinnova *Finland*	Wood	✓			✓	**Spinnova**'s breakthrough technology produces textile fiber from wood or waste textiles without the dissolving or harsh chemical processes usually associated with MMCF. The potential for circulating fibers back through the same process to regenerate them is equally promising.
Kraig Biocraft Laboratories *US*	Silk protein	✓		✓		**Kraig** has exclusive rights to use patented spider silk gene sequences in silkworms. They are commercializing genetically engineered spider silk technologies, a next generation bio-polymer replacement for high performance technical textiles typically produced from virgin synthetic fibers.
KINTRA FIBERS *US*	Sugar	✓		✓		**Kintra** developed a proprietary bio-based and compostable polyester alternative derived from sugar. Designed to replace conventional polyester and be digested to CO2 and water within wastewater treatment facilities, it simultaneously solves the need for fossil fuel extraction and the issue of microplastics.

COMPANY	CORE MATERIAL	RENEWABLE	WASTE FEEDSTOCK	COMPOSTABLE	CIRCULAR	ABOUT
MANGO MATERIALS *US*	Methane gas	✓	✓	✓		**Mango Materials** is producing a bio-based polyester alternative utilizing methane, the potent GHG emissions, as feedstock. This PHA biopolymer is fully biodegradable and can be optimized for different end-of-life environments, including safe marine biodegradation, leaving no trace of microplastics.
FLOCUS *Netherlands*	Plant fibers	✓				**FLOCUS™** is producing yarns made with Kapok, a nonfood fruit crop whose woolly seed pods can be harvested without damaging the tree. Kapok trees grow easily throughout the tropics on land unsuitable for agriculture and need no irrigation, pesticides or fertilizers — resulting in an incredibly low footprint.
QMILK *Germany*	Milk waste	✓	✓			**QMILK** is a leading producer of fibers from milk proteins. The milk is a wasted byproduct of the dairy industry and not suitable for food. Their patented upcycling process generates 100% natural, functional fibers similar to silk and offers an alternative to blending textiles with polyester or viscose.
The Hurd Co. *US*	Agro waste		✓			**The Hurd Co** has developed a MMCF from agricultural waste rather than virgin wood pulp. Their agrilose™ pulp utilized plant materials that are normally wasted or burned after harvest to offer tree-free lyocell in a zero-waste process.
Galy *US*	Lab grown	✓				**GALY** is a biotech start-up focused on cellular agriculture. They produce lab-grown cotton from cells, rather than plants in a field. Cotton is the focus, but the process could extend to a multitude of crops, challenging the global dynamics of textile fiber cultivation.
HEIQ *Switzerland*		✓	✓		✓	**HeiQ** is a speciality textiles innovator. Their latest development is a new class of cellulosic fiber derived from multiple low-grade cellulose inputs including pre- and post-consumer textile waste. It is being marketed as a bio-based alternative to synthetics.
CLARUS® *US*		✓				**NFW** has commercialized processes which enable natural fibers like cotton, flax, silk and wool to compete with high performance synthetics. CLARUS® is based on intermolecular bonding of natural polymers, effectively lengthening and strengthening fibers for Performance without Plastic™.

CONCLUSION

Material dilemmas

Where we are now and where we need to go

The material composition of clothing will become of prime importance as brands transition to more circular models and respond to enhanced regulation and public scrutiny.

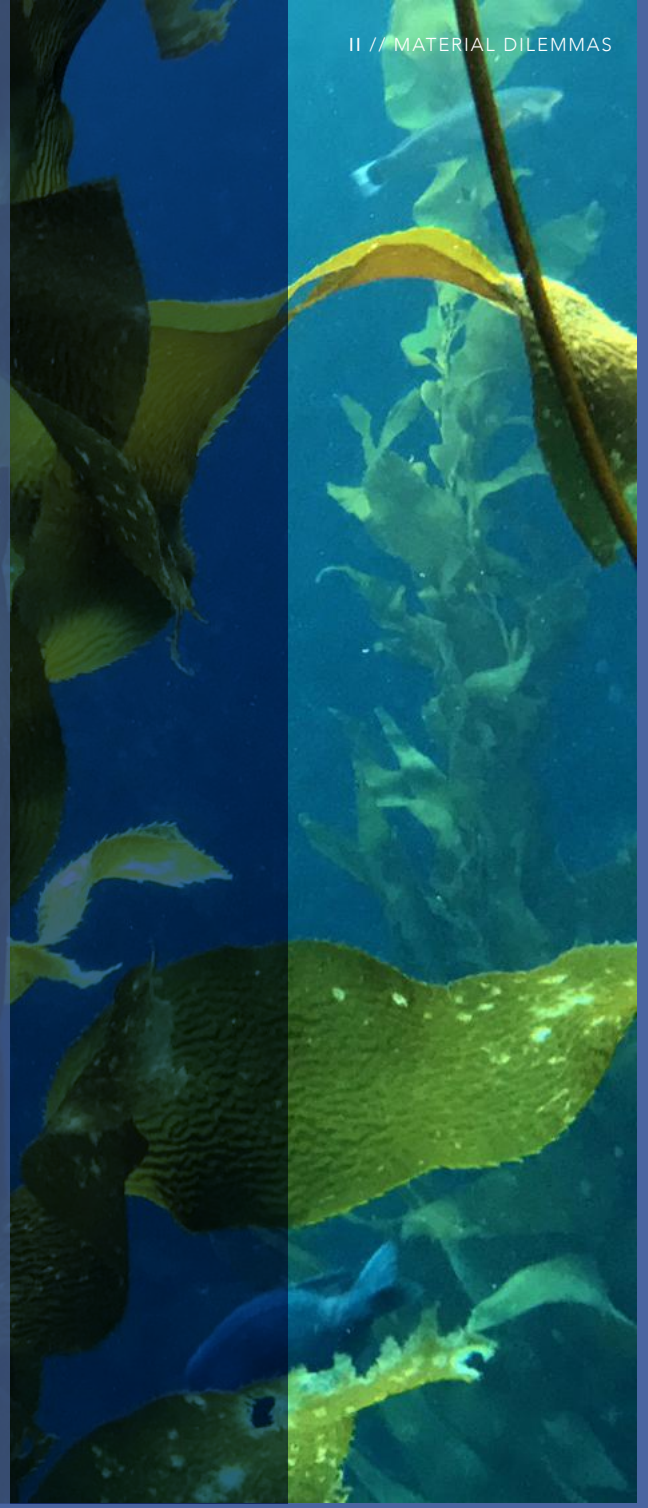
From an innovation perspective, building an understanding of material capabilities will give committed brands a competitive advantage when transitioning to circular models. The knowledge to develop durable products suited for recommerce, repair or rental models and the ability to be recycled at the end-of-life will help to further recover value. This will set brands apart from their linear counterparts.

Brands invested in training on environmental impacts of material choices, supporting regenerative farming practices through their supply chains, and placing more value on raw materials will further increase their market share as this evolves to be the industry standard.

Fashion audiences will benefit from improved products and services with better peace of mind regarding the impact of their consumption.

RECAP

- *Polyester is the most common fiber used and is projected to continue growing beyond 2030*
- *Blending a mix of fibers into one material results in a lower probability that any fibers can be recovered through recycling*
- *Brand procurement of recycled fibers is growing but needs to increase at a faster rate*
- *Recycled content targets or policies should stipulate the source needs to be recycled textiles, to stimulate textile-to-textile recycling infrastructure*
- *Respecting materials and the intensity of their production will help reframe textile waste as a valuable resource*
- *Accurate material composition labeling of clothing will better influence key stages of the value chain downstream*



KEY ACTION POINTS

Material dilemmas

01 SCALE COLLECTION & SORTING INFRASTRUCTURE	– Sorting textiles for circularity (i.e., reuse, repair, resale, recycling) is a critical, foundational step for circular supply chains – Accurate, automated sorting by material composition and color is essential for textile recycling to flourish
02 INVEST IN RECYCLING INFRASTRUCTURE	– Prioritize recycled fibers from textile sources – Support raw material suppliers with offtake agreements – Circulate textile waste from all tiers of the supply chain (pre-consumer, post-consumer)
03 REDUCE PRODUCTION & CONSUMPTION	– Decrease overall volume of textile materials produced – Increase the proportion of recycled fibers from textile sources
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	– Without brand procurement teams sourcing innovative materials/using mono-materials or governments requiring recycled textile content in products or investors supporting material innovations, the supply chain will continue to depend on fossil fuel based materials
05 DESIGN FOR DURABILITY & RECYCLING	– Use mono-materials where possible and minimize complex blends – Use circular design framework to produce products that are compatible with available recycling technologies – Evaluate elastane's use; reduce or eliminate where possible – Explore elastane alternatives where stretch is a functional requirement
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	– Clear communication of recycled input sources – Material passports to increase supply chain transparency and material provenance
07 DIVEST FROM FOSSIL FUELS	– Phase out virgin synthetics; prioritize biodegradable, bio-based alternatives – Support raw material suppliers to transition to renewable energy – Support raw material suppliers practicing regenerative farming techniques
08 CHANGE THE METRICS OF SUCCESS	– The true cost of materials needs calculating to allow educated comparisons between materials

CHAPTER III

Supply chain connectivity

Empowering all players to drive circularity

- → Foundations for circularity
  - – Collecting, sorting, aggregating and pre-processing
  - – Repair and resale
  - – Rental and subscription
  - – Digital services
- → Textile recycling routes
- → Current textile recyclers
- → Barriers to textile recycling progress

The inherent complexity of the global fashion supply chain presents unique challenges when determining the most viable, cost-effective approaches to circularity.

The network of highly skilled suppliers is what enables the fashion industry to progress and innovate, and supporting them will be central to its ability to transition effectively. Policy, collaboration and investment to regulate, nurture and scale infrastructure were the three most resounding themes cited by key industry stakeholders consulted for this research. The knowledge and tools for system transformation are there; connecting and amplifying them will accelerate the transition to a system focused on repairing, refurbishing, renting and recycling to elongate the life of clothing and textiles.

Consumers have signalled an interest in exploring non-traditional ownership models in other industries, making a case for success for circularity in fashion. This chapter focuses on textile recycling as a key part of the solution to decarbonize the industry, covering pre-recycling stages as well as the role of circular business models. It uncovers the main challenges facing stakeholders throughout the value chain, proposing recommendations to overcome them.

Notable players within each stage of the textile value chain are highlighted in various geographies and stages of development to showcase stakeholders working to scale textile circularity.

"The industry should have understood the demand for circularity long back, especially the textile industry. We should have been promoting for this for the last 10 years. If you look at the innovations happening, these are not rocket science or complicated technologies. It is just that the focus on such technologies has only been in the last 5-8 years."

Umar Faruk Chowdhury
CELLULOSE INDUSTRY EXPERT

Foundations for circularity

Different types of waste require distinct channels for processing. For example, a recycling company that processes cotton materials would not want to purchase a mix of material blends, demonstrating the need for streamlined systems to collect and sort textiles properly.

COLLECTING

Current options for collection include: publicly placed drop boxes, thrift/charity shops, resale platforms, consignment stores, brand-sponsored recommerce and municipal/council curbside pickups. [140] Collection is an essential part in scaling circularity in an efficient and impactful way. Some governments, like the French government, have created an "Extended Producer Responsibility" program to shift the collection responsibility from local municipalities to brands (see Chapter VI).

If the government has yet to mandate collection, brands can offer support to textile recyclers by committing to gathering textiles directly from their consumers — either through collection boxes in stores or offering an option to send back clothes through the mail. Some brands are already active in this space. Another key factor that would support textile recycling is if brands committed to "offtake agreements" — meaning each brand would offer to buy back an agreed volume of recycled textile fiber. This would help recyclers expand production and guarantee that their output would remain in demand.

SORTING

The primary reason to sort clothing is for the purpose of resale, with the goal of wearable clothing going to thrift shops, while non-wearable clothing would be recycled. Recyclers, in order to achieve the best results, need high-quality feedstock to properly convert textile waste into new textiles. Receiving the correct quality needed for recycling is one of the biggest identified challenges for recycling companies, as different types of recycling require sorting according to the color and/or the material composition. Sorting, predominantly a manual, time intensive process, is an essential step for textile recycling to be successful. Manual sorters make an informed decision per garment every six seconds. [141] It is common for almost half of textiles to either not have a label, incorrect information on the label or display a washed-out label difficult to decipher. An optical recycling sorting machine uses NIR (Near Infrared) light to determine the contents of the material and sort it accordingly. Therefore, automated sorting technologies can help with material identification which would be otherwise both costly and labor intensive. [142]

"We always talk about inclusivity in a circular supply chain, and it's key to engage and support waste handling companies to participate. We're most active in countries like Bangladesh, which has a highly corrupt waste handling network. They have the most recyclable waste of any garment producing country which offers a unique opportunity for transitioning to circularity."

Nin Castle, Co-Founder & Chief Project Officer
REVERSE RESOURCES

AGGREGATING & PRE-PROCESSING

A large part of designing for circularity involves making a product which can be easily prepared for recycling. In order for the desired materials to be recovered during the recycling process, parts not made from the fiber or which are obstructive to the process need removing. This includes hard trims like zippers and buttons, textile trims which are often mixed fibers and bulky seams. [143] Prints, particularly thick screen prints, also create difficulties when recycling. **Garments created with laminated fabrics, seam sealing, PU or other coatings or high elastane content are generally not recycled through any existing processes**. Some technologies are emerging which offer solutions to make the preparation for onward recycling easier. However, the mountains of textile waste already created without circularity in mind make the pre-processing step more complicated.

Efficient sorting and pre-processing is a critical unlock for recycling to scale, and currently one of the least developed and connected parts of the value chain. The projects highlighted here are both seeking to demonstrate its viability to scale.

CASE STUDIES

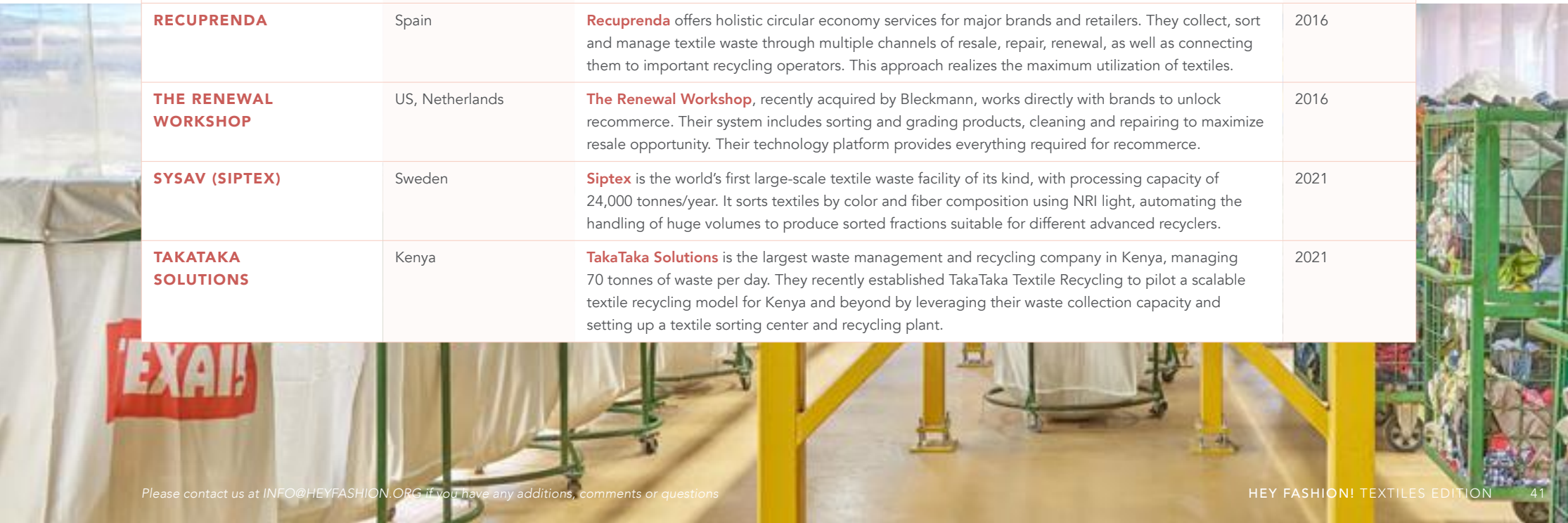
Sorting For Circularity is a consortium project led by Fashion for Good seeking to understand both the pre- and post-consumer textile waste streams in India, and pilot waste mapping and sorting solutions. India is a major manufacturing and consumption market of textiles, as well as one of the largest recipients of global post-consumer textile waste, with millions of tonnes imported annually and manually sorted through various hubs. [144] The aim is to demonstrate a new textile value chain over the course of 15 months and build accessible infrastructure for manufacturers, sorters, collectors, waste handlers and recyclers. By mapping out, categorizing and properly sorting waste to meet the quality requirements of advanced recycling technologies, they can be brought back into circularity and build a clear business case for recycling infrastructure in the region. Multiple global brands are involved, with Reverse Resources as a key technology partner. [145]

Circular Fashion Partnership

The Circular Fashion Partnership is a cross-sector project led by Global Fashion Agenda in collaboration with Reverse Resources, The Bangladesh Garment Manufacturers and Exporters Association (BGMEA) with the support of P4G. It focuses on identifying and fostering circular commercial collaborations between textile and garment manufacturers, recyclers and waste handlers in Bangladesh — where Reverse Resources estimates that ~400,000 tonnes of production waste accumulates annually. [146] This is perfect feedstock for recycling, requiring much less pre-processing than post-consumer waste and with much less contamination. Powered by Reverse Resources SaaS tool, stakeholders are able to track and trade textile waste to generate value, both environmental and economic. The partnership aims to engage local regulators on current barriers and economic opportunities and attract investors to build recycling infrastructure in the region.

TABLE 3: COLLECTING & SORTING

COMPANY	LOCATION	ABOUT	FOUNDED
SOEX / I:CO	Germany, UK, UAE, China, Japan	SOEX is one of the most established major groups leading mass collection, processing, trading and recycling of used textiles and shoes. Their subsidiary I:CO is the global service provider for in-store take-back services for brands and retailers. Items unsuited to resale are downcycled on site and sold as fibers.	1977
TEXAID	Switzerland, Germany, Austria, Bulgaria, Hungary, US	TEXAID is one of Europe's leading groups for textile collection and sorting, handling around 80,000 tonnes each year. The company employs innovative processes, professional collection logistics and state-of-the-art sorting. Textiles that have reached end-of-life enter downcycling to be transformed into cleaning cloths or insulation.	1978
SATCOL	UK	Satcol is the trading arm of The Salvation Army, the largest charity-owned textiles collector in the UK. They currently manually sort into multiple categories for resale, as well as distribution through the charity — donating £76 million over the last 10 years.	1991
BANK & VOGUE	Canada	Bank & Vogue is a global leader in wholesale used goods, originally founded to service The Salvation Army. Beyond Retro is its retail network that resells approximately 500,000 items each year. They have a multi-year agreement with recycler Renewcell to supply >30,000 tonnes of textile waste annually.	1992
RECUPRENDA	Spain	Recuprenda offers holistic circular economy services for major brands and retailers. They collect, sort and manage textile waste through multiple channels of resale, repair, renewal, as well as connecting them to important recycling operators. This approach realizes the maximum utilization of textiles.	2016
THE RENEWAL WORKSHOP	US, Netherlands	The Renewal Workshop, recently acquired by Bleckmann, works directly with brands to unlock recommerce. Their system includes sorting and grading products, cleaning and repairing to maximize resale opportunity. Their technology platform provides everything required for recommerce.	2016
SYSAV (SIPTEX)	Sweden	Siptex is the world's first large-scale textile waste facility of its kind, with processing capacity of 24,000 tonnes/year. It sorts textiles by color and fiber composition using NRI light, automating the handling of huge volumes to produce sorted fractions suitable for different advanced recyclers.	2021
TAKATAKA SOLUTIONS	Kenya	TakaTaka Solutions is the largest waste management and recycling company in Kenya, managing 70 tonnes of waste per day. They recently established TakaTaka Textile Recycling to pilot a scalable textile recycling model for Kenya and beyond by leveraging their waste collection capacity and setting up a textile sorting center and recycling plant.	2021



> **The way that textile waste management generally works is not a basis for a circular economy. We need to reinvent the whole textile waste management business model.**

Pailak Mzikian, Founder // RECUPRENDA

"There's still a general lack of conversation around repairing, upcycling, and how important sewing technology is. No one actually talks about sewing as a technology anymore in the fashion space, which I find very concerning."

Liz Ricketts, Co-Founder & Director
THE OR FOUNDATION

"These fast fashion brands claim they have a recycling system, a whole take back system for circularity of clothing, for example in the UK - but if that is working then why do we suffer? Why do we get so much of the waste here?."

Yayra Agbofah, Founder
THE REVIVAL

REPAIR & RESALE

Resale models offer brands new revenue streams from existing products, offer discounted products to consumers and extend the life of clothing. In the United States, the thrift store industry reached 10.2 billion USD in 2019, and has been growing by 2.3% annually since 2014. [147] Online thrift stores, like ThredUP, have stated that the "secondhand market is projected to double in the next 5 years, **reaching 77 billion USD.**" [148] This is a win for sustainability in fashion, as **"buying an item secondhand replaces the need to manufacture a new item, reducing its carbon footprint by 82%."** [149] That being said, due to the low quality of clothing to begin with, the durability is limited making it more difficult to resell items. Hilde van Duijn, Associate Circular Textiles Expert, explained that the quality of "reusable [products] are decreasing from **60 to 50% overall and continuing to drop.**" To ensure that textiles can be reused and generate long-term revenue streams for brands, it is essential to design durable products. Brands like Gap, Zalando, H&M and Patagonia have already launched websites to capture the resale market.

Repair offers an attractive opportunity for consumers to wear their clothes for a longer period of time. Kering opened a repair center in Shanghai offering a range of simple repairs from sewing on buttons or stitching on patches, to more technical repairs like repairing broken pieces of jewelry. [150] Laura Coppen, Head of Circularity at Zalando, described the new customer demand for the pilot program set to launch in Berlin. Zalando will partner with Save Your Wardrobe for repairs, because in her experience "there is clear customer interest in making sure that products get repaired at the quality level they need." This presents an opportunity for brands to capitalize on customer demand, provide additional services for their customers and provide a new revenue stream.

Thrift stores/charity shops remain an extremely important part of a circular economy in fashion. High-quality products donated in large volumes on a local level promote reuse and by extension — extend the life of products. That being said, the terminology of "thrift" store and "charity" shop are highly problematic. The secondhand market is first and foremost a business endeavor. The act of donating to a "good cause" allows consumers to continue purchasing clothing at a rapid pace, guilt free. This prevents consumers from understanding the substantial environmental damage caused by the high level of global textile consumption. Donating to a "charity" shop prevents consumers from connecting the gravity of their actions to the substantial change required to reducing overall textile waste.

"It's not a given that a circular business model will have better impact than a linear one. There's no one size fits all model for companies who are trying to build out a circular business model... each needs to be built specifically for that brand, customer and product. And that takes a lot of innovation and R&D."

Gwen Cunningham, Lead Circle Textiles Program
CIRCLE ECONOMY

RENTAL & SUBSCRIPTION

The goal of rental and subscription models for consumers is variety and access over ownership. For providers, the goal is to maximize utilization, which allows for increased profits from the same products. Rental and subscription options reinforce the idea that clothing should not be disposable, while simultaneously meeting consumer needs for "new" items. Short-term clothing rental companies such as "Rent the Runway" offer consumers clothing for special events. Compared to other levels of fashion, outdoor sportswear is a leader in rental options offering durable gear for short-term and long-term outdoor trips. In order for rental and subscription services to be successful, products must be durable to withstand multiple wears.

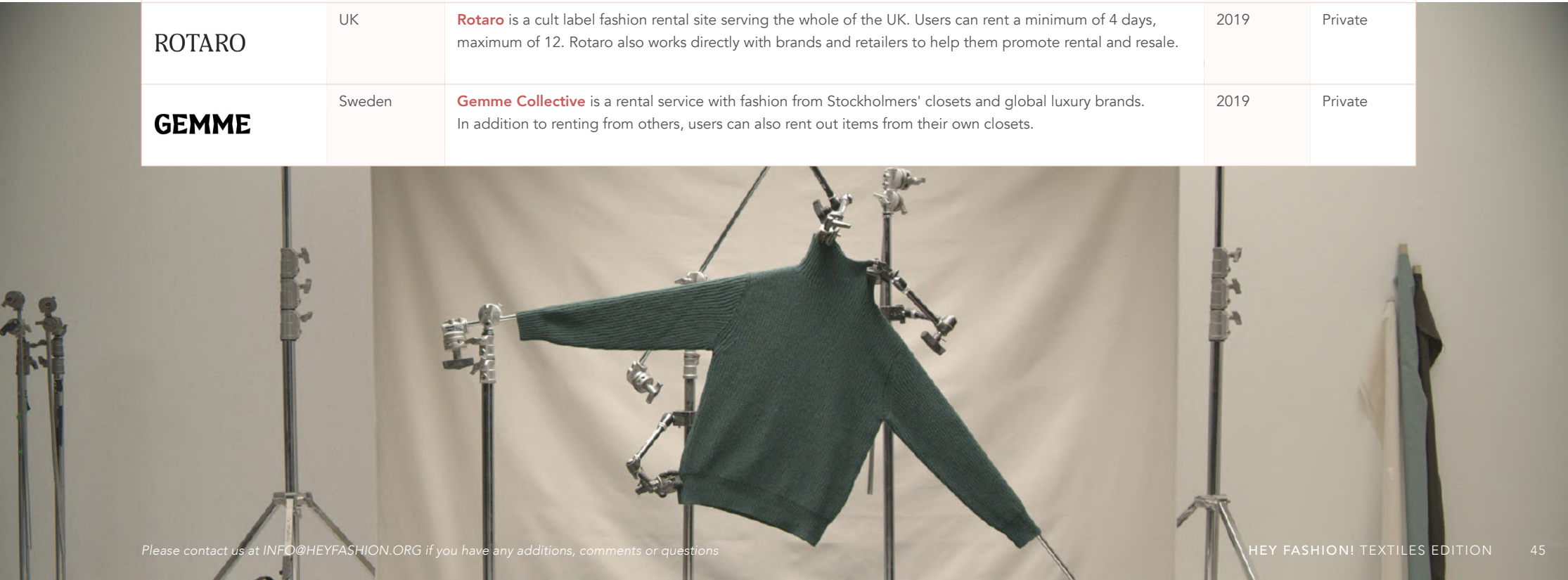
It is undeniable that rental and subscription services can provide an important role in the market. However, services that deliver a collection of fast fashion garments monthly based on a fixed fee could have negative environmental repercussions. Rental and subscription services need to be clear on the carbon emissions of frequent pick-up and drop-offs, data on product usage and wear, while still considering disposal options at the item's end of life. Logistics of moving clothing items need to be examined in further detail. Utilizing existing infrastructure like click-and-collect or collaborating with other stakeholders to cut down on multiple trips needs to be considered to ensure that these services are environmentally beneficial.

Rental services need to prevent worn or damaged items from reaching new customers. It is largely unclear how many times an item can remain in the rental system; although the longer an item is worn, the better it is for the environment. Consumer demand for increased traceability will push rental and subscription services to provide more information on the life of the garment. Digital services, explained on the next page, can help provide data on the effectiveness of rental services. Understanding the average wear of each item of clothing will reveal the environmental benefits of improved rental options.

The pressure to incorporate new business models and be successful can be a daunting task for brands. Gwen Cunningham explained, "many brands are overwhelmed at the task ahead, feeling pressure to build the infrastructure and skills within their own teams and supply chain." Although in Gwen's experience, "there's a huge assortment of solution providers and innovators that can step into that space. **Collectors and sorters have massive amounts of expertise on how to manage post-consumer textiles**, but they're not the solution providers to these brands for the most part. That's an insight that there's a divide now, between these new innovators and solution providers and these traditional players. **We're kind of starting from scratch, when we don't have to. A lot of these traditional players have huge social impact benefits to their business models.**" Collaboration across the fashion supply chain is fundamental to pushing circular systems and innovation forward.

TABLE 4: REPAIR, RENTAL & RESALE

COMPANY	LOCATION	SUMMARY	FOUNDED	IPO
RENT THE RUNWAY	US	**Rent the Runway** is an established e-commerce platform for users to rent, subscribe or buy designer fashion. The average member rents $37K* in clothing a year. They claim to have displaced production of an estimated 1.3M new garments in the past decade.	2009	Public
The RealReal	US	**The RealReal** is one of the largest resale marketplaces for authenticated luxury goods with +25M buyers and a trusted following. They have 19 physical retail locations in the US where customers can access free product valuations and expert advice on product care, repair or alterations.	2011	Public
女神派 MS PARIS	China	**Ms. Paris** is the oldest women's luxury fashion rental company in China, serving 7 million registered users. It has one of the most reasonable fees at $50 per month and has built a solid following over time.	2015	Private
HURR	UK	**HURR** is a service enabling thousands of renters and lenders to circulate luxury fashion. Their partnership with Depop directs items no longer suited for rental to be sold exclusively on this resale platform.	2017	Private
ROTARO	UK	**Rotaro** is a cult label fashion rental site serving the whole of the UK. Users can rent a minimum of 4 days, maximum of 12. Rotaro also works directly with brands and retailers to help them promote rental and resale.	2019	Private
GEMME	Sweden	**Gemme Collective** is a rental service with fashion from Stockholmers' closets and global luxury brands. In addition to renting from others, users can also rent out items from their own closets.	2019	Private



> We need a new collaborative system harmonizing the work of charities and private companies, doing the collection, sorting and recycling of textiles.

Arianna Nicoletti, Circular Textiles Lead // CIRCULAR.BERLIN

DIGITAL SERVICES

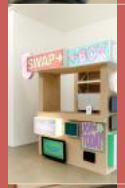
The main types of digital services identified:

Analytics

Digital product passports to track clothing along the whole value chain and store critical end-of-life data

Databases

Connect industry stakeholders together, foster collaboration and knowledge sharing and increase supply chain transparency



Rental platform

Digital infrastructure to support rental services to circulate product between more users

Resale platform

Digital infrastructure to support resale services to circulate product between more users

3D design software

Promote waste reduction through enhanced digital design and prototyping

Virtual reality

Enhanced shopping experiences improve style and fit to reduce returns and associated waste

DIGITAL INNOVATION FOR CIRCULARITY

Lack of transparency is a clear barrier to advance the implementation of circularity. More than ever, society has access to an abundance of information, but this alone does not provide transparency. To drive circularity, tools are needed to navigate and digest this information to make it truly useful and democratic.

There continues to be a lot of innovation in the digital space to develop different platforms and software to help unlock circularity in fashion, targeted at different stakeholders. The graphic on the left outlines the most common types of services.

DATA, ANALYTICS & TRACEABILITY

RFID or "Radio Frequency Identification" is a technology used by all internet of things (IoT) companies. EON is an example of a leading company using RFID to create product ID's to track them along the supply chain. [151] Prada, Walmart and Procter & Gamble are using the technology on their products to improve the accuracy of their supply chain data. [152] **Approximately 2 out of 5 fashion executives plan to adopt product passports in 2022 or have already done so.** [153]

Product passports support consumer trust, especially in regards to counterfeit luxury goods, which is especially interesting within resale. Luxury resale platforms like Vestiaire Collective and The RealReal are expected to profit from digital passports. [154]

Using traceability for other emerging models such as rental and recommerce will help reveal the levels of clothing utilization and user behaviors, encouraging a data driven approach to circularity to help ensure environmental benefits become a reality.

Dr. Christina Raab, President & CEO of Cradle to Cradle, predicted that in the future, transparency will be key to bring visibility and track garments across their life cycle. In her opinion, investing in this kind of technology is extremely important to know where products were made, their reliable composition and if they were designed for recycling.

On demand manufacturing to the exact measurements of the customer is an effective way to reduce waste. Making a custom product could minimize textile waste and has the potential to encourage consumers to wear the item for longer, avoiding alterations and reducing the need for returns. "McKinsey estimates that around **70% of returns are a result of garments not fitting properly**, which is often down to the accuracy of the information a company gives about its products. [155] Zeekit is a virtual fitting room start-up that works with brands like Gucci, ASOS, Levi's and Tommy Hilfiger. It maps clothing onto models with a wide variety of body shapes and ethnicities, helping customers to visualize products on someone who resembles them. The company founder, Yael Vizel, says that **two chain stores that are using Zeekit have seen returns drop from 38% to 2%**. [156]

Virtual fashion is also growing in popularity. [157] Some brands are testing virtual clothing options with a personal avatar before checkout to ensure the product matches consumer expectations; others are offering fashion for gaming avatars. With a new generation focused on social media and Web 3.0, brands are exploring virtual clothing and stores. With the rise in digital services, the fashion supply chain should become more transparent, offering powerful insights to multiple stakeholder groups from investors, governments and citizens and driving brands' accountability. If properly utilized, they have the power to keep products circulating at their highest value for as long as possible, provide crucial information to end recyclers to confidently recoup products back into raw material and optimize new production to minimize textile waste.

TABLE 5: COMPANIES PROVIDING DIGITAL SERVICES

COMPANY	LOCATION	SUMMARY	NOTABLE PARTNERS OR CLIENTS
ATMA - AVERY DENNISON	UK	Atma is a platform that unlocks the power of connected products by assigning unique digital IDs to them. It provides end-to-end transparency by tracking, storing and managing all events along the whole value chain from source to consumer and beyond, to enable circularity.	Smartrac, Adidas
EON / ADETEXS	US & UK	EON is a product cloud provider using a digital RFID technology thread developed by Adetexs to verify, track and facilitate sorting and recycling of textiles and products thereof. The digital information is stored within the thread and can be scanned from a distance.	H&M Foundation, SBT, InProtect, Microsoft
CIRCULAR. FASHION	Germany	Circular.Fashion is an agency supporting circularity in fashion and textiles. Alongside circular design software and assessment tools, their circularity.ID® contains essential material and product data to enable reuse, resale and recycling for key stakeholders.	H&M Group, Zalando, Ganni, Bestseller, Waste2wear, Gr3n, Recover, Renewcell, I:CO, Texaid
WASTE2WEAR® BLOCKCHAIN SYSTEM	China	Waste2wear utilizes a blockchain system that provides evidence that fabrics are made of plastic waste. The blockchain records the journey from plastic bottles to finished textile product, allowing transparency and consumer trust in the value chain.	
MATERIAL EXCHANGE	Sweden	Material Exchange works with fashion brands to analyze, optimize and digitize their material supply chains to provide transparency. Their platform helps brands and manufacturers to connect, fostering collaboration and new business.	Kingpins Show, FDRA, USFIA, Eurofins, Textile Exchange, Taiwan Textile Federation, Fibre2Fashion
REVERSE RESOURCES	Estonia / Bangladesh	Reverse Resources is a tracking and trading platform for all stakeholders handling textile waste and is providing a 360-degree transparency of the waste flows. Their mission is to turn textile waste into a valuable commodity.	Accelerating Circularity, P4G Global Fashion Agenda, The Bangladesh Garment Manufacturers and Exporters Association (BGMEA)
TROVE	US	Trove is a platform facilitating ready-made recommerce services for apparel brands, enabling them to quickly and easily take control of their resale marketplace.	Levi's, Patagonia, REI, EILEEN FISHER, Inc., lululemon, Arc'teryx, NEMO
CONTINUED FASHION	Denmark	CONTINUED is a platform facilitating take back and resale for brands, while also providing data insights that can help them understand the life cycle and long-term value of their products.	
SYNFLUX	Japan	SYNFLUX utilizes artificial intelligence and a straight cut pattern technique to reduce fabric waste. Additionally, they aim to only cut on demand, to avoid overproduction.	

Textile recycling routes

This section will focus on the two main types of recycling: mechanical recycling and chemical recycling. Both can be classified differently based on the degree of transformation, which is conducted to recover the material for reuse.

TABLE 6: TYPES OF RECYCLING

TYPE OF RECYCLING	ABOUT	BENEFITS	CHALLENGES	SUMMARY
MECHANICAL OR FIBER RECYCLING	Mechanical recycling is a well established set of processes that involve tearing or shredding material into small pieces, which go through a process called carding to reorient the fibers ready to be spun into yarns for weaving or knitting. Most notably, mechanical recycling of wool has been practiced in the Prato region of Italy since the mid-nineteenth century. The textile construction is an important factor in its ability to be torn open into fibers. Wool, cashmere, cotton, silk and polyester are the most common fibers diverted through fiber recycling.	• Color of input textiles is retained, avoiding need for additional dyeing or bleaching if pre-sorted • Chemical-free process • Widespread global suppliers with considerable capacity	• Fibers are shortened and damaged, deteriorating in quality as a result • High percentage of elastane is problematic • Material blends cannot be separated • Contaminated dyes & chemicals can't be removed	Post-consumer waste needs careful management, since textiles produced in less regulated markets or during times when certain chemicals were allowed may be retained in the recycled fibers. This can be problematic as recyclers do not want to recirculate contaminants, and brands do not want to risk procuring unsafe materials. Due to the loss of physical properties during the mechanical recycling process, virgin fibers (and increasingly recycled PET fibers) are blended in varying ratios to ensure commercial quality of the new yarns.
MECHANICAL POLYMER RECYCLING	Mechanical polymer recycling is only suited to synthetic textiles as it relies on the melting of mono-material plastic-based fibers at high temperatures. It is sometimes known as thermo-mechanical recycling for this reason. The process breaks fibers down to polymer level. They are heated to a viscous state then forced through very small holes to create new filament. Nylon is the most common fiber used in clothing which gets diverted to mechanical polymer recycling. Feedstock for this process	• Color of input textiles is retained, avoiding need for additional dyeing or bleaching • Targeted to recovering specific, pure materials • Texturing of the extruded filament yarn can be controlled for different properties and applications	• Contaminants like dyes and chemicals cannot be removed • Process is sensitive to input purity • Significant loss of mechanical properties in each recycling loop	As with mechanical fiber recycling, the process cannot filter out substances of concern from residual dyes and contaminants. It should be noted that synthetics like polyester or nylon are still suitable for the previous mechanical fiber recycling process. The properties of the output fiber achieved will vary.

TYPE OF RECYCLING	ABOUT	BENEFITS	CHALLENGES	SUMMARY
	is often used in fishing nets or carpets, rather than textiles from clothing.			
CHEMICAL POLYMER RECYCLING	Chemical polymer recycling also retains fibers at the polymer level by dissolving textiles with solvents or sustainable chemicals. This type of recycling can process synthetic, cellulose-based fibers or blends of both. When blends are used as feedstock, cotton-polyester is most commonly optimized. Materials like elastane can decrease the effectiveness of the process, however, it is possible to dissolve them to remove their influence on the process.	• Cotton and polyester can both be recovered • Virgin equivalent quality can be achieved • Mechanical properties of cotton are improved • Contaminants like dyes and chemicals can be removed • Other fibers present can be removed • Emerging suppliers are replacing harsh solvents with green chemistry alternatives	• Generally optimized to recover one fiber, meaning all others leave the process as waste • Traditionally, a chemically intensive process • Not yet available at considerable scale • Process is sensitive to input purity, many suppliers prefer pure undyed feedstock	Chemical polymer recycling offers a solution to the industry-wide practice of mixing numerous fibers into one garment. Currently, most recycling plants are optimized for a single input, typically one of the two most prevalent fibers used in clothing — cotton or polyester. Cotton is a polymer made up of cellulose. Through chemical polymer recycling, it is broken down into cellulose pulp and output as a MMCF with properties stronger than that of the original cotton. Polyester recycled through this process is output as PET and can be turned into a variety of products in addition to new textiles. The PET pellets can reenter the market for application in industries outside of the fashion. Chemical recycling can return post-consumer clothing, a complicated and impure feedstock, into virgin quality fibers, a huge commercial advantage. Because of this, these fibers can be recycled more times without losing their structural integrity, although loss of quality will eventually occur.
CHEMICAL MONOMER RECYCLING	Chemical monomer recycling involves a sequence of chemical processes to break down the fiber polymers into their individual monomer form — a process called depolymerization. They can then be used as feedstock to be re-polymerized into new, virgin quality fibers. This process is limited to plastic-based fibers and is not applicable to most fibers sourced from plants or animals.	• Virgin quality output • Contaminants like dyes and chemicals can be removed • Other fibers present can be removed • Output materials applicable to applications and industries outside of textiles	• Chemically intensive process • Highly energy intensive process • Currently not cost competitive with virgin fibers • Not yet available at meaningful scale	Although these technologies exist, they are not established at any meaningful scale for textiles. This is largely due to the limited funding in scaling them past lab or pilot stage, meaning they are largely out of reach to brands and manufacturers and considerably more expensive compared to virgin polyester.

Interest in recycled fibers continues to rise, and a select number of brands have already started to invest in recycled fibers. Under current progress, recycled polyester will be more expensive than virgin polyester fibers until textile recycling infrastructure and recycling technologies scale globally. As more brands seek to procure recycled fibers, the demand could help elevate all types of textile recycling. Nora Eslander, Brand Manager of chemical recycler Renewcell, explained the demand for recycled material is huge. And it's growing.

Commitments like offtake agreements, where a set volume of material is agreed upon, (usually several years in advance) would help recyclers plan their production capacity and give them the necessary time to expand their factories. Other industries use offtake agreements to assist with bringing technologies to scale by demonstrating market demand for the product to their investors and shareholders.

Anita de Wit, Founder of circular textile consultancy ReBlend, says brands should be obligated to include 30% recycled content. Dr. Ashley Holding, Founder of technical sustainability consultancy Circuvate, supported a similar approach, suggesting 50% recycled content with minimum 25% of that from textile waste. Such a requirement would help stimulate the growth of the recycled textile market in a similar way to the success of the packaging industry.

In Gwen Cunningham's experience as Circular Textiles Program Lead at Circle-Economy, brands seem to be waiting for chemical recycling technologies instead of investing in mechanical recycling which is more robust and widespread within the industry.

> **"Everyone is holding out for this silver bullet of chemically recycled output, whereas we actually have quite advanced mechanical recycling options available now, which have very good results if utilized in the right way."**

Gwen Cunningham, Circular Textiles Program Lead
CIRCLE-ECONOMY

> *"The reason that EILEEN FISHER, Inc. has circular initiatives is the materials. They just inherently allow for longevity and for multiple lives of a product. The first thing companies can really look at is materials, it affects people, it affects the planet, it affects all these ESG values... designing with the mindset not just to sell a product and be done with it, but what this product could be first life, second life, all the iterations of the product, and how it can be recycled."*

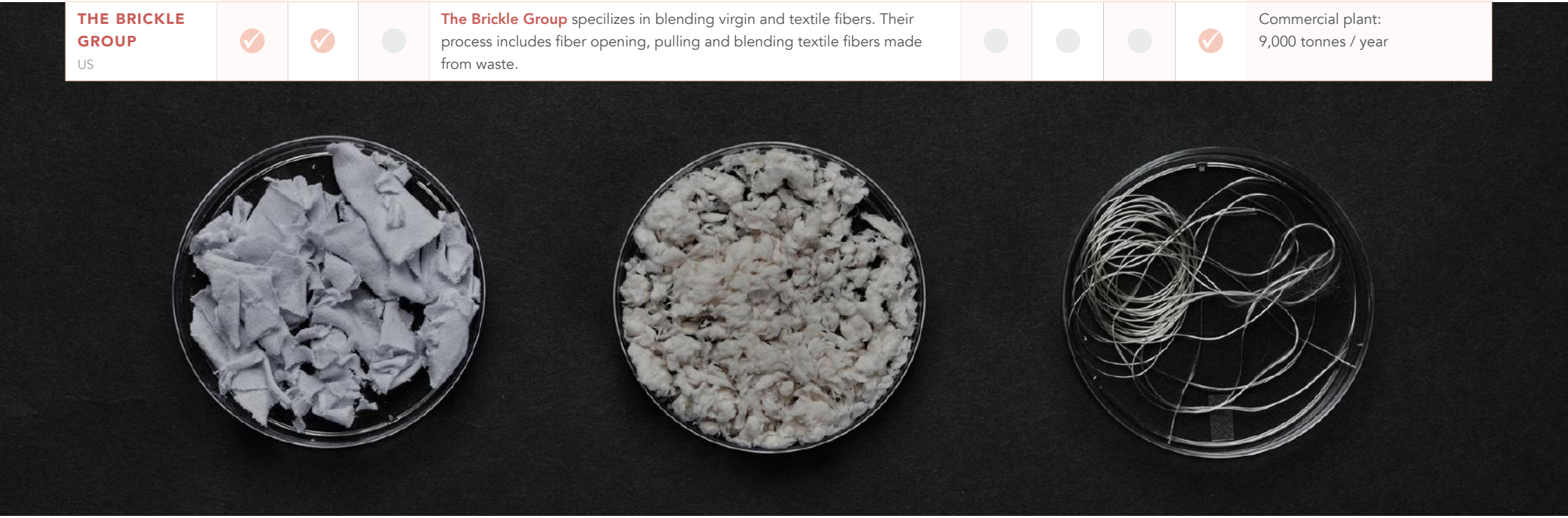
Abigail Erickson, Former Project Manager, Waste No More
WASTE NO MORE | EILEEN FISHER INC

TABLE 7: RECYCLERS

COMPANY & LOCATION	SYN	NAT	MMCF	SUMMARY	LAB	PILOT	DEMO	COM	STAGE & CAPACITY
AMBERCYCLE US	✓	✓		**Ambercycle** has developed a technology which enables separation of post-consumer polyester/cellulosic blends on a molecular level, yielding high-quality PET pellets and cellolusic dissolving pulp.		✓	✓		Current pilot: 10-100 KG / day Demo plant (in planning): 1 tonne / day
BLOCKTEXX Australia	✓	✓	✓	**BlockTexx** has developed a technology which enables recovery of polyester/cotton blends, specifically of products such as sheets, towels and clothes of any color or condition, yielding high-quality recycled materials of rPET pellets and cellulose powder.	✓			✓	Currently lab scale Commercial plant (planned for 2022): 10,000 tonnes / year
CIRC US	✓	✓		**Circ** has developed a technology which enables separation of fibers, especially polyester/cotton, at any ratio in a hydrothermal process, yielding polyester monomers and cellolusic dissolving pulp.			✓		Current demo plant: 4 tonnes / day
CIRCULAR SYSTEMS US	✓	✓	✓	**Circular Systems** is a materials science company that has developed Texloop, Argaloop and Orbital using their circular plus regenerative technology to create valuable fiber, yarn and fabrics made from food-crop and fashion waste.		✓			Current pilot: 10,000 tons / year
CURE TECHNOLOGY Netherlands	✓			**CuRe Technology** has developed a low-energy chemical recycling process for any type of colored textile polyester.		✓	✓		Current pilot: 20 kg / hour Commercial plant (in planning): 25 tons / year
EVRNU US	✓			**Evrnu** is a textile innovations company that has developed NuCycl, which is a repolymerization method of post-consumer clothing, enabling the material to be recycled into new textiles multiple times.		✓	✓		Current pilot (live) Demo plant (planned for 2022/2023): 19,000 tonnes / year
INFINITED FIBER COMPANY Finland		✓	✓	**Infinited Fiber Company** has developed a chemical recycling technology for cellulosic textile waste based on a decarbonization process. This process enables them to separate out other materials such as elastane and polyester. The output material is the Infinna fiber.		✓		✓	Current pilot: 150 tonnes / year Commercial plant (planned for 2024): 30,000 tonnes / year
PURFI US / Belgium	✓	✓	✓	**PurFi** has developed a rejuvenation process combining both mechanical and chemical recycling, turning textile supply chain material back to virgin quality fiber, as well as separating textile fiber compositons. Their process allows multilple fiber types to be recycled.				✓	Current commercial plant: 4,000 tonnes / year New commercial plants (planned for 2023): 24,000 tonnes / year
PHOENXT Australia, Europe, US	✓	✓		**Phoenxt** has developed a solvent-free textile fiber separation technology, focusing on synthetic/cellulosic blends.		✓	✓		Pilot (live) Demo plant (in planning)

COMPANY & LOCATION	SYN	NAT	MMCF	SUMMARY	LAB	PILOT	DEMO	COM	STAGE & CAPACITY
RENEWCELL Sweden		✓	✓	**Renewcell** has developed Circulose, which is a dissolving pulp product made from 100% post-consumer and post-industrial waste with high cellulosic content.			✓	✓	Demo plant: 4,500 tonnes / year Commercial plant (planned for 2022): 60,000 tonnes / year
SPINNOVA Finland		✓	✓	**Spinnova** has developed a fiber made from FSC and/or PEFC certified wood in a mechanical process, turning it into micro fibrillated cellulose feedstock. This process also allows for cellolusic textile waste to be recycled into new fibers.		✓		✓	Pilot (live) Commercial plant (in process): Target 1 million tonnes / year by 2031
WORN AGAIN UK	✓	✓		**Worn Again** has developed a recycling technology that enables separation, decontamination and extraction of polyester and cellulose from non-reusable textiles, PET bottles and packaging, producing dual PET and cellulose outputs.		✓	✓		Demo plant (in planning): 1,000 tonnes / year
SÖDRA - ONCEMORE® Sweden		✓	✓	**Södra** has developed OnceMore, which is an industrial-scale textile recycling technology. The process combines wood pulp with cellulose textile waste. The output is a pure, high-quality cellulosic dissolving pulp.				✓	Commercial plant: 6,000 tonnes / year Planning on 25,000 tonnes / year by 2025
IRIS TEXTILES THE NEW DENIM PROJECT Guatemala		✓		**Iris Textiles** is a mechanical textile recycler and textile manufacturer focusing on post-industrial waste made from natural compositions only. They are chemical-free, dye-free and use minimal water and energy.				✓	Commercial plant: 800 tonnes / year
HIVESA TEXTIL SL Spain	✓	✓	✓	**Hivesa** works across multiple functions such as collection, transportation, sorting and recycling textile waste into high-quality fibers in a mechanical recycling process.				✓	Commercial plant (live)
HILATURAS FERRE - RECOVER® Spain		✓		**Hilaturas Ferre** works across multiple functions such as collection, sorting and mechanical recycling. Their yarn, "Recover," contains 50% of their recycled material, blended with 50% recycled content from cotton resources, creating RCotton and RColorBlend.		✓		✓	Commercial plant: 12,000 tonnes / year Planning on 200,000 tonnes / year by 2025
LEIGH FIBERS USA	✓	✓	✓	**Leigh Fibers** is an international manufacturer of engineered fiber solutions. Through their blending and processing equipment they can produce a clean and homogenous material made from repurposed textile waste, serving as raw material.				✓	Commercial plant: 136,000 tonnes / year

COMPANY & LOCATION	SYN	NAT	MMCF	SUMMARY	LAB	PILOT	DEMO	COM	STAGE & CAPACITY
MARTEXFIBER (ECO2COTTON) US	✓	✓		**Martex Fiber** is a textile waste trading company. They provide waste management services to textile mills across North and Central America and the Caribbean. Martex Fiber specializes in 100% cotton and cotton/ polyester knits.				✓	Commercial plant: 72,000 tonnes / year
RB FIBRES Spain	✓	✓	✓	**RB Fibres** is working with a mechanical recycling technology and is able to process both synthetics and cellolusic fiber compositions.		✓		✓	Commercial plant: 6,000 tonnes / year
REFIBERD US	✓	✓		**Refiberd** has developed a textile recycling system using AI & robotics to convert post-consumer garments into new, 100% recycled threads. Refiberd also sources fabrics through their custom sorting technology for new textile production.	✓				Currently lab scale
RENAISSANCE TEXTILES France				**Renaissance Textiles** is a collaborative platform for recycling. They are working with collection and mechanical recycling of post-consumer textiles.		✓			Pilot plant (planned for 2022)
THE BRICKLE GROUP US	✓	✓		**The Brickle Group** specilizes in blending virgin and textile fibers. Their process includes fiber opening, pulling and blending textile fibers made from waste.				✓	Commercial plant: 9,000 tonnes / year



Barriers to textile recycling progress

Textile-to-textile recycling offers an alternative destination to the landfill or incineration. The biggest barriers identified in the research include largely absent infrastructure, feedstock and process limitations, cost of recycling, high-energy consumption, lack of traceability of materials and the role of COVID-19.

MISSING INFRASTRUCTURE

Although collection and sorting systems for charity or thrift shops are well established, there is a lack of large-scale systems in place to collect and sort clothing for recycling. The infrastructure surrounding the essential pre-recycling processes remains an enormous challenge. Until robust systems are in place to capture and utilize materials throughout the entire textile value chain, the fashion industry will not be able to transition to circularity and incorporate meaningful volumes of textile-to-textile fibers into clothing.

When it comes to recyclers sourcing raw materials, there is a lot of textile waste to use for feedstock but getting it sorted to the quality standards required for recycling is challenging.

The collection, sorting and preparation process needs to be robust by the time textile recycling facilities scale globally for the entire system to be successful.

> **The biggest knowledge gap comes from no clearly defined value chain...there's a big knowledge gap in who the recyclers are, what they want, what thresholds they need, what level of purity. Once we know all of these clearly, then we can develop our sorting even more to make sure that we meet those requirements.**

Louisa Hoyes, Business Development Manager
TOMRA

> *We need more recycling activities within Europe, keeping volumes close to the producer or consumer. The proximity principle would mean that if you collect clothing in London, you would be required to find a sorter close to London. And if you don't, you have to explain why you send it to Morocco or to India.*

Christoph Rittersberger, Business Development Manager
RE-TEXTIL (GERMANY)

FEEDSTOCK LIMITATIONS & COST OF RECYCLING

Fiber-to-fiber recycling requires a steady supply of feedstock which, generally, includes a mix of industrial textile waste and sorted post-consumer textile waste. The sorting process for post-consumer waste is labor intensive and primarily manual. Rewearable fractions are extracted and carefully graded for domestic and international resale markets. Remaining non-wearable fractions can be considered for textile recycling feedstock, currently primarily downcycling. The lowest quality fractions are incinerated.

Recycling needs precise sorting to produce the highest quality, cost competitive outputs. Both mechanical and chemical recyclers have requirements regarding which materials can be used in their recycling process. A multi-material fiber would be a possible feedstock option for a recycler if the product was downcycled, meaning that the product would be turned into a lower-quality product such as carpet or insulation. However, a multi-blended garment would be difficult to separate under the current recycling technologies.

> **"Verified, clean feedstocks for recycling will imminently become essential."**

John Beelen, Founder
WEAR2GO

Incorrect labeling presents another challenge to recyclers, since the process currently relies on manual sorting based on the garment label. Unfortunately, the industry is known for inaccurate material compositions on clothing labels, which can be overcome by governmental regulations (see Chapter VI).

This time-consuming and inaccurate process has the potential to be automated, which would help scan and sort garments more accurately and at a faster pace.

Depending on the country, the collection of textiles varies based on the available infrastucture. "Countries such as the Netherlands and Germany have 'kerbside' collection schemes to collect post-consumer textile waste. In the UK, the charity sector collects and sorts a large number of textiles, but consistent kerbside collection is patchy." [158]

> **"If you take post industrial white cotton scraps, there are end-use markets that aggressively compete for this feedstock. But for poly/cotton waste, people will often pay you to take it."**

Peter Majeranowski, Founder
CIRC

Currently, the cost of purchasing recycled textiles is more expensive compared to clothing made from virgin material. Recycling textiles needs to be financially feasible to compete with the current production prices. Economies of scale, when more recyclers reach commercial capacity, will drive down the cost of textile-to-textile products. Although large upfront investments are required to launch textile recycling in a meaningful way, textile-to-textile recycling offers an opportunity for brands to control their waste and utilize it as a resource for profit.

COVID-19

Supply chains around the world have felt the impacts of COVID-19. With mandatory instructions for workers to stay home, supply chains have been impacted in almost every industry. In relation to textile recycling, President and Co-founder of Circ, Peter Majeranowski, explained that they experienced supply chain delays and disruptions like many others did during the pandemic. They were forced to change piloting partners due to international travel restrictions. Majeranowski added, "But in the face of delays to shipments of machinery, approvals of audits and permits, and construction, I'm amazed at what our team was able to accomplish over the last two years - it would have been remarkable even in the absence of a pandemic."

TECHNOLOGY LIMITATIONS

Many obstacles exist when it comes to fiber-to-fiber recycling technologies. One challenge is the extraction of impurities in the recycling processes." These impurities can be small amounts of other materials, most prominently elastane, but also glues or specific textile dyes. There is also a very wide range of coatings, treatments and auxiliary chemicals which could interact with a recycling process but that aren't possible to detect by sorting technologies." [159]

> **"For many brands, when they think about recyclability, they don't understand what the feedstock specifications of the mechanical or chemical recycler are."**

Gwen Cunningham, Lead Circle Textiles Program
CIRCLE-ECONOMY

Another hurdle to overcome is separating polyester-cotton blended fabrics, one of the most common material blends for clothing. "Some technologies in development retrieve both cotton and polyester, whereas others may discard one as waste product. The biggest challenge in this respect is in getting two high-quality products that can be used to make new fibers again. Overall, every technology has its individual strengths and specific limitations, and no one technology is able to deal with all possible types of textile waste." [160]

Removing non-textile materials like labels, zippers and buttons is also a problematic step for recyclers. If the feedstock is not properly disassembled or sorted correctly, it adds additional work and risk for the recyclers.

ENERGY USE

Fiber-to-fiber recycling processes can use significant amounts of energy, making it of critical importance for the energy mix to be from primarily renewable sources. This is difficult for individual textile recyclers to overcome, demonstrating the need for collaborative efforts to help transition the energy mix to renewable sources.

It is important to keep in mind that recycling should not be the first option for end-of-use textiles but considered when the clothing has reached its end-of-life. "Recycling is generally the more energy efficient and environmentally friendly option, specifically for synthetics and man-made cellulosic fibers," when compared to the landfill. [161]

> **"If the energy source has been very poorly chosen, then it deletes all the sustainability credits."**

Tanja Karila, CMO
INFINITED FIBER COMPANY

CASE STUDY

H&M IKEA

Ensuring recycled textiles are safe to use and free from hazardous chemicals is another issue. H&M and IKEA led research analyzing these residues. Adidas, Bestseller, Kingfisher, Gap and PVH Corp also contributed to the research which involved the creation of a databank to increase cross-industry knowledge of the chemical content of recycled textiles. [162] "The database included more than 70,000 pieces of information from samples of post-consumer cotton, wool and polyester waste sourced from different regions of the world. Some **2.5% of these data points showed undesirable detections of chemicals but less than 1% exceeded the safe limits for restricted substances** in apparel, footwear and accessories set by the Apparel and Footwear International RSL Management (AFIRM Group). Post-consumer polyester samples had the widest variety of substances detected. In post-consumer wool, almost all samples contained at least one substance that failed against AFIRM limits." [163] Industry collaboration such as this can support circularity and widespread uptake of best practices.

> **Recycling is not a circular economy. It's a starting point towards a closed loop system. It starts with the design of the products — they need to be designed with several life cycles in mind.**

Christina Raab, President & CEO // CRADLE2CRADLE

CONCLUSION

Supply chain connectivity

Empowering all players to drive circularity

Circularity will be the biggest disruption in the fashion industry since e-commerce.

The industry is faced with a huge opportunity to reinvent the entire supply chain and use its immense economic power to create holistic, meaningful change. Moving from a linear supply chain to a circular model will require significant commitments from all stakeholders across the global fashion industry.

The actors in this space are vast and evolving fast alongside myriad technological solutions and collaborative projects. Shifting the perception of materials and products as valuable feedstock for flourishing new business models will unlock systemic change with an empowered supply chain at the core.

RECAP

- *Utilizing both chemical and mechanical recycling will help the industry tackle the mountain of textile waste*
- *Substantial funding is required for textile recycling infrastructure to become successful at scale*
- *Different technologies already exist at varying scales to recycle most unblended fibers*
- *Recycling technologies to handle more complex blends have yet to come to market in a substantial way*
- *Identified barriers to textile recycling will need to be addressed in order to maintain momentum*
- *Trends indicate that repair and resale opportunities will continue to grow along with rental and subscription options*
- *Digital tools will help consumers, brands and governments navigate and better understand the textile supply chain*
- *Lack of transparency is a clear barrier to advance the implementation of circularity. All stakeholders need tools to navigate the abundance of information and platforms to digest and utilize data effectively*

KEY ACTION POINTS

Supply chain connectivity

01 SCALE COLLECTION & SORTING INFRASTRUCTURE	– Separate post-industrial textile waste by composition (and color) at the point of collection – Divert all post-industrial textile waste to textile-to-textile recycling. Divert any pre-consumer waste to be sorted for resale, repair or recycling as a last resort – Recyclers to communicate demand and criteria for sorted feedstock – Recyclers to consider offtake agreements with sorters
02 INVEST IN RECYCLING INFRASTRUCTURE	– Utilize all types of recycling
03 REDUCE PRODUCTION & CONSUMPTION	– Utilize production management tools and alternative models, i.e., just in time, made to order, 3D printing custom fits – Smarter cutting room textile waste management for manufacturers
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	– Collaborate and share industry knowledge; communicate successes and failures – Consider pooling purchase orders of recycled fibers or yarns to enable brands of all sizes to procure niche or high order volume materials
05 DESIGN FOR DURABILITY & RECYCLING	– Consider repair or refurbish services for garments within manufacturing operations – Work with brands to set durability standards and encourage life cycle assessments for design and development
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	– Encourage the collection of waste data throughout the supply chain – Eliminate hazardous chemicals and reduce overall chemical usage – Digitally track textiles and clothing to redirect appropriately and recover value
07 DIVEST FROM FOSSIL FUELS	– Support the use of renewable energy throughout the supply chain – Focus on Scope 3 indirect value chain emissions (where 96% of apparel companies have emissions)
08 CHANGE THE METRICS OF SUCCESS	– Altering the priorities within the supply chain from rapid production of new textiles to keeping textiles within the supply chain as long as possible

CHAPTER IV

Brand cooperation

Vital to an industry-wide system transformation

- Macro & micro level overview
- Brand participation & brand led initiatives
- Current barriers
- Common misconceptions
- Standardized reporting
- Barriers preventing accurate & reliable reporting

Brands hold significant power when it comes to promoting and signaling the shift for the fashion industry to become circular.

They are the link between supply chains who produce their products, citizens who consume them and governments who must regulate the sector. Alarmingly, research by Fashion Revolution recently found that "**one-third of the fashion industry has yet to take action at all**" [164] on climate change commitments. Although important steps have been made to transition away from fossil fuels and start trialing circular business models like repair and resale, the overarching problem of overproduction and consumption remains largely untouched. Current recycling technologies cannot keep up with the volumes of textiles produced globally. The fashion industry cannot rely on circular business models alone to mitigate their environmental damage, they need robust strategies for managing textile waste.

Most brands, motivated by turning over large profits for their shareholders, have yet to discuss the topic of minimizing production. Without financial certainty, many brands view circularity as a risk instead of an opportunity to future proof themselves and open new sources of income. Industry-wide collaboration and pooling of funds could help improve access to circular technologies, reduce the costs and make circularity the norm in fashion.

TOP PERFORMERS BY ECONOMIC PROFIT

2019-2020

NIKE

LVMH

INDITEX

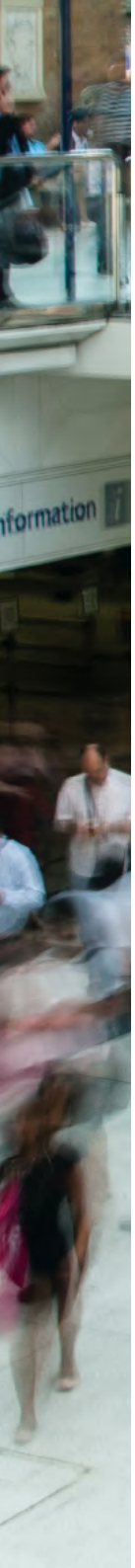
TIFFANY & CO.

KERING

HERMÈS PARIS

~$13m

USD ECONOMIC PROFIT [165]



MACRO

Brands have a major role to play in driving behavioral change and promoting a drastic shift to a circular economy. These actions can take many forms. However, it is clear that brands need to act urgently.

One projection found that fast fashion retailers could see their revenues drop by between 10% and 30% over the next five to 10 years, if they refuse to implement more sustainable strategies. [166]

With a high business and reputational risk of maintaining current linear business models, the case for circularity to simultaneously reduce textile waste while helping to decarbonize the fashion industry has never been stronger.

MICRO

Brands are pursuing many different paths when it comes to incorporating circularity into their sustainability strategies. Some invest very little, demonstrating little to no understanding of the topic, while others have already published holistic strategies and launched multiple initiatives. After analyzing the sustainability reports of over 30 brands across all market levels, many contain goals of improving the material content of clothing, or services such as repair. However, most do not directly mention waste, either throughout their supply chain or post-consumer textiles. The issue of collection sizes, cadence, or levels of production is also largely absent.

Greenpeace produced a report which found that the most impactful action a brand can do is to design a garment for a longer life and promote its extended use. [167] Increasing warranties, making higher quality garments and offering repair services is already common practice within the outdoor industry. [168]

THE BUSINESS CASE FOR CIRCULAR FASHION

To leverage growth and mitigate risk, circularity needs to be included in business plans moving forward. Citizens and governments will play an important role in demanding circular integration in fashion.

CITIZEN PRESSURE

Citizens will demand more access to circular business models and product longevity. Citizens are already requesting information on the contents of the materials and the conditions of the workers who made them.

Brands will face increasing scrutiny by an informed public and will no longer be able to make false or misleading claims. Public scandals can lead to a loss in revenue, further incentivizing brands to act quickly and transition to sustainable supply chains to minimize risk.

Brands that are not prepared to adapt to circular models will **risk losing customers who want to support clothing brands that are aligned more with their values.**

GOVERNMENT REGULATION

Governments will have the potential to ban greenwashing, require traceability, mandate take-back systems, set recycled fiber requirements, tax virgin materials like polyester and use tax breaks to incentivize repair and resale services.

Without circular systems, the cost of virgin materials could become more expensive as natural resources become more scarce with climate change. **Brands can mitigate both of these potential costs by procuring recycled textiles**. As textile recycling grows in scale, the cost of procuring recycled textiles will over time decrease. By securing offtake agreements with recyclers, brands can drive down costs while simultaneously purchasing better materials for the planet.

“We need leadership to make a decision, because once leadership says do it, it gets done. It’s that simple.”

Stacy Flynn, Co-Founder & CEO // EVRNU

The following chart indicates brands participation in an assortment of certifications, commitments, initiatives and pacts. These were selected to be representative across the industry in materials, waste and circular commitments.

Figure 6, shown below, demonstrates that the overwhelming majority of brands selected for the literature review are not participating in some of the most common commitments and pledges, which would help brands shift to more circular business models.

32 brands were selected for deeper analysis:

Adidas, Allbirds, Arc'teryx, ASOS, Burberry, C&A, Chanel, Columbia, Forever21, GAP, Gucci, H&M, Hermes, Icebreaker, Levi's, Louis Vuitton, lululemon, Mammut, New Balance, Nike, Pangaia, Patagonia, Primark, REI, Stella McCartney, Timberland, TJ Maxx, Under Armour, Uniqlo, Urban Outfitters, Zalando SE, ZARA

FIGURE 6: BRAND PARTICIPATION

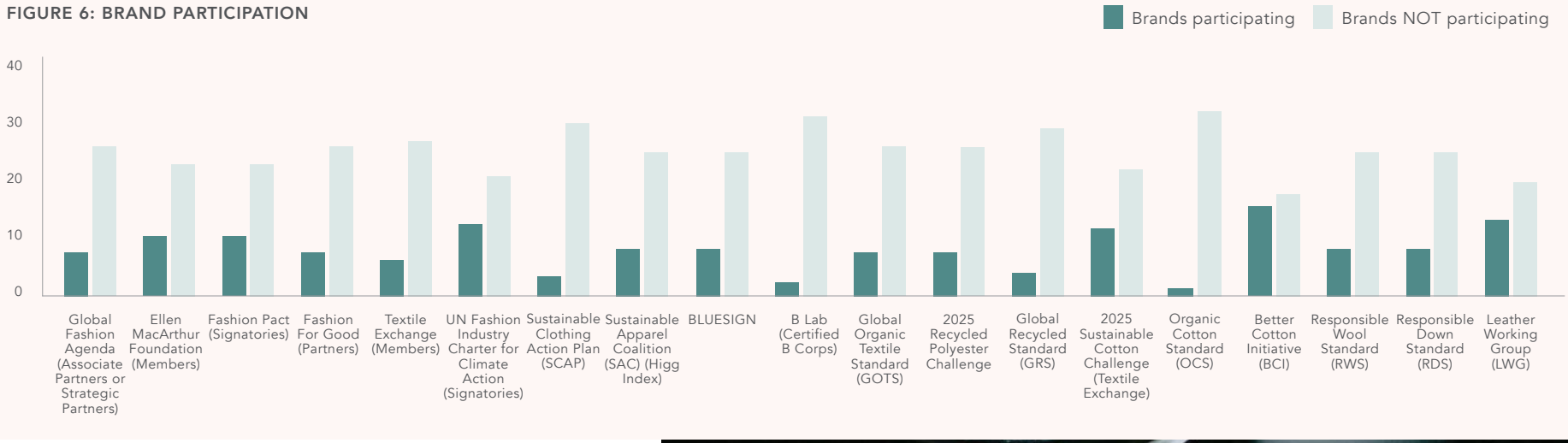


FIGURE 7: SYNTHETICS ANONYMOUS REPORT

Fashion Revolution found that "18% of brands explain what they are doing to develop circular solutions that enable textile-to-textile recycling (innovations beyond reuse and downcycling), but only 4 brands (2%) publish data on what percentage or number of products are designed to enable closed loop or textile-to-textile recycling at the end of the product's life." [169]

Brands continue to promote their efforts on the lowest hanging fruit.

GREENWASHING

Greenwashing is common practice within the fashion industry due to the limited mandatory global legislation addressing false claims and inadequate universal standards in brands' sustainability reports.

That being said, many nonprofit organizations within the fashion industry are working to determine if the claims made by brands are truly based on scientific evidence. Brands can avoid greenwashing by backing up claims with certifications demonstrating that a third party has verified the information. The Changing Markets Foundation reviewed items of clothing that were identified to be sustainable and conducted research to determine if they were supported by an accredited certification.

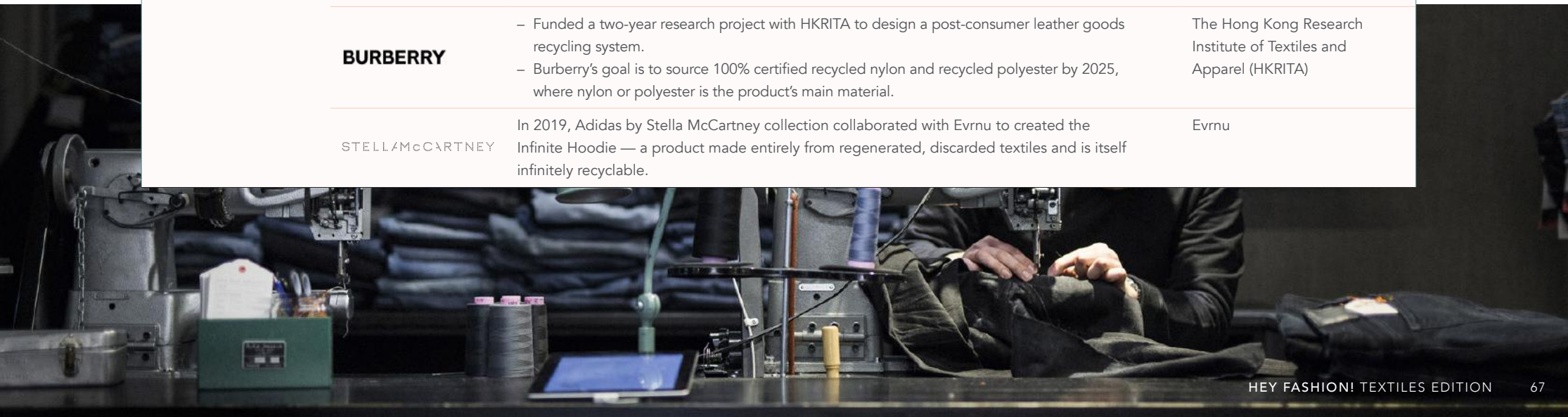
For example, Gucci had 283 items of textiles listed with a sustainability claim but 0 items had a certification to support the claim. [170]

Zalando had 360 claims with 206 certifications to support the claims while H&M had a total of 212 claims and 0 certifications to support the claim. [171] Greenwashing and lack of consistent definitions prevents consumers from being able to trust the content produced by brands. Upcoming legislation and certifications aim to prevent the widespread use of incorrect statements and help consumers navigate claims made by brands.

Brand led initiatives

TABLE 8: SNAPSHOT OF RECENT BRAND INITIATIVES

TYPE OF INITIATIVE	BRAND	ADDITIONAL DETAILS	PARTNER ORGANIZATION
PRODUCT DESIGN	adidas	The Futurecraft.loop shoe is made from one material with no glue and is 100% recyclable.	
	icebreaker Move to natural	Spinnova and VF brand Icebreaker are developing circular midlayer products with blends of merino wool and SPINNOVA fiber that can be separated and reused.	Spinnova
	finisterre	Finisterre created a circular, biodegradable jacket called Finisterre Biosmock, which contains BIO™ Yarn made from recycled materials that have the capacity to break down quickly in landfills and marine environments.	PrimaLoft®
RECYCLED MATERIALS	Levi's	Levi Strauss & Co made a jean with organic cotton and Circulose using material made partly from worn-out jeans.	Wellthread™ Renewcell
	patagonia	– By 2025, all apparel products will be made from 100% recycled, reclaimed or renewable resources. – By 2030, 100% of the cotton and hemp fiber used will be Regenerative Organic Certified (ROC).	
	BURBERRY	– Funded a two-year research project with HKRITA to design a post-consumer leather goods recycling system. – Burberry's goal is to source 100% certified recycled nylon and recycled polyester by 2025, where nylon or polyester is the product's main material.	The Hong Kong Research Institute of Textiles and Apparel (HKRITA)
	STELLA McCARTNEY	In 2019, Adidas by Stella McCartney collection collaborated with Evrnu to created the Infinite Hoodie — a product made entirely from regenerated, discarded textiles and is itself infinitely recyclable.	Evrnu



TYPE OF INITIATIVE	BRAND	ADDITIONAL DETAILS	PARTNER ORGANIZATION
RESALE	GAP	Customers turn in secondhand clothes in exchange for shopping credit that can be redeemed at Gap, Banana Republic, Athleta or Janie and Jack brands.	ThredUP
	patagonia	Patagonia and its Tin Shed Ventures investment partner, Yerdle, launched WornWear.com, a re-commerce platform for selling repurposed Patagonia gear that's traded in for Patagonia store or Worn Wear credit.	Trove Yerdle
	KERING	Tiger Global Management and French luxury group Kering invested €178M (US$216M) and acquired a 5% stake in the Vestiaire Collective (the resale platform).	Vestiaire Collective
	COACH	Coach (Re)Loved is the brand's latest initiative that allows customers to recycle previously used bags and shop for secondhand bags.	
	STELLA McCARTNEY	The RealReal, a secondhand fashion marketplace, launched a new upcycled apparel collection with 8 luxury brands.	The RealReal
REPAIR	zalando	Offering affordable aftercare services — trialing in Berlin and Dusseldorf allowing Zalando customers to repair, alter or clean their clothes.	Save your wardrobe
	patagonia	Fixed more than 100,000 items in 2020 through the Worn Wear Program (re-commerce platform).	Trove
	BURBERRY	Offer a range of professional repair services for Burberry clothing, including replacement of trench coat parts if lost or broken. Complimentary basic alterations on full-price items within 3 months of purchase in the majority of stores.	
	HERMÈS PARIS	– From saddles to silks to watches, all Hermès objects can be repaired and spruced up again. – 123,000 repairs were carried out in 2020.	
	Nudie Jeans co	– Every pair of Nudie Jeans comes with a promise of free repairs. – Nudie Jeans offers Repair Shops for jeans to be repaired, resold as secondhand or even donated to the Nudie Jeans recycling program.	
TAKE BACK (DONATION)	NIKE	Nike decided to re-energize the product take-back program called "Reuse-A-Shoe" program, which has been running for 25+ years.	
	INDITEX	Inditex invested €7 million from 2016–2022 to create the Moda Re-Programme by Cáritas. Cáritas is dedicated to the collection and processing of used textiles for recovery and reuse while also generating employment for vulnerable groups.	Cáritas

TYPE OF INITIATIVE	BRAND	ADDITIONAL DETAILS	PARTNER ORGANIZATION
RENTAL	MUD JEANS	MUD jeans offers a "Lease a jeans" program for a monthly fee, allowing the customer to keep or swap jeans after a year of rental.	Save your wardrobe
	REI co-op	REI offers gear rentals programs in select stores, which gives members and customers an affordable way to try out a new activity (offer items from snowshoes to fully equipped camping and backpacking kits).	Trove
TEXTILE-TO-TEXTILE RECYCLING	BESTSELLER	– Bestseller invested €30 million in Infinited Fiber Company and signed a multi-year sales agreement for the company's Infinna fiber. – Bestseller also invested in TakaTaka Solutions, a textile waste management company in Kenya.	Infinited Fiber Company
	zalando	Zalando invested in the Textile Regeneration Technology Group, Infinited Fiber Company, to help them achieve their goal of extending the life of at least 50 million fashion products by 2023.	Infinited Fiber Company
	H&M	– The Circular Innovation Lab ran a pilot project with Infinited Fiber Company, which led to a CO:LAB investment and to a first proof of concept of a sustainable cellulosic fiber made from recycled cotton textiles. – H&M also supported Renewcell to develop its Circulose fiber (made from recycled cotton) launching the first product in 2020.	– Infinited Fiber Company – Renewcell
	KERING	Kering was one of the first investors in Worn Again Technologies (since 2015). Worn Again is a closed-loop solution capable of separating polyester polymers and cellulose from non-reusable textile in cotton before it is spun back into new fibers.	Worn Again
FOSSIL FUEL ELIMINATION	icebreaker Move to natural	Eliminating all fossil fuels from their material (both recycled and virgin) by 2023.	
	patagonia	By 2025: 100% carbon-neutral across the entire supply chain. To reach this goal, they will invest in renewable projects and purchase certified carbon offsets.	

CASE STUDY

EILEEN FISHER

EILEEN FISHER, Inc. focuses on durability, timeless fashion and high-quality materials. RENEW is one of the first take-back systems established in 2009, which has saved over 1 million EILEEN FISHER, Inc. items to date.

A so-called "Tiny Factory" was established at their HQ, where products are manually sorted, graded, then directed for reuse or recycling. Items in good condition are washed and resold on the RENEW platform. Simple repairs or style overhauls such as over dye or patchwork expand the RENEW range. [172]

Remaining items are recycled into new materials for accessories, pillows, wall hangings and artworks. Each item is unique, handmade and utilizes different textile scraps. To encourage customers to give EILEEN FISHER, Inc. clothing another life, a $5 "Renew Rewards card" per item is offered.

By taking ownership of their products, and ultimately, the materials, feedback loops are created that benefit the overall development process and understanding of customers. Product wear and tear or characterful aging of materials provide invaluable insights to iterate and improve upon, in contrast to constant newness.

Many brands have since followed suit; however, few have been able to keep products circulating within their ecosystem as effectively as EILEEN FISHER, Inc. as it is a time consuming, labor intensive process that they have consciously invested in. EILEEN FISHER, Inc. has helped elevate the problem of textile waste and continues to demonstrate the importance of proactive leadership.

> So much time can be lost theorizing, at some point, you just have to start. You never even get the opportunity to know what the problems are if you never get started.

Abigail Erickson, Former Project Manager, Waste No More // EILEEN FISHER, INC.

WHAT CAN WE CONCRETELY ACHIEVE WITH TEXTILE RECYCLING IN 5-10 YEARS?

Dr. Ashley Holding, founder of Circuvate [173] (an expert consultancy company specializing in sustainable materials, recycling and circular product innovation), and Arianna Nicoletti, Circular Textiles Lead with Circular Berlin, remain skeptical about the ambitious targets set by brands for textile recycling in 2025 and 2030. In Dr. Holding's opinion, a more realistic timeline for scaling textile recycling globally would be three decades. In the next five years, he would expect a "handful of facilities, which have a larger capacity, but there will still be a very, very tiny fraction of the available waste. And it really won't scratch the surface, in terms of textile waste." In his opinion, people tend to forget the amount of time it takes to scale a new technology. "Time is an important factor when considering how to scale textile recycling to commercial capacity worldwide." Tanja Karila from Infinited Fiber Company explained that "**it takes time to build a factory with the capacity of 30,000 tonnes per year.** We have everything in place, but it just takes a long time to finalize the project and ramp up the production. And it is not enough that we build our factory, the demand is exceeding our supply capacity. Therefore, we have a parallel business model to license our technology."

Karla Magruder, Founder of Accelerating Circularity, seems more optimistic: **"I'm excited about the potential of textile circularity! I think we can figure it out by 2030**, there will absolutely be facilities that will be commercialized, and there will be a bigger percentage of circular materials. A percent of the industry will absolutely be circular by then."

Cyndi Rhoades from Worn Again says, "**2025 is going to be a significant year in terms of regenerative recycling technologies.** It will be a year when multiple innovators have launched industrial scale re-processing plants which are able to turn the vast majority of non-reusable textiles, including mono fiber and blends, back into virgin equivalent resources for making new textiles. While early capacities will represent just a drop in the bucket in terms of global fiber consumption, 2025 will mark an essential turning point on the roadmap to full circularity for textiles."

Current barriers

LIMITED INFRASTRUCTURE

Some brands have started to collect clothing with the intention of eventually recycling it once textile-to-textile recycling is commercially available. Governments and investors can help promote the infrastructure needed to optimize the process of collecting, sorting and recycling. While the unified infrastructure for recycling is being established, other circular models are being explored. With no time to spare, brands need to test a variety of options, such as collaborating with service providers and other stakeholders to iterate and assess the best circular options for their business.

OVERPRODUCTION, UNSOLD INVENTORY AND ONLINE RETURNS

In 2018, H&M stated that their unsold inventory was worth 4.3 billion USD. [174]

Overproduction, unsold inventory and online returns have resulted in an influx of waste. Brands desperate to "out-convenience their competitors" have offered free and fast return policies driving forward new industry standards. "With the pandemic pushing shopping online more than ever before, **returns have skyrocketed, more than doubling from 2019 to 2020**. Last year in the US, citizens returned 102 billion USD of online purchases." [175]

Returns can cost retailers more than double the original delivery. The economic incentive for retailers to process returns back into their network is therefore low — especially with products of low value. [176]

In many countries, the US included, destroying excess product is a legal and cheap solution. For fashion companies, the rise of online shopping has resulted in high return rates between **30-50%**. [177] "Brands across the price spectrum from H&M to Burberry have been caught incinerating or dumping products. Most recently, Coach was blasted online for chopping up and dumping 'unsellable' damaged bags, despite 40% of the brand's stores offering repair workshops for broken products." [178]

In truth, all brands have unsellable products to deal with, whether it's unsold inventory, damaged goods or customer returns and the industry has not yet created enough solutions for dealing with them effectively. [179]

Rachel Kibbe, founder of Kept SKU, works to resell returned items that would otherwise not be used again. In her experience, quality assurance standards are not fit for purpose. "A lot of times items might have a light nick, or be missing a hang tag. That's considered damage. Some of the things considered damage aren't even visible to the human eye. Some brands will not incinerate, but they'll just pay for storage for years and years."

With almost half of online purchases returned, the industry needs to urgently address its product management of e-commerce to keep clothing circulating at its highest value and out of the landfill.

CASE STUDY

SHEIN allyLikes

Shein is a Chinese fast fashion company that has experienced explosive growth over the pandemic and solely exists online. It currently reaches 250 million people through YouTube, TikTok and Instagram, adds a staggering 6,000 new items online daily and ships globally directly from its Guangzhou warehouse. [180] Shein leverages proprietary software to apply big data from sales to its designs, alongside proximity to a huge network of suppliers to deliver short production runs within expedited timelines of only 25 days — far outpacing competitors. The average item costs 10 USD and is targeted to the US, Europe and Australia. This "test and repeat" model coupled with ultra-low prices enables Shein to accelerate fast fashion yet further. [181]

AllyLikes, from Chinese e-commerce giant Alibaba, is a similar concept looking to compete. Their customer base outside China hit 300 million in 2021, and the company has stated their goal of reaching 2 billion people worldwide. [182] These models target young consumers with endless cheap new products at ever increasing speeds. This rapid consumption model reinforces the disposability of clothing, and their success shows there is still significant appetite for it, demonstrating a need for immediate, impactful change.

COMMON MISCONCEPTIONS

01 Circularity by definition will be more sustainable

Rental models, for example, aim to keep product in use. However, the environmental cost of transporting items to and from customers is not yet understood. It could be the case that CO2 emissions outweigh the environmental benefits of clothing reuse.

02 Recycled means circular

Different terms, not to be used interchangeably. Recycled fibers are not by definition able to be recycled, and therefore circular. Circular fibers are those capable of multiple cycles through available recycling technologies. Following the waste hierarchy, recycling should be considered as the last step to recover value.

03 Bespoke closed loop cycles are what brands need

Recycling product back into the same product can work for certain specific products but in reality does not have the scale needed for most fashion brands. Textile recycling which can be applicable to a wider range of high value applications may have a much bigger impact.

04 Current consumption levels can be balanced by proposed sustainability initiatives

The planet and people cannot withstand the current consumption levels. Landfills are overflowing with waste, which directly harm the environment. Citizens need to consume less and care for the clothing they already own.

05 Brands need to act alone

Brands need to collaborate, come together and form strategic partnerships to solve the scale of the structural and systemic problems being faced.

CASE STUDY

GANNI Levi's

Carbon offsetting is a tactic used to offset a company's emissions by paying for decarbonizing programs elsewhere, like planting trees. Carbon *insetting*, an approach being trialed by Danish brand **GANNI**, addresses emissions directly within the supply chain. Brands have largely not accounted for their entire supply chain when reporting emissions (indirect supply chain emission known as Scope 3). Considering Scope 3 represents on average 96% of fashion brands' emissions, the urgency for businesses to address them is clear. [183] GANNI plans to partner with their T-shirt supplier to build a solar plant in Portugal, helping one of their primary suppliers transition to renewable energy. The carbon and biodiversity will be measured before and after the pilot to ensure the brand is creating positive change.

Levi's is also *insetting* by helping to reduce the energy and water consumption of their factories and mills in a partnership with the International Finance Corporation. [184] Carbon *insetting* offers an exciting opportunity for brands to directly impact their own supply chain and take responsibility over their production process.

> Consuming less, that's the most difficult thing we have to get to. Companies find it very difficult to change their business concept of selling clothing.

Arnoud Passenier, Strategic International Advisor on Circular Economy

Standardized reporting

Standardized reporting would allow reliable comparisons to be made across brands' sustainability performance. It is a pathway to allow governments, citizens and investors to reward progress and build trust. With rampant greenwashing in the fashion industry, a standardized reporting framework for brands would help increase transparency, ensuring that adequate sustainability measurements are included and that they are accurate and verifiable.

SUGGESTED CONTENT IN SUSTAINABILITY REPORTS

- Include and establish universal definitions & key terminology
- Create quantifiable and measurable targets with detailed roadmaps for implementation
- Collect data on the quantity of post-industrial textile waste throughout supply chains, and record its current destination
- Include fiber specific goals and textile waste management strategies
- Report annual volumes of material procured by fiber type
- Report annual unsold inventory, followed by strategies on how to improve and manage it (the EU will soon ban the destruction of unsold products)
- Publish a 2025 and 2030 net-zero roadmap
- Communicate failed and successful circular initiatives to help all stakeholders learn and grow

STANDARDIZED LABELING

Consumer-facing product labels are better placed to directly communicate to citizens. Standardizing the data on them would be an effective tool for citizens to evaluate the sustainability of products on the market, giving them the agency to compare and understand the impact of their actions. For example, the Sustainable Apparel Coalition (SAC) is working with Everythng, Avery Dennison Retail Branding and Information Solutions to create a "digital identity for products." [185] This pilot program will test how suppliers, manufacturers, retail brands and consumers interact with sustainability data to create the most effective label possible. Standardized labels could also convey information to recyclers and other end users. The European Commission will consider the possibility of introducing a standard digital label for all EU Member States making it an important consideration for brands moving forward. [186] A standard label would push brands to be more transparent and communicate science-based verified data.

AVAILABLE STANDARDS & CERTIFICATIONS

Standards offer a platform for brands to publicly showcase their sustainability efforts, while helping to provide guidance and support when setting up the appropriate systems required to track key performance indicators. However, voluntary initiatives have received growing criticism around the effectiveness of their initiatives. According to the "License to Greenwash" Report released by Changing Markets Foundation in 2022, "most schemes are not comprehensive, i.e., they do not cover the full life cycle of textile production or they focus just on one material or product." [187] The qualitative analysis of +100 sustainability certification schemes concluded that "most fail to meaningfully uphold high levels of ambition" allowing brands to project the impression of progress. [188] By allowing brands to self-select from a variety of standards and initiatives, entire topics or tiers of the supply chain with the largest GHG emissions can be omitted entirely. It is important to keep in mind that no standard is perfect, but they can be effective tools for understanding baseline measurements and providing the structure for brands to be successful. The following pages explore examples of popular standards used in the fashion industry.

EXAMPLES OF BRANDS AND GROUPS CURRENTLY USING THE HIGG INDEX:

GROUPS

HANES BRANDS
H&M GROUP
VF CORP
KERING
INDEX

INDIVIDUAL BRANDS

ASOS
BOOHOO
C&A
CHAMPION
COV
DICKIES
GAP
HANES
J BRAND
LEVI'S
LOUIS VUITTON
LULULEMON
MONKI
NIKE
PATAGONIA
PRIMARK
SUPREME
THE NORTH FACE
WEEKDAY
ZALANDO

THE SUSTAINABLE APPAREL COALITION & THE HIGG INDEX

The aim of The Sustainable Apparel Coalition (SAC) is to join stakeholders together to reduce the environmental impacts and promote social justice within the fashion industry. [189] It's made up of over 250 leading apparel, footwear and textile brands, retailers, suppliers, service providers, trade associations, nonprofits, NGOs and academic institutions. [190]

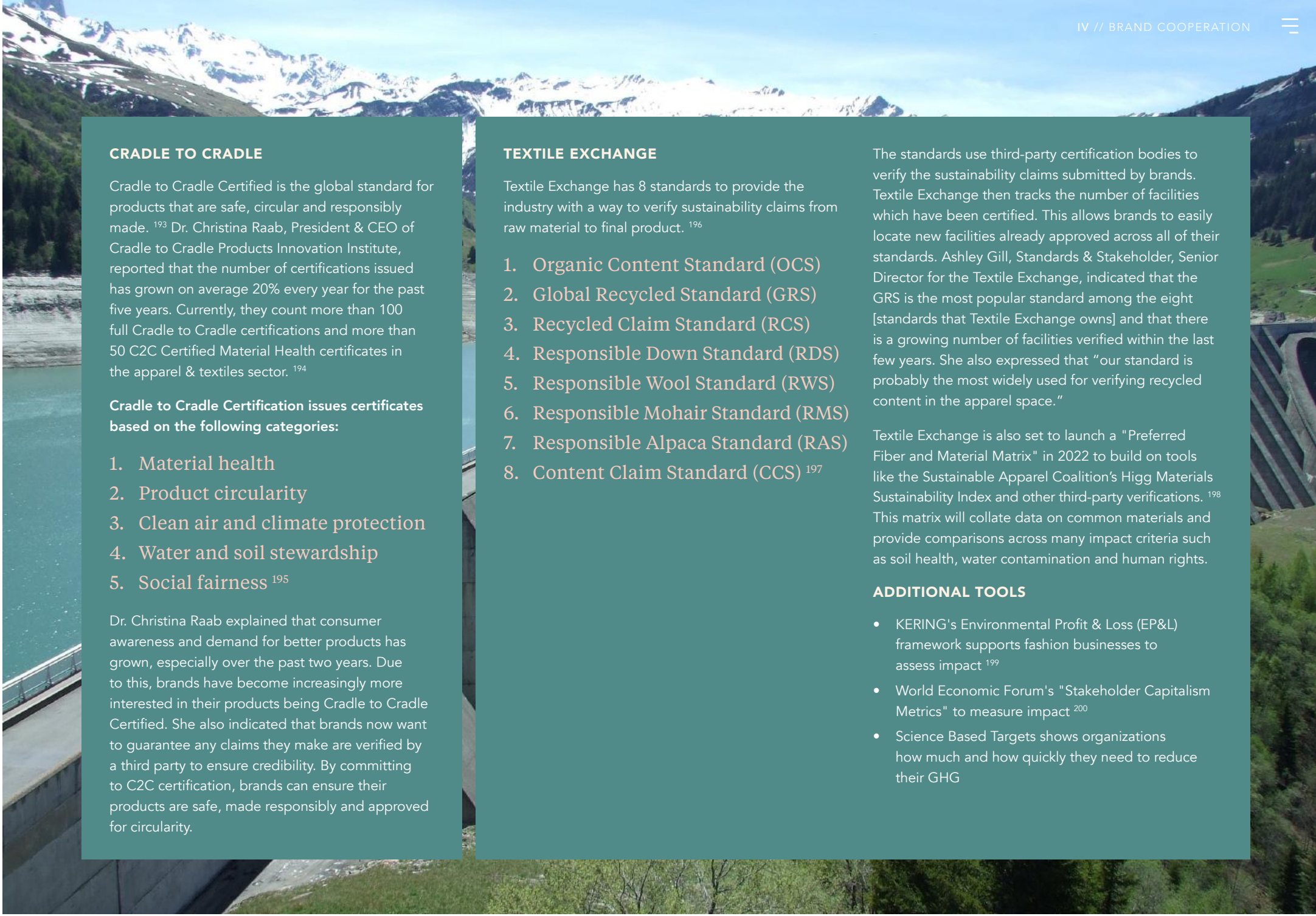
By 2025, we're aiming to have all SAC members participate in public-facing ratings of sustainable performance that are credible and trusted. [191]

SAC offers a suite of tools under The Higg Index:

FACILITY ENVIRONMENTAL MODULE (FEM)
FACILITY SOCIAL & LABOR MODULE (FSLM)
BRAND & RETAIL MODULE (BRM)
MATERIALS SUSTAINABILITY INDEX (MSI)
PRODUCT MODULE (PM)

Each tool has a verification program to verify the data submitted by brands. Currently, companies participate in self-assessments before becoming verified. Factory audits take place to verify that the data reported is credible and comparable. Brands use this index to understand their environmental and social impacts along the value chain. The sustainability measurements are consistent for all participants, allowing brands to understand where they can make improvements and prove to customers their data is reliable and accurate.

The Materials Sustainability Index (MSI) specifically scores the environmental impact of materials. For example, the MSI compares the environmental impacts of different cotton varieties to help inform brands of the best options available. The MSI primary data is vetted by a third-party gatekeeper, while secondary data is independently peer reviewed. [192] Offering common criteria for life-cycle assessments, methodology and procedures allows for direct comparisons currently missing across the industry. MSI therefore helps brands make informed decisions and improve their procurement strategies.



CRADLE TO CRADLE

Cradle to Cradle Certified is the global standard for products that are safe, circular and responsibly made. [193] Dr. Christina Raab, President & CEO of Cradle to Cradle Products Innovation Institute, reported that the number of certifications issued has grown on average 20% every year for the past five years. Currently, they count more than 100 full Cradle to Cradle certifications and more than 50 C2C Certified Material Health certificates in the apparel & textiles sector. [194]

Cradle to Cradle Certification issues certificates based on the following categories:

1. Material health
2. Product circularity
3. Clean air and climate protection
4. Water and soil stewardship
5. Social fairness [195]

Dr. Christina Raab explained that consumer awareness and demand for better products has grown, especially over the past two years. Due to this, brands have become increasingly more interested in their products being Cradle to Cradle Certified. She also indicated that brands now want to guarantee any claims they make are verified by a third party to ensure credibility. By committing to C2C certification, brands can ensure their products are safe, made responsibly and approved for circularity.

TEXTILE EXCHANGE

Textile Exchange has 8 standards to provide the industry with a way to verify sustainability claims from raw material to final product. [196]

1. Organic Content Standard (OCS)
2. Global Recycled Standard (GRS)
3. Recycled Claim Standard (RCS)
4. Responsible Down Standard (RDS)
5. Responsible Wool Standard (RWS)
6. Responsible Mohair Standard (RMS)
7. Responsible Alpaca Standard (RAS)
8. Content Claim Standard (CCS) [197]

The standards use third-party certification bodies to verify the sustainability claims submitted by brands. Textile Exchange then tracks the number of facilities which have been certified. This allows brands to easily locate new facilities already approved across all of their standards. Ashley Gill, Standards & Stakeholder, Senior Director for the Textile Exchange, indicated that the GRS is the most popular standard among the eight [standards that Textile Exchange owns] and that there is a growing number of facilities verified within the last few years. She also expressed that "our standard is probably the most widely used for verifying recycled content in the apparel space."

Textile Exchange is also set to launch a "Preferred Fiber and Material Matrix" in 2022 to build on tools like the Sustainable Apparel Coalition's Higg Materials Sustainability Index and other third-party verifications. [198] This matrix will collate data on common materials and provide comparisons across many impact criteria such as soil health, water contamination and human rights.

ADDITIONAL TOOLS

- KERING's Environmental Profit & Loss (EP&L) framework supports fashion businesses to assess impact [199]
- World Economic Forum's "Stakeholder Capitalism Metrics" to measure impact [200]
- Science Based Targets shows organizations how much and how quickly they need to reduce their GHG

“

We’re never ever saying that transparency is the end result. We know that it is a first step. But it basically allows a culture of scrutiny.

”

Orsola de Castro, Founder // FASHION REVOLUTION

Barriers preventing accurate & reliable reporting

Sustainability reporting is gaining traction but is far from a widespread industry practice.

LACK OF TRANSPARENCY

Without a universal format or regulatory framework to follow, brands' sustainability reports vary dramatically. Some include specific data and targets on material usage, waste collected or circularity commitments, while others have little to no information. Brands can hide inaction by not reporting data, exclude supply chain emissions or communicate targets devoid of implementation strategies. A prescribed format with agreed upon metrics would be beneficial to all stakeholders to reliably understand which brands are actively driving progress and easily compare efforts across the most important ESG topics.

LACK OF DEFINITIONS

Without industry standard definitions across all sustainability reports, it is difficult to compare information and initiatives between brands. Broad statements such as "more sustainable, recycled or circular" need context and definitions to offer clarity to the reader.

LACK OF ACCURATE DATA

Accurate reporting of facts and figures needs regulating to prevent false or misleading data being circulated. One example involves the amount of water required to make a T-shirt. **It is widely reported that 2,700 liters (713 gallons) are needed to produce the average cotton T-shirt and yet this statistic is inaccurate.** [201] There is a vast difference between how cotton is produced across different regions. "To start, 56% of the world's cotton area is purely rainfed and doesn't require irrigation," according to Dr. Keshav Kranthi, who worked as a cotton scientist in India for 27 years before joining ICAC in 2017. [202] "It's not a water-thirsty crop, it's one of the most resilient," he said. "That's why farmers in many parts of the world, including Africa and India, prefer to grow cotton instead of other crops." [203]

This example illustrates that "sustainable" sourcing is complex and multifaceted. Continuing the cotton example, considering other externalities such as region and method of cultivation, pesticide and fertilizer use, provision of jobs and income would give a more balanced picture. Inaccurate data, especially when influencing decisions that have ramifications along the supply chain and for the overall climate, is highly problematic. Brands need to do a better job fact-checking information circulated within their reports and marketing material.

Without scrutiny from experts, marketing from large multi-national brands can also overemphasize or misconstrue information. The use of recycled polyester from PET bottles is another example. It has been widely adopted by the industry as a progressive solution, and subsequently many consumers now believe it is a highly sustainable option, despite the limited global capacity to recycle it back into textiles versus much more widely established and cost effective bottle-to-bottle recycling.

The accuracy of claims published in sustainability reports poses significant threat to brands. A lawsuit recently brought against US footwear brand *Allbirds* concerns their sustainability advertising. [204] The main allegation centers around their life cycle assessment tool — which identifies the carbon footprint of each product. The lawsuit argues that they "did not assess the environmental impact beyond the manufacturing of the shoes. This meant it ignored the impact of wool production, including water, eutrophication or land occupation, which meant that almost half of wool's environmental impact was excluded." [205] The outcome of this case will not only impact Allbirds but potentially all brands.

Without experts and scientists verifying information published in sustainability reports, consumers are subject to potentially false and misleading information.

CONCLUSION

Brand cooperation

Vital to an industry-wide transformation

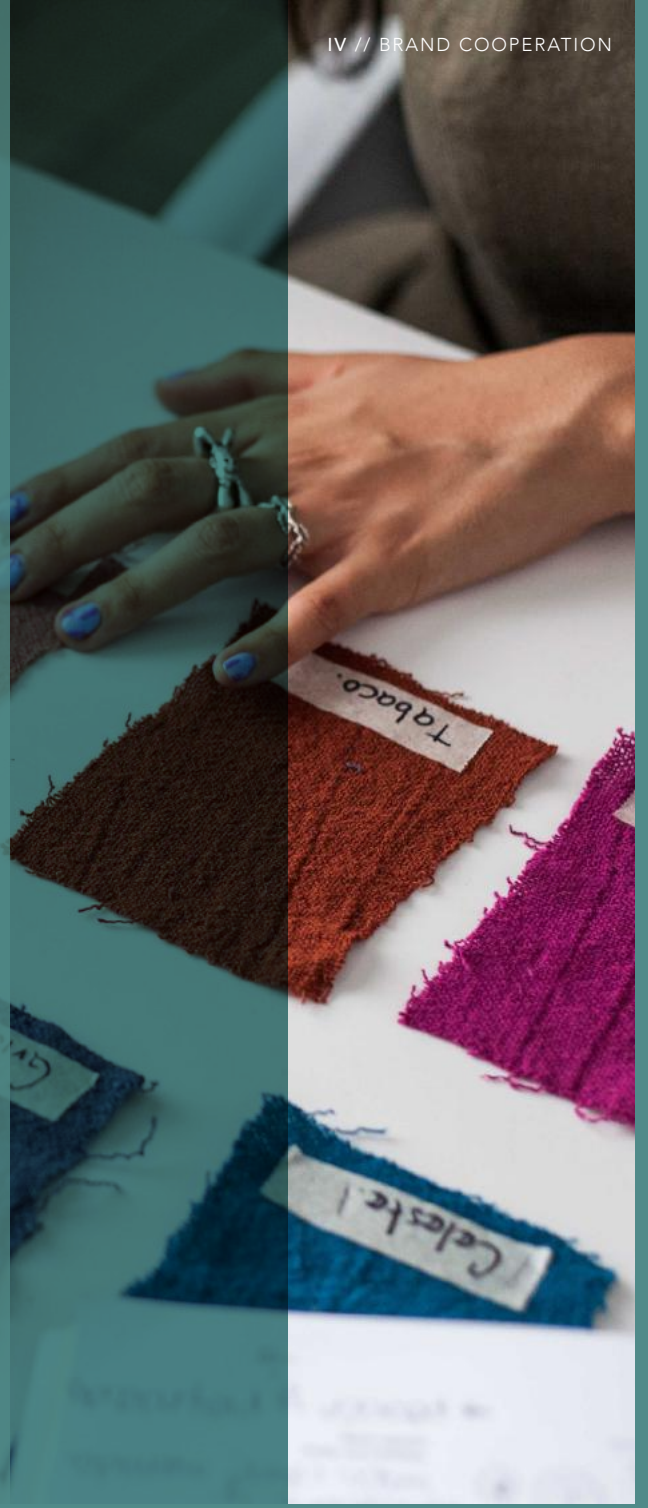
Brands have significant work to do when it comes to industry-wide change.

Being proactive and understanding all aspects of circularity in the context of fashion will ensure brands evolve responsibly and profitably, with highly skilled teams and supply chain partners to enact these principles. Continual analysis of new initiatives and business models is essential to ensure they have the intended impacts on increasing clothing utilization and eliminating textile waste.

Fostering deep cross-sector collaboration and strategic partnerships throughout their operations will accelerate the transition. Promoting transparency will equip brands with the data to make informed decisions while building trust with increasingly engaged and demanding citizens.

RECAP

- *Collectively, brands are not doing enough to reduce textile waste*
- *Brands need to incorporate circular product design, resale, rental, repair, take-back systems, recycled materials, recycling, and eliminating fossil fuels.*
- *With only a third of the fashion industry on board to make lasting, urgent change, the fashion industry needs to push for increased collaboration and funding to drive forward meaningful circular strategies*
- *Data analysis and constant evaluation of the impacts of new business models are important to ensure desired impact*
- *Greenwashing is prominent in the fashion industry and should not be tolerated as a common practice*
- *Some industry experts are hesitant to believe textile-to-textile recycling will be launched globally, at scale, in the next 5-10 years, while others are more optimistic*
- *Infrastructure, overproduction, unsold inventory and online returns present major challenges for the industry to overcome*



KEY ACTION POINTS

Brand cooperation

01 SCALE COLLECTION & SORTING INFRASTRUCTURE	– Engage with established collection companies to divert textiles away from the landfill – Carefully consider any self-operated take-back programs: What products will you accept? What is the intention? What systems need implementing to process them? What partners exist to support implementation?
02 INVEST IN RECYCLING INFRASTRUCTURE	– Signal demand for recycled materials, make offtake agreements with recyclers – Financially invest in textile-to-textile recycling and sorting infrastructure
03 REDUCE PRODUCTION & CONSUMPTION	– Support customers to repair clothing via information, access or rewards – Explore alternative production models like on-demand or pre-order to minimize excess stock – Utilize technology to improve forecasting and procurement efficiency – Carefully monitor any alternative models such as rental or subscription, ensuring they increase clothing utilization and reduce environmental impact. Prioritize resale channels with a goal of replacing revenue from new product sales
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	– Actively engage in pre-competitive collaboration with other brands and suppliers – Seek mutually beneficial partnerships with all levels of textile value chain – Consider pooling purchase orders of recycled fibers or yarns to procure niche or high order volume materials
05 DESIGN FOR DURABILITY & RECYCLING	– Educate teams on circular design principles as defined by leading industry experts – Engage with textile recyclers to understand requirements and barriers to their processes – Minimize fiber blends and overall chemical usage within textiles – Focus on durable garment construction and improved testing of materials from resistance to pilling and wash care
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	– Commit to comprehensive reporting against standardized metrics – Set Science Based Targets – Explore digital passports embedded in clothing to encourage transparency
07 DIVEST FROM FOSSIL FUELS	– Phase out virgin synthetic materials – Transition to renewable energy within own operations and logistics – Financially support all tiers of supply chain to transition to renewable energy, prioritizing Scope 3 indirect value chain emissions
08 CHANGE THE METRICS OF SUCCESS	– Triple bottom line accounting, including true cost of materials, labor and environmental impact into products

CHAPTER V

Engaging citizens

Buying into circular fashion

- Overconsumption
- Education
- Common misconceptions

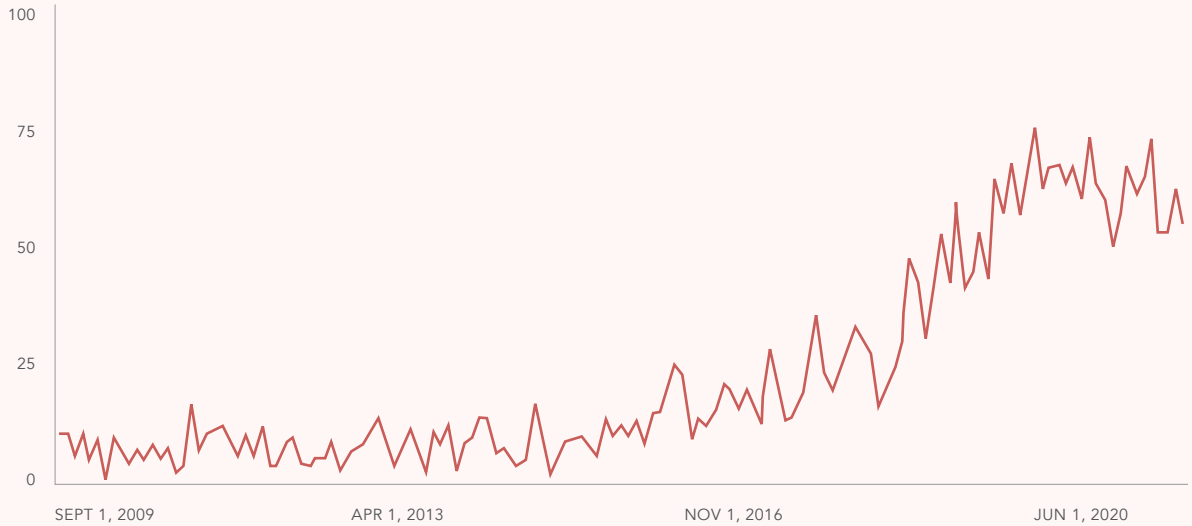
Understanding the climate conscious citizen

Citizens are in a unique position to exert their agency and demand circular systems in fashion.

Empowering them with the knowledge of the escalating dangers of current consumption habits and the wider environmental repercussions of fashion can make significant positive impacts. Using their purchasing power to support brands transitioning to circularity and really buying into new ways of consuming clothing will enable its widespread implementation.

Google searches for "Fashion industry waste" (Figure 8) increased significantly from 2009-2020 with the most hits in the UK and US. In 2020, the question **"Is Nike Fast Fashion" was up 300% from the previous year.** "Fast Fashion" as a topic was up 550% compared to the previous year. [206] The Google trend graph below captures the growing interest in sustainable fashion.

FIGURE 8: NUMBER OF GOOGLE SEARCHES FOR "SUSTAINABLE FASHION" OVER 11 YEARS



OVERCONSUMPTION

Reducing consumption is challenging because it requires *collective* behavioral change. Social habits like gifting during the holidays or shopping as a social activity makes it a difficult habit to break. Although the initial thrill of purchasing new clothing might be satisfying short term, many people feel unfulfilled long term despite marketing communicating that fashion will make them feel happy and beautiful. About "60% of German and Chinese citizens admit to owning more clothes than they need." [207] Over and over, capitalism fuels the constant need for more and more products, which perhaps detracts from longer lasting fulfillment or happiness.

All citizens have the power to reduce consumption and shift their purchasing habits to support circularity. Buying pre-loved fashion is the easiest alternative to displace new products, alongside celebrating the clothing they already own. Engaging with services such as repair, rental and resale is a way to signal to the industry, investors and policymakers that circularity is a priority.

> This cannot be done without the consumer. If it's not coming back into the system at the point of the consumer, we cannot achieve a full circular economy.

Dr. Christina Raab, President & CEO // CRADLE TO CRADLE PRODUCTS INNOVATION INSTITUTE

EDUCATION

Education is a powerful tool to inspire change and help citizens make informed choices. The easiest, low-tech, solutions have the power to make enormous impact.

Arianna Nicoletti, Circular Textiles Lead at Circular Berlin, explained that the environmental and social impacts of fast fashion should be taught as early as primary school. In her experience, education and practical know-how are essential because young people are often not even aware, for example, that cotton is a plant or that clothes are actually sewn by humans and not automated machines, making it difficult for them to understand the true value of their clothes. Younger generations have "always had fast fashion in their wardrobes" and might not have been exposed to the idea that a garment can be kept for 20 years. Learning making & repairing skills is another crucial instrument to teach new generations that clothes should not be considered disposable.

> **"Education is key, not only with brands and their teams but in educational institutes. Circular economy skills are often missing and it is a crucial component to push the fashion industry forward."**
>
> Gwen Cunningham, Lead Circle Textile Program
> CIRCLE ECONOMY

COMMON MISCONCEPTIONS

01 Used clothing is commonly recycled into clothing

In reality, this figure is less than 1%. Cotton, cashmere and wool clothing is most commonly recycled into new clothing, while the vast majority of recycled polyester comes from waste packaging sources like PET bottles.

02 What happens to donated clothes

Approximately 10-30% ends up in local charity shops. The rest is exported for resale in other countries, often in the global south, a huge percentage of which ends up landfilled, incinerated or dumped illegally.

03 Items donated are of good quality

With the growth of resale, people typically keep valuable items to sell themselves and donate lower value items. The abundance of low-quality clothing has simultaneously increased the overall volume for collectors to sort through.

> Calling people consumers reduces their sphere of influence; people are citizens first.

Ashley Gill, Standards & Stakeholder, Senior Director // TEXTILE EXCHANGE

"We've talked to not only consumers, but people working in retail and H&M stores, about what they think happens to the clothing in the take-back bins that say recycling on them. And the people working retail literally thought that the clothing that people were putting in there was going into the clothes that they were then hanging on the rack."

Liz Ricketts, Co-Founder & Director
THE OR FOUNDATION

CONCLUSION

Engaging citizens

Buying into circular fashion

Consumers hold significant power and will dictate the future of circularity in fashion.

Their engagement with new business models and services offered by brands will ultimately decide their success and therefore widespread adoption. The more consumers signal to brands that they care about responsible materials, production and handling of clothing waste, the more brands will have no choice but to change their behavior to remain relevant. A growing number of people are scrutinizing brands' actions and reliability of their sustainability marketing claims and overall lack of transparency, as illustrated by the sharp rise in Google searches for "Fashion industry waste." Governments can enable them further by communicating the textile waste situation clearly, regulating greenwashing and making genuinely sustainable products and services costs competitive through various policy mechanisms.

RECAP

- *Citizens are becoming more aware of the environmental degradation associated with the fashion industry*
- *Global consumption of textiles and associated fashion products is nevertheless at an all time high and projected to keep growing past 2050*
- *Post-consumer clothing is a global industry with a considerable carbon footprint*
- *The consequences of high-income countries exporting their citizens' textile waste and subsequent pollution to lower-income countries are becoming more publicized*
- *Greenwashing combined with the multitude of certifications and standards is creating confusion around brands' claims*
- *Lack of transparency around the textile value chain*

KEY ACTION POINTS

Engaging citizens

01 SCALE COLLECTION & SORTING INFRASTRUCTURE	
02 INVEST IN RECYCLING INFRASTRUCTURE	
03 REDUCE PRODUCTION & CONSUMPTION	– Reduce overall consumption – Engage with new ways of experiencing fashion, such as swapping or renting – Repair and resell clothing to retain value – Invest in quality, timeless products wherever possible from brands using high-quality materials offering warranties or repairs – Always wash items before donating, and dispose through responsible channels like municipal recycling or in-store bins – Pressure governments to support anti-greenwashing, improved labeling, EPR policies and textile recycling infrastructure investment
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	
05 DESIGN FOR DURABILITY & RECYCLING	
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	
07 DIVEST FROM FOSSIL FUELS	
08 CHANGE THE METRICS OF SUCCESS	

CHAPTER VI

Government action

Directional policies to elevate textile circularity

- → Global commitments
- → Regional commitments
- → Country level commitments

Global commitments

PAVING THE WAY FORWARD

To achieve swift action across all levels of the fashion industry and drive circularity forward, bold, directional policies from governments are essential. Some brands are self-motivated to incorporate circularity into their long-term strategies and are already taking action; but a large proportion have yet to demonstrate any appetite to develop circular models, push for renewable energy use or transition away from virgin fibers. Governments can help promote effective, comprehensive and affordable circular models through economic incentives, investing in infrastructure and promoting EPR programs which ensure a just distribution of funds throughout the global supply chain. Preventing greenwashing alongside pushing public educational campaigns will empower citizens to make informed decisions on where to spend their money.

UNITED NATIONS ALLIANCE FOR SUSTAINABLE FASHION

The United Nations Alliance for Sustainable Fashion consists of UN agencies and other organizations invested in supporting and advancing the SDG within the fashion industry.

The 17 Sustainable Development Goals act as a blueprint to help tackle climate change, while protecting people and the planet.

This alliance helps promote collaboration and transparency between UN agencies to ensure that the SDG targets are achieved. The alliance works through every level of the supply chain—from raw materials to distribution of garments. [208]

During the United Nations Climate Change Conference (COP26), "signatories to the Fashion Industry Charter for Climate Action have agreed to update their science-based emission reduction targets in recognition of the swift need for climate action." [209] Companies will now need to halve their carbon emissions by 2030 instead of the previously agreed upon 30%, which met the Paris Climate Agreement's target. [210] "Further commitments outlined in this update include sourcing 100% of electricity from renewable sources by 2030, sourcing 'environmentally friendly' raw materials, and phasing out coal from the supply chain by 2030." [211]

The **UN Fashion Industry Charter for Climate Action**'s mission is to

> "drive the fashion industry to net zero Greenhouse Gas emissions no later than 2050 in line with keeping global warming below 1.5 degrees." [212]

A total of 125 signatories have committed to the charter signaling the desire for a transformation within the industry. A few examples of brands that have signed the charter include: VF Corporation, Adidas, LVMH, Kering Group, H&M Group and Primark. The **UN Fashion Industry Charter for Climate Action** also launched a collaborative initiative with Textile Exchange to produce the "2025 Recycled Polyester Challenge" to encourage recycled polyester consumption to minimize the GHG emissions produced from virgin polyester. [213]

The rest of the chapter aims to provide an example of different policy actions taken from countries around the world. It is not intended to be an in-depth exploration of all initiatives globally but instead highlight a variety of approaches.

> **Fundamentally, the far bigger question is around overproduction and overconsumption and the flawed incentives that enable that.**

Dr. Alice Payne, Associate Professor // QUEENSLAND UNIVERSITY OF TECHNOLOGY (QUT)

Regional commitments

The European Union, a collection of 27 Member States, introduced the EU Green Deal in 2019. The EU Green Deal dictates a set of short and long-term policy initiatives to help the *EU become the world's first climate-neutral continent by 2050.* [214]

EU CIRCULAR ECONOMY ACTION PLAN (CEAP)

The CEAP is a part of the EU Green Deal and outlines the EU's plans for circular growth. The CEAP was updated in March 2022 with proposals for new directives, regulations and initiatives, such as the new Ecodesign for Sustainable Products Regulation [215] and a new Green Claims Initiative. [216] The EU also reviewed both the Textile Labeling Regulation [217] and the EU Ecolabel Criteria for Textiles and Footwear. [218] Additionally, the Waste Framework Directive [219] and Unfair Commercial Practices Directive [220] were revised and amended.

The new Ecodesign for Sustainable Products Regulation will mandate that a Digital Product Passport will be included for textiles—providing key information on circularity and other key environmental aspects. [221]

The EU strategy for Sustainable and Circular Textiles **was also introduced under the CEAP** to **ensure that all textiles placed on the EU market by 2030 have no hazardous chemicals, are durable, repairable and recyclable, are made of recycled fibers and respect social rights**. [222] Overall, the CEAP works to minimize waste and empower EU citizens to understand how their clothing is made, who made it, what it is made of and the environmental impacts associated with production.

Under the CEAP's Proposal for Empowering Consumers in the Green Transition, the EU plans to prevent greenwashing by monitoring claims made by brands to ensure that terms like "eco-friendly" or "sustainable" are based on legitimate scientific data. [223] With over 200 environmental labels in the EU and 450 worldwide it is difficult for citizens to differentiate between which ones are *claiming* to be sustainable and which ones are truly sustainable. [224] This proposal aims to better inform citizens on the environmental sustainability of their products.

The CEAP aims to ensure that the textile industry recovers from the COVID-19 crisis in a sustainable way by making the EU more competitive by applying circular economy principles to production, products, consumption, waste management and secondary raw materials, while also directing investment, research and innovation. [225]

EU EUROPEAN CLOTHING ACTION PLAN

The European Clothing Action Plan (ECAP) ran for four years and ended in December 2019. [226] The research helped map the environmental impacts of clothing, created partnerships and collaborations in Europe, started pilot programs and communicated the opportunity for the environmental reduction strategies in the sector. ECAP helped create the EU policy on sustainable clothing.

The objectives of the ECAP aimed to:

- Divert clothing waste from landfills and incinerators
- Reduce the carbon, water and waste footprints of clothing in Europe
- Ensure that fewer low-grade textiles go to incinerators and landfills
- Prevent waste in the clothing supply chain
- Encourage innovation in resource-efficient design, recycling of textile fibers and service models to encourage business growth in the sector
- Influence consumers to buy smarter and use clothing for longer by using the existing Love Your Clothes consumer campaign [227]

The key highlight included a behavior change campaign, #LoveNotLandfill, led by London Waste and Recycling Board (LWARB), clothing surveys and a Design for Longevity platform run by the Global Fashion Agenda. [228]

EU WASTE FRAMEWORK DIRECTIVE

The EU recognized the need to increase recycling rates and divert waste from landfills. The Waste Framework Directive was created to promote healthy communities and the environment. The EU Waste Framework Directive has two key objectives. The first is "to prevent and reduce the negative impacts caused by the creation and management of waste and secondly, to improve overall resource efficiency." [229]

The Waste Framework Directive also outlines that by 2025 it will be mandatory to collect textiles separately.

This mandatory collection of textiles will have widespread impacts for brands operating in the EU and pave the way for other governments to incorporate similar legislation.

EU FIBER LABELING DIRECTIVE

Introduced at the end of 2011, the Fiber Labeling Directive works to ensure that the label accurately describes the fiber content in clothing. This directive aims to assist the collection, sorting, resale and recycling process of garments through accurate data. The directive also states that producers need to provide product care instructions. As of March 2022, the EU Commission will review the Textile Labeling Regulation, requiring that all textiles sold on the EU market must carry a label clearly identifying the fiber composition and indicating any non-textile parts of animal origin. [230] Additionally, brands must also provide a mandatory disclosure of other information such as circularity parameters, products' size and, where applicable, the country where the manufacturing processes takes place.

Not only will accurate labels help in the recycling process, brands will have the opportunity to use the label as a platform to promote their transition from virgin fossil fuel-based fibers to recycled and natural materials.

UNFAIR COMMERCIAL PRACTICES DIRECTIVE

To prevent the spread of false information, the EU created the "Unfair Commercial Practices Directive" to limit greenwashing and maintain customer trust. The legislative text explains, "misleading commercial practices, involving the provision of false information that would cause consumers to take a transactional decision that they would not have taken otherwise, are prohibited." [231]

In 2022, the European Commission examined 344 consumer product claims and found that in 42% of cases, authorities had reason to believe that the claim might **be false or deceptive** and could potentially qualify as an unfair commercial practice under EU law. [232]

According to the EU's Consumer Market Study, there is a clear need for reliable data as approximately 60% of EU citizens prefer a product with an environmental label and 50% look for environmental information when purchasing a product. [233] Overall, the directive will help mitigate greenwashing and ensure accurate information is provided to EU citizens.

CONCLUSION

The EU is a global leader in sustainable policy and can inspire other governments around the world to adopt similar environmental legislation promoting circular economy initiatives. This snapshot of EU policies aims to demonstrate a few of the directives, regulations and initiatives that will impact the fashion industry.

CASE STUDY

EASTMAN

Eastman, a specialty materials company, together with the French government, will be investing up to **1 billion USD to build a chemical recycling facility in France**. [234] The facility, to be fully operational by 2025, is set to recycle up to 160,000 metric tonnes of plastics currently being incinerated and will output virgin quality materials for textiles, speciality and packaging applications. To help position France as a circular economy leader, Eastman also plans to create an innovation center for chemical recycling. In addition to the environmental benefits, the plant and innovation center will create 1,500 new jobs. [235]

Country level commitments

MAIN THEMES INCLUDE

01 Bans against greenwashing

02 Introducing Extended Producer Responsibility systems

03 Regulating material content of clothing

04 Encouraging new circular business models

FRANCE

In regards to the end-of-life for textiles, on February 10, 2020, French President Emmanuel Macron signed into law No. 2020-105 Regarding a Circular Economy and the Fight Against Waste (law "relative à la lutte contre le gaspillage et à l'économie circulaire").

In this French circular economy roadmap, "France prohibits brands and retailers from discarding or incinerating unsold items." [236] Unsold textiles will be required to be donated or recycled for reuse.

In 2008, France introduced decree no. 2008-602, which requires that companies are responsible, by law, for providing or managing the recycling of their products at the end of their usage. Each company must either organize their own recycling program (approved by the French Public Authorities) or contribute to an organization accredited by law to provide for them. [237] If they refuse to comply, companies are fined. This concept is called EPR and intends to transfer responsibility from municipalities to producers in order to hold them accountable for products they create. EPR schemes are most common for packaging (bottle) returns and are not yet commonplace for textiles. They can be industry-led or state-led, voluntary or mandatory. EPR systems need to be coordinated between municipalities and waste management providers to prevent confusion for customers. Without proper infrastructure, EPR systems, if poorly executed, could create more problems than solutions - leading to increased clothing exports, typically to lower income countries with even less waste management laws and infrastructure. This has been referred to as 'waste colonialism' with organizations such as the Or Foundation calling for stricter governance on the distribution of EPR funds internationally, ensuring communities in the global south are justly compensated. This is a relevant policy because it would require brands to think about the end-of-life stage of their products. The intention behind the legislation is to encourage more durable products, create systems to keep products in use for as long as possible, and build infrastructure for improved recycling or disposal options.

SWEDEN

Sweden has long been a hub for innovation and testing new circular systems. The Swedish government, in 2017, created a "Repair Law," which gives tax credits to incentivize clothing repairs. [238] In addition, the Swedish Environmental Protection Agency outlined specific national targets to reduce consumption. For example, "the amount of textiles in Swedish household waste should be **reduced by more than half** from around 8 to 3 kg/capita/year," [239] meaning that the majority (90%) of textiles should be reused or recycled." [240] Creating specific, actionable laws to reduce waste is crucial to engaging citizens and providing the necessary infrastructure to achieve the national goals.

NETHERLANDS

The Netherlands has a global reputation for promoting circular economy initiatives, and textile circularity is no exception. However, only 1% of all waste in the Netherlands is sent to the landfill but 16% of waste is incinerated, [241] resulting in the loss of valuable materials and increasing CO2 emissions.

To avoid relying on the incineration of waste, the Netherlands developed a government-wide circular economy program called "A Circular Economy in the Netherlands by 2050," [242] which provides the country with a roadmap for circularity within the textile industry. This program aims to cover all aspects of textile circularity such as increasing the share of recycled content in products and making sure all products sold in the Dutch textile market are recycled. [243] The Netherlands is also looking to incorporate an EPR system for clothing, based on the model in France, to hold brands responsible for the management of the product's end-of-life. [244]

The Dutch government also funded research to better understand the accuracy of clothing labels pertaining to their composition. The random analysis included 7,454 discarded garments with a legible and valid label.

Approximately 59% of the garments with a multiple fiber composition label were accurate, while single fiber garments revealed 77% of labels were accurate. [245]

The Denim Deal or the "Green Deal on Circular Denim" is a project jointly funded by the Dutch government and the city of Amsterdam to close the loop on denim. So far, 30 companies have signed the deal to achieve the necessary sustainable systemic change in the value chain. Parties in the value chain, from collectors and recyclers to producers, brand owners, retailers and public authorities, have jointly developed an approach to take major steps towards using recycled denim in all denim products marketed in the Netherlands. The aim of the Denim Deal is to ensure the use of recycled fibers in denim will become the new standard. [246]

CASE STUDY

Under the national procurement plan for textiles, the Dutch Ministry of Defense coordinated two pilot projects. The first project involved collecting and sorting military uniforms from 58,800 members. The second project focused on textile-to-textile recycling of the military clothing. [247] The pilot projects became such a profitable business that the program expanded to cover uniforms for police officers, firefighters and EMTs. Now, it is standard to have all military clothing collected, sorted and broken down to become fibers for new clothing.

"What is your advice or tips on how other cities or countries can start circular economy projects? "Just do it!" In the Dutch Ministry of Defense example, it was one person with the initiative to make a change with setting up a recycling system to recycle soldiers' clothing, which saved millions of euros."

Arnoud Passenier, Strategic International Advisor Circular Economy
MINISTRY OF INFRASTRUCTURE AND WATER MANAGEMENT

> **Financially, there's an incentive for governments to make their own citizens more aware of the end of the (textiles value) chain.**

Hilde van Duijn, Associate Circular Textiles Expert // CIRCLE-ECONOMY

UNITED STATES OF AMERICA

Although there is no overarching national plan for a circular economy, the National Recycling Strategy is aligned with and supports implementation of the National Recycling Goal to increase the national recycling rate to 50% by 2030. [248] In 2020, the United States Environmental Protection Agency reported that recycling created **681,000 jobs**, $37.8 billion in wages and $5.5 billion in tax revenues. [249] Additionally, the Federal Trade Commission's Green Guides is a tool used to fight greenwashing which has led to brands facing litigation on marketing campaigns in the past. [250] This indicates an opportunity for growth and movement towards a cleaner future.

In terms of regulation, the US is behind Europe when it comes to engaging citizens in recycling initiatives and paving the way toward a circular fashion system. With significant global influence and being the largest textile consumer in the world, the US needs to create impactful legislation to drive forward circularity in fashion.

> **"I would like to see textile to textile circularity really arrive in the United States because it is not here in a substantive way."**
>
> Natalie Betts, Former Circular Economy Program Manager
> CITY OF AUSTIN

Ashley Gill, working as the Standards & Stakeholder, Senior Director, for the Textile Exchange, echoed Natalie's sentiments and explained that the EU has been a hotspot for action while the US has fallen behind when it comes to implementing meaningful legislation and infrastructure to address textile waste.

With a flurry of new directives and proposals launching in the EU on the topic of circularity in fashion, the US will have the opportunity to learn from the EU and replicate the legislation most relevant to the US context. The US needs to act quickly to minimize the environmental damage caused by textile waste and pave the way for comprehensive change, whether by state or federal law.

CASE STUDY

NEW YORK FASHION ACT

On October 20, 2021, **the Fashion Sustainability and Social Accountability Act or "Fashion Act"** (Assembly Bill A8352) was brought to the New York State Senate to "require fashion retail sellers and manufacturers to disclose environmental and social due diligence policies and establish a community benefit fund." [251] In practice, the bill would require any fashion brand with global revenue over $100 million, trading in New York, to disclose detailed impact data. Compliance would be expected within one year or else they will face fines specifically targeting their annual revenues.

Specifically, the act would require transparency for over 50% of brands' supply chain, require mapping of tangible plans to reduce emissions (including GHG emissions, water, energy, waste and chemical use reductions) and publicly disclose their material production volumes. This level of data will allow citizens to make more informed decisions and hold many of the world's biggest brands accountable for their production practices.

This bill is sponsored by State Senator Alessandra Biaggi and Assemblymember Anna R. Kelles, in addition to nonprofits such as the New Standard Institute, the Natural Resources Defense Council, New York City Environmental Justice Alliance and fashion designer Stella McCartney. Brands, regulators and citizens alike are eagerly awaiting the outcome of the proposed Fashion Act, which has the potential to transform the sustainability agenda.

UNITED KINGDOM

Textile 2030 Circularity Pathway

The targets for 2030 are to, firstly, reduce the aggregate GHG footprint of new products by 50%, limit global warming to 1.5°C (in line with the Paris Agreement on climate change) and to achieve net zero by 2050 at the latest. Secondly, the UK plans to reduce the aggregate water footprint of new products sold by 30%. [252]

The Textile 2030 Circularity Pathway also identified the following steps to ensure success:

- Design products to look good for longer and to be recyclable
- Trial reuse business models such as re-commerce, rental and subscriptions
- Set up partnerships to supply and use recycled fibers in new products

The Competition Markets Authority (CMA) aims to prevent false environmental claims in order to help reinstate trust among consumers. [253] The CMA will be publishing a list of fashion brands that are guilty of misleading the public through greenwashing.

Phrases such as "eco" or "sustainable collection" will no longer be accepted without science-based evidence. Therefore, motivating brands to provide evidence or risk ending up on the CMA's list.

CHINA

China created a 14th Five Year Plan and a Water Ten Plan to combat negative environmental harm and encourage circular systems. The Five-Year Plan, which covers the period of 2021-25, aims to develop the circular economy through various initiatives, such as **promoting recycling, remanufacturing, green product design and renewable resources**. "Beijing is prioritizing the development of China's circular economy, with planned goals to maximize resource use and the life cycle of products. These will have direct consequences for businesses engaged in the manufacturing sector and create new market opportunities for green enterprises." [254] In the Water Ten Plan, China's State Council has prioritized the textiles sector as one of ten industrial sectors in which to initiate circular measures. The plan was originally issued in 2015 with the aim of combatting heavy water consumption and pollution by setting objectives to be met by 2020. [255]

AUSTRALIA

In Australia, textile waste is one of the largest waste streams. The Australian government created the National Product Stewardship Investment Fund to reduce waste and prevent materials from going to the landfill. In addition, the fund aims to increase recycling, recover materials and promote a circular economy. The Australian government offered grants between $300,000 and $1 million for new or existing programs. [256]

The Australian Circular Textile Association Ltd (ACTA), received support from the Australian government to address the topic of recycling uniforms and workwear. In Australia, approximately 11,000 tonnes of uniform textile waste enter the landfill annually. [257] In response, "Circular Threads is developing a business case and designing a product stewardship scheme for uniforms and workwear." [258] The project is expected to launch in late 2022, and is supported by the University of Technology Sydney-Institute for Sustainable Futures and the Global Product Stewardship Council. This national scheme aims to reduce waste and support recycling and recovery options for products to accelerate the circular economy in Australia.

The Australian government reported that "**recycling waste generates three times more jobs than landfilling**; that is 9.2 jobs per 10,000 tonnes versus 2.8 jobs for landfill." [259] With clear economic incentives, the fashion industry will be moving in the direction of recycling and enacting impactful policies for both people and the planet.

National governments can be a powerful tool for developing circular infrastructure and directing a more resilient future. France, the Netherlands, Sweden, the US, the UK, China and Australia all demonstrate how policy can help move the fashion industry to a more circular path.

CONCLUSION

Government action

Directional policies to elevate textile circularity

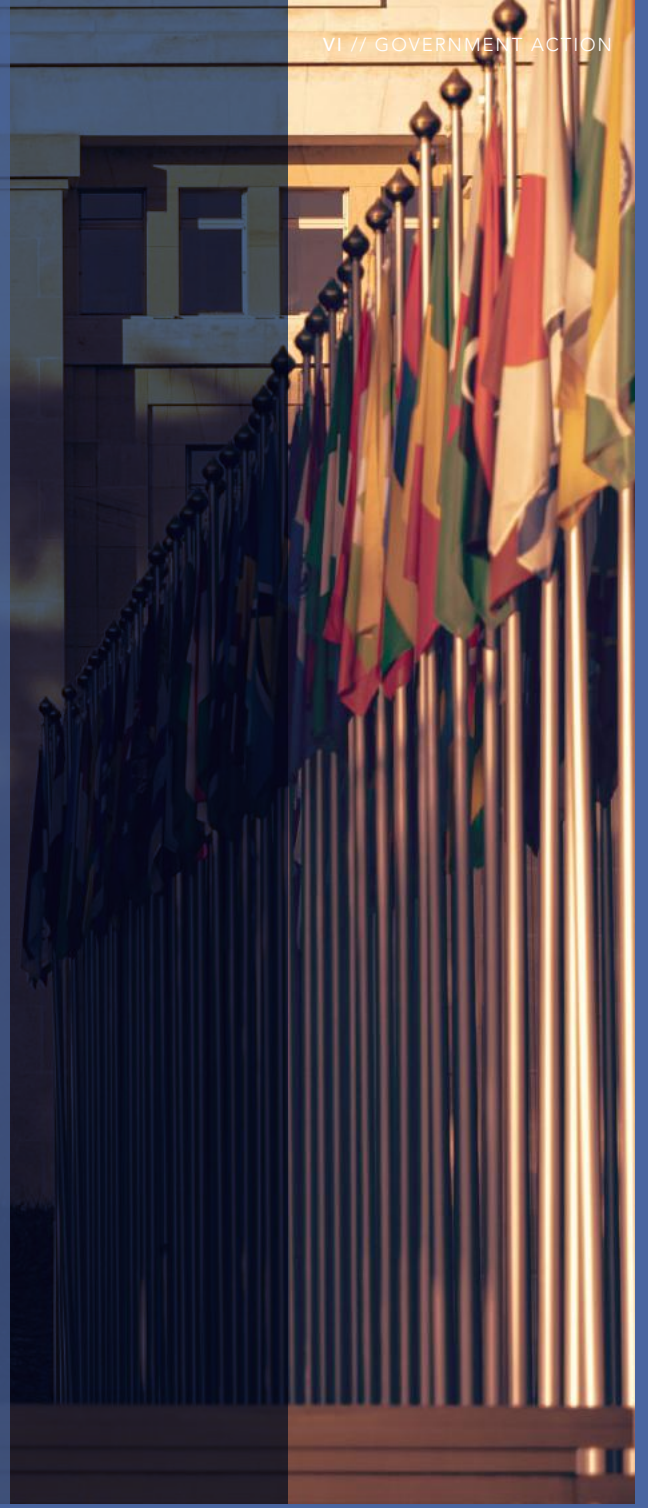
Enacting impactful legislation with clear economic incentives for businesses and citizens alike will help the fashion industry transition to a circular system.

An overwhelming 80% of all industry stakeholders interviewed for this research stressed the importance of policy in realizing textile circularity. Global, regional, national and local levels of government can all support circularity and ensure the rapid success of those prepared to make change.

Overall, legislation promoting transparency, accurate labeling, mandatory collection systems and tax breaks to support circular initiatives will help democratize a circular economy for fashion and make sustainable choices the most affordable ones.

RECAP

- *Policy can be a catalyst for ensuring brands meet their commitments*
- *Regulatory frameworks help level the playing field*
- *The EU is the global leader in the creation of circular economy policy*
- *Policy can reduce greenwashing, promote EPR systems, regulate material content, stipulate recycling targets and encourage investment in circular business models*
- *Circularity offers job opportunities and increased economic growth*



KEY ACTION POINTS

Government action

01 SCALE COLLECTION & SORTING INFRASTRUCTURE	– Ensure the collection of textiles from all relevant commercial and residential channels – Educate citizens on the importance of collecting textiles to minimize landfils – Incentivize local sortation of collected waste prior to any exportation – Mandate sorting against suitable criteria (according to recyclers and other users) for both domestic and export markets
02 INVEST IN RECYCLING INFRASTRUCTURE	– Stipulate recycled content targets (i.e., 50% recycled content minimum with 25% of that from recycled textiles) – Reduce import duties for recycled fibers – Subsidize recycling production sites and support with permits – Financially penalize any company (brand, retailer or other) that does not discard of clothing responsibly – Make it illegal to discard clothing and textiles in landfills
03 REDUCE PRODUCTION & CONSUMPTION	– Empower citizens through educational campaigns on the impact of textile waste on the environment – Offer tax deductions to brands which offer resale and repair options
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	– Ensure all stakeholders have a voice, not only brands – Facilitate conversations between exporters and importers of used textiles to avoid transporting materials to unsuitable regions (i.e., skiing apparel to hot countries) – Encourage the growth of a system based on fair competition for brands to be compared based on sustainability initiatives, making it easier for citizens and investors to be informed
05 DESIGN FOR DURABILITY & RECYCLING	– Set a minimum warranty for products
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	– Implement strict legislation around greenwashing to prevent misleading the public – Mandate standardized reporting from brands – Incentivize Science Based Targets from brands
07 DIVEST FROM FOSSIL FUELS	– Create policies to support the renewable energy transition – Create a plastics tax on virgin synthetic fibers
08 CHANGE THE METRICS OF SUCCESS	– Promote triple bottom line accounting – Strong governance of EPR schemes, ensuring distribution of funds internationally with communities in the global south justly compensated.

CHAPTER VII

Financing circularity

A multibillion-dollar opportunity

- Environmental, social and governance
- Seizing the opportunity
- Stages of innovation
- Next generation material investments
- Textile recycling barriers & opportunities
- Where are current textile-to-textile investments going?
- Current circular economy investors
- Banks & investment firms

Financial investments will help boost circularity and ensure technological innovations can scale rapidly. Across the fashion supply chain, industry leaders have indicated a widespread need for large-scale funding to continue driving innovation, commercialize proven technologies and expand existing infrastructure.

Private investors, public investors and foundations will be needed to funnel money into the most needed areas. Investment firms and banks have already responded by investing in emerging technologies and green bonds to support the switch to circularity. Experts from within the fashion industry should be consulted to ensure finance reaches the most impactful areas.

To sufficiently tackle the mounting textile waste, it is essential that venture capital and private equity firms are pursuing opportunities in making fashion more circular and sustainable for both the lucrative nature of the field and because it resonates with their high-net-worth stakeholders.

ENVIRONMENTAL, SOCIAL AND GOVERNANCE

In the last two years, banks and other financial service firms have been confronted with intensifying pressure to invest in businesses committed to ESG or climate change related issues.

It is not a question of *if* the industry will respond to the growing client pressure but *how* the industry will proceed to support circular systems.

By addressing circular economy objectives, financial institutions can meet their required or voluntary ESG commitments. The circular economy connects to ESG in many ways. Reducing water consumption and water pollution, promoting supply chain transparency, paying workers a living wage and providing a safe work environment are all components of a circular economy.

SEIZING THE OPPORTUNITY

Banks, private investors and government grants are essential in creating lasting, systemic change by providing financial backing and elevating the issue. Investments in textile-to-textile recycling are already starting to accelerate. According to the Global Fashion Agenda, ***textile recycling alone* could create a $10-20 billion profit pool by 2030**. [260] In the last four years, 40 deals have taken place to invest in recycling companies such as Renewcell, Circ, Evrnu, Worn Again Technologies and Nathan's Wastesavers. [261]

Textile recycling offers an incredible opportunity for investors but will require significant upfront investment to grow with the speed and scale necessary. Many parallels can be found with the alternative meat industry, which also struggled to move from the pilot stages to large-scale commercial plants. However, after overcoming the initial financial barriers, it is now projected to become a $140 billion industry in the next ten years. [262] Textile recycling offers the same potential for investment and will play a pivotal role in achieving the global shift to circularity in the fashion industry.

> **"People who missed the boat are now looking for the next Beyond Meat. I say look no further than the next-gen material industry. Next-gen materials are where alternative protein was about 5 years ago."**
>
> Nicole Rawling, Co-founder and CEO
> MATERIAL INNOVATION INITIATIVE

A report co-authored by Fashion for Good and the Apparel Impact Institute estimated that by 2050, **more than $639 billion will need to be invested in low-carbon solutions across the value chain**. [263] By focusing on low-carbon solutions that already exist, the fashion industry can help counteract the 2-3% of *global* emissions created by the sector in 2020. [264]

Additionally, the report indicated that **$405 billion** should be invested in emerging solutions, such as low-carbon fabric processing innovations, material innovations, chemical recycling and agricultural technologies. [265] There is a clear and urgent need for financial support in the fashion industry. Investments in pre-existing technological solutions coupled with supporting new research and development will be key to unlocking the transition to circular systems and achieving net-zero emissions targets by 2050.

> **If all of us scaled 10 major factories, we'd still not be stepping on each other. The markets are huge, and we hope everyone scales.**

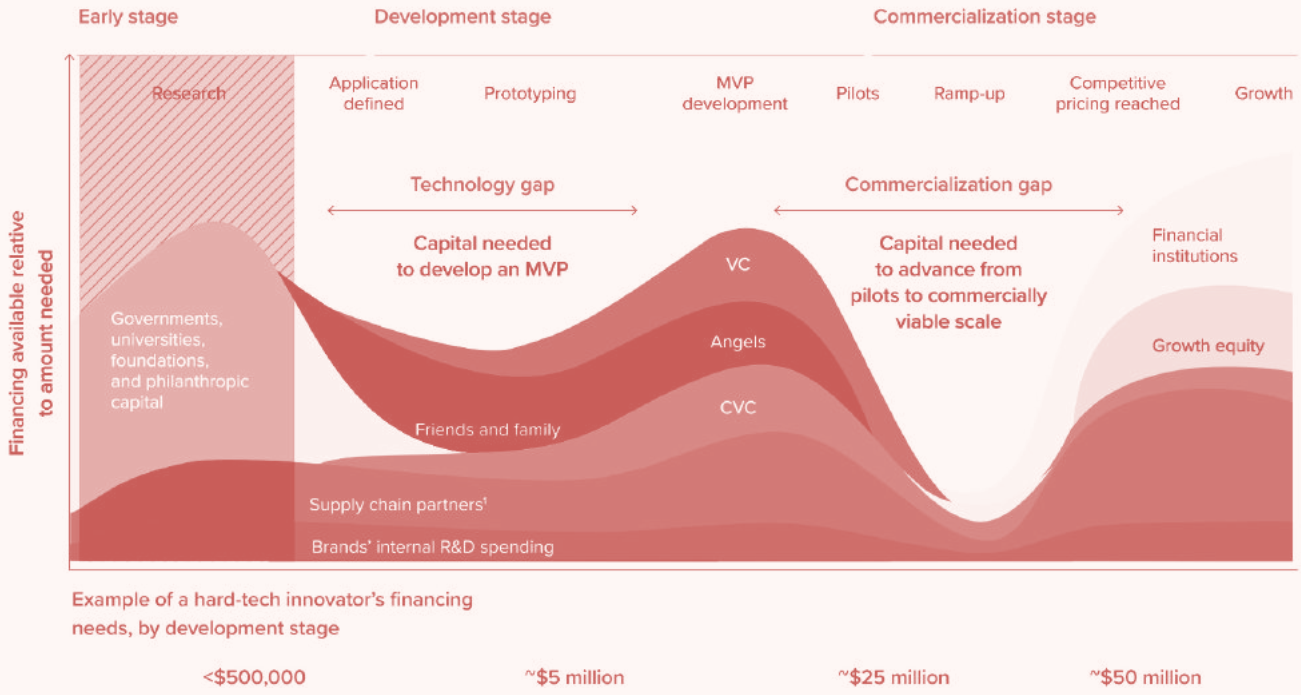
Peter Majeranowski, Founder // CIRC

Stages of innovation

For a new recycling or material technology to become available on the market, it needs to pass a series of stages to reach a level of commercial development.

FIGURE 9: TYPICAL FINANCING DEMAND AND SUPPLY LANDSCAPE FOR A HARD-TECH INNOVATOR

For hard-tech innovators, two financing gaps during the development stages are especially challenging to bridge



Note: All dollar amounts are in US dollars; actual financing needs may vary. CVC = corporate venture capital; MVP = minimum viable product; VC = venture capital

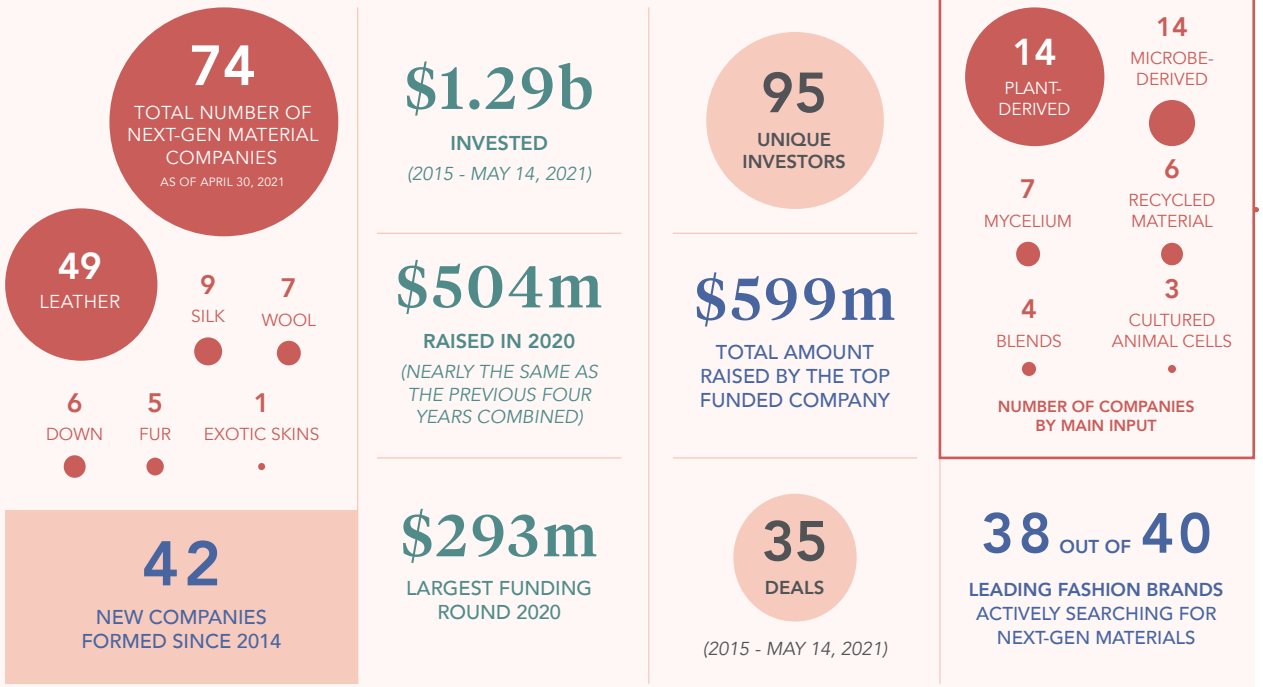
[1] Refers to both external investments and internal R&D spending by suppliers

The initial process starts with an idea which requires significant research to develop the concept. Following the concept creation, a prototype is created to test the technology and to determine if the prototype is feasible. Then a minimum viable product or MVP, is developed to further demonstrate the capabilities of the technology. From this point, the technology would grow to a demo plant before reaching a commercially viable scale. Each step requires capital; however, from the pilot stage to the commercial stage, where the most funding is necessary, is often the most difficult stage to secure funding. **Textile recycling technologies are essential for progress, and funding will be required to move companies beyond the pilot stage and to a commercial scale.** Typically, the most cost-effective way to produce a recycled product is to achieve a commercial scale with higher processing volumes or economies of scale. Once the desired scale is reached, it is easier to compete with the virgin products on the market.

Next generation material investments

These graphics from recent notable reports show the range of decarbonizing opportunities for the fashion industry. Funding requirement is split roughly 60/40 across existing/new solutions. The estimated funding requirement of **$272B for next generation materials, which includes recycled materials**, is being somewhat disproportionately attributed — further demonstrating the opportunity of textile recycling. Companies producing leather alternatives and plant-derived materials have secured the most attention and funding. Providing a more even spread of investments will ensure a diverse and multifaceted portfolio of material options to drive circularity forward with recycled materials crucial to mitigate textile waste.

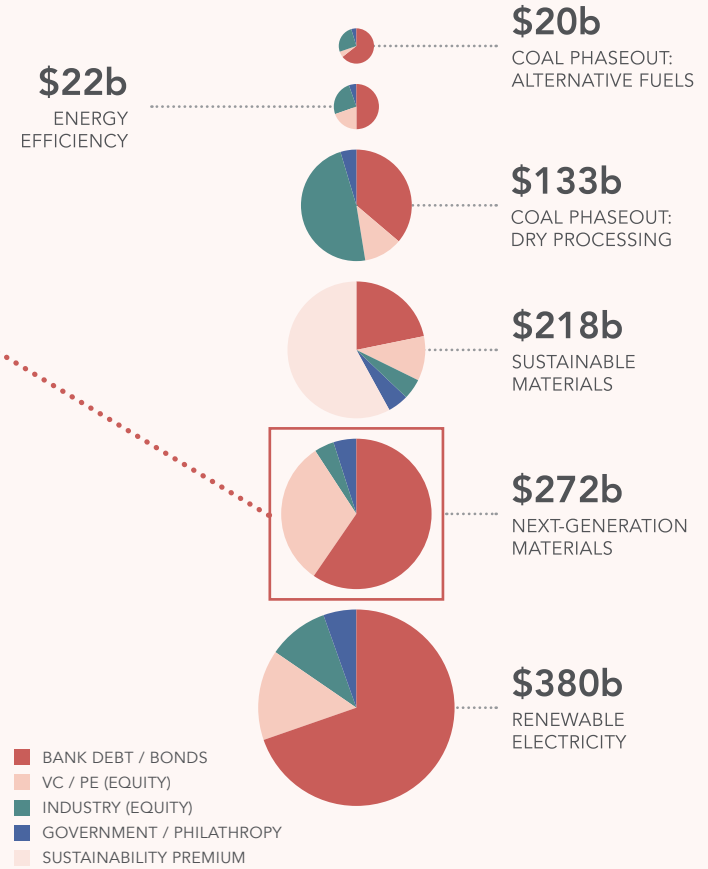
FIGURE 10: STATE OF THE NEXT-GEN MATERIAL INDUSTRY AT A GLANCE



*Note: Some companies create more than one next-gen material. **Note: To simplify the broad landscape of formulation and processing approaches for next-gen materials, Mil categories next-gen categorizes next-gen innovation by main input (greater than 50%).

FIGURE 11: INVESTMENT BY FUNDER TYPE

Solution categories that enable a net-zero fashion industry by 2050 and the funding requirements across all stakeholders.



Textile recycling barriers & opportunities

BIGGEST BARRIERS

Investment gap: It is difficult to move technology from the pilot stage into the commercial stage

Limited awareness of the opportunity

POTENTIAL FOR SIGNIFICANT FINANCIAL OPPORTUNITIES

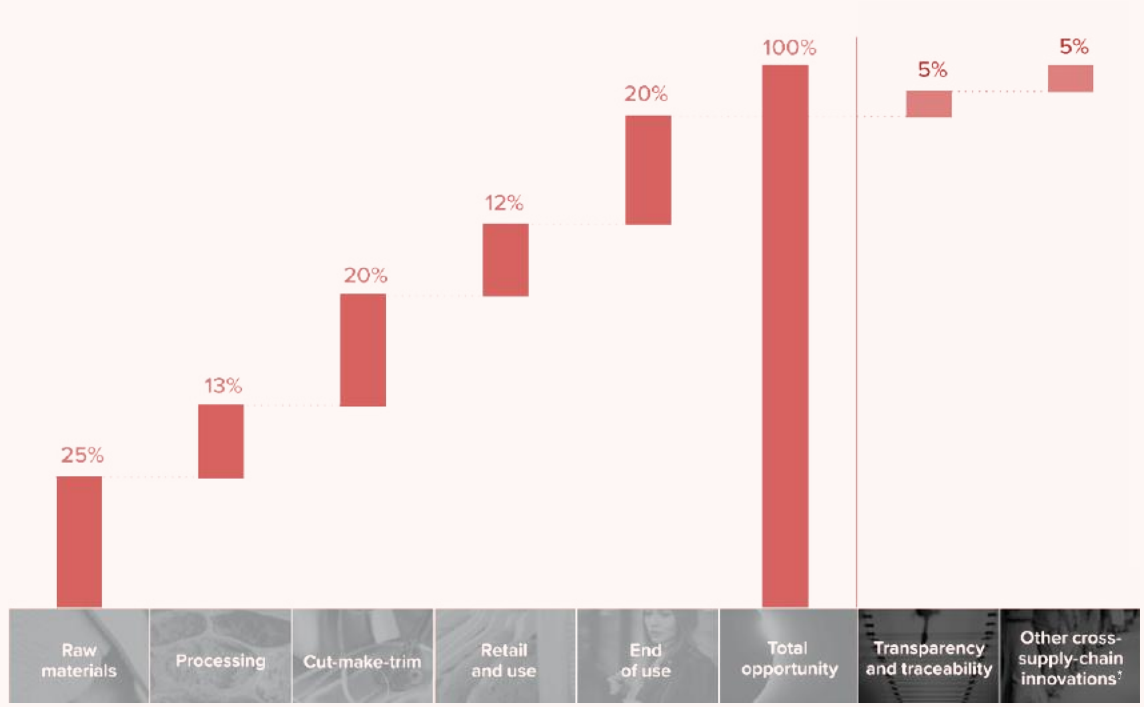
Collectively support recycling companies through pooled investments to mitigate risks

Educate investors and demonstrate the importance of textile-to-textile recycling

Figure 12 produced by BCG and Fashion For Good demonstrates where the most potential occurs along the supply chain. The raw materials category holds the most potential, followed closely by cut-make-trim and end-of-use, indicating that despite large barriers, many opportunities exist to scale investment in this space.

FIGURE 12: INVESTMENT OPPORTUNITIES FROM BCG AND FASHION FOR GOOD

The largest needs for financing are concentrated at the beginning and the end of the value chain

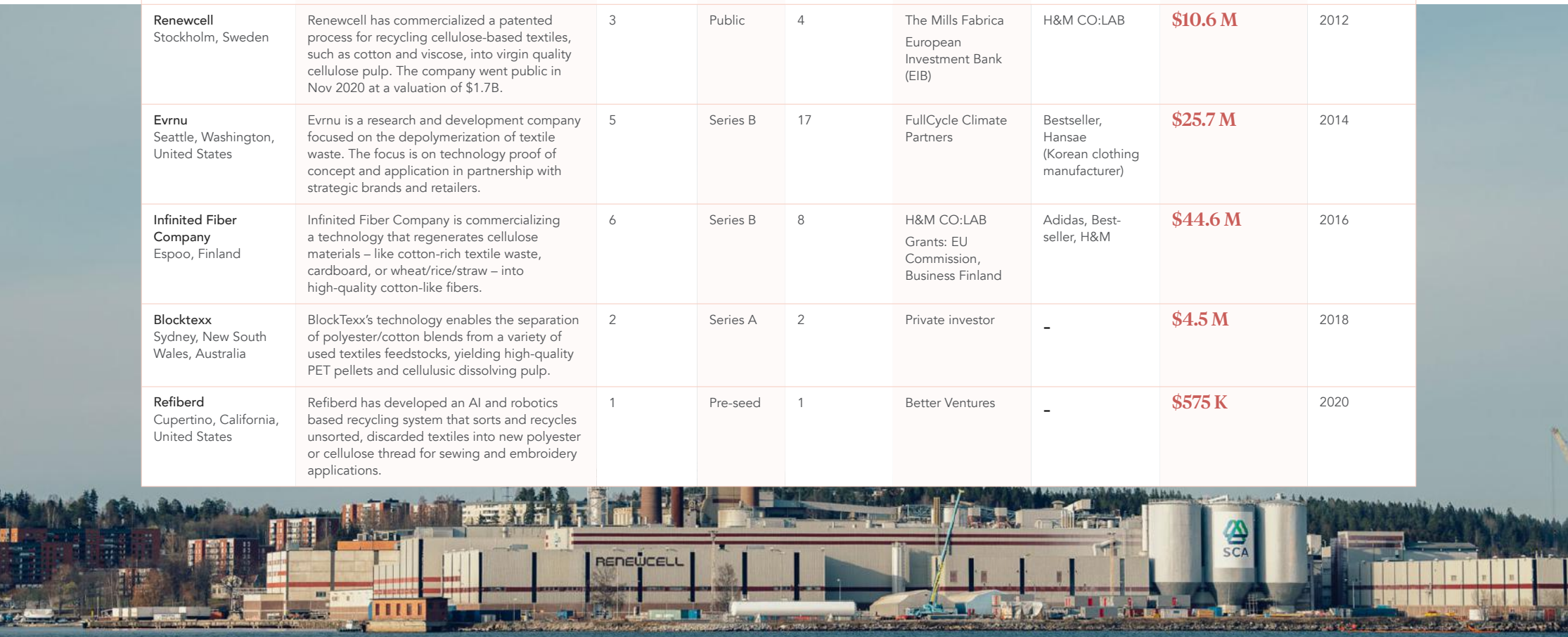


*Includes logistics and transportation innovations, overarching water management solutions and worker empowerment

TABLE 9: WHERE ARE CURRENT TEXTILE-TO-TEXTILE INVESTMENTS GOING?

The following data was collected from Crunchbase (January 2022)

ORGANIZATION NAME AND HQ LOCATION	ABOUT	FUNDING ROUNDS	STAGE	INVESTORS	LEAD INVESTORS	BRANDS INVESTING	COMBINED INVESTMENT	FOUNDED
Worn Again London, England, United Kingdom	Worn Again's technology enables the separation of polyester and cellulose from non-reusable textiles, PET bottles and packaging, producing both PET and cellulose outputs.	3	Venture, series unknown	4	H&M, Future Tech Lab	H&M	$15.5 M	2005
Circ / Tyton BioSciences Danville, Virginia, United States	Circ's technology enables the cost-effective separation of polyester/cotton at any ratios, yielding polyester monomers and cellolusic dissolving pulp.	4	Series A	6	Tin Shed Ventures (corporate venture capital fund of Patagonia)	Patagonia	$15.5 M	2011
Renewcell Stockholm, Sweden	Renewcell has commercialized a patented process for recycling cellulose-based textiles, such as cotton and viscose, into virgin quality cellulose pulp. The company went public in Nov 2020 at a valuation of $1.7B.	3	Public	4	The Mills Fabrica European Investment Bank (EIB)	H&M CO:LAB	$10.6 M	2012
Evrnu Seattle, Washington, United States	Evrnu is a research and development company focused on the depolymerization of textile waste. The focus is on technology proof of concept and application in partnership with strategic brands and retailers.	5	Series B	17	FullCycle Climate Partners	Bestseller, Hansae (Korean clothing manufacturer)	$25.7 M	2014
Infinited Fiber Company Espoo, Finland	Infinited Fiber Company is commercializing a technology that regenerates cellulose materials – like cotton-rich textile waste, cardboard, or wheat/rice/straw – into high-quality cotton-like fibers.	6	Series B	8	H&M CO:LAB Grants: EU Commission, Business Finland	Adidas, Best-seller, H&M	$44.6 M	2016
Blocktexx Sydney, New South Wales, Australia	BlockTexx's technology enables the separation of polyester/cotton blends from a variety of used textiles feedstocks, yielding high-quality PET pellets and cellulusic dissolving pulp.	2	Series A	2	Private investor	-	$4.5 M	2018
Refiberd Cupertino, California, United States	Refiberd has developed an AI and robotics based recycling system that sorts and recycles unsorted, discarded textiles into new polyester or cellulose thread for sewing and embroidery applications.	1	Pre-seed	1	Better Ventures	-	$575 K	2020

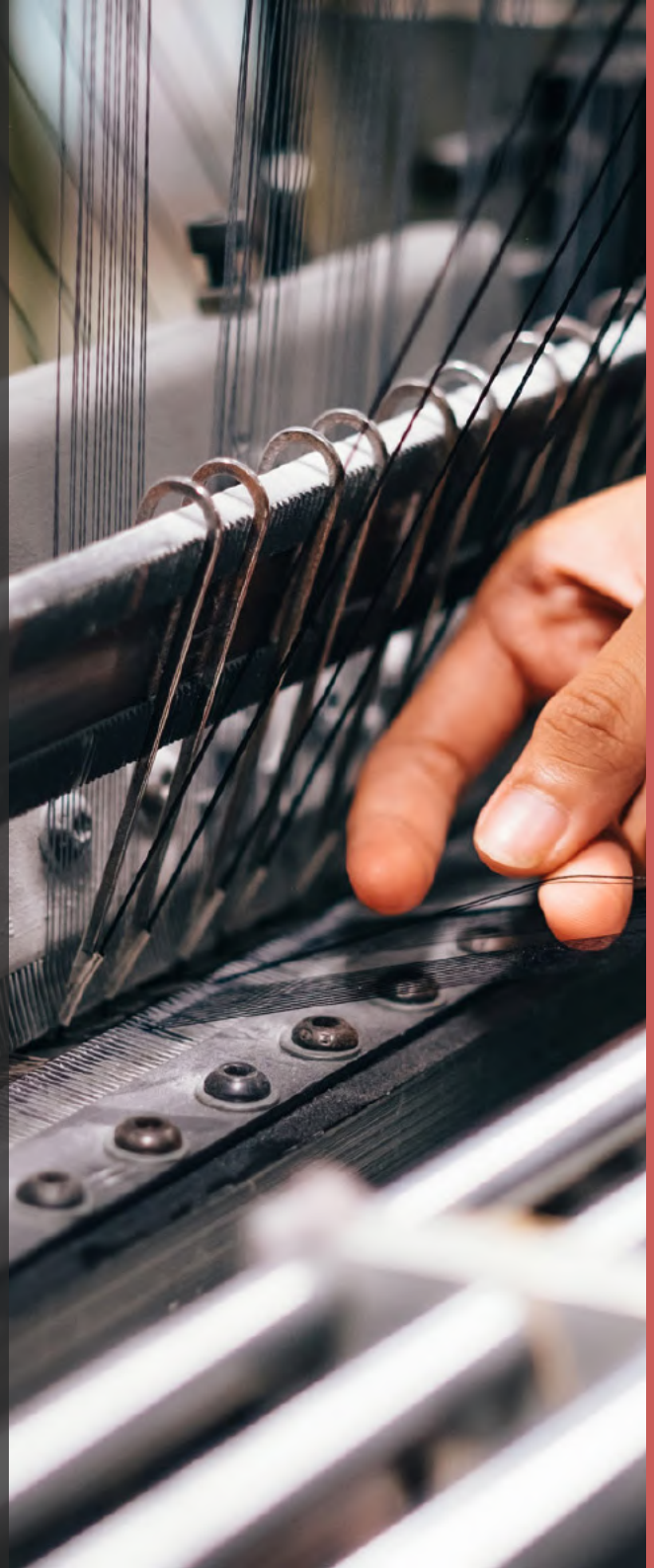


"Significant money needs to be directed to support the scaling of recycling technologies both mechanical, regenerative/chemical. However, to enable these companies to build large recycling plants significant investment also needs to go into establishing waste feedstock routes. Currently, there are multiple market barriers that need to be addressed as waste flows through informal channels."

Nin Castle, Co-founder, Chief Program Officer
REVERSE RESOURCES

"A fully automated sorting facility costs several million euros, depending on the size and processing capacity. It may sound like a big investment, but is it really, compared to the size of the brands?"

Louisa Hoyes, Business Development Manager
TOMRA



"We have to get behind as many of these [recycling] technologies as possible. Everybody's got to get involved and we've got to try lots of different things. We're trying to stop a train and turn it around. It's not easy and the numbers are staggeringly large."

Karla Magruder, Founder
ACCELERATING CIRCULARITY

Current circular economy investors

Circular economy specific investments have grown drastically from only three funds in 2016 to 30 private market funds (venture capital, private equity and private debt funds) with a circular economy focus in 2020. [266]

Public equity funds, focused only on the circular economy, have increased from 0.3 billion USD at the beginning of 2020 to over 2 billion USD in 2021. [267]

CASE STUDY

BlackRock

BlackRock, the world's largest asset management firm, has identified "fast fashion" as one of four key sectors which it expects to accelerate post-pandemic growth towards circularity in the coming months. Other key sectors include plastic, technology and healthcare. [268] **BlackRock's circular economy fund raised almost 1 billion USD in its first year, from just 20 million USD seed funding in October 2019. As of July 2021, BlackRock's circular economy fund has grown to more than 2 billion USD assets under management.** [269] BlackRock aims to design out waste and pollution, keep products and materials in use and help regenerate natural systems. [270]

"I think we'll see more brands investing at a later stage, as some of these innovations get to a place where there's less risk around them and already at a scale where it can move into their supply chain. In order to attract additional investment from outside of the apparel industry, which is very necessary for many of these really early stage companies, there needs to be a signal that the industry itself is interested."

Leslie Harwell, Co-Founder & General Partner
ALANTE CAPITAL

Banks & investment firms

Banks are not only providing financial backing to the circular economy but also offering expert advice on how to structure financial projects.

TABLE 10: SNAPSHOT OF CIRCULARLY ECONOMY INVESTMENTS MADE BY BANKS IN 2020

BANKS	ACTION
Barclays, BNP Paribas, Deutsche Bank, Goldman Sachs, HSBC, Intesa Sanpaolo's Banca IMI, Mizuho Financial Group, Morgan Stanley, Rabobank and Société Générale	Issued bonds with a total of over 10 billion USD to support circular activities. [271]
Barclays Investment Bank	Created a Sustainable Product Group to focus on the development and execution of green and sustainable banking products and solutions. Created a green bond portfolio that captures £3.1 billion of the market value with 6% focused on water and waste. [272]
Goldman Sachs	Committed 750 billion USD. [273]
HSBC	Advised Henkel's 70 million USD plastic waste reduction bond. [274]
Citi and Stifel	Invested 228 million USD of private activity revenue bonds for CalPlant's rice straw recycling plant. [275]
Asian Development Bank	Invested 150 million USD to fund circular economy projects. 1.7 million USD invested to build infrastructure to reduce plastic pollution in Asia and the Pacific. [276]
European Investment Bank (EIB)	Partnered with five of Europe's largest national promotional banks and institutions to launch a 10 billion EUR (11.8 billion USD) loan and investment initiative dedicated to the circular economy. [277]
EXAMPLES OF INVESTMENT FIRMS INVESTING IN TEXTILE INNOVATIONS	
Closed Loop Partners	A leading investor in circular economy solutions with a core focus in fashion at both the early stage venture and growth equity levels. Based in New York, the firm manages investments from some of the leading companies of the world and targets circular fashion investments in the US, EU and Israel. Examples of current and historical investments include: Browzwear, For Days, DAI, By Rotation, Algaeing, Retrievr, Thrilling, The Renewal Workshop, EVRNU and Dimpora. [278]
Girindus Investment AB	Invests in sustainable commercial forest plantations and sustaintech within the energy and cellulosic industry.
Alante Capital	Directs money into the apparel production and retail space to address climate change and create a more sustainable future. [279] Invested in Circ.

CONCLUSION

Financing circularity

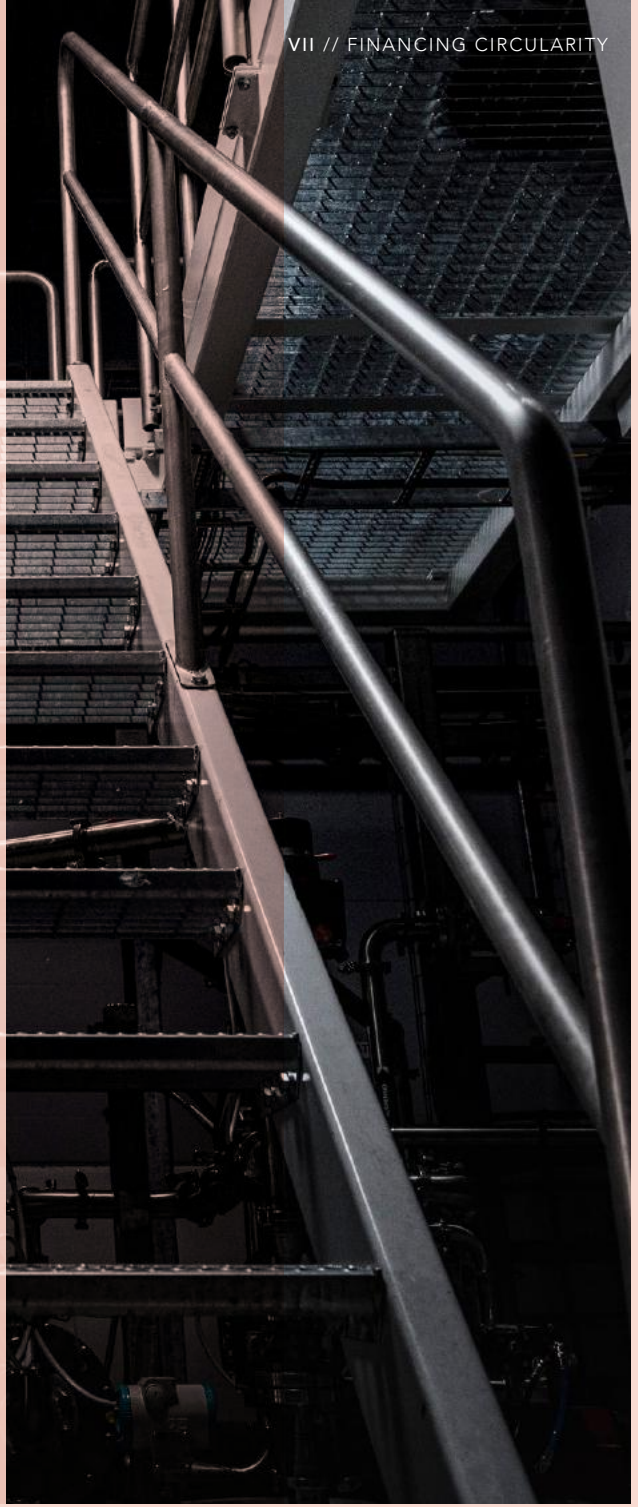
A multibillion-dollar opportunity

Entities which make it to a reasonable pilot scale are poised to be in a seller's market where there is too little capacity around.

Their ability to command and maintain solid margins, benefit from subsidies and future regulations will allow them to reinvest and scale. Exit potential is also massive. Overall, the financial market is drastically increasing the amount of public and private equity funds going into the ESG and circular economy sector. However, the research indicates that funding to help scale textile recycling facilities is essential to handle the growing number of clothing produced globally. Investment firms and banks have responded to the need for circular systems and have invested in emerging technologies and green bonds to support the transition. Investing in circular economy companies or the fashion industry specifically will help drive forward important technologies to help provide options to dispose of textile waste.

RECAP

- *Raw materials offer the largest financial opportunity along the fashion value chain*
- *Scaling textile-to-textile recycling will offer brands and investors opportunities to profit from materials in high demand*
- *Financing all stages of innovation is essential to help companies bring textiles recycling technologies to commercial scale*
- *Existing infrastructure and operators should not be overlooked, particularly in collecting and sorting of textile waste*
- *Banks, investment firms and venture capitalists are all investing billions in the push for circular economy initiatives*



KEY ACTION POINTS

Financing circularity

01 SCALE COLLECTION & SORTING INFRASTRUCTURE	– Prioritize sorting technologies and facilities, as well as technologies which support automated sorting and product disassembly
02 INVEST IN RECYCLING INFRASTRUCTURE	– Invest in emerging recycling technologies to build diverse options to handle textile waste – Invest in established textile waste management and mechanical recycling infrastructure to handle the volume of waste – Early stage investments to move technologies from lab/pilot to demo/full-scale plants – Consider supportive technologies targeting dyeing and printing to further reduce the impact of fashion production
03 REDUCE PRODUCTION & CONSUMPTION	– Fund initatives and businesses which are proven or promising to keep products and materials in use for longer
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	
05 DESIGN FOR DURABILITY & RECYCLING	– Diversify portfolio to fund companies specifally focused on textile recycling, not only general circularity funds – Support businesses educating their teams on circular design principles
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	– Include verifiable ESG metrics in financial disclosures – Require financial institutions and market participants to report ESG metrics in a standardized way to promote transparency and encourage comparability. For additional information: – US investors, reference the Securities and Exchange Comission (SEC) – EU investors, reference the European Union's Sustainable Finance Disclosure Regulation (SFDR)
07 DIVEST FROM FOSSIL FUELS	– Support the transition to renewable energy through the supply chain – Divest from companies not transitioning to renewable energy – Support recycling technologies focused on synthetic fibers, particularly post-consumer polyester
08 CHANGE THE METRICS OF SUCCESS	– Support in-depth ESG reporting – Overall investment in education to build highly-skilled workforces in the long term

CHAPTER VIII

Circular fashion

The way forward

- Report conclusion
- Tangible recommendations summarized
- The future of fashion

CONCLUSION

Circular fashion

The way forward

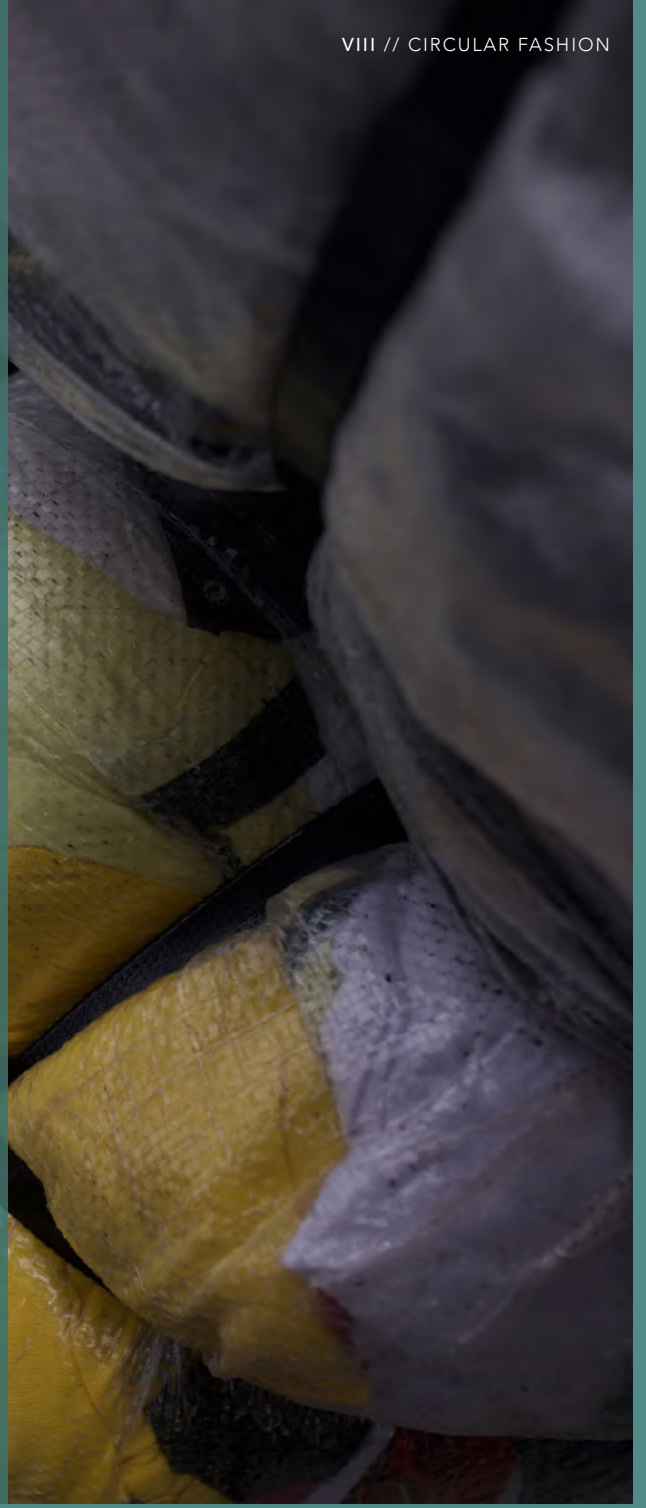
Climate change is a direct threat to the existence of the fashion industry, while the industry itself is simultaneously one of the largest contributors to climate change.

It is undeniable that textile waste presents one of the most complex challenges facing the fashion industry to date. Reducing consumption is an inconvenient truth for both brands and citizens, requiring drastic behavioral change and commitments to new ways of conducting business. In a world of intensifying demand for declining resources, the importance of circulating materials effectively has never been more critical. Textile-to-textile recycling offers the fashion industry an opportunity to mitigate its environmental impacts and the rising levels of textile waste entering landfills.

By mapping the life cycle of textiles and the innovations seeking to better utilize them, this research demonstrates how textile-to-textile recycling, in combination with other circular strategies, is a central component to achieving circularity within the fashion industry. The eight priority actions outlined across the six categories (materials, supply chain, brands, citizens, governments and investors) need to evolve in unison in order to achieve lasting, meaningful change.

This report offers a comprehensive, data-driven, guide to help mobilize fashion executives and other powerful stakeholders to take bold action to mitigate textile waste. The solutions are out there. Investing in recycling, pushing for decisive regulations and collaborating to realize these resilient, thriving new economies is the next step in the move to net zero.

Viewed as an opportunity, textile waste represents a valuable commodity that when fully utilized will future proof fashion businesses against resource scarcity and changing consumer demands, while significantly reducing environmental harm.



KEY ACTION POINTS

Summary

	MATERIALS	SUPPLY CHAIN	BRANDS	CITIZENS	GOVERNMENT	INVESTORS
01 SCALE COLLECTION & SORTING INFRASTRUCTURE	– Sorting textiles for circularity (i.e., reuse, repair, resale, recycling) is a critical, foundational step for circular supply chains – Accurate, automated sorting by material composition and color is essential for textile recycling to flourish	– Separate post-industrial textile waste by composition (and color) at the point of collection – Divert all post-industrial textile waste to textile-to-textile recycling. Divert any pre-consumer waste to be sorted for resale, repair or recycling as a last resort – Recyclers to communicate demand and criteria for sorted feedstock – Recyclers to consider offtake agreements with sorters	– Engage with established collection companies to divert textiles away from the landfill – Carefully consider any self-operated take-back programs: What products will you accept? What is the intention? What systems need implementing to process them? What partners exist to support implementation?		– Ensure the collection of textiles from all relevant commercial and residential channels – Educate citizens on the importance of collecting textiles to minimize landfills – Incentivize local sortation of collected waste prior to any exportation – Mandate sorting against suitable criteria (according to recyclers and other users) for both domestic and export markets	– Prioritize sorting technologies and facilities, as well as technologies which support automated sorting and product disassembly
02 INVEST IN RECYCLING INFRASTRUCTURE	– Prioritize recycled fibers from textile sources – Support raw material suppliers with offtake agreements – Circulate textile waste from all tiers of the supply chain (pre-consumer, post-consumer)	– Utilize all types of recycling	– Signal demand for recycled materials, make offtake agreements with recyclers – Financially invest in textile-to-textile recycling and sorting infrastructure		– Stipulate recycled content targets, i.e., 50% recycled content with 25% of that from recycled textiles – Reduce import duties for recycled fibers – Subsidize recycling production sites and support with permits – Financially penalize any company (brand, retailer or other) that does not discard of clothing responsibly – Make it illegal to discard clothing and textiles in landfills	– Invest in emerging recycling technologies to build diverse options to handle textile waste – Invest in established textile waste management and mechanical recycling infrastructure to handle the volume of waste – Early stage investments to move technologies from lab/pilot to demo/full-scale plants – Consider supportive technologies targeting dyeing and printing to further reduce the impact of fashion production

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	MATERIALS	SUPPLY CHAIN	BRANDS	CITIZENS	GOVERNMENT	INVESTORS
03 REDUCE PRODUCTION & CONSUMPTION	– Decrease overall volume of textile materials produced – Increase the proportion of recycled fibers from textile sources	– Utilize production management tools and alternative models, i.e., just in time, made to order, 3D printing custom fits – Implement smarter cutting room textile waste management for manufacturers	– Support customers to repair clothing via information, access or rewards – Explore alternative production models like on-demand or pre-order to minimize excess stock – Utilize technology to improve forecasting and procurement efficiency – Carefully monitor any alternative models such as rental or subscription, ensuring they increase clothing utilization and reduce environmental impact. Prioritize resale channels with a goal of replacing revenue from new product sales	– Reduce overall consumption – Engage with new ways of experiencing fashion, such as swapping or renting – Repair and resell clothing to retain value – Invest in quality, timeless products wherever possible from brands using quality materials and offering warranties or repairs – Always wash items before donating, and dispose through responsible channels like municipal recycling or in-store bins – Pressure governments to support anti-greenwashing, improved labeling, EPR policies and textile recycling infrastructure investment	– Empower citizens through educational campaigns on the impact of textile waste on the environment – Offer tax deductions to brands which offer resale and repair options	– Fund initatives and businesses which are proven or promising to keep products and materials in use for longer
04 ESTABLISH COMPREHENSIVE CROSS-SECTOR COLLABORATION	– Without brand procurement teams sourcing innovative materials/using mono-materials or governments requiring recycled textile content in products or investors supporting material innovations, the supply chain will continue to depend on fossil fuel based materials	– Collaborate and share industry knowledge; communicate successes and failures – Consider pooling purchase orders of recycled fibers or yarns, to enable brands' of all sizes to procure niche or high-order volume materials	– Actively engage in pre-competitive collaboration with other brands and suppliers – Seek mutually beneficial partnerships with all levels of textile value chain – Consider pooling purchase orders of recycled fibers or yarns to procure niche or high-order volume materials		– Ensure all stakeholders have a voice, not only brands – Facilitate conversations between exporters and importers of used textiles to avoid transporting materials to unsuitable regions (i.e., skiing apparel to hot countries) – Encourage the growth of a system based on fair competition for brands to be compared based on sustainability initiatives, making it easier for citizens and investors to be informed	

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	MATERIALS	SUPPLY CHAIN	BRANDS	CITIZENS	GOVERNMENT	INVESTORS
05 DESIGN FOR DURABILITY & RECYCLING	– Use mono-materials where possible and minimize complex blends – Use circular design framework to produce products that are compatible with available recycling technologies – Evaluate elastane's use, reduce or eliminate where possible – Explore elastane alternatives where stretch is a functional requirement	– Consider repair or refurbish services for garments within manufacturing operations – Work with brands to set durability standards and encourage life cycle assessments to influence design and development	– Educate teams on circular design principles as defined by leading industry experts – Engage with textile recyclers to understand requirements and barriers to their processes – Minimize fiber blends and overall chemical usage within textiles – Focus on durable garment construction and improved testing of materials from resistance to pilling and wash care		– Set a minimum warranty for products	– Diversify portfolio to fund companies specifally focused on textile recycling, not only general circularity funds – Support businesses educating their teams on circular design principles
06 PROMOTE INDUSTRY STANDARDIZATION & UNIVERSAL DEFINITIONS	– Clearly communicate recycled input sources – Use material passports to increase supply chain transparency and material provenance	– Encourage the collection of waste data throughout the supply chain – Eliminate hazardous chemicals and reduce overall chemical usage – Digitally track textiles and clothing to redirect appropriately and recover value	– Commit to comprehensive reporting against standardized metrics – Set Science Based Targets – Explore digital passports embedded in clothing to encourage transparency		– Implement legislation around greenwashing to prevent misleading the public – Mandate standardized reporting from brands – Incentivize Science Based Targets from brands	– Include verifiable ESG metrics in financial disclosures – Require financial institutions and market participants to report ESG metrics in a standardized way to promote transparency and encourage comparability. For additional information: – US investors, reference the Securities & Exchange Comission (SEC) – EU investors, reference the European Union's Sustainable Finance Disclosure Regulation (SFDR)

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	MATERIALS	SUPPLY CHAIN	BRANDS	CITIZENS	GOVERNMENT	INVESTORS
07 DIVEST FROM FOSSIL FUELS	– Phase out virgin synthetics, prioritize biodegradable, bio-based alternatives – Provide support for raw material suppliers to transition to renewable energy – Provide support for raw material suppliers practicing regenerative farming techniques	– Support the use of renewable energy throughout the supply chain – Scope 3 indirect value chain emissions (where 96% of apparel companies have emissions)	– Phase out virgin synthetic materials – Transition to renewable energy within own operations and logistics – Financially support all tiers of supply chain to transition to renewable energy, prioritizing Scope 3 indirect value chain emissions		– Establish policies to support the renewable energy transition – Create a plastics tax on virgin synthetic fibers	– Support the transition to renewable energy through the supply chain – Divest from companies not transitioning to renewable energy – Support recycling technologies focused on synthetic fibers, particularly post-consumer polyester
08 CHANGE THE METRICS OF SUCCESS	– Calculate the true cost of materials to allow educated comparisons between materials	– Alter the priorities within the supply chain from rapid production of new textiles to keeping textiles within the supply chain as long as possible	– Promote triple bottom line accounting, including true cost of materials, labor and environmental impact into products		– Promote triple bottom line accounting – Strong governance of EPR schemes, ensuring distribution of funds internationally with communities in the global south justly compensated.	– Support in-depth ESG reporting – Investment in education to build highly-skilled workforce longer term

STAKEHOLDER INSIGHTS

The future of fashion

"I think by 2030, global brands as we understand them today will have moved their manufacturing to renewable energy, and transitioned away from polyester and synthetic fabrics. I still think they'll be over producing. On circularity, and transparency, I think we're going to have many more examples of leadership than today, and that's going to be key for transformative change."

Gary Cook, Global Climate Campaigns Director
STAND.EARTH

> Fashion should make us look beautiful, but not at the expense of nature.

Yayra Agbofah, Founder // THE REVIVAL

THANK YOU!

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