CIRCULARITY Guidelines

for Textile & Apparel Sector of India

Stitching the Circle

Regenerate

Recycle

Remanufacture

Reuse

Reduce

Redesign

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german cooperation DEUTSCHE ZUSAMMENARBEIT
Partners in Transformation develoPPP
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
ADITYA BIRLA FASHION & RETAIL
ReEarth 20 FOR OUR TOMORROW
CEE Centre for Environment Education

EXECUTIVE SUMMARY

The Indian textile and apparel industry faces critical environmental and sustainability challenges, driven by the longstanding linear "take-make-waste" model. This model's high resource consumption, pollution, and waste generation have contributed to a global sustainability crisis.

As one of the largest contributors to the world's textile output, India has a unique opportunity to lead by example in implementing circular economy principles.

OBJECTIVES AND BENEFITS OF CIRCULAR ECONOMY FOR INDIA'S TEXTILE SECTOR

By embracing circular principles, India's textile industry can significantly reduce its environmental footprint, cut down on raw material use, and address pollution at each stage of the value chain.

The **"Stitching the Circle"** guidelines have been crafted to assist the industry in transitioning to a circular model that prioritizes resource efficiency, waste reduction, and maximized material reuse, creating a framework that benefits the economy, environment, and society.

Additionally, implementing these guidelines can generate new economic opportunities, increase employment in green jobs, foster innovation, and align with India's Sustainable Development Goals (SDGs). The guidelines emphasize collaboration across stakeholders—from manufacturers to recyclers, consumers, and policymakers—to achieve a sustainable and resilient textile ecosystem.

KEY SECTIONS OF THE GUIDELINES

Introduction to Circular Economy in Textiles

This section introduces the circular economy framework and outlines its advantages over the linear model. It explains key circularity principles—such as designing out waste, keeping materials in use, and regenerating natural systems—and how they can be applied in the Indian textile context. The goal is to redefine the design, usage, and disposal of textile products to promote resource conservation and sustainable growth.

Measuring Circularity and Key Performance Indicators (KPIs)

To support measurable progress, the guidelines define essential indicators and KPIs. These metrics allow businesses to assess and improve their circularity performance in areas like sustainable fiber use, chemical management, energy efficiency, water stewardship, and waste management. By tracking these KPIs, companies can evaluate the effectiveness of their efforts and align them with global standards in sustainability reporting.

Transformation Tools and Certifications for Circular Transition

This section highlights assessment tools, certifications, and standards that facilitate the industry's shift toward circular practices. Key tools include the Circularity Assessment Tool, Circular Textiles Ready-to-Use Assessment, and the Circular Transition Indicators framework, which help organizations measure their circularity levels.

Certifications such as Global Organic Textile Standard (GOTS), OEKO-TEX, Cradle-to-Cradle (C2C), and Global Recycled Standard (GRS) provide the quality assurances necessary for adopting circular practices at scale. Additionally, these tools and certifications cover a range of areas, from supply chain transparency to chemical safety and renewable material sourcing.

Steps for Transitioning to Circularity

The guidelines present a roadmap for businesses to integrate circularity into each stage of production:

- **Sourcing Raw Materials** Emphasizes the use of sustainable and recycled fibers, such as organic cotton, recycled polyester, and innovative bio-based fibers.
- **Circular Production** Encourages resource-efficient practices, including closed-loop water systems, energy conservation, and advanced processing technologies like low-impact dyeing. Circular production also promotes the use of renewable energy and sustainable chemicals to reduce environmental impacts.
- **Waste Management** Outlines practices to minimize and repurpose waste at each stage of textile production, from spinning to garment manufacturing. For example, manufacturers are encouraged to recycle fabric scraps into new products and promote take-back programs for end-of-life garments.
- **Consumer Engagement and Education** Advocates for educating consumers on sustainable practices, offering transparent labeling, and promoting new business models like clothing rental, resale, and repair services.

Case Studies and Best Practices

Real-world examples illustrate how leading organizations have successfully implemented circular practices. Case studies cover topics like cradle-to-cradle garment production, recycled packaging innovations, and waste-to-resource initiatives. These examples demonstrate the tangible benefits and practical applications of circular principles, providing valuable insights and actionable lessons for industry stakeholders.

Annexes and Practical Guides

The annexes provide supplementary resources, including a step-by-step guide for businesses to assess their current circularity phase, set goals, establish timelines, and create actionable roadmaps. These practical tools facilitate collaboration among stakeholders, establish clear milestones, and emphasize the need for continuous improvement in adopting circular practices.

The "Stitching the Circle" guidelines serve as a comprehensive roadmap for the Indian textile and apparel industry to adopt circular economy principles. By incorporating the strategies outlined, the industry can transition towards a model that not only enhances environmental stewardship but also strengthens competitiveness in the global market.

BACKGROUND

The “Stitching the Circle” guidelines are developed as part of the **“Approaches for Circular Textiles and Apparel Industry in India” initiative,** a public-private cooperation initiative between Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) India and Aditya Birla Fashion and Retail Limited (ABFRL), with the Centre for Environment Education (CEE) as implementation partner.

This project, supported by the develoPPP.de program of the German Federal Ministry for Economic Cooperation and Development (BMZ), is strategically designed to embed circular economy principles in India's textile and apparel sector.

The initiative aligns with the United Nations Sustainable Development Goals (SDGs), particularly those focused on responsible production, climate action, and clean water.

Aditya Birla Fashion and Retail Limited (ABFRL)
ABFRL is one of India's leading fashion brands and plays a pivotal role in driving the adoption of sustainability and circularity in the industry. Through this initiative, ABFRL aims to empower its teams, partners and suppliers to integrate circularity in their operations.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) India
GIZ brings its international cooperation and sustainability knowledge to the initiative, offering tools, technical resources, and capacity-building expertise to help the Indian textile industry implement circular practices.

Centre for Environment Education (CEE)
As the implementation partner, CEE has spearheaded the execution of activities, from developing training programs to facilitating stakeholder collaboration.

STRATEGIC APPROACH

The initiative followed a comprehensive four-fold approach to drive a circular transformation across the textile and apparel value chain:

Showcasing Circular Business Models

Pilot projects led by ABFRL in partnership with innovative startups that demonstrate scalable solutions, including textile re- and up-cycling, plastic packaging alternatives, and enhanced supply chain traceability.

Building Capacity

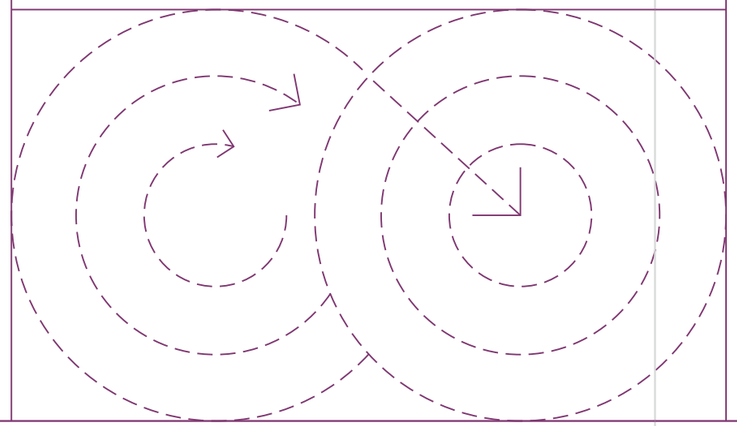
Over 400+ stakeholders across textile clusters - including brands, suppliers, and recyclers - trained through dedicated modules to integrate circularity into their operations.

Industry-Wide Dissemination

Through consultations, workshops, and knowledge-sharing platforms, the project fostered collaboration to ensure widespread adoption of circular practices.

Developing Voluntary Circular Business Guidelines

The guidelines compile best practices, metrics, and key performance indicators (KPIs) to support brands in embedding circular economy principles.



SIGNIFICANCE OF THE GUIDELINES

The "Stitching the Circle" guidelines provide a structured framework for adopting circular economy principles across the textile and apparel value chain. The guidelines focus on four critical areas:

- **Sustainable Material Sourcing** Promoting the use of recycled and renewable fibers.
- **Resource-Efficient Production** Encouraging low-impact processes, and use of renewable energy and sustainable chemicals.
- **Waste Management** Advocating for recycling, upcycling, and take-back programs, for end-of-life textiles.
- **Consumer Engagement** Supporting transparency through labeling, and promoting circular business models such as resale, repair, and rental services.

Supplemented with tools, certifications, and real-world case studies, the guidelines enable businesses to measure, improve, and scale their circular practices.

IMPACT AND THE PATH FORWARD

This initiative exemplifies the power of collaboration between public and private sectors to address systemic challenges. Through continued commitment to circular principles, the Indian textile and apparel industry can create a model for sustainable development, benefiting the economy, environment, and society alike.

ABOUT "STITCHING THE CIRCLE" GUIDELINES

The guidelines aims to provide comprehensive and actionable steps for Indian textile and apparel businesses to integrate circular practices.

These guidelines encompass a thorough overview of circular economy principles, detailed strategies, specific tools, and relevant case studies tailored to the unique context of the Indian market.

By adhering to these guidelines, businesses can enhance their sustainability efforts and minimize waste generation, thereby gaining a competitive advantage. The ultimate goal is to foster a more sustainable and resilient textile and apparel industry in India through the adoption of circular practices.

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This complex and challenging initiative required the expertise of various stakeholders. To address this, a working group was formed, chaired by Dr. Naresh Tyagi, with members from developmental agencies, industry experts, associations, non-governmental organizations, and other key contributors.

Through collaboration, the group combined their diverse knowledge and experience to develop effective and actionable guidelines.

The working group has played a crucial role in ensuring inclusivity. The guidelines need to reflect the needs of all stakeholders within the textile and apparel value chain for successful implementation.

WORKING GROUP

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Additionally, the document was developed through an extensive nationwide stakeholder consultation process. Stakeholders from various sectors were actively engaged, including academia, manufacturing (spinning, weaving, wet processing, and garmenting), prominent brands, recyclers, and other relevant entities.

This inclusive approach ensured that the guidelines are comprehensive, practical, and reflective of the needs and insights of all stakeholders in the Indian textile and apparel sector.

PURPOSE AND SCOPE

WHY THESE GUIDELINES

The overarching aim of these circularity guidelines is to catalyze a paradigm shift towards sustainable and circular practices. These guidelines are designed to benefit all stakeholders involved in the industry, serving as a roadmap for adopting and integrating circularity principles throughout the value chain.

Promoting Circular Economy Principles

Actionable Strategies

Provide practical and implementable strategies for embracing circularity across the textile value chain, encompassing sourcing, production, and end-of-life management.

Encouraging Sustainability

Advocate for sustainable sourcing practices, efficient waste management systems, and robust recycling initiatives to minimize environmental impact and maximize resource utilization.

Fostering Responsible Design

Promote circular product design methodologies and encourage responsible material choices to ensure products are designed with longevity and recyclability in mind.

Minimizing Environmental Impact and Enhancing Resource Efficiency

Resource Conservation

Emphasize the importance of reducing resource consumption, minimizing waste generation, to foster sustainability.

Enhancing Resource Efficiency

Encourage measures to reduce waste and improve resource efficiency in water, energy, raw materials, that will lead to optimized production processes.

Compliance and Incentives

Showcases how to address national and international requirements related to environmental protection and sustainability while advocating for incentives that reward circular and eco-friendly practices.

Establish KPIs and Alignment with SDGs

Defining Key Performance Indicators (KPIs)

Establish measurable KPIs to gauge progress towards circularity goals, focusing on waste reduction, material efficiency, and environmental performance.

Alignment with UN SDGs

Ensure alignment with United Nations Sustainable Development Goals (SDGs), particularly SDG 12 (responsible consumption and production), SDG 6 (clean water and sanitation), and SDG 13 (climate action), to contribute to global sustainability objectives.

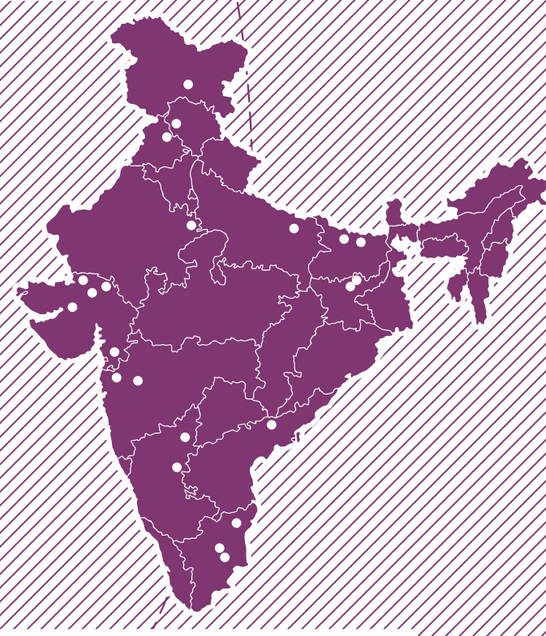
Enhancing Global Competitiveness

Position the Indian textile and apparel sector as a frontrunner in sustainability and circular practices, enhancing its global competitiveness

North
Kashmir, Ludhiana and Panipat account 80% of woolen in India

West
Ahmedabad, Mumbai, Kutch, Rajkot, Indore and Vadodara are key places for the cotton industry

Surat, Bhiwandi are key places for manmade textile industry



East
Bihar for jute. Parts of Uttar Pradesh for woolen and West Bengal for cotton and jute industries.

South
Tirupur, Coimbatore and Madurai for hosiery. Bengaluru, Mysuru and Chennai for silk.

Note: Based on the latest available information ● *Major textile and apparel zones*
Source: Textiles Apparel Presentation, IBEF | Sutherland Research

By embracing these guidelines, stakeholders across the textile and apparel sector can proactively contribute to a more sustainable and circular future while bolstering economic competitiveness.

WHAT IT COVERS

These guidelines are tailored to provide the guidance on transition from linear to circular economy of textile and apparel sector in India. Here is a brief overview of what the guidelines cover:

01

INTRODUCTION TO CIRCULAR ECONOMY

- Explanation of circular economy principles and their importance for the Indian textile sector.
- Comparison with the traditional linear economy.

02

KEY INDICATORS FOR MEASURING CIRCULARITY

- Metrics for tracking material flow, resource efficiency, waste management, and product lifecycle.

03

TOOLS FOR CIRCULAR TRANSFORMATION

- Overview of assessment tools, certifications, and standards to support circular practices.
- Best practices for supply chain management.

04

STEPS FOR TRANSITIONING TO CIRCULARITY

- Detailed strategies for sourcing sustainable materials, implementing circular manufacturing practices, and promoting sustainable consumption.

05

CASE STUDIES AND BEST PRACTICES

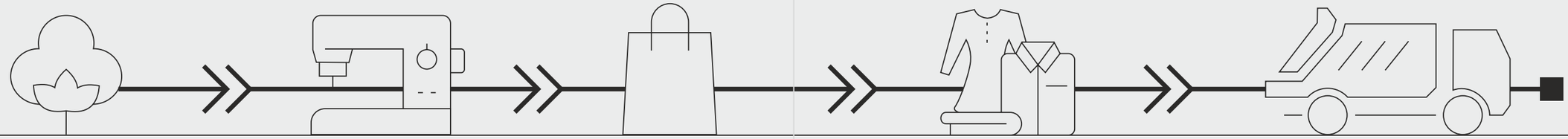
- Real-world examples and lessons learned from successful circularity implementations.

06

STRATEGIES FOR CIRCULARITY IMPLEMENTATION

- Step-by-step guidance on assessing your current circularity phase, establishing a baseline, setting goals and metrics, and creating an actionable roadmap.
- Setting timelines and milestones for achieving circularity goals.

Textile Value Chain



Source: Cradle to Cradle Approach in the Fashion Industry, www.onlineclothingstudy.com

INTRODUCTION TO CIRCULAR ECONOMY

Environmental and social awareness has made sustainable manufacturing a primary focus for all countries worldwide.

Over the past years, the spotlight has increasingly turned-on environmental impact of rapidly increasing production volumes and shorter product shelf life.

In the past 15 years, apparel production has doubled while the number of times garments are worn before being discarded has reduced by

36%[1]

The rapid growth in textiles has largely been accounted to be synthetic fibres (mainly produced from oil), which, over the last 20 years, have grown from less than 20% of global fibre production to

62%

of global fibre production in 2018.[2]

With less than 1% of the fibres used for producing recycled clothing, the textile industry uses large amounts of resources, negatively impacting the environment.[3]

A linear approach increases resource demand, consumption and waste, which must be disposed of in an environmentally acceptable manner, creating an inefficient linear economy.

With the most significant fashion businesses in the world progressively pledging to achieve Net Zero standards, there is a rising trend for sustainability in the global fashion industry.

Such positive international developments will significantly influence the Indian textile sector, given its crucial role in the global Textile & Apparel value chains.

Implementation of circular economy principles in the Indian Textile & Apparel industry has been a cumbersome task, as communication channels between recyclers, yarn makers, and designers in the Textile sector and other industries are still in their infancy. Furthermore, knowledge about recycling is often still rudimentary and not fully integrated into strategic business developments.

Hence, coordinated actions in all regions by all stakeholders (government, industry, and consumers) and changes at each stage in the value chain involving players of all sizes and market segments are required for switching to a more sustainable and circular fashion.

THE OLD WAY: LINEAR ECONOMY

The traditional textile and apparel industry operates in a linear "take-make-waste" model. Here's how it unfolds:

Resource Extraction

Raw materials like cotton, wool, synthetic fibers, and dyes are extracted. This can involve intensive processes like cotton farming that requires high water usage and pesticides, or mining for synthetic resources which can disrupt ecosystems.

Transformation (Production & Distribution)

Extracted materials undergo various stages of processing. Fibers are spun into yarn, fabrics are woven or knitted, and garments are manufactured. This transformation phase is energy-intensive, often utilizes harmful chemicals in dyeing and finishing, and generates significant textile waste.

Consumption

Consumers purchase the finished apparel. While this drives economic activity, trends towards fast fashion promote overconsumption, leading to a culture of discarding clothes quickly.

Disposal

Unwanted garments reach landfills or incineration plants, contributing to textile waste accumulation. This not only takes up valuable space but can also release harmful toxins when incinerated.

THE LINEAR ECONOMY IMPACT

This linear system is unsustainable because:

- **Resource Depletion** Excessive extraction of natural resources like cotton strains ecosystems and depletes finite resources.
- **Environmental Pollution** Production processes pollute air and water with chemicals and dyes.
- **Waste Generation** Massive amounts of textile waste end up in landfills, taking hundreds of years to decompose.

A CALL FOR CHANGE

The linear model is no longer viable. As the demand for textile goods continues to rise, this linear model leads to resource depletion, environmental degradation, biodiversity loss, and a growing waste problem.

Linear Economy Model

take » make » waste

[1] *A New Textiles Economy: Redesigning Fashion's Future, Ellen McArthur Foundation 2017* | [2] *Preferred Fiber and Materials Market Report 2018, Textile Exchange*
[3] *A New Textiles Economy: Redesigning Fashion's Future, Ellen McArthur Foundation 2017*

ENVIRONMENTAL IMPACTS OF LINEAR ECONOMY

Resource & Natural Capital Inputs

PRODUCTION OF FIBRES	PRODUCTION OF TEXTILE PRODUCTS	DISTRIBUTION AND RETAIL	USES OF TEXTILES	COLLECTION, SORTING & RECYCLING	WASTE MANAGEMENT
Agricultural Land Water Biodiversity Energy Chemicals (fertiliser, pesticides, reagents)	Water Energy Chemicals (dyes, finishing agents)	Energy	Water Energy Chemicals (detergents)	Energy Chemicals	Land Energy
				Fibre Recovery	Energy Recovery
Land & Soil Degradation Deforestation Water Stress Greenhouse Gas Emissions Eutrophication Air & Water Pollutants Biodiversity Loss	Water Stress Greenhouse Gas Emissions Air & Water Pollutants (including toxic susbstances) Microfibre Release Production Waste	Greenhouse Gas and Transport Emissions Packaging Waste Textile Waste from Unsold Items	Greenhouse Gas Emissions Emissions of Phosphates, Chemicals and Microfibres into Wastewater Textile Waste	Greenhouse Gas Emissions Air & Water Pollutants, including Toxic Susbstances Textile Waste	Greenhouse Gas Emissions Air & Water Pollutants, including Toxic Susbstances

← Environmental Impacts →

THE NEW WAY: CIRCULAR ECONOMY

A Circular Economy in the textile and apparel sector aims to reduce waste and pollution by keeping products and materials in use for as long as possible.

The Circular Economy takes a holistic approach to economic development, addressing both environmental and social impacts by designing products and industrial processes that ensure resources remain in continuous use. Unavoidable waste and residues are systematically recycled or recovered.

The circular economy offers a solution to the unsustainable practices of the linear model in the textile and apparel sector. It's a system designed to:

MINIMIZE WASTE AND POLLUTION

By keeping textiles in use for longer periods and maximizing reuse and recycling.

REDUCE RELIANCE ON VIRGIN RESOURCES

By prioritizing recycled materials and minimizing the extraction of new resources like cotton or synthetic fibers.

CREATE A CLOSED-LOOP SYSTEM

Where textiles are constantly circulated within the economy, reducing environmental impact.

WHY CIRCULARITY IS VITAL FOR INDIA

India, with its resource-intensive economy and large, rapidly growing population, has significant potential to lead the Circular Economy in the textile and apparel sector. Rooted in a rich cultural heritage of reduce, repair and reuse. This shift can foster a more prosperous, equitable society while preserving the environment for future generations.

By embracing Circular Economy principles, the sector can enhance sustainability and align with the three pillars of sustainability: People, Planet, and Profit.

Planet Focuses on reducing environmental impact, such as lowering carbon footprints, water consumption, and packaging waste.

People Emphasizes fair practices, diversity, and positive interactions with employees, customers, and the community, contributing to societal equity.

Profit Encourages transparent accounting, regulatory compliance, and cost optimization through recycling, waste reduction, and renewable materials.

The Indian textile and apparel sector can drive transformation through:

Sustainable Resource Management
Reducing reliance on virgin materials and optimizing the use of natural resources.

Enhanced Recycling Processes
Developing efficient systems to manage textile waste.

Innovative Design and Manufacturing
Promoting eco-friendly designs and sustainable production methods.

Extended Product Lifecycle
Supporting reuse, repair, and remanufacturing to extend product life.

Consumer Engagement
Educating consumers on sustainable practices and encouraging responsible consumption.

THE 6R APPROACH TOWARDS CIRCULARITY

The baseline assessment report[4] published last year showcases how the 6R approach can be applied to a circular textile industry.

Redesign

FOR CIRCULARITY

Focus on Mono and Recycled Fibres

Designing garments from single fibre types (e.g., organic cotton, linen) facilitates easier recycling compared to blends (poly-cotton) which are difficult to separate. Using mono-materials, along with recycled fibers, ensures smoother and more efficient recycling processes.

Prioritize Biodegradability

Using natural materials and dyes that decompose after use, minimizing landfill waste.

Eliminate Harmful Chemicals

Phasing out harmful dyes and finishes to minimize environmental impact.

Design for Disassembly

Develop garments that can be easily disassembled and recycled at the end of their life. This includes choosing materials that are compatible with recycling processes and avoiding mixed fibers that are difficult to separate.

Reduce

RESOURCE CONSUMPTION

Optimize Production Processes

Minimizing water, energy, and chemical usage throughout the textile value chain.

Reuse

REUSE FOR LONGEVITY

Repair and Refurbish

Encouraging clothing repair services and extending garment life through proper care.

Second-hand Clothing

Promoting resale platforms and fostering a culture of buying and selling pre-owned clothing.

THE 6Rs STRATEGY

Remanufacture

UPCYCLE FOR KEEPING IN THE LOOP

Disassemble and Redesign

Breaking down used garments, recovering usable components, and reassembling them into new creations.

Higher Value from Waste

Transforming post-industrial and used clothing into new garments or other textile products of similar or even better quality.

Recycle

Innovation in Sorting

Investing in advanced sorting techniques to ensure accurate fiber separation and minimize downcycling.

Textile-to-Textile Recycling

Developing technologies that separate and recycle fibers back into high-quality materials for new clothing production.

Regenerate

FOR CLOSING THE LOOP

All post-use textiles should enter back into the value chain through technical or biological cycle.

Ensuring that apparel is made biodegradable by regenerative agricultural techniques.

Where no viable alternatives exist, textile waste must be disposed of scientifically by evaluating risk, minimizing emissions and air pollution during the process.

By embracing these principles, the textile and apparel industry can move away from the wasteful linear model and transition towards a more sustainable and closed-loop circular economy.

This transition will help decouple economic growth from resource consumption and environmental damage, leading to a more prosperous and equitable society while safeguarding natural resources for future generations.

[4] *www.ceeindia.org/pdf_files/Baseline%20Assessment%20Report%20(Digital%20Version).pdf*

KEY INDICATORS FOR MEASURING CIRCULARITY

MATERIAL (FIBRES)

Transitioning to a circular economy in the textile and apparel sector requires a shift towards materials that are safe, sustainable, and minimize environmental impact throughout their lifecycle.

Here are some key indicators to consider when measuring circularity with respect to materials:

USE OF SUSTAINABLE FIBERS

Percentage of Recycled Fibres

- This can be established by measuring and declaring the proportion of recycled materials like recycled polyester, cotton, viscose or lyocell used in garments compared to virgin fibres with traceability of recycled material.
- This will initiate the development of circular products and promote textile-textile recycling.

Natural and Next-gen/Alternate Fiber Content

- This indicator can be established by measuring and declaring the percentage of natural, plant-based fibers like hemp, banana or other agricultural or innovative alternative fibres used in production.
- This will promote the utilization of sustainable alternative fiber which upon recycling limit will lead to natural decomposition and proceed towards the regeneration cycle.

List of various recycled and new-gen fibres such as recycled cotton, polyester, hemp and so on are provided with details and significance of each in **Annex I.**

RESOURCE EFFICIENCY

While material is crucial, circularity also hinges on responsible management of natural resources like energy and water. Here are key indicators to consider.

CHEMICAL MANAGEMENT

Low-toxicity Wet Processing Chemicals

- This indicator can be determined by listing and disclosing the number of safer alternative chemicals used, out of the total chemicals, in the production processes to minimize effluent pollution and other hazards.
- This will assist in generating a low environmental footprint for the product and further its low/no impact upon final disposal into the environment.

The textile and apparel sector has been under scrutiny for its significant environmental impact, leading to the rise of green-chemistry-focused initiatives that aim to foster sustainability and circularity.

Various initiatives such as Bluesign, ZDHC, Detox Campaign, Higg Material Sustainability Tool, CHEM-IQ, GreenScreen for Safer Chemicals, The Sustainability Consortium, and OEKO-TEX Standard 100 are at the forefront of this movement.

The details and significance of each of these programs is provided in **Annex II.** Each program implements different strategies to enhance sustainability and circularity within the industry.

ENERGY EFFICIENCY

- This indicator can be established by identifying and establishing baseline and setting reducing targets for energy consumption year on year from the baseline.
- This process will establish energy-efficient production and further help in achieving a low carbon footprint.

RENEWABLE ENERGY

- This indicator can be easily established by calculating the percentage of renewable energy generated and utilized through onsite generation, offsite generation and third-party purchase compared to total energy consumption.
- Adoption of renewable energy for production like solar, solar-thermal or wind to reduce reliance on fossil fuels and minimize carbon footprint.

WATER STEWARDSHIP AND CONSERVATION

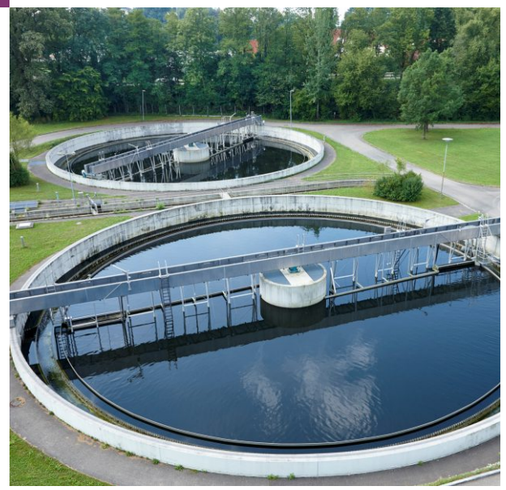
Water Consumption

- This indicator can be established by measuring the amount of water used for production compared to per unit (meter, KG or piece) of textile/garment produced.
- Similar to energy consumption the best practice is to establish plant level baseline and set targets for reduction of water consumption year on year compared to baseline value through the implementation of water-saving technologies and practices to minimize water consumption throughout the production chain.

Water Recycling & Reuse

- This indicator can be established by measuring percentage of water (KLD) treated/non-treated being utilized back in the process compared to total fresh water consumption of the plant.
- It require monitoring the effectiveness of wastewater treatment systems in removing pollutants and harmful chemicals so that water becomes complaint for process use (viz. ZLD, wash water reuse, recovery of hot or cold water streams from utilities etc.) and strive for closed-loop systems that minimize or eradicate effluent discharge and maximize water reuse within production processes.

Water Positive



- This indicator is established by measuring and declaring water consumption, ensuring that water from regenerative sources (e.g., rainwater harvesting, treated wastewater) exceeds that from non-regenerative sources (e.g., municipal supply, surface water, groundwater).
- This will lead to an increase in the utilization of regenerative sources of water in production and thus help in reducing water footprint.
- Even organizations can practice the development of additional water resources beyond the fence as CSR or community development programs to become water neutral or in best case water positive.

By focusing on these key natural resource indicators, the textile industry can demonstrate responsible stewardship of the environment. This ensures that the production of textiles minimizes its impact on energy resources and water sources.

WASTE MANAGEMENT

Minimizing waste generation and maximizing resource recovery are crucial aspects of circularity in the textile industry.

Here are key indicators to consider when measuring circularity from a waste management perspective across different stages.

Soft Waste (Fiber Form)

- This indicator measures the overall efficiency of soft waste management within the spinning process by tracking the percentage of soft waste that is effectively generated, utilized or recycled rather than being disposed of. It can be calculated by determining the ratio of recycled and repurposed soft waste to the total soft waste generated.

Yarn Waste

- This indicator measures the overall efficiency of yarn waste management within a textile manufacturing process by tracking the generation, recycling, and repurposing of yarn waste.

The calculation involves determining the percentage of yarn waste generated per unit of fabric, the proportion of sized yarn waste shredded for reuse, and the percentage of yarn waste diverted from landfills.

Fabric Waste

This indicator tracks fabric waste generated per unit of garment produced (e.g., selvedge cuts, chindi), emphasizing efficient cutting techniques and optimized pattern layouts to reduce waste.

- It also monitors the proportion of fabric waste diverted from landfills through recycling, downcycling, and repurposing initiatives.
- This includes reusing fabric waste for secondary products like bags or upcycling into new garments, as well as recycling knitted/woven waste into new yarns, demonstrating a commitment to closing the loop on material use.

By establishing and focusing on improving waste management indicators across all stages, the textile industry can demonstrate its commitment to circularity. This ensures that resources are used efficiently, waste generation is minimized, and valuable materials are recovered and reintroduced into the production cycle whenever possible.

TOOLS FOR CIRCULAR TRANSFORMATION

Transitioning to a circular economy requires robust assessment and measurement tools to guide businesses. This section provides an overview of key frameworks and platforms designed to support organizations in their circular journey. These tools offer a variety of functions, from assessing circularity performance to providing practical guidance on implementing circular design principles. By leveraging these resources, companies can gain valuable insights, measure progress, and identify opportunities for improvement.

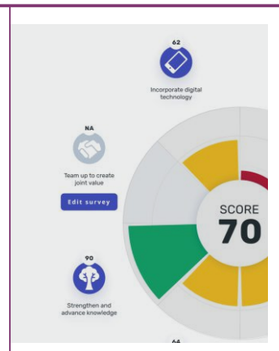
TOOLS FOR TRANSITION

CIRCULAR DESIGN FOR FASHION BOOK

This book by Ellen McArthur Foundation provides actionable strategies and innovative approaches to design products that minimize waste, extend material life cycles, and regenerate ecosystems. With real-world examples, design methodologies, and tools for implementation, it serves as a practical blueprint for brands, designers, and educators committed to fostering a sustainable future for fashion.[5]

ELLEN MACARTHUR FOUNDATION

[5] Circular Design for Fashion Book

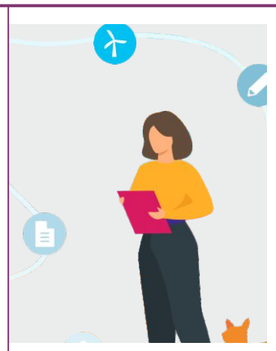


CIRCULARITY ASSESSMENT TOOL

Provided by Circle Economy, this tool helps companies assess their business or products against circular frameworks, identify opportunities for improvement, and benchmark their circular strategies. It includes case studies and good practices to inspire and guide businesses.[6]

CIRCLE ECONOMY

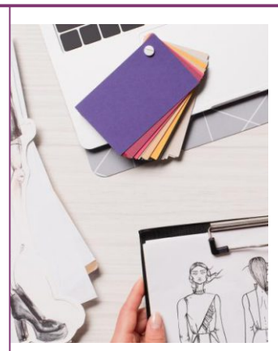
[6] Circularity Assessment Tool



CIRCULAR TEXTILES READY-TO-USE ASSESSMENT

Created by the European Union, this tool supports companies in measuring their circularity performance, providing a baseline score, and offering recommendations for adopting circular strategies.[7]

[7] EU Circular Economy Platform



CIRCULAR DESIGN TOOLKIT FOR FASHION AND TEXTILES

Developed collaboratively with industry stakeholders through Textiles 2030's Circular Design Working Group, the Toolkit offers a practical framework to integrate circular design principles in textile product development. The Toolkit accelerates the industry's transition towards a circular economy by empowering organisations to create lower-impact products.[8]

Textiles 2030

[8] Circular Design Toolkit

CIRCULAR TRANSITION INDICATORS

The Circular Transition Indicators (CTI) framework, developed by the World Business Council for Sustainable Development (WBCSD), offers a standardized approach to quantifying a company's circularity performance. By providing a comprehensive and comparable measurement system, It assesses circularity progress, communicates environmental benefits, and identifies opportunities for improvement.[9]

WBCSD World Business Council for Sustainable Development

[9] Circular Transition Indicators

NIKE CIRCULAR DESIGN GUIDE

Inspired by the Global Fashion Agenda, the company developed the "Circularity: Guiding the Future of Design" framework. This resource promotes a holistic approach to product creation, emphasizing the importance of circular design principles across the industry.[10]

[10] Nike Circular Design Guide

IKEA CIRCULAR BLUEPRINT

This interactive tool provides a framework for understanding and applying circular design principles, inspiring innovation and driving progress towards a more sustainable future. It is designed to serve as a starting point, offering guidance rather than prescriptive solutions.[11]

IKEA

[11] IKEA Circular Blueprint

H&M CIRCULATOR GUIDE

It is a framework designed to guide product development towards circularity. It focuses on design for circularity, sustainable materials, product care, recycling, and repurposing. The goal is to create durable, repairable, and sustainable products.[12]

H&M Group

[12] H&M Circulator Guide 2

It is important to note that this list is non-exhaustive, and the circular economy landscape is continually evolving. While these tools represent some of the most widely recognized and accessible options currently available, businesses may also develop their assessment methodologies or adapt existing frameworks to suit their specific needs. (refer to **Annex IV** - How to implement circularity within industry).

The choice of tool should be based on a comprehensive evaluation of organizational goals, resources, and the desired level of detail in circularity assessment. Ultimately, the successful transition to a circular economy requires a tailored approach that combines both standardized tools and innovative, industry-specific solutions.

CERTIFICATIONS & STANDARDS

The section explores various certifications and standards that can assist in implementing circularity in the textile industry throughout the value chain.

GLOBAL ORGANIC TEXTILE STANDARD (GOTS)

It is the stringent voluntary global standard from harvesting to labelling (including spinning, knitting, weaving, dyeing and manufacturing) of apparel and home textiles made with certified organic fibre (such as organic cotton and organic wool) which can contribute to a more sustainable and circular approach to textile production.

It includes both environmental and social criteria. Key provisions include banning genetically modified organisms (GMOs), highly hazardous chemicals (such as azo dyes and formaldehyde), and child labour while requiring robust social compliance management systems and strict waste water treatment practices.

GOTS-certified final products may include fibre products, yarns, fabrics, clothes, home textiles, mattresses, personal hygiene products, food contact textiles, and more. Organic fibres are often produced using practices that minimize environmental impact and promote biodiversity, which are key aspects of the circular economy.

GLOBAL RECYCLED STANDARD (GRS)

The Global Recycled Standard (GRS) is a comprehensive product standard that certifies recycled content, chain of custody, and environmental practices. It promotes recycling, extending material lifespan, and reducing environmental harm caused during production.

GRS-certified products incorporate recycled materials, conserving resources, cutting energy use, and lowering emissions for a greener planet. Its objectives include standardizing definitions, enabling traceability, informing customers, reducing environmental impact, ensuring material authenticity, and fostering innovation.

Applicable to products with 20% recycled material, GRS mandates certification for each production stage, emphasizing transparency through self-declaration, documentation, and site visits. However, it doesn't cover quality or legal compliance and adheres to recognized definitions like ISO 14021 and US FTC Green Guides. The current standard will be replaced by the Unified standard V2.1 which is currently in draft mode

CRADLE TO CRADLE (C2C)

The Cradle to Cradle Certified® framework integrates the Circular Economy beyond waste solutions, emphasizing circular pathways for every product stage.

It focuses on five categories, with Product Circularity at its core. This category encompasses Circular Sourcing, promoting cycled or renewable content, Circular Design, emphasizing intentional design for cycling, and Circular Systems, which involve education, data reporting, and active cycling processes.

These pillars ensure products are intentionally designed and actively cycled within their intended pathways, aligning with the Cradle to Cradle® design concept.

OEKO-TEX STANDARDS

OEKO-TEX® aligns with the circular economy model by integrating sustainability criteria into their certifications.

The MADE IN GREEN label emphasizes sustainable and responsibly manufactured materials without specifically banning fibers, aiming for eco-friendly production.

The STANDARD 100 certification ensures products are free from harmful substances, promoting consumer health and environmental protection. Additionally, the STeP certification guarantees environmentally and socially responsible production, encouraging energy efficiency and waste reduction.

OEKO-TEX® prioritizes transparency, utilizing product labelling for traceability and engaging in initiatives for supply chain transparency through blockchain technology.

RECYCLED CLAIM STANDARD (RCS)

The Recycled Claim Standard (RCS) is an international voluntary standard certifying recycled input and chain of custody. It aims to boost the usage of recycled materials and offers clear objectives: aligning recycled definitions, enabling traceability, aiding consumer decisions, and ensuring material authenticity in final products.

Applicable to items with 5% recycled material, each production stage must be certified, beginning from recycling to the last transaction seller. Material Collection and Concentration sites adhere to self-declaration, documentation, and on-site visits.

However, the RCS doesn't cover social/environmental aspects, quality, or legal compliance. It follows ISO 14021 definitions, aligned with recognized standards like US FTC Green Guides for stringent compliance.

ISO 14040 AND 14044 - LIFE CYCLE ASSESSMENT (LCA)

Life Cycle Assessment (LCA) is a methodology used to evaluate the environmental impacts of a product, process, or service throughout its entire life cycle, from raw material extraction to disposal.

ISO has developed several standards related to LCA, including ISO 14040 and ISO 14044.

- ISO 14040: Provides principles and framework for conducting LCA studies, including goal and scope definition, inventory analysis, impact assessment, and interpretation of results.
- ISO 14044: Specifies requirements and guidelines for conducting LCA studies, including data quality assessment, life cycle inventory analysis, impact assessment methods, and reporting.

LCA helps organizations identify environmental hotspots, prioritize improvement opportunities, and make informed decisions to minimize environmental impacts across the life cycle of products, processes, and services.

BS 8001:2017

This British Standard offers a comprehensive framework to guide organizations in adopting circular economy principles. It provides practical steps for shifting from the traditional linear economy (take-make-dispose) to a more sustainable, circular model that emphasizes resource efficiency, waste minimization, and extending product lifecycles.

The Key areas include innovative business models such as product-as-a-service, remanufacturing, and reverse logistics.

The standard promotes life cycle thinking, systems-level collaboration, and value retention, encouraging organizations to maximize the use of resources and minimize waste across the supply chain.

Applicable to organizations of any size and sector, it helps to unlock new business opportunities, enhance resource management, reduce environmental impacts, and support long-term sustainability goals.

ISO 59000 – CIRCULAR ECONOMY

ISO 59000 is the series of international standards dedicated to the circular economy.

This series provides a framework for organizations to adopt circular economy principles, measure their progress, and transition to more sustainable business models.

Key Standards in the ISO 59000 Series:

- ISO 59004:2024
  Defines the core concepts, principles, and implementation guidance for circular economy.
- ISO 59010:2024
  Offers guidance on transitioning business models and value networks towards circular economy principles.
- ISO 59020:2024
  Provides a framework for measuring and assessing circularity performance.

STEPS FOR TRANSITION TOWARDS CIRCULARITY

The Indian textile and apparel sector transition requires a comprehensive approach that addresses raw material sourcing, production practices, and end-of-life management.

Here, we outline the key goals and actionable steps necessary for the sector to make this crucial transition.

KEY GOALS

Reduce Reliance on Virgin Resources

Minimize dependence on non-renewable resources like petroleum-based fibers by shifting towards renewable and recycled materials.

Circular Design

Develop garments with disassembly and recyclability in mind to ensure products can be reused or recycled at the end of their lifecycle.

Resource Efficiency in Production

Optimize energy and water usage during manufacturing to reduce the environmental footprint of production processes.

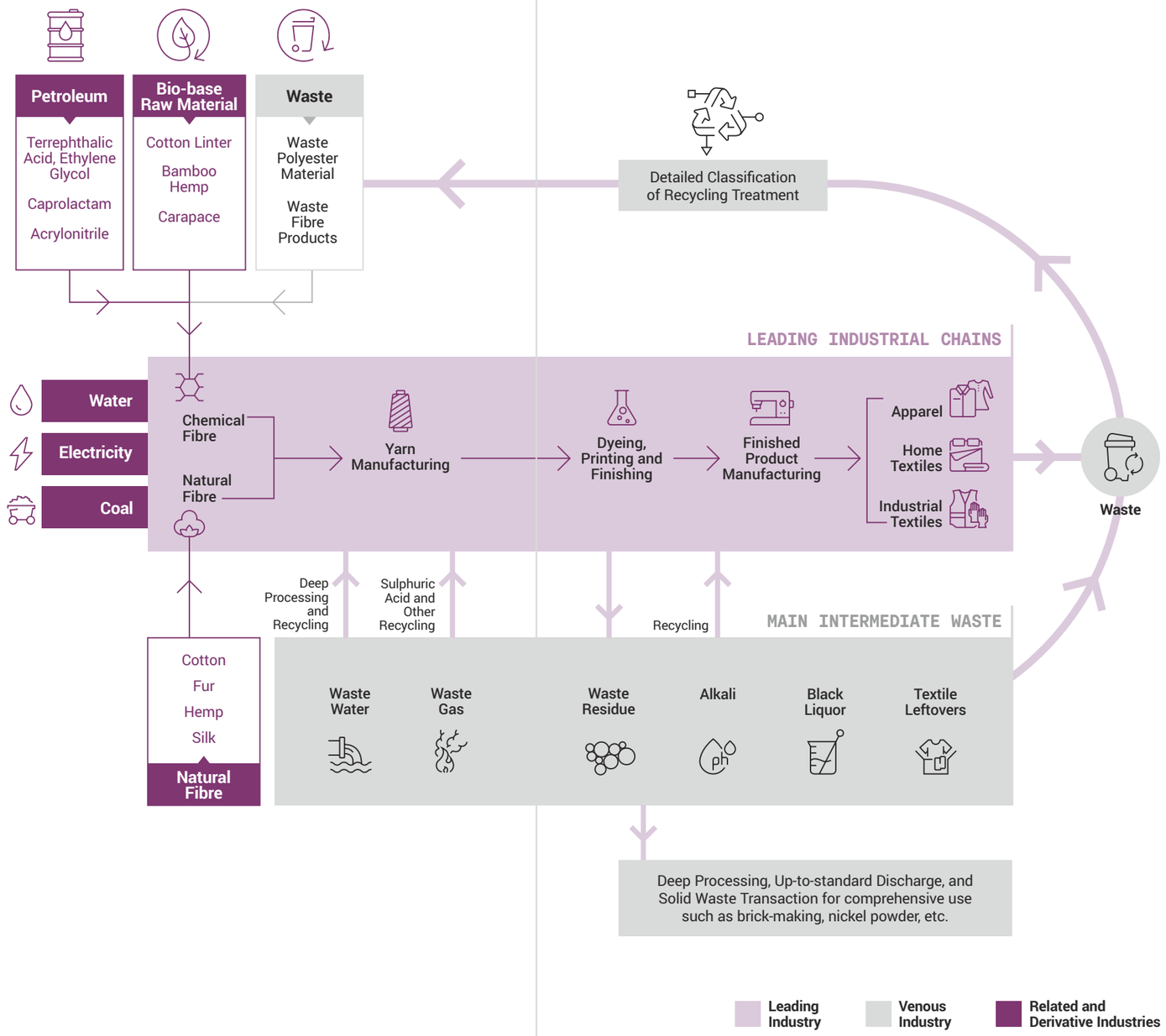
Circular Business Models

Circular Business Models: Promote green consumption and innovative recycling technologies to support a circular economy.

Upgrade Textile Waste Recycling

Enhance the quality and efficiency of textile waste recycling infrastructure to handle increased volumes of recyclable materials.

CIRCULAR BUSINESS MODEL



ACTION STEPS

Raw Material Transformation

- New age Fibers
- Recycled Fiber Options
- Trims and Packaging

Circular Production

- Resource Conservation
- Water Circularity
- Advanced Technologies
- Circular Production Practices

Enhancing Apparel Manufacturing

- Digitalization
- Sustainable Materials
- Waste Management

Empowering Brands

- Design for Circularity
- Circular Business Models
- Consumer Education
- Circular Ecosystems and R-HUBs
- Standardizing Industry Practices and Specifications

ACTION STEPS

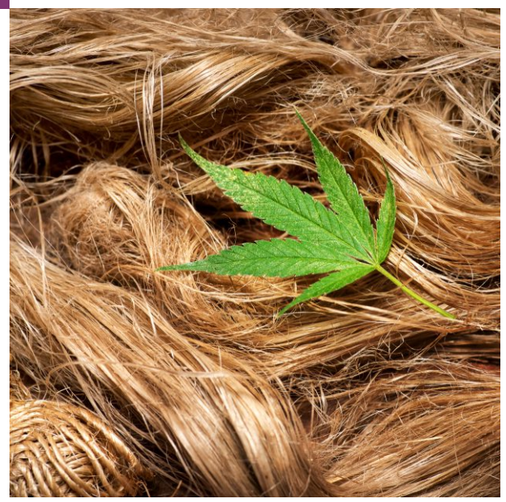
RAW MATERIAL TRANSFORMATION

Diversify raw material sources to mitigate dependence on petroleum resources. Explore the potential of sustainable options like recycled fibers and bio-based chemical fibers.

Also, assess raw materials from a lifecycle perspective to minimize environmental impact and resource consumption.

NEW AGE FIBERS

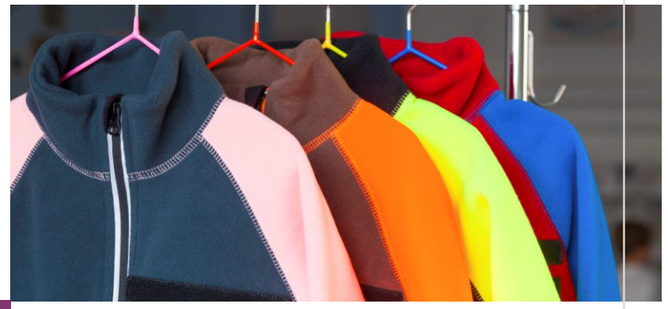
- **Develop and Utilize Bio-based Materials** Accelerate development and adoption of bio-based fibers (cotton linter, bamboo, hemp) to replace petroleum-derived materials. These materials are renewable and have a lower environmental impact compared to conventional fibres.
- **Diversify Raw Material Sources** Explore using agricultural residues and industrial by-products as alternative raw materials to reduce reliance on petroleum-based fibers.



RECYCLED FIBER OPTIONS

- **Increase use of Recycled Fibers** Focus on producing high-quality recycled fibers from sources such as industrial textile waste.

Recycled/ Next-Gen Fiber	Application	Benefit
Tencel™/ Birla Excel (Lyocell fiber from wood pulp)	Clothing (shirts, dresses, activewear)	Biodegradable, soft, moisture-wicking



Repreve® (recycled polyester from plastic bottles)	Sportswear, Fleece jackets, Backpacks	Sustainable, good performance for activewear
Liva Reviva™ (recycled cellulosics – viscose and lyocell)	Apparel (formal wear, casual wear)	Lower environmental impact, maintains quality standards
HempLoop (made from hemp)	Home Textiles, Clothing (shirts, pants, bags)	Sustainable, durable, naturally anti-bacterial

TRIMS AND PACKAGING

Trims, Labels and Tags

- Design for disassembly by choosing trims that are easily recyclable, like snaps or clips.
- Opt for sustainable/recycled materials.
- Include information for proper disposal of trims.

Packaging

- Minimize overall plastic use.
- Replace virgin plastic with compostable alternatives or recycled plastic.
- Use FSC-certified or recycled paper.

Sewing Threads

- Use recycled or natural fiber threads that match the garment's material.

CIRCULAR PRODUCTION

The textile industry can be more sustainable by adopting several key practices.

Focusing on resource efficiency, water stewardship, employing efficient processing methods and continuous improvement in resource utilization, selecting sustainable chemicals, and responsible chemical management all contribute to a more circular production process.

RESOURCE CONSERVATION

Adopt High-efficiency Systems

- Invest in energy-efficient equipment across various stages of production, including spinning, weaving, knitting, and dyeing.
- Consider retrofitting existing machinery to reduce energy and water consumption during production.

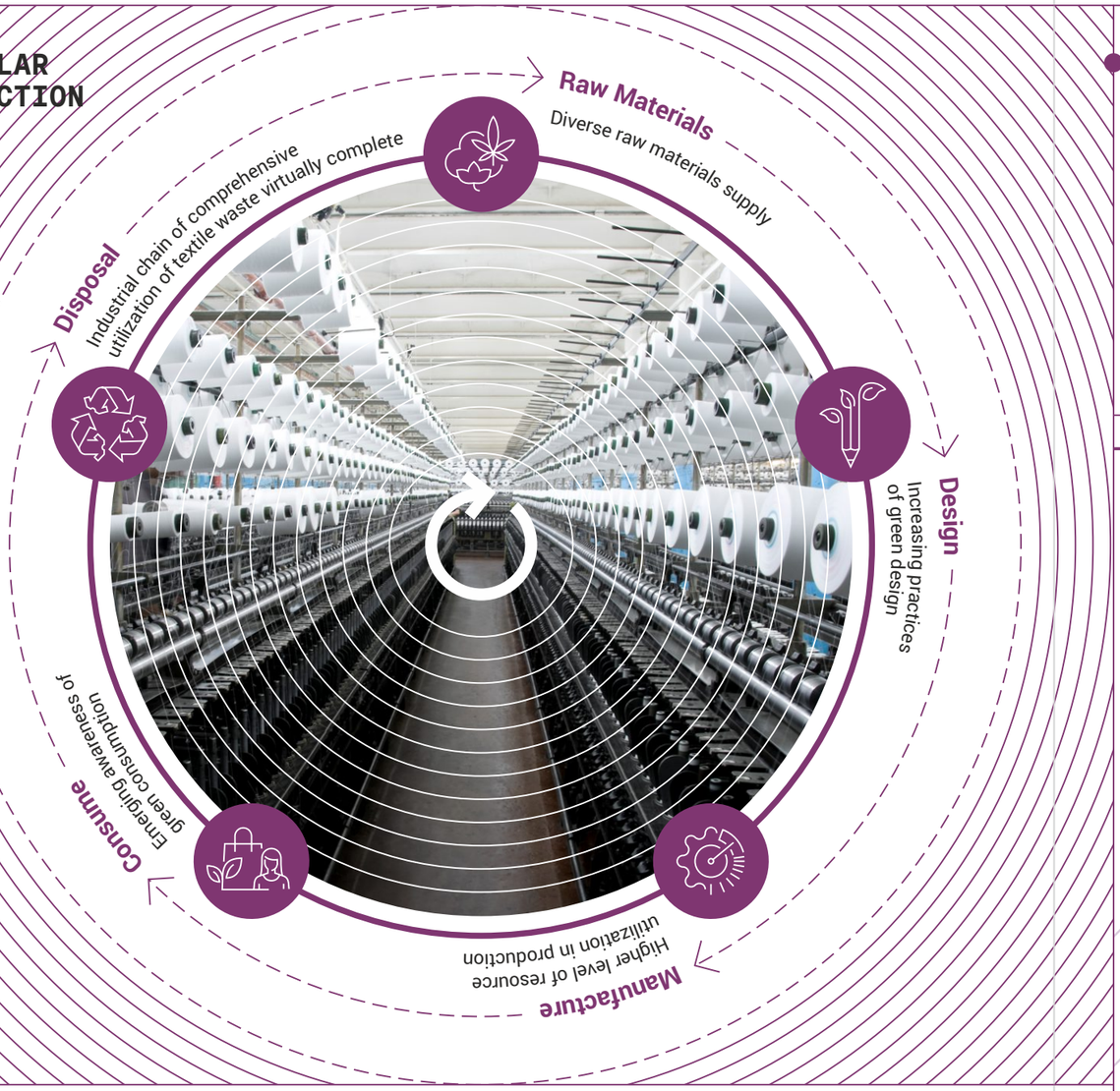
Automation

- Integrate smart automation systems to optimize resource utilization and production efficiency.
- This can involve sensors for real-time monitoring of energy consumption and automated adjustments to optimize settings.
- It includes automated climate control systems, and other advanced technologies to enhance production efficiency.

Utilize Clean Energy Sources

- Shift towards renewable energy sources, such as solar and wind power, to decrease the carbon footprint of manufacturing operations.

CIRCULAR PRODUCTION MODEL



WATER CIRCULARITY

Closed-Loop Water Systems

- Implement closed-loop water systems wherever possible, particularly in dyeing and finishing processes.
- This involves reusing treated wastewater within production after appropriate purification.

Rainwater Harvesting

- Implement rainwater harvesting systems to capture rainwater and reduce reliance on municipal water sources.

Water-saving Technologies

- Invest in water-saving technologies such as low liquor ratio dyeing machines, spray dyeing systems, and foam dyeing techniques.
- These methods significantly reduce water consumption during dyeing and finishing processes.

ADVANCED TECHNOLOGIES

The successful implementation of advanced technologies across the textile value chain requires a tailored approach. Factors such as product type, production processes, and local circumstances will influence the specific technologies and strategies adopted.

To identify the most impactful areas for improvement, a comprehensive audit is essential. To foster innovation and adoption, collaborative partnerships between industry, government, and financial institutions are essential to provide necessary support and incentives.

Promote Efficient Processing Techniques

- Utilize efficient short-flow pretreatment and processing techniques in printing and dyeing to conserve resources such as cold pad batch, genelogy spray and waterless dyeing, digital printing.

Printing

- Use materials that do not conflict with compostability or recyclability.

CASE STUDY

A PARTNERSHIP FOR SUSTAINABLE DYEING

H&M Group, Arvind Ltd., and Deven Supercriticals have formed a groundbreaking partnership to revolutionize the textile industry through **Waterless Dyeing.**

By introducing Suprauno, an innovative technology that utilizes **Supercritical CO_2** — the collaboration aims to significantly reduce the environmental impact of textile production.

H&M Group · Arvind Fashioning Possibilities · Deven Supercriticals Pvt. Ltd.

Source - Ecotextile News: Project explores water-free dyeing for denim production

CIRCULAR PRODUCTION PRACTICES

Sustainable Chemical Selection

- Prioritize the use of safer and less harmful chemicals in production processes. Partner with chemical suppliers to identify and adopt environmentally responsible alternatives.

Chemical Lifecycle Management

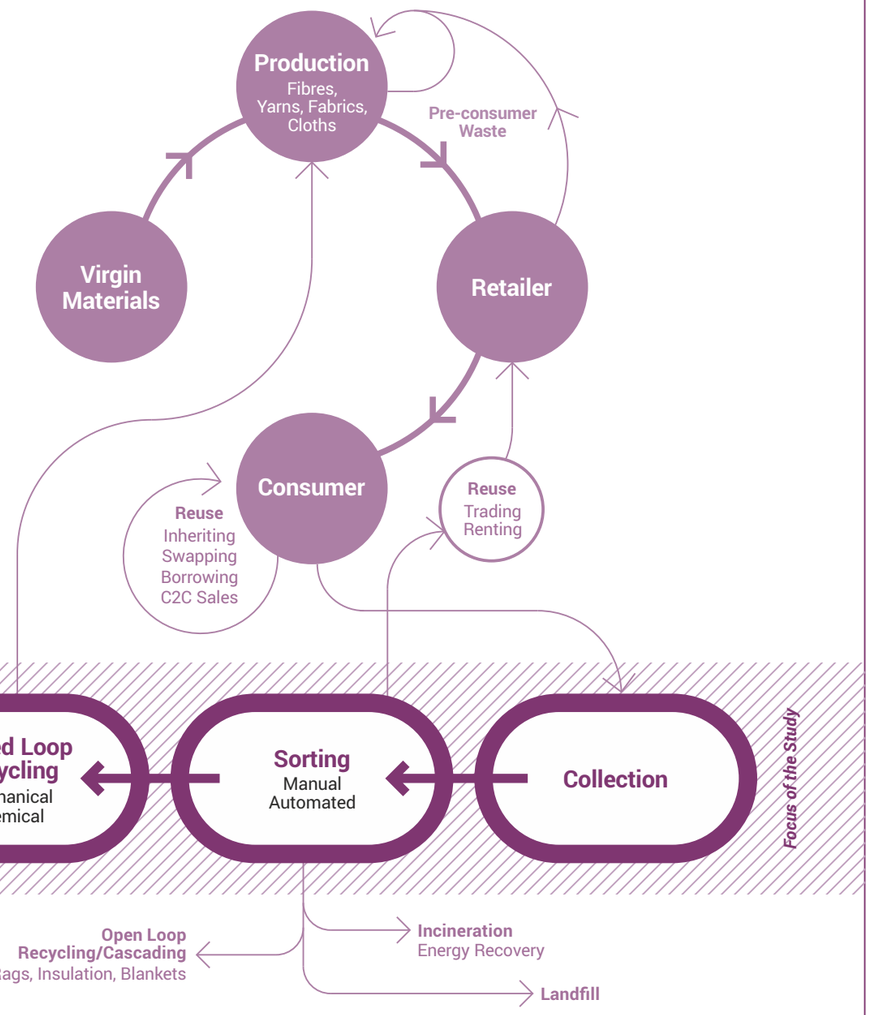
- Implement a robust chemical lifecycle management system to ensure the safe handling, storage, transportation, and disposal of chemicals. This minimizes the risk of environmental contamination and promotes responsible chemical stewardship.

GARMENT MANUFACTURERS

Sustainable textile production goes beyond resource efficiency. It incorporates circularity throughout the process.

This means applying the 6R principles (likely Rethink, Refuse, Reduce, Reuse, Repair, Repurpose, Recycle) to minimize waste at every stage, from sourcing materials to delivering the final product. Additionally, digitalization plays a key role along with using renewable and recyclable materials and putting proper waste management plan in practice ensures valuable materials are recovered and reused effectively.

THE CIRCULAR TEXTILE SUPPLY CHAIN



DIGITALIZATION

Leverage Big Data and AI

- Utilize big data, cloud computing, and artificial intelligence (AI) to optimize production processes, manage resources more efficiently, and reduce waste.

SUSTAINABLE MATERIALS

Increase Use of Renewable and Recyclable Materials

- Prioritize the use of renewable, circular, and recyclable materials in product design and production.

WASTE MANAGEMENT

Segregation at Production Lines

- Establish dedicated waste streams at production lines for different types of textile waste (fabric scraps, offcuts, yarn trimmings). This facilitates efficient collection, sorting, and recycling of valuable materials.

Develop Standardized Recycling Methods

- Establish standardized methods for recycling waste products and packaging materials. This ensures that waste is managed efficiently.

Source: Exploring supply chain capabilities in textile-to-textile recycling - A European interview study

BRANDS

Brands have role that extends beyond the creation of clothes. They must aim for a circular life cycle for garments that involves designing clothes that can be easily disassembled and recycled later. Sustainable materials with a lower environmental impact, like organic cotton or recycled fibers, are preferred.

Furthermore, the concept goes beyond production - it looks at how clothes are used and disposed of. Circular business models come into play here. Rental services, take-back programs for used clothes, and repair services all aim to extend the lifespan of clothing.

Finally, consumer education is key. Clear labels empower informed choices, and educational campaigns raise awareness about sustainable fashion practices. This creates a cycle where clothes are designed, used, and disposed of responsibly, minimizing waste.

DESIGN FOR CIRCULARITY

Design for Recyclability and Disassembly

- Develop garments that can be easily disassembled and recycled at the end of their life. This includes choosing materials that are compatible with recycling processes and avoiding mixed fibers that are difficult to separate.

Sustainable Product Design

- Design products with the entire lifecycle in mind, focusing on reducing resource consumption and environmental footprint. This involves considering the impact of materials, production processes, packaging, and end-of-life disposal.
- Use materials with a lower environmental footprint, such as organic cotton, recycled fibers, and bio-based alternatives.

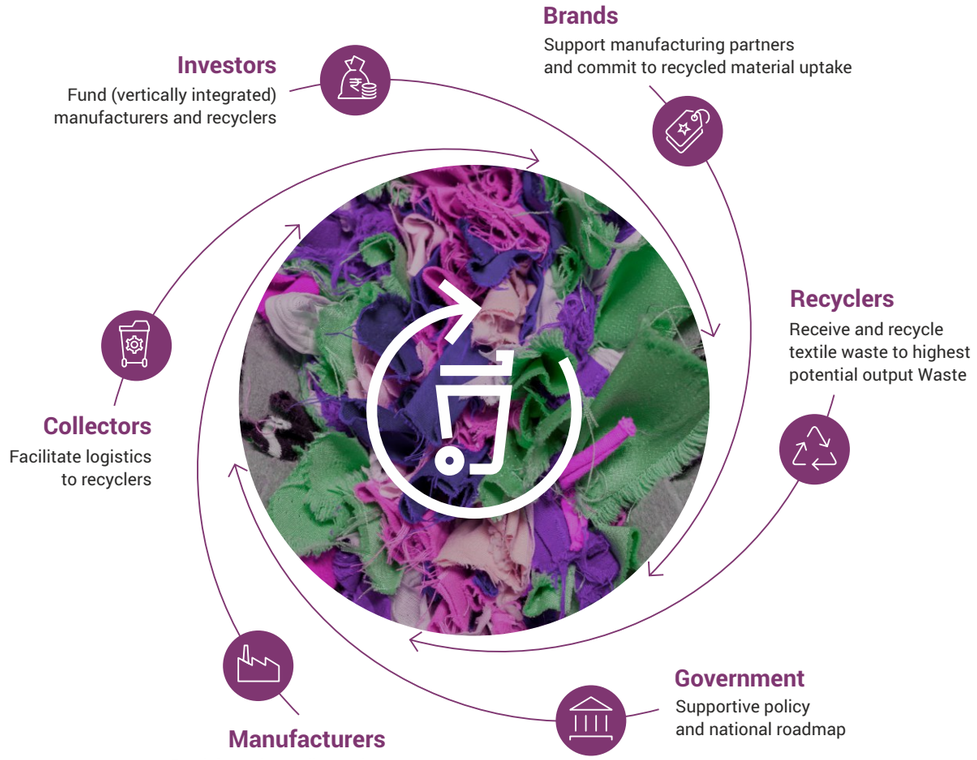
Optimize Fiber Selection

- Focusing on the inherent properties of mono fibers is essential. Utilizing mono-fiber materials reduces or eliminates the need to blend different fiber types while simplifying the recycling process. Also, blends of natural fibers like cotton and wool, or regenerated fibers like rayon and acetate, are acceptable as they naturally decompose.

Preserving Traditional Skills and Knowledge

- It underscores the importance of preserving traditional handloom and handicraft techniques, integral to the circular design philosophy. Passed down through generations, these artisanal skills embody a heritage of sustainable craftsmanship that supports local economies. Incorporating these time-honored practices into circular design ensures the longevity of both cultural knowledge and the sustainable livelihoods of artisan communities, while fostering a system that values regeneration and resource efficiency.

CIRCULAR ECOSYSTEM FOR TEXTILE WASTE MANAGEMENT



CONSUMER EDUCATION

Provide Clear Labeling

- Include detailed information on clothing labels about fiber content, recycling instructions, and disposal options. This significantly impact consumer behavior by providing clear information on garment composition, care instructions, and end-of-life options by helping in segregating the textile waste.

Responsible Disposal Campaigns

- Initiatives that encourage consumers to donate, recycle, or return old clothes to take-back programs can significantly reduce textile waste.

Highlighting the Environmental Impact

- Educating consumers about the environmental consequences of textile waste, including landfill pollution and resource depletion, can foster a sense of responsibility and motivate them to adopt more sustainable habits.

Benefits of Circular Practices

- Educating consumers about the environmental and economic benefits of repair, reuse, and recycling can inspire them to adopt more sustainable habits.

CIRCULAR BUSINESS MODELS

Product-as-a-Service (PaaS)

- **Clothing Rental** Offer clothing rental subscriptions, allowing customers to access a variety of garments for a fixed monthly fee. This model reduces overconsumption and encourages responsible fashion choices.
- **Reverse Leasing** Lease high-quality garments to customers, offering them the option to purchase the item at the end of the lease term. This model extends garment life and caters to customers who prefer ownership after use.

Take-Back and Repurpose Programs

- **Post-consumer Garment Collection** Implement take-back programs where customers can return used clothing in exchange for discounts or rewards. The collected garments can be recycled, upcycled, or resold as pre-owned clothing.
- **Repair and Refurbishment Services** Offer in-house or partnered repair and refurbishment services to extend the life of garments. This caters to customers who value quality and want to keep their clothing for longer.

Collaborative Consumption

- **Clothing Swap Events** Organize or partner with clothing swap events where customers can exchange unwanted garments for pre-loved items. This promotes circularity and fosters a community around sustainable fashion.
- **Peer-to-Peer Rental Platforms** Partner with existing peer-to-peer rental platforms that allow individuals to rent out their own garments to others. This extends the use cycle of existing clothing and creates a sharing economy within the fashion industry.
- **Collaborate with Recycling Companies** Partner with professional recycling companies to ensure traceability and recycling of waste materials.
- **Handloom and handicraft** Brands are collaborating with the sector to utilize indigenous craft involving natural and biodegradable materials like organic cotton, jute, and silk. By incorporating mono-material designs, brands can enhance the recyclability of their products. Promoting eco-friendly practices, such as using natural dyes and non-toxic finishes, will further embed these sectors into the circular economy.

Upcycling and Redesign

- **Upcycled Clothing Lines** Design and launch new clothing lines made from salvaged or leftover materials. This reduces reliance on virgin resources and creates unique, sustainable fashion options.
- **Customization and Personalization** Offer customization options for garments, allowing customers to personalize existing designs or upcycled materials. This caters to individuality and reduces the need for entirely new clothing.

INDUSTRY ECO-SYSTEM AND INFRA-STRUCTURE FOR R-HUB

Robust Recycling Infrastructure

- **Material Recovery Facilities (MRFs)** Establish advanced MRFs to sort, clean, and process post consumer-textile waste effectively.
- **Recycling Technologies** Invest in state-of-the-art recycling technologies to convert textile waste into new fibers and materials.
- **Chemical Recycling** Explore chemical recycling processes to recover high-quality fibers from complex textile blends.

Supply Chain Collaboration

- **Transparent Supply Chains** Foster transparency and collaboration among all stakeholders in the supply chain, from raw material suppliers to retailers.
- **Traceability** Implement robust traceability systems to track the origin and journey of materials and products.
- **Shared Responsibility** Encourage shared responsibility for environmental impact throughout the supply chain.

HARMONIZING STANDARDS AND TECHNICAL SPECIFICATIONS FOR THE INDIAN TEXTILE INDUSTRY

Standardization

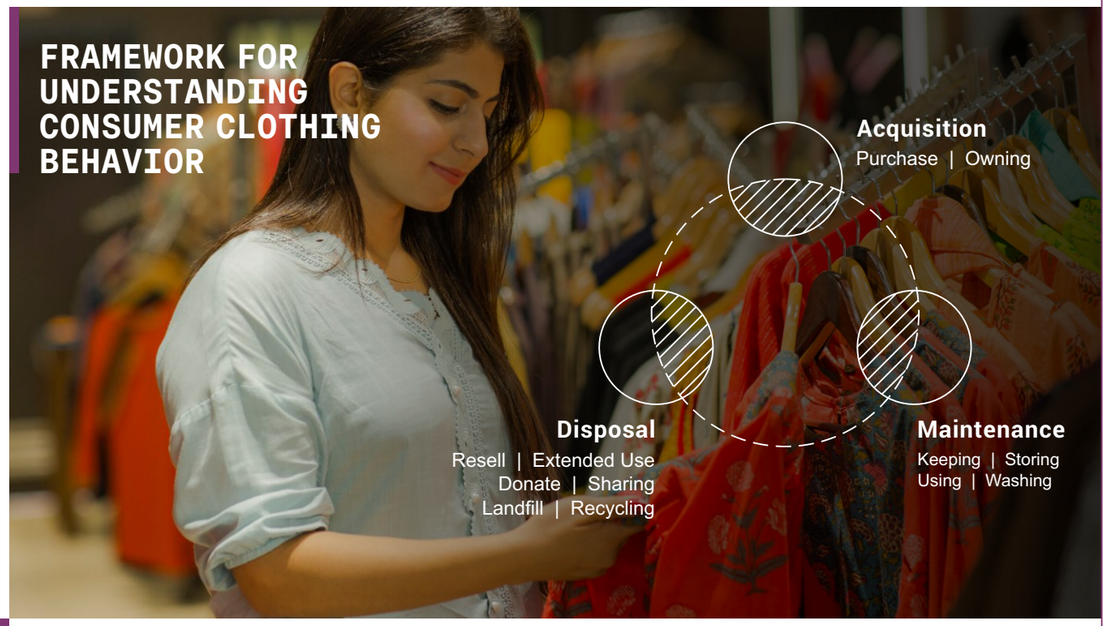
- **Global Standards** Adopt and align with international standards for textile recycling and eco-design.
- **National Standards** Develop and implement national standards for textile labeling, certification, and traceability.

Technical Specifications

- **Fiber Identification** Develop clear technical specifications for fiber identification and sorting.
- **Recycling Processes** Establish technical guidelines for various recycling processes.

Certification and Labeling

- **Certification Schemes** Implement certification schemes to recognize and reward businesses that adhere to circular practices.
- **Eco-Labels** Develop and promote eco-labels to identify sustainable products



Source: Apparel Consumer Behavior and Circular Economy: Towards a Decision-Tree Framework for Mindful Clothing Consumption

CASE STUDIES AND BEST PRACTICES

This chapter showcases real-world examples of successful circularity initiatives within the textile and apparel industry, highlighting how companies have adopted sustainable practices, navigated challenges, and achieved measurable results. These case studies serve as practical guides, offering valuable insights into the steps, strategies, and innovations that can make circularity attainable and commercially viable.

By examining pioneering efforts across material recycling, waste-to-resource initiatives, and closed-loop systems, this chapter demonstrates the tangible benefits of circular practices and provides replicable models for companies seeking to integrate circularity within their operations.

CASE STUDY 1

CRADLE-TO-CRADLE GARMENT

BY SHAHI EXPORTS

Shahi Exports' 'Arth' collection stands as a pioneering example of circular fashion. By achieving Cradle to Cradle Certified® Gold, the company demonstrated a profound commitment to sustainability and innovation. This case study delves into the key learnings and strategies employed by Shahi Exports in creating this groundbreaking product.

RETHINKING PRODUCT DEVELOPMENT: A CIRCULAR APPROACH

Shahi's journey to create the 'Arth' collection was a significant departure from traditional apparel manufacturing.

It began with a series of questions on which resources and techniques can be used in a cradle to cradle certified® dress.

It took more than **18 months** from the inception of the product to deliver to the brand partner. This period also includes the certification process for the facilities.

By embracing a circular economy model, the company reimagined the entire product lifecycle for designing the product from scratch, from design to end-of-life.

Design for Disassembly

The garment 'Arth' was meticulously crafted with the intention of being fully disassembled. Detachable components, minimalist aesthetics, and the utilization of fewer accessories and simple silhouettes to facilitate the separation of materials at the end of the product's life cycle to assure easy recycling.

Material Innovation

The collection is made from renewable GOTS certified organic cotton grown without the use of harmful pesticides and fertilizers, coconut buttons, and recyclable labels, it demonstrates a focus on sourcing materials with minimal environmental impact and potential for reuse.

Chemical Restrictions

Adhering to the Cradle to Cradle Certified® Product Standard, the design team at Shahi avoided the use of restricted chemicals and dyes. This necessitated the exploration of alternative processes and materials, ultimately leading to the use of two basic fabric shades—black and henna—achieved through safe and sustainable dyeing methods.

ENVIRONMENTAL IMPACT

The Arth collection set a high standard for environmental stewardship, achieving:

C2C Gold Standard in Renewable Energy and Carbon Management

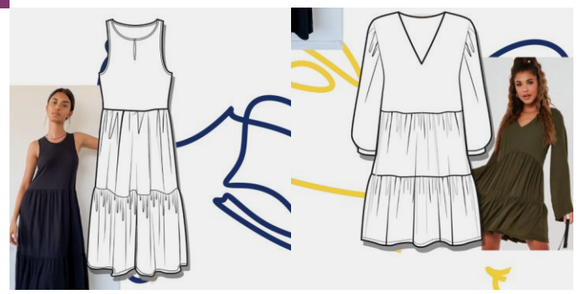
The production process utilized 96% renewable energy, primarily sourced from Shahi's solar grid in Bellary, Karnataka.

C2C Platinum Standard in Water Stewardship

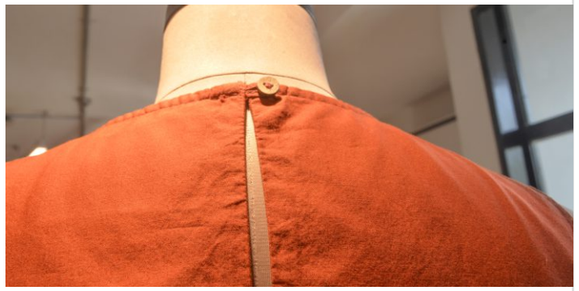
The fabric was produced in a Zero Liquid Discharge Facility, ensuring that no water was wasted during the manufacturing process. Also, the facility recycled 86% of the water used in fabric processing.

Carbon Neutrality

Shahi purchased carbon credits to offset emissions from its boiler and garmenting units, further emphasizing its commitment to reducing its carbon footprint.



Early versions of the Arth dress sport minimalism and accentuate silhouettes



The buttons on the dress were made of natural coconut

SOCIAL FAIRNESS

Social fairness is a critical component of the Cradle to Cradle Certified® Product Standard, that includes ethical labor practices and worker well-being. The company's factories are designed to provide a safe, healthy, and supportive environment for workers, with a focus on continuous improvement and skill development.

KEY INITIATIVES

Worker Well-Being Programs

Shahi has implemented several programs aimed at enhancing worker well-being, including technical and soft skill training initiatives. One notable program is STITCH, co-developed with Good Business Lab, which focuses on building the core competencies of supervisors to manage their roles effectively.

Inache Platform

Shahi's homegrown tool, Inache, is an anonymous two-way communication platform that allows workers to voice their complaints, grievances, suggestions, or questions. This platform fosters transparency and ensures that workers' concerns are addressed promptly and effectively.

These initiatives contributed to Shahi's achievement of the gold standard in the social fairness category.

OVERCOMING CHALLENGES AND BUILDING CAPABILITIES

The path to Cradle-to-Cradle certification was filled with opportunities to overcome challenges.

Capacity Building

The company invested significant time and resources in understanding the Cradle-to-Cradle framework and identifying suitable materials and processes.

Supply Chain Transformation

Sourcing Cradle to Cradle certified materials required building new supplier relationships and implementing stringent quality control measures.

Technological Adaptation

Modifying production processes to align with circular principles necessitated investments in new machinery and equipment.

KEY LEARNINGS AND RECOMMENDATIONS

Shahi Exports' experience offers valuable insights for the apparel industry:

- **Circular Design** Integrating circularity principles into product design from the outset is paramount.
- **Material Selection** Prioritizing materials with low environmental impact and high recyclability is essential for circularity.
- **Ecosystem** Partnerships with brands, suppliers, and certification bodies can accelerate the transition to a circular economy.
- **Continuous Improvement** Circularity is an ongoing journey. Regular evaluation and innovation are necessary to stay ahead.

Shahi Exports' 'Arth' collection serves as a blueprint for the apparel industry's shift towards sustainability. By demonstrating that circular fashion is not only achievable but also commercially viable, the company has inspired others to follow suit. As the industry continues to evolve, Shahi's dedicated efforts will undoubtedly shape the future of fashion.

CASE STUDY 2

ABFRL'S PIONEERING INITIATIVE IN RECYCLED PACKAGING WITH PUNARBHAVAA SUSTAINABLE PRODUCTS (PSP)

Aditya Birla Fashion and Retail Ltd (ABFRL), a leader in India's fashion sector, is setting new standards for sustainability with its VH Innerwear brand. In partnership with Punarbhavaa Sustainable Products (PSP), a Tamil Nadu-based company, ABFRL has embarked on an innovative journey to tackle textile waste through the creation of eco-friendly packaging. This case study highlights ABFRL's forward-thinking approach in adopting circularity and showcasing its commitment to environmental stewardship.

ABFRL'S COMMITMENT TO CIRCULARITY

ABFRL has always been at the forefront of sustainable fashion practices. With growing concerns about garment waste and its environmental impacts, ABFRL saw an opportunity to turn waste into a resource.

By partnering with PSP, ABFRL was able to close the loop in its packaging needs, creating a sustainable solution that transforms post-consumer cotton garment waste and industrial offcuts into 100% cotton-based recycled paper.

This initiative exemplifies ABFRL's dedication to minimizing its ecological footprint and reducing its dependence on virgin materials.

COLLABORATION FOR INNOVATION

ABFRL's VH Innerwear brand faced a challenge with accumulating customer-returned merchandise and laminated paper packaging waste. **Rather than simply disposing of these materials, ABFRL sought a responsible, innovative solution.** The company teamed up with PSP to explore the possibility of converting this waste into usable, eco-friendly packaging materials. ABFRL's strategic decision to collaborate with PSP underscored its commitment to finding sustainable, scalable solutions.

PSP INNOVATION FROM "WASTE TO RESOURCE"

PSP runs its manufacturing facility on renewable energy and they use vegetable-based, chemical-free inks for printing, further minimizing their environmental footprint. PSP's innovative process utilizes a multi-step approach to transform discarded garments and paper waste into high-quality packaging solutions. Here's a glimpse into the magic:

Sorting and Shredding

The used garments and paper boxes are meticulously sorted to remove non-recyclable materials like zippers and buttons. Then, they're shredded into small pieces.

Pulping

The shredded material is pulped with water, breaking it down into a fibrous slurry.

Beating and Refining

The pulp undergoes a beating and refining process to refine the fibers and improve their strength and quality.

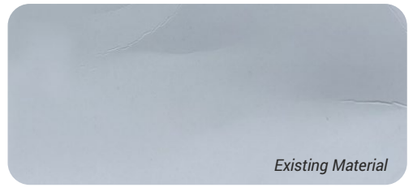
Sheet Formation and Drying

The refined pulp is transformed into sheets of paper using a papermaking machine. Finally, the paper is dried to achieve the desired consistency.

PILOT PROJECT WITH RESULTS

The partnership began with a proof-of-concept (POC) project, where ABFRL sent 100 kgs of customer used garments and packaging waste to PSP for recycling. The outcome was impressive—PSP successfully created a range of packaging materials including hangers, tags, and collar travelers. Based on careful evaluation, **ABFRL identified innerwear inserts as the ideal application for the recycled paper, eliminating the need for virgin white paper inserts.**

Initial Waste Materials



Existing Material

Developed Wastage Material

CHALLENGES AND OVERCOMING OBSTACLES

The project wasn't without its hurdles. Initially, the cost of the recycled paper inserts was higher compared to the existing solution. Through open communication and collaboration, ABFRL and PSP worked together to find cost-effective solutions, including sharing some logistical costs. Additionally, the color consistency of the recycled paper was not readily controllable, a concern for aesthetics. However, both parties recognized that this didn't significantly impact the functionality of the inserts for innerwear packaging. Finally, the process yielded a lower material realization rate due to discarding non-recyclable components like zippers and buttons. These challenges highlighted areas for further refinement and optimization.

SCALING UP FOR SUSTAINABILITY

Following the success of the POC, ABFRL expanded the initiative, sending 8 tons of used garments and paper waste to PSP for processing into innerwear inserts. This significant step highlights ABFRL's ability to scale up sustainable initiatives while maintaining a strong focus on environmental responsibility. This collaboration not only diverted waste from landfills but also demonstrated the commercial viability of closed-loop systems within the fashion industry.

BROADER ENVIRONMENTAL IMPACT

Through its collaboration with PSP, ABFRL is achieving measurable environmental benefits:

Waste Diversion ABFRL successfully diverted textile waste from landfills, reducing environmental pollution.

Lower Resource Usage The use of recycled materials led to reduced water and energy consumption compared to traditional paper production methods.

Renewable Energy Use PSP's use of solar drying and renewable energy in its manufacturing process further minimized greenhouse gas emissions, aligning with ABFRL's sustainability commitments.

CONCLUSION

ABFRL's partnership with PSP exemplifies how leading brands can create meaningful environmental impact while remaining commercially viable. Through its commitment to innovation and circularity, ABFRL has not only reduced waste but also set a strong precedent for sustainable practices in the fashion industry. The success of this initiative positions ABFRL as a sustainability leader, proving that fashion can be both stylish and environmentally conscious, paving the way for a circular future.

CASE STUDY 3

SAAHAS ZERO WASTE

POST-CONSUMER TEXTILE WASTE MANAGEMENT

Post-consumer textile waste is a significant challenge, with 50-52% of India's textile waste coming from discarded clothing. Saahas Zero Waste (SZW) tackles this through its Textile Recycling Facilities (TRFs) in Bengaluru and Gurugram, managing 15-20 tons of waste per month.

WASTE MANAGEMENT PROCESS

SZW's post-consumer textile waste management system is designed to maximize value at every stage:

Collection

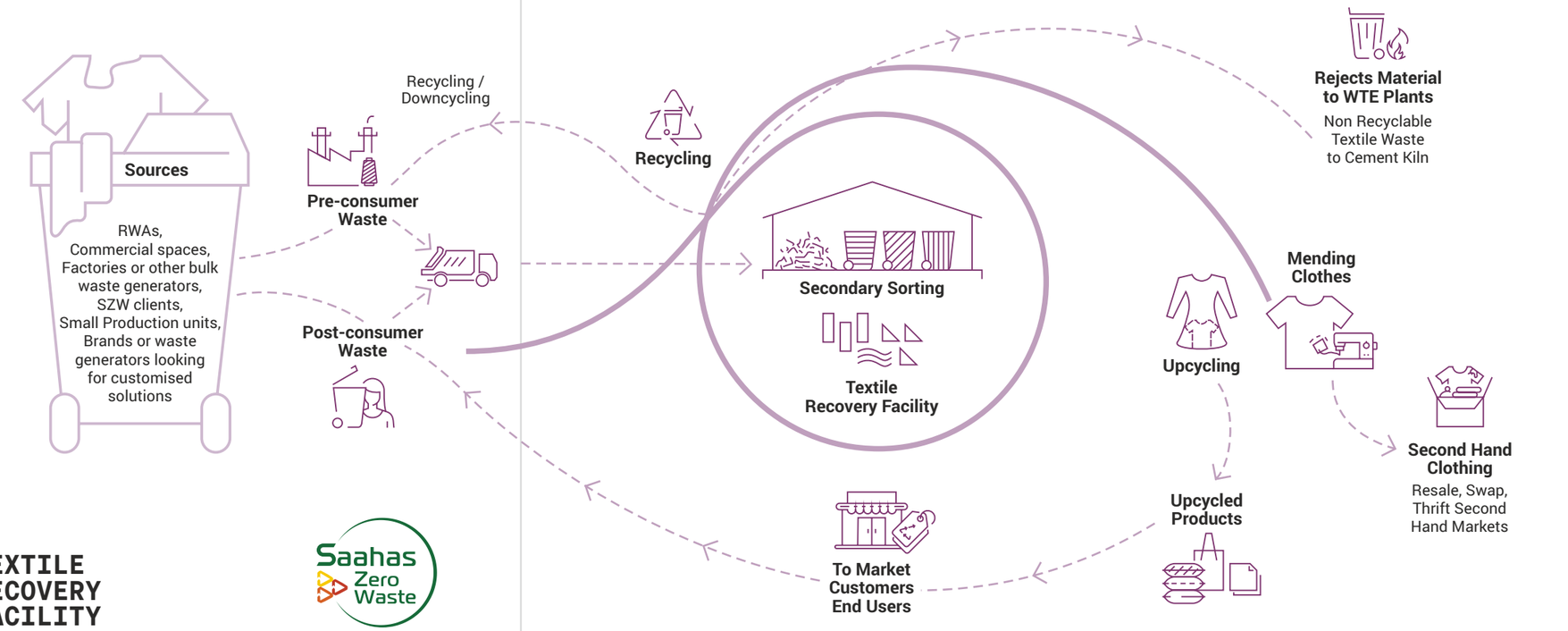
- **Post-Consumer Textile Waste** SZW primarily collects textile waste from households, factories, institutions, and tech parks. Public participation is encouraged through collection drives and programs, helping consumers responsibly dispose of their used garments.
- **Post-Production Textile Waste** Waste from manufacturing processes, such as fabric scraps and cutting remnants from tailors and factories, is also collected.

Sorting

- After collection, the waste undergoes thorough manual sorting. This step is crucial in differentiating high-quality fabrics, which are upcycled, from lower-quality materials, which are recycled. Sorting plays a vital role in unlocking the potential for reuse and ensuring that no valuable material is left unutilized.

Sustainable Solutions

- **Swap Shops** These are thrift-like stores where consumers can exchange up to 5 garments for a nominal fee of about $2. This initiative promotes reuse, extends the life of clothing, and encourages a shift toward sustainable consumption habits.
- **Upcycling** Garments deemed suitable are upcycled into new products such as bags, pouches, or home décor items. This process not only reduces waste but also fosters creativity by transforming discarded textiles into desirable goods.
- **Recycling** Textiles unfit for upcycling are processed to recover fibres and produce new yarn. This reduces reliance on virgin materials and creates a closed-loop supply chain.



TEXTILE RECOVERY FACILITY

ENVIRONMENTAL IMPACT

SZW's initiatives have significant environmental benefits:

Waste Diversion

Over 291 tons of textile waste have been diverted from landfills so far, reducing the environmental burden associated with textile disposal.

Resource Conservation

Recycling one ton of cotton through these initiatives can save approximately 1,800 kg of CO_2 emissions and 90% of water compared to producing new cotton, highlighting the efficiency of recycling over raw material use.

SOCIAL IMPACT

In addition to its environmental benefits, SZW is committed to social fairness:

Job Creation

The organization provides employment opportunities, particularly to marginalized communities and women. Employees receive training and fair wages, empowering them while contributing to a circular economy.

Community Awareness

Through swap shops and collection drives, SZW educates consumers about sustainable fashion and responsible waste management, fostering community participation in the textile waste challenge.

COLLABORATIVE RECYCLING PILOTS

SZW has collaborated with major brands like IKEA in recycling pilots to integrate post-consumer textile waste into their supply chains. In one instance, SZW collected 50,000 MT of textile waste in Bangalore, sorted and processed it, and then sent it to Usha Yarns in Ludhiana for recycling. This pilot demonstrated the feasibility of large-scale recycling initiatives and informed a framework for training staff to identify and sort textile waste effectively.

OVERCOMING CHALLENGES & BUILDING CAPABILITIES

Geographic Constraints Most textile recycling plants are located in northern India, posing logistical challenges for operations in Southern India.

Consumer Behavior Convincing Indian consumers to embrace second-hand clothing has been challenging due to cultural preferences.

Scaling Operations To make a larger impact, it is important to expand partnerships and invest in infrastructure to scale up the operations.

Policy Regulation There are no policy regulations around textile waste management in India, Currently textile waste domestic falls under dry waste (SWM 2016) and oil-soaked waste is categorized under hazardous waste (KSPCB, 5a-b).

Clients and Partners

Recycler Partners

KEY LEARNINGS AND RECOMMENDATIONS

Community Involvement

Engaging the community has been key to effective waste collection. When consumers are involved in the process, participation rates are significantly higher.

Education

Raising awareness about the environmental impact of textile waste can lead to shifts in consumer behavior towards more sustainable practices.

Flexibility in Operations

Textile waste is varied, requiring adaptable sorting and recycling processes to maximize the value of each material.

THE ROAD AHEAD

A CIRCULAR FUTURE FOR THE TEXTILE AND APPAREL INDUSTRY

The transition to a circular economy is a complex and multifaceted undertaking. It demands a holistic approach that encompasses material innovation, process optimization, and collaborative partnerships. While the preceding chapters have outlined the foundational principles, tools, and case studies, the road ahead requires a strategic and concerted effort from all stakeholders.

KEY PRIORITIES FOR THE TEXTILE AND APPAREL INDUSTRY

Based on the stakeholder consultations conducted across textile clusters in India, we found that to accelerate the circular transition, the industry must prioritize the following:

Policy and Regulatory Support

Governments and policymakers play a crucial role in creating an enabling environment for circular economy initiatives. This includes developing supportive regulations, providing incentives for circular practices, and in R&D.

Industry Collaboration

Collaborative platforms and partnerships can facilitate knowledge sharing, resource optimization, and the development of shared standards.

Consumer Awareness and Engagement

Educating consumers about the benefits of circularity and empowering them to make informed choices is essential for driving demand for circular products.

Innovation and Technology

Continued investment in R&D is vital for developing new technologies and materials that support circularity.

Circular Metrics and Reporting

Establishing metrics and reporting frameworks will enable companies to track progress, benchmark performance, and communicate their circularity achievements.

BUILDING A CIRCULAR VALUE CHAIN

The feedback received during the consultations showcases that to achieve a truly circular economy requires a systemic transformation that involves all actors in the value chain. This includes:

Raw Material Producers

Shifting towards sustainable and renewable sources, implementing circular production practices, and collaborating with downstream partners.

Textile Manufacturers

Adopting circular design principles, investing in resource-efficient technologies, and prioritizing waste reduction and recycling.

Brands and Retailers

Promoting circular business models, extending product lifespans, and engaging consumers in circular initiatives.

Consumers

Making informed choices, participating in take-back programs, and embracing circular consumption patterns.

Waste Management and Recycling Industries

Developing efficient and effective systems for collecting, sorting, and recycling textile waste.

OVERCOMING CHALLENGES AND CAPTURING OPPORTUNITIES

The transition to a circular economy will undoubtedly present challenges, such as overcoming infrastructure limitations, addressing cost considerations, and building consumer trust. However, the potential benefits are immense, including reduced environmental impact, cost savings, and new business opportunities.

By embracing circularity, the Indian textile and apparel industry can contribute to a more sustainable future while enhancing its competitiveness and resilience.

CALL TO ACTION

To drive this transformation, industry leaders, policymakers, and consumers must collaborate to create a supportive ecosystem for circularity. By implementing the strategies outlined in this document and continuously innovating, the textile and apparel industry can lead the way towards a more sustainable future.

ANNEX I LIST OF SUSTAINABLE FIBRES

Sr No.	Fibres[13, 14]	Description
PLANT BASED FIBRES		
01	**Organic Cotton**	It is grown from non-GMO seeds and without the use of pesticides, insecticides, or chemical fertilizers. Unlike conventional cotton, organic farmers employ sustainable farming practices such as crop rotation, mixed farming, or no-till cultivation to preserve soil health.
02	**Linen**	Linen, a natural fiber derived from the flax plant, is renowned for its exceptional strength, durability, and luxurious feel. It boasts excellent moisture-wicking properties, making it ideal for warm weather wear. The flax plant is remarkable for its rapid growth and ability to thrive in diverse climates. It enriches the soil, making it a sustainable and environmentally friendly crop.
03	**Hemp**	Hemp fabric comes from the plant with the same name. It is one of the fastest growing plants and it doesn't need much water, energy, pesticide, or fertilizers. The plant is very good for soil, it can be grown for many years in the same place without exhausting it. This is why hemp is considered to be eco-friendly. Hemp has very similar properties to linen. They are often difficult to differentiate.
04	**Banana**	Textile grade fibres made from the stem of banana plants
REGENERATED FIBRES		
05	**Lyocell**	Lyocell is a manufacturing process of rayon which is much more eco-friendly than its relatives modal and viscose. Lyocell is made in a closed-loop system that recycles almost all of the chemicals used. “Lyocell” is the generic name of the manufacturing process and fiber.
06	**Modal**	Modal fabric is a bio-based fabric manufactured from spinning cellulose from beech trees. Because beech trees don't require much water to develop, modal is typically considered a more environmentally friendly option to cotton. The manufacturing process consumes roughly 10-20 times less water. Beech tree fiber is extraordinarily soft and feels like silk when worn; it has double the softness of cotton and feels wonderful against the skin.
RECYCLED FIBRES		
07	**Recycled Nylon**	Recycled Nylon has the same benefits as recycled polyester. It diverts waste from landfills and its production uses much fewer resources than virgin nylon (including water, energy and fossil fuel). A large part of the recycled nylon produced comes from old fishing nets. This is a great solution to divert garbage from the ocean. It also comes from nylon carpets, tights, etc.
08	**Recycled Polyester**	The production of recycled polyester requires far fewer resources than that of new fibers and generates fewer CO_2 emissions. There are 2 ways to recycle polyester. For mechanical recycling, plastic is melted to make new yarn. This process can only be done a few times before the fiber loses its quality. Chemical recycling involves breaking down plastic molecules and reforming them into yarn. This process maintains the quality of the original fiber and allows the material to be recycled infinitely, but it is more expensive.
09	**Recycled Next-Gen Textile Fibers**	To make textile from textile pre-consumer as well as post-consumer waste, However, due to the difficulty to separate fibers blend and other technological challenges, this type of textile is not yet easily available. Some examples of Patented fibres using technology: Circulose®; NuCycl™, Liva Reviva, Textloop™.

[13] *https://prakati.in/dress-green-eco-friendly-fabrics-for-a-sustainable-wardrobe*
[14] *https://www.sustainyourstyle.org/en/fiber-ecoreview*

ANNEX II GREEN CHEMISTRY FOCUSED INITIATIVES

Initiative	Emphasis	Major Brands Involved
bluesign®	Similar to the approach of the C2C Certified Products Program, but with different rating systems and endpoints; Bluesign studies the combination of hazard and exposure, to determine the risk posed by ingredients and to help in optimising formulations	Adidas, Columbia, GStar Raw, Patagonia, Lands' End, Puma, Nike, Lululemon, Eileen Fisher, and others
ZDHC	Based on a Manufacturing Restricted Substances List to eliminate ingredients of concern, particularly from wastewater	Nike, Adidas, Gap, Inditex, Kering, Levi Strauss, Marks & Spencer, Nike, Puma, C&A, Esprit, H&M, GStar Raw, PVH, Primark, and others
DETOX	A Greenpeace initiative to get brands to adopt a Manufacturing Restricted Substances List and eliminate those substances from their operations by 2020 (with corresponding transparency and management plans); also, to achieve a global ban on PFCs	Inditex, Benetton, H&M, C&A, Fast Retailing, G-Star Raw, Adidas, Levi Strauss, Primark, Puma, Marks & Spenser, Nike, Esprit, Li-Ning, and others
Higg Index **HIGG Material Sustainability Tool (MSI)**	Delivers a holistic overview of a product's sustainability performance; HIGG includes in its analysis green-chemistry considerations, and recognises many of the green-chemistry certifications such as OEKO-TEX Standard 100	Adidas, Fast Retailing, Esprit, Eileen Fisher, Gap, H&M, Kering, Hanes, Lands' End, Levi Strauss, Lululemon, Nike, Patagonia, Puma, PVH, Under Armor, VF Corp, and others
CHEM-IQ	Tests samples for the presence of 400 chemicals; if the samples are above set levels, VF Corp works with suppliers to optimise the chemistry	Developed by VF Corp with NRDC
GREENSCREEN CERTIFIED®	Focuses on hazard profiling (only) of chemicals, and on developing alternatives to the most objectionable	Nike, Levi Strauss, and others
THE SUSTAINABILITY CONSORTIUM™	Focuses on optimising chemistry to reduce water pollution, as well as on reducing water and energy consumption	Walmart, Hanes, Marks & Spencer, Wrangler, and others
OEKO TEX® **Standard 100**	Tests products for ingredients of concern, via four kinds of exposure	Esquel, Hanna Andersson, Pottery Barn, Fruit of the Loom, and others

ANNEX III WATER AUDIT TEMPLATE

As part of the water circularity process, Industry can use the following water audit template:

I. Sources	
Municipal Supply	XXXX m^3
Industrial Estate Supply	XXXX m^3
Borewell Supply	XXXX m^3
Recycled/Reclaimed	XXXX m^3
% of total reclaimed	XX %
Total All Sources	**XXXX m^3**
II. Storage	**XXXX m^3**
III. Discharge	**XXXX m^3**
IV. Consumption/Loss	
Total Water Input	XXXX m^3
Borewell Supply	XXXX m^3 (evaporation, leaks)
Total Water Consumption	**XXXX m^3**
V. Use	
Embodied in Products	
Process & Equipment Use	XXXX m^3
Cooling & Heating	XXXX m^3
Other Facility Support	
Personnel Sanitary & Domestic	XXXX m^3
Outdoor Uses	XXXX m^3
Total Use Estimate	**XXXX m^3**

ANNEX IV HOW TO IMPLEMENT CIRCULARITY WITHIN INDUSTRY

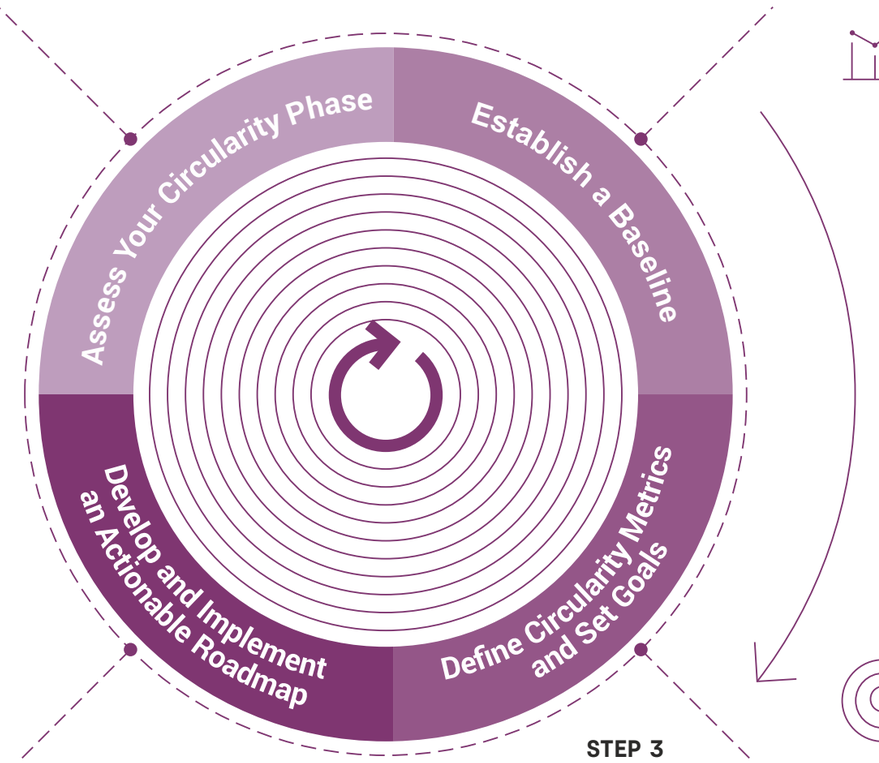
Building on the foundational principles and strategies outlined in Chapters 2, 3, and 4, this annex presents a detailed, actionable roadmap for implementing circularity in the textile and apparel sector. The following steps help companies assess their circular readiness, establish a baseline, set achievable targets, and create a roadmap that drives transformation across operations.

STEP 1

- Determine if your company is a beginner, intermediate, or advanced in circularity by using a provided questionnaire or checklist.

STEP 2

- Gather data on your resource usage and waste generation to establish a starting point for circularity efforts.



STEP 4

- Use insights from the metrics to develop a plan for implementing circular practices.
- Set clear goals, prioritize actions, and allocate resources accordingly.
- Monitor progress regularly and adjust strategies as needed to meet your circularity targets.

STEP 3

- Use circularity metrics to measure how well your company is performing in various aspects like material usage, water management, and waste reduction.
- Compare your performance against benchmarks to see where you stand.

STEP 1 ASSESS YOUR CIRCULARITY PHASE

At present, companies have varying degrees of maturity when it comes to adopting the circular practices. While some are just beginning their journey, others have taken significant steps to embed circular thinking into their operations. For many companies, their focus is on weaving a circular economy narrative into their current operations. This involves identifying areas where the principles of the circular economy can be applied, such as waste reduction, product design, and supply chain optimization.

As there is no one-size-fits-all approach to achieving it, the criteria for companies will vary depending on their size and their position in the supply chain (e.g., whether the industry is performing spinning or wet processing).

Circularity Level

Circular Metric Phases	Beginner	Intermediate	Advanced
Circularity Level	No awareness of circularity	Circular thinking in the sustainability plan	Circular thinking in corporate strategy

Understanding the phase helps set realistic goals and creates a phased approach to rolling out circularity practices. The table below is designed to guide industries in assessing their circularity levels and provide a roadmap for implementing circular practices. By adopting circular practices, industries can improve their sustainability, reduce costs, and contribute to a more sustainable future.

Circularity Level Checklist

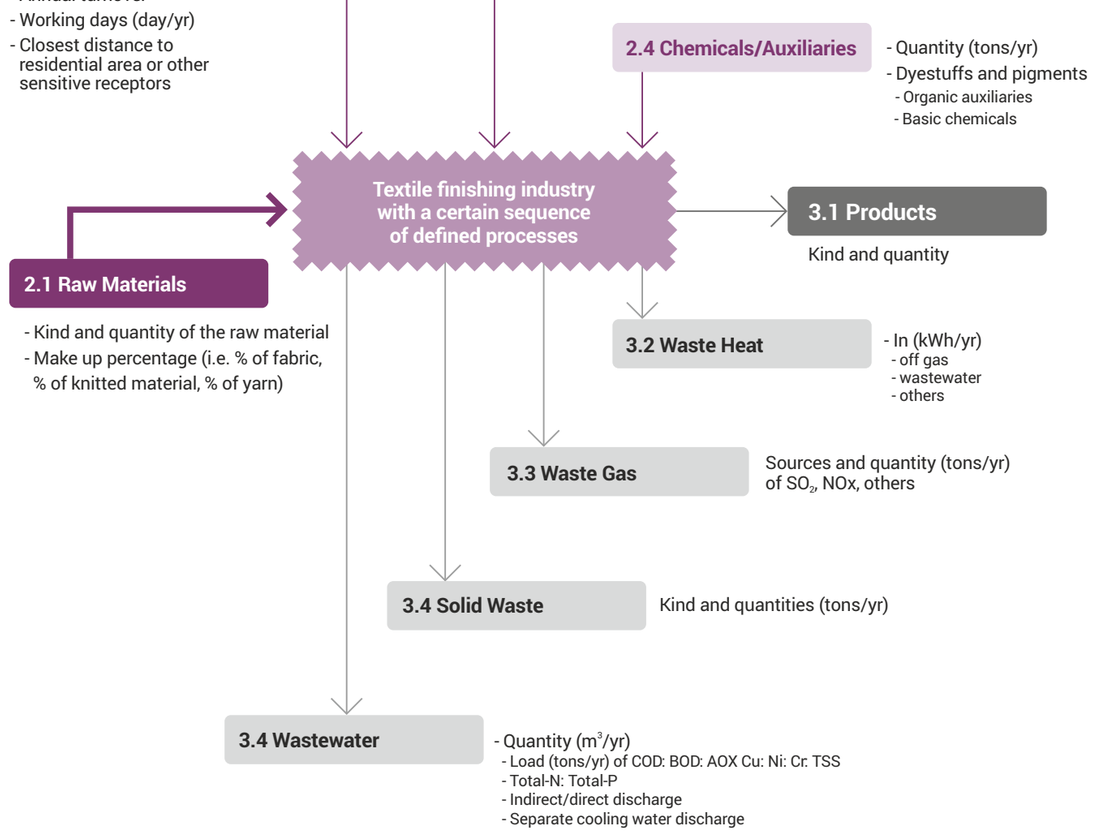
Criteria	Question	Beginner	Intermediate	Advanced
Circularity Strategy	Is there a defined roadmap for circularity?	No roadmap	Circular thinking is part of sustainability	Circular thinking integrated
Circularity Targets	Are there measurable circularity goals?	No goals set	Targets set for extended product life	Circular design principles implemented
Leadership	Is there leadership involvement?	Limited leadership involvement	Clear commitment from leadership	Vision for circularity
Investment	Is there a financial commitment?	No financial commitment	Investments in sustainable practices	Resources for Circular Innovation
Reporting	Are circular initiatives communicated?	No reporting	Periodic metrics shared	Comprehensive reporting on circularity
Business Model	Is the business model aligned with circular principles?	Business model not aligned	Circular principles considered	Circular integration in business model
Resource Efficiency	Is there an efficient use of resources?	Resource usage not monitored	Measures for resource efficiency	Robust resource efficiency measures
Design for Circularity	Are circular design principles integrated?	No consideration for circular design	Circular design principles explored	Full circular design integration
Waste Management	Are there basic waste management systems?	Waste management systems as per compliance	Waste reduction in place	Comprehensive waste management systems
Recycled Content	Is recycled content incorporated?	No recycled content usage	Limited usage of recycled materials	Wide incorporation of recycled materials

STEP 2 ESTABLISH A BASELINE

After the circularity phase is determined, establishing a baseline is essential. This involves collecting comprehensive data on the company's current resource utilization, waste generation, energy use, water consumption, and emission levels. The baseline serves as a diagnostic tool that identifies areas for improvement and tracks the impact of circularity initiatives.

For example, companies can look at ways to reduce their resource consumption, minimize waste generation by using more sustainable materials and processes, and implement measures to reduce emissions from their operations.

INPUT/OUTPUT OVERVIEW AT INDUSTRY LEVEL



Source: BREF of Gujarat

Material and Resource Flow Analysis

Map the lifecycle of all input materials, from sourcing to production to end-of-life. This includes identifying renewable vs. non-renewable materials, tracking sourcing and production locations, and examining end-of-life options.

It entails the assessment of the flows within the company's boundaries at three key intervention points:

- **INFLOW** - If the resources, materials, products, and parts sourced are intentionally designed, produced, and utilized in alignment with circular economy principles?

  Resource and Waste Mapping Analyze energy and water consumption across each stage of production (e.g., spinning, dyeing, garment construction). For waste, identify specific types generated (fabric scraps, dye residues, packaging) and potential for recycling or reuse.

- **OUTFLOW – RECOVERY POTENTIAL** - How does the company ensure the technical recovery of components and materials at a functional equivalence? To use the 6R framework, which involves designing products for disassembly, repairability, and recyclability. Additionally, to ensure that the materials used are biodegradable/recyclable so that they can be seamlessly integrated into future production cycles without generating waste.

  Identifying Waste Recovery Potential Quantify the volume and type of waste that can be diverted from landfills through recycling, upcycling, or repurposing. This helps prioritize waste streams based on recovery ease and environmental impact.

- **OUTFLOW – ACTUAL RECOVERY** – What is the percentage of the outflow that the company can recover? To link it with monetary benefits that the company can retrieve after it has been spent or invested. This will give management a better understanding of the company's financial performance and help make informed decisions.

The outflow includes products, by-products and waste streams. Companies can improve actual recovery rates through closed loop business models or mandatory or voluntary open loop recovery scheme efforts.

The results will illustrate how effectively a company closes the loop.

STEP 3 DEFINE CIRCULARITY METRICS AND SET GOALS

To establish circularity metrics tailored to each stage of the value chain—spinning, weaving, wet processing, and garment manufacturing—we must consider the unique requirements and characteristics of each segment.

To monitor and evaluate progress, companies should define precise, quantifiable circularity metrics that align with their existing data. This involves setting challenging yet attainable goals that adhere to international standards and industry benchmarks, fostering ongoing improvement.

For example,

- Spinning mills can focus on sustainable material sourcing, such as the use of organic cotton or recycled fibres. They can also work towards reducing their energy consumption by using more efficient machinery.
- Wet processing plants can explore ways to minimize water usage and properly treat wastewater.
- Garment manufacturers can emphasize cutting waste for circularity, by using production techniques that minimize fabric scraps and developing take-back programs for end-of-life garments.

Any company, regardless of size, sector or position in the value chain, can use the metrics mentioned in chapter 2. As such, the selection of indicators relevant to any business will vary.

STEP 4 DEVELOP AND IMPLEMENT AN ACTIONABLE ROADMAP

The final step involves creating a detailed, phased roadmap with concrete actions, milestones, and resource allocations to guide the circularity journey. This roadmap integrates the insights gathered from the baseline, metrics, and circularity phase assessment, ensuring a structured approach to change.

This involves identifying the appropriate circular economy framework that aligns with the circularity goals and values of the organization. The table below outlines the steps to begin the circularity journey, which may include conducting a material flow analysis, identifying opportunities for circularity, and designing circular products and services.

Circular Metric Phases	Beginner	Intermediate	Advanced
Circular Metrics	Efficiency in operations	Environmental & Social Impact Assessment	Creating Value through Circular Practices

CIRCULAR METRICS

Operational Efficiency Metrics

Focus on improving resource usage and waste management.

- Identify and implement low-cost, high-impact initiatives to create immediate gains in circularity, such as switching to more sustainable fibers, improving waste sorting practices, or implementing energy and water conservation programs in production.

Sustainability Performance Metrics

Operational Efficiency Metrics + Assess environmental and social impacts, such as carbon footprint and community engagement.

- Focus on operational improvements that require moderate investments, such as upgrading to energy-efficient machinery, adopting water recycling technologies, or rolling out circular design practices in product development.

Circular Value Metrics

Sustainability Performance Metrics + Measure the effectiveness of circular initiatives in creating value for the business and the environment.

- For advanced companies, prioritize systemic changes that reshape the core business model, such as transitioning to circular business models (e.g., product-as-a-service, take-back schemes), developing closed-loop supply chains, and building partnerships to create value from post-consumer waste.

The above showcases the different phases of circular metrics implementation and the corresponding focus areas at each stage of their circular journey.

RESOURCE ALLOCATION AND BUDGETING

Ensure that financial and human resources are allocated to each initiative within the roadmap. This may include investments in technology upgrades, staff training, and external partnerships with recycling and waste management providers.

SETTING MILESTONES AND DEADLINES

For each phase, establish specific milestones to track progress. Examples include achieving a 20% reduction in water usage within two years, implementing 100% renewable energy in certain facilities, or reaching a 50% reduction in fabric waste.

MONITORING AND ADJUSTMENT

Regularly monitor progress against the roadmap and adjust strategies as needed based on performance data and evolving industry trends. Consider creating an internal circularity task force to oversee this ongoing process and report on metrics quarterly.

GLOSSARY

Circularity The concept of goods, services and systems adhering to circular economy principles and therefore being suitable for consistent circulation within the economy.

Chemical Recycling A recycling process in which collected waste textile material is chemically treated using solvents or enzymes to produce new filaments, typically either cellulosic or synthetic fibres. Recovered synthetic fibres are converted to pellets suitable for being reused in the yarn manufacturing process. Recovered cellulosic fibres are dissolved into a pulp that can be used in the production of viscose-like materials.

Circular Business Models Business models, such as clothing rental or subscription schemes that minimise the material used and waste produced while maximising the value of materials and products by keeping them in use for as long as possible, if not permanently. These models promote a focus on the triple bottom line – people, planet and profit.

Circular Design The concept of designing products and services in line with the principles of a circular economy. Using sustainable materials and designing out waste and pollution represent fundamental first steps. The overarching focus is to preserve the value of a safe-to-use product or service for as long as possible by designing for upgradeability/ modularity, repair/refurbishment, and reuse.

Recognising that end-of-life can be inevitable for some products, the focus shifts to maximising the sustainability of the end-of-life process by designing for redesign, disassembly, and recycling. Within this, circular clothing design refers to designs that use recycled and renewable materials (and/or post-production offcuts), and designs for emotional and physical durability, reuse, repair, redesign, modularity, disassembly, and recyclability.

Circular Economy An economic system that is founded on the principles of regenerating natural systems, preserving products and materials in use, and designing out waste and pollution, while also rejecting traditional linear economy.

Ecosystem A dynamic network of interconnected actors operating within a bounded geographical space.

Linear economy An economic system in which raw materials are extracted, transformed into goods and services, consumed, and ultimately disposed of as waste. This is currently the dominant system in the global economy. This document uses the related terms linearity and linear to describe activities, processes and flows that are characteristic of a linear economy.

Mechanical recycling A recycling process in which machinery physically separates and deconstructs waste textile material, typically through a chopping and pulling process, into shredded fragments until a stage is reached at which fibres can be recovered individually.

Product Circularity The concept of a product adhering to circular economy principles and therefore being suitable for consistent circulation and reuse by consumers and/or businesses.

Raw Material Circularity The concept of raw materials adhering to circular economy principles and therefore being suitable for consistent circulation and reuse by industry.

Recycled Raw Material Synthetic or natural material that is derived from the recycling of used textiles and other fashion related materials and either suited to replacing virgin inputs for new clothing manufacturing or suited to use in alternative applications and industries.

Regeneration Enabling the preservation or enhancement of the planet's resources and environment.

Stakeholders An individual, group, or party who has an interest in, or who is affected by, the operation and outcomes of the India's fashion ecosystem. In this document, we make reference to different stakeholder groups that span the fashion ecosystem: Academia; Brands; Collectors; Consumers; Designers; Digital Innovators; Government; Institutions, industry bodies and third sector; Investors; Logistics Providers; Manufacturers; Reprocessors; and Retailers.

Sustainability The state in which we are able to meet all of our needs within the ecological boundaries of the planet. These needs range from minimum standards for education, housing, social equality, income, and health to the basic provision of food, water, and energy. Meeting them within the ecological boundaries of the planet means that we must stop damaging and demanding too much of our planetary environment.

DISCLAIMER

The "Stitching the Circle" guidelines document has been prepared based on information available at the time of its publication. This document provides a general overview of circular business practices relevant to the Indian textile and apparel industry. Interpretations of data, insights, and recommendations are subjective, reflecting the perspectives and expertise of the authors and contributing stakeholders. It is important to note that the textile industry is constantly evolving, and the guidelines may not fully represent the current industry landscape. Consequently, findings and recommendations in this document may become outdated due to changes in market conditions, government policies, and technological advancements.

Scope and Focus
This document focuses on circularity practices for the Indian textile and apparel sector as of 2022-23. The guidelines are based on data and insights from a diverse sample of stakeholders across India and may not capture every nuance of the industry's dynamics. The document is not exhaustive and may not reflect specific details or circumstances unique to certain segments of the industry.

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CIRCULAR APPAREL

RETHINK textile & apparel processes, waste management and circularity standards

REVISE circular business guidelines/policy for textiles & apparel sector

REDUCE resource consumption across the value chain – REUSE AND RECYCLE

REBUILD capacities and collaboration between public and private sector

REDESIGN material and process innovation into production

REPLENISH knowledge repositories for influencing local and global discourse

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