Retail Practice

Closing the loop: Increasing fashion circularity in California

The fashion value chain is predominantly linear and global. It has put the apparel industry on an unsustainable path.

This report is a collaborative effort by Danielle Bozarth, Alyssa Bryan, Steve Hoffman, Nancy Jones, Melissa Mazin, Kimika Padilla, Giulia Siccardo, and Brennan Wong, representing views from McKinsey's Consumer Packaged Goods, Retail, and Sustainability Practices.

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In 2020, Californians bought and wore 510,000 to 530,000 tons of clothing.[1] Some 500,000 of those tons will eventually enter landfills—covering an area about 3.5 times the size of the City of Los Angeles.[2] More than 97 percent of the textiles used in this clothing are virgin materials. Less than 1 percent of the materials worn today will resurface in clothing manufactured tomorrow (Exhibit 1).[3]

Such waste requires transformative change. The key lies in circularity—specifically, in building a closed loop for recycling materials back into the manufacturing process, reducing both waste and reliance on natural resources.

To date, California has seen relatively little investment in (or research into the benefits of) closed-loop recycling of apparel, so progress on building collection, sorting, and recycling capacity to execute this process has remained limited. We launched this research to understand what effort building a closed-loop system in California will require, what stakeholders need to participate, and what initial impact the effort may have.

Our research shows that the effort promises to be very worthwhile.

California consumers want closed-loop recycling. Our survey results revealed the following:

— Among surveyed consumers, 54 percent anticipate buying more clothes made with recycled materials.[4]

— Younger Californians (aged 18–24) report a willingness to pay a premium of almost 15 percent for clothes made with recycled materials.[5]

— Of surveyed consumers, 92 percent would participate in a brand-sponsored apparel-recycling program if offered the opportunity.[6]

A fully closed-loop apparel-recycling system in California could potentially achieve a total holistic impact (economic, environmental, and social benefits) of $7 billion to $9 billion a year. These figures are based on our estimate of a total holistic impact of approximately $3.5 billion to $4.5 billion from closed-loop recycling of polyester, which represents nearly 50 percent of apparel textile fibers thrown away by Californians (Exhibit 2).[7] That translates into a holistic impact of $2.70 for every $1.00 spent.[8] Scaled up across the United States,

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[1] Sum of all imported finished apparel and apparel manufactured in-state, less the quantities exported or lost throughout the production and retail process (see Chapter 2, Exhibit 5, in the main report for a further breakdown and assumptions); *Crop production annual summary*, US Department of Agriculture Economics, Statistics and Market Information System, January 12, 2022; interviews with fashion/circularity experts (October–December 2021); *Preferred fiber and materials market report 2021*, Textile Exchange, August 2021; "The life cycle of secondhand clothing," Simple Recycling, October 2014; "Textiles: Material-specific data," US Environmental Protection Agency, last updated July 2, 2021; *Textiles and apparel*, US International Trade Commission, 2018; *2020 guide to the business of chemistry*, American Chemistry Council, December 31, 2020.

[2] Assumes about 85–90 percent, or about 455,000 tons, of apparel sold to and worn by Californians ends up in landfills through curbside municipal solid waste (MSW) collection. An estimated 25,000 tons of production losses and 15,000 tons of deadstock also end up in landfills through curbside MSW collection. Of the remaining tons of apparel used by Californians and collected through other channels (that is, donation centers, consignment stores, drop-off containers, mailed-collection programs, curbside textile collection programs, and in-store take-back programs), about 5 percent, or 5,000 tons, is ultimately landfilled. See Chapter 2, Exhibit 5, in the main report for a further breakdown and assumptions. Average weight of, and average square meter of fabric required to manufacture a T-shirt and pair of jeans used to convert estimate of weight of apparel eventually landfilled to surface area; interviews with fashion/circularity experts (October–December 2021); "The life cycle of secondhand clothing," October 2014; "Textiles: Material-specific data," July 2, 2021; "How much does a pair of jeans weigh?," What Things Weigh, accessed 2021; "How much does a T-shirt weigh [with examples]," Silver Bobbin, accessed 2022; Kristin, "How many yards to make a pair of pants?," *Venus Zine*, January 27, 2022; Leonard M. Pitt, "Los Angeles, California, United States," *Encyclopædia Britannica*, last updated March 10, 2022.

[3] *"A new textiles economy: Redesigning fashion's future,"* Ellen MacArthur Foundation, January 12, 2017.

[4] McKinsey 2021 California Fashion Circularity Survey (conducted in October 2021).

[5] Ibid.

[6] Ibid.

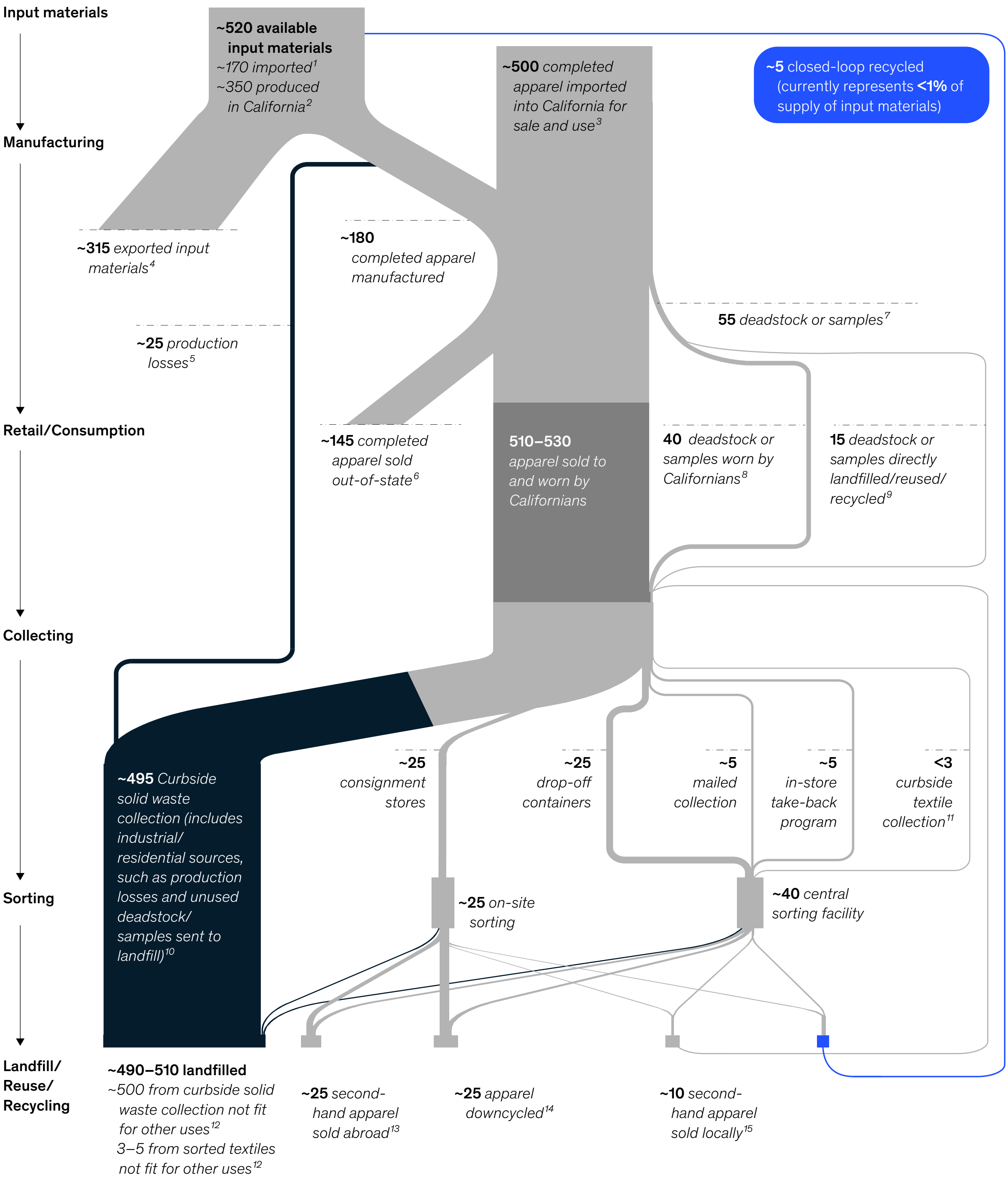
[7] Holistic impact includes environmental, social, and economic benefits: CO_2 equivalent (CO_2e) emissions abatement, water-use reduction, land-use reduction, chemical-use reduction, job creation, GDP growth from job creation, revenue growth, and cost savings. The $50 billion to $70 billion potential holistic impact for the United States is based on sizing for the polyester use case in California. Since pure- and blended-polyester apparel accounts for an estimated 49 percent of all apparel, an estimated multiplier of two can be used to roughly size the total holistic impact for California of switching from virgin to recycled apparel for all fiber types (for example, polyester, cotton, manmade cellulosic fibers), which would be an estimated $7 billion to $9 billion. Additional detail on an initiative-by-initiative level is available in the main report; "How much does garment industry actually waste?," Reverse Resources, February 1, 2021; Interviews with fashion/circularity experts (October–December 2021); *Preferred fiber and materials market report 2021*, Textile Exchange, August 2021.

[8] Capital expenditure (capex) and operating expenditure (opex) estimates were calculated at a high level for each individual initiative and were based on public data inputs and cost estimates from experts in the apparel- and textile-waste-management industries. Additional detail on an initiative-by-initiative level is available in the main report.

Exhibit 1

490,000–510,000 tons of apparel used by Californians today could be eventually landfilled; only 5,000 tons are closed-loop recycled.

Estimated 2020 California apparel textile inflows and outflows, thousands of tons



Note: Width of bars in diagram sized based on volume of apparel flows.[1]Assumes that total materials used to manufacture apparel in California are derived by applying California GDP/US GDP proportion to total US textile fiber imports in 2020 (estimated 65–75% of total textile fiber output is used in apparel) and that 100% of textile material imports are fabrics. [2]Input material production in this case is assumed to be cotton and polyester only. Cotton and polyester made up ~76% of the fiber market in 2020. Remaining input materials production in California is assumed to be negligible. ~605,000 bales of cotton were produced in California in 2020, at an assumed ~480 pounds of cotton per bale; this converts to kilotons to get ~145. US polyester fiber production in 2019 was ~1,275 metric kilotons, and we assume similar production for 2020. A ~2,205 pounds per metric ton conversion helps us reach ~1,405 kilotons US production and ~200 kilotons California polyester production after applying the California GDP/US GDP proportion. [3]Assumes ~600,000–660,000 tons of initially imported completed apparel by applying California GDP/US GDP proportion to total US apparel imports in 2020, then applying the 2019 US textiles and apparel re-export rate of ~20% to get to imported completed apparel that remains for sale to and use by Californians. [4]Assumes ~20% of total imported input materials and ~80% of total input materials produced in California are exported to other geographies, based on the 2019 US textiles and apparel domestic exports rate. [5]Materials lost during production based on global estimate of ~12%. [6]Assumes ~80% of completed apparel produced in California is exported to other geographies, based on the 2019 US textiles and apparel domestic exports rate. [7]Assumes 5–15% of finished apparel imported into or manufactured in California is deadstock (eg, unsellable and unused inventory, including damaged or incorrectly produced items) or samples, based on interviews with fashion/circularity experts (Oct–Dec 2021). [8]Of the ~55,000 tons of deadstock or samples, assumes ~75% are given to employees or donated to be worn, based on interviews with fashion/circularity experts (Oct–Dec 2021). [9]Of the ~55,000 tons of deadstock or samples, assumes ~25% are sent directly to collection channels to be landfilled, reused, or recycled, based on interviews with fashion/circularity experts (Oct–Dec 2021). [10]Assumes 100% of production losses (ie, industrial solid waste) and 85–90% of postconsumer used apparel (ie, residential solid waste) are sent directly to landfills through curbside solid waste collection. Remaining used apparel units are collected via other channels (ie, consignment stores: ~5%, drop-off containers: ~5%, mailed collection: ~1%, in-store take-back programs: ~1%, curbside textile collection: <1%). [11]Separate from curbside solid waste collection, curbside textile collection programs specifically collect postconsumer textile waste to be eventually recycled, reused, or landfilled. [12]Assumes ~5% of collected apparel units are sent to landfill or incineration. [13]Assumes 50–60% of collected apparel units are wearable and resold as secondhand; assumes 65-70% of that is sold overseas. [14]Assumes 40–45% of collected apparel units are downcycled, a process of recycling that yields a product of lower value or functionality than the original item, such as recycling apparel into insulation or mattress stuffing (ie, not textile-to-textile recycled). [15]Assumes 50–60% of collected apparel units are wearable and resold as secondhand; assumes 30–35% of that is sold locally.Source: 2020 guide to the business of chemistry, American Chemistry Council, Dec 31, 2020; A new textiles economy: Redesigning fashion's future, Ellen MacArthur Foundation, Jan 12, 2017; interviews with fashion/circularity experts; "The lifecycle of secondhand clothing," Simple Recycling, Oct 2014; Preferred fiber and materials market report 2021, Textile Exchange, Aug 2021; USDA Economics, Statistics and Market Information System; USDA ERS; US EPA; US International Trade Commission

closed-loop apparel recycling could achieve a total holistic impact of $50 billion to $70 billion.[9]

We identified eight core initiatives that could significantly advance fashion circularity for apparel made with polyester (100 percent or blended) in California and help unlock this holistic impact. Future efforts could build on these initiatives to address other textile materials:

— *Purchase recycled polyester to replace virgin polyester in apparel*, probably at a premium, but with few other switching costs involved.

— *Promote and sell recycled apparel to shoppers*, touting clothing "made with recycled polyester."

— *Partner with apparel manufacturers to collect preconsumer polyester waste*, such as scraps and rejected apparel that manufacturers discard.

— *Partner with retail stores to collect preconsumer polyester waste*, such as unsold garments that are typically thrown away if not diverted for low-cost resale or donation to employees.

— *Partner with existing collectors, such as donation or consignment stores, to divert postconsumer polyester waste* that would otherwise be downcycled or sent abroad.

— *Introduce and scale curbside textile collection in Los Angeles, San Francisco, and select Bay Area counties* because the high cost of curbside collection makes it most viable in densely populated metropolitan areas.

— *Build a highly automated facility to sort and deconstruct polyester textiles* because the inability of recycling processes to handle more than one type of textile waste and the potential for unsorted waste to introduce contamination make sorting necessary.

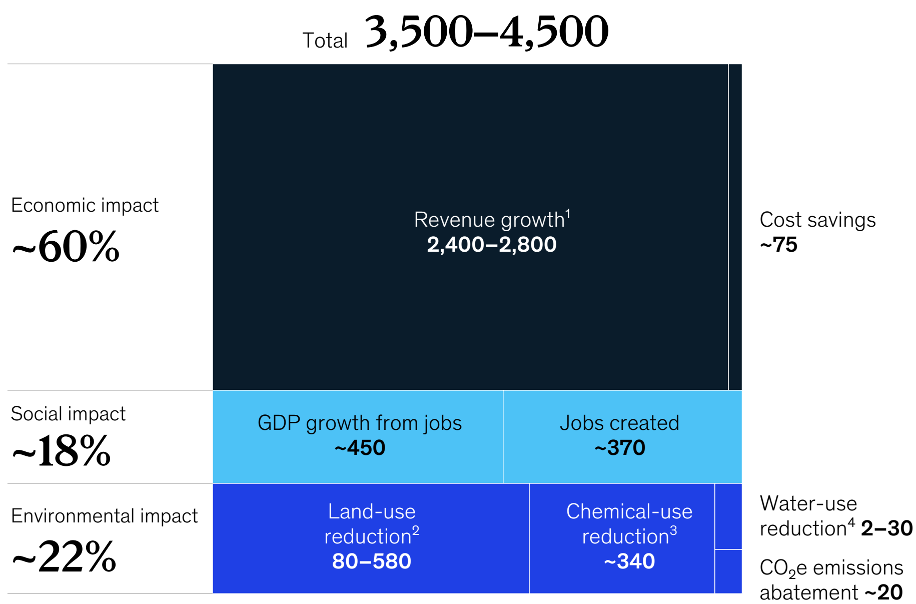
— *Build a chemical recycling facility to process polyester textiles* because using chemicals for

[9] Since California's retail industry accounts for approximately 13 percent of US GDP, an estimated multiplier of seven to eight can be used to roughly size the holistic impact for the United States from switching to recycled apparel from virgin for all fiber types; "Gross domestic product (GDP) by state," US Bureau of Economic Analysis, October 1, 2022, accessed November 2021.

Exhibit 2

Advancing closed-loop recycling of polyester in California could have holistic impact of $3.5 billion to $4.5 billion.

Total potential holistic impact by type and source of impact, $ million



[1]Within total revenue growth, $1.9 billion to $2.2 billion based on different scenarios for total economic benefit realizable from a combination of Californians' willingness to pay a premium, improvements in at-scale recycling processes that help achieve an input cost for recycled materials that is below virgin materials, and policy-driven interventions. We assumed that adoption would require margin improvement of at least 2–3% beyond cost neutrality. We assumed adoption by the 55% of Californians who say they would pay this margin as a premium for access to recycled products in the low scenario and for all Californians in the high scenario, accounting for wider adoption driven by technological, economic, and/or policy factors.
[2]High end based on average price for undeveloped land in California (~$8,500 per acre); low end based on average price for undeveloped land in low-cost country (eg, Bangladesh: $1,100–$1,200 per acre).
[3]Includes ethylene glycol (EG) and terephthalic acid (TPA), the two main crude-oil-derived chemical components of polyester.
[4]High end based on average water price in Bay Area of California (~$2.60/m^3); low end based on average water price in low-cost country (e.g., Dhaka, Bangladesh: ~$0.17/m^3).
Source: "Organic chemical process industry: Poly(ethylene terephthalate)," *AP 42,* fifth edition, Jan 1995, Volume 1, Chapter 6.62; "Dhaka WASA raises water price by 24.97% for households," bdnews24.com, Feb 28, 2020; Tamma Carleton and Michael Greenstone, *Updating the United States government's social cost of carbon*, Becker Friedman Institute, Nov 12, 2021; nonresidential metered service in 2021, rates and tariffs, California Water Service, Jan 2021; "California cap and trade," Center for Climate and Energy Solutions, Aug 2021; *EcoCosy climate leadership white paper 2020*, CNTAC–SDG, Jan 6, 2020; "Terephthalic acid required to produce PET pellets," IHS Markit PEP Yearbook, accessed Oct 2021; Sarah Anderson, "Wall Street bonuses and the minimum wage," Institute for Policy Studies, Mar 12, 2014; interviews with fashion/circularity experts; Malin Johansson, Sandra Roos, and Gustav Sandin, *Environmental impact of textile fibers—what we know and what we don't know: The fiber bible, part 2*, Mistra Future Fashion, Mar 2019; Katherine Ricke et al., *Country-level social cost of carbon*, *Nature*, Oct, 2018, Volume 8; "California to boost solar and wind capacity to meet renewable goals," Reuters, Aug 24, 2021; Nia Cherrett et al., *Ecological footprint and water analysis of cotton, hemp and polyester*, Stockholm Environment Institute, Dec 13, 2005; *Material snapshot: Virgin polyester*, Textile Exchange, 2016; Fashion Industry Charter for Climate Action (FICCA), *Identifying low carbon sources of cotton and polyester fibers*, United Nations Framework Convention on Climate Change, Apr 23, 2021; *Land values: 2021 summary*, US Department of Agriculture, Aug 2021; *Fashion on Climate*, McKinsey, August 26, 2020

recycling is critical to sustaining the quality of textile fiber over many iterations.

But any effort to build closed-loop recycling capacity faces a "catch 22"—the disconnect between the supply of and the demand for recycled materials. While benefits outweigh costs systemwide, both benefits and costs are distributed unevenly among stakeholders across the value chain. Unlocking the total holistic impact will require actions to level the playing field, such as forging public–private partnerships, enacting recycling-friendly policies, and encouraging vertical integration in the apparel industry.

The California apparel industry can start building closed-loop recycling capacity today to reduce waste and reliance on limited natural resources. We hope that this report will establish the opportunity at stake for textile circularity in California, as well as the actions stakeholders across the fashion industry can take to capture it. Furthermore, we hope this report can serve as the foundation for further research and action across other materials and geographies, catalyzing even more positive economic, environmental, and social benefits.

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