Case Study Dossier: Business Innovations towards Circularity in the Indian Apparel & Textile Industry

Supported by:

Preface

Globally, there is considerable momentum towards circular apparel, led by international brands. This offers an opportunity for Indian apparel suppliers/manufacturers, by demonstrating transition towards circularity. Despite Indian government's current attention towards resource efficiency/circular economy, an inclusive policy process to trigger circular innovation/initiatives in the apparel sector is lacking. A mechanism that links ground-level industry issues/realities to policy is absent.

Given the complexity of the subject, effective policymaking and implementation of circular economy also requires coordination between relevant government organs viz. central government, sectoral/line ministries, central and state departments. Centre for Responsible Business (CRB) along with its partners Intellecap and Fashion For Good (FFG) has undertaken a project titled Circular Apparel Policy Innovation Lab (CAPIL) to explore policy interventions that can accelerate circular economy transition in the Indian A&T sector (circular apparel). The Lab would contribute towards well-informed policies and implementation mechanics to support transition towards circular apparel in India. This would help gradually position Indian industry for taking advantage of the global movement towards circular apparel.

The project has been supported by the Laudes Foundation.

This **case study dossier** contains **best-practice cases from India and abroad** that focus on various aspects of circular apparel. Challenges and opportunities to adapt and scale them are discussed. Policy support to enable the scaling and replication of such solutions are also covered.

Very often, innovations promoting a social circular economy aren't able to scale up and spread their impact owing to lack of recognition, lack of conducive policy environment, and lack of evidence-based knowledge dissemination on such innovations. Also, many businesses perceive sustainable or circular solutions as costly affairs that might cripple them. This dossier will help engage both the private sector and the government, and communicate to them the **interdependency of green, inclusive innovations and public policy.** It will also highlight how circular innovations can be applied at varying scales and geographical spread, which makes them suitable for micro, small and medium enterprises (MSME).

Disclaimer:

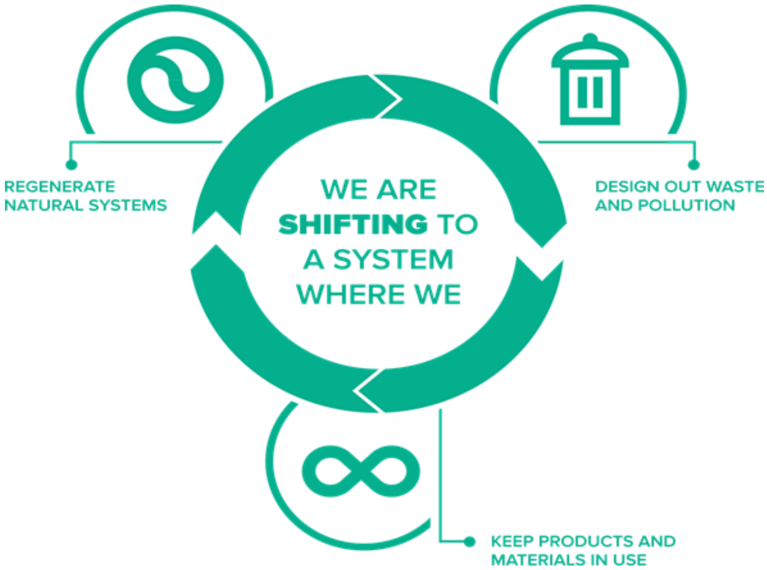
Information in the case studies are as supplied by the innovators/organizations covered in them. These have not been verified by the CAPIL Team (CRB, Intellecap, and FFG) through site visits due to constraints to geography and the Covid-19 pandemic.

Introduction

Background

The Apparel and Textile (A&T) sector, globally, is the second-most polluting industry. Interventions are being planned across continents to tackle the problem of A&T waste and manufacturing impacts on society and the environment. The areas for immediate concern vary for each country/region. In Europe and US markets, recycling and product lifetime extension have emerged as the top priority areas to focus on, whereas for India and other manufacturing hubs for A&T it is more urgent to focus on the manufacturing process itself along with post-consumer recycling.

Circular economy in the textile and apparel sector (**circular apparel**) can provide some of the solutions. Circular economy is an economic system where materials and energy circulate in loops and stay within the value chain, as opposed to a linear system of take-make-dispose. In a circular economy the concept of *waste* is eliminated—material value is reused, recycled, and repurposed.



Circular Economy Vision (Ellen Macarthur Foundation)

The 7 Rs of circularity are: Re-think; Reduce; Re-Use; Repair; Refurbish; Recover; Recycle.

The present economic model of ‘take-make-dispose’ relies on cheap, easily available materials and sources is often subjected to supply chain risks and is extremely wasteful and unsustainable both environmentally and economically. The increasing supply chain risks, price volatility, and decreasing availability of natural resources is increasing the relevance of circular economic model. A successful circular economic model forms a closed loop and is restorative and regenerative by design. It aims to keep products, material, and components at their highest value and utility. By incorporating circular business models, not only sustainability issues like resource efficiency, pollution can be solved but also issues like reduction in unemployment and better livelihoods of stakeholders can be dealt efficiently.

In India, circular economy principles have always been at play; many clusters in India are solely based on recycling and repurposing. Traditionally, repair and reuse have been the norm for all consumers. In recent decades, owing to changing consumer behaviour (both in terms of purchasing power and fast changing preferences and mass production of affordable A&T, pollution and waste generation from the industry has increased manifold. Therefore, there is a need for a broad adoption of circular economy in India to tackle these challenges. There is an increasing awareness and exploration of the potential for Circular Apparel in India. In this changing scenario, supportive and progressive Public Policy can be an effective way to drive the transformation.

Circular Apparel Aspects and Summary of the innovation cases

Under the Policy Innovation Lab, the following aspects of circular economy were identified through stakeholder consultations and secondary research:

Aspect	Examples
Design	Circular design (reduces environmental impacts, slows down or closes material cycles, prevents waste by design)
Raw Material	Conventional & Alternative fibres
Chemicals	Rational/judicious use of chemicals, use of natural dyes, quality of chemicals/dyes used, etc.
Waste (material and water)	Reduction in use of hazardous chemicals (generation of hazardous waste), scope of industrial symbiosis (waste from one industry as input for another one)
Energy	Grid, Captive power plants, Renewables, Heat/energy recovery, Process efficiency – modern equipment with lower energy consumption
Water	Low-water intensive options raw materials, one-shot dyeing, processes with lower water requirement, Recycling process water, effluent water treatment, recovered steam
Business models and ecosystem	Circular Supply Chain/Resource Recovery/Product Lifetime Extension/Product as Service/Sharing Platforms, Socio-political situation; credit; financial system

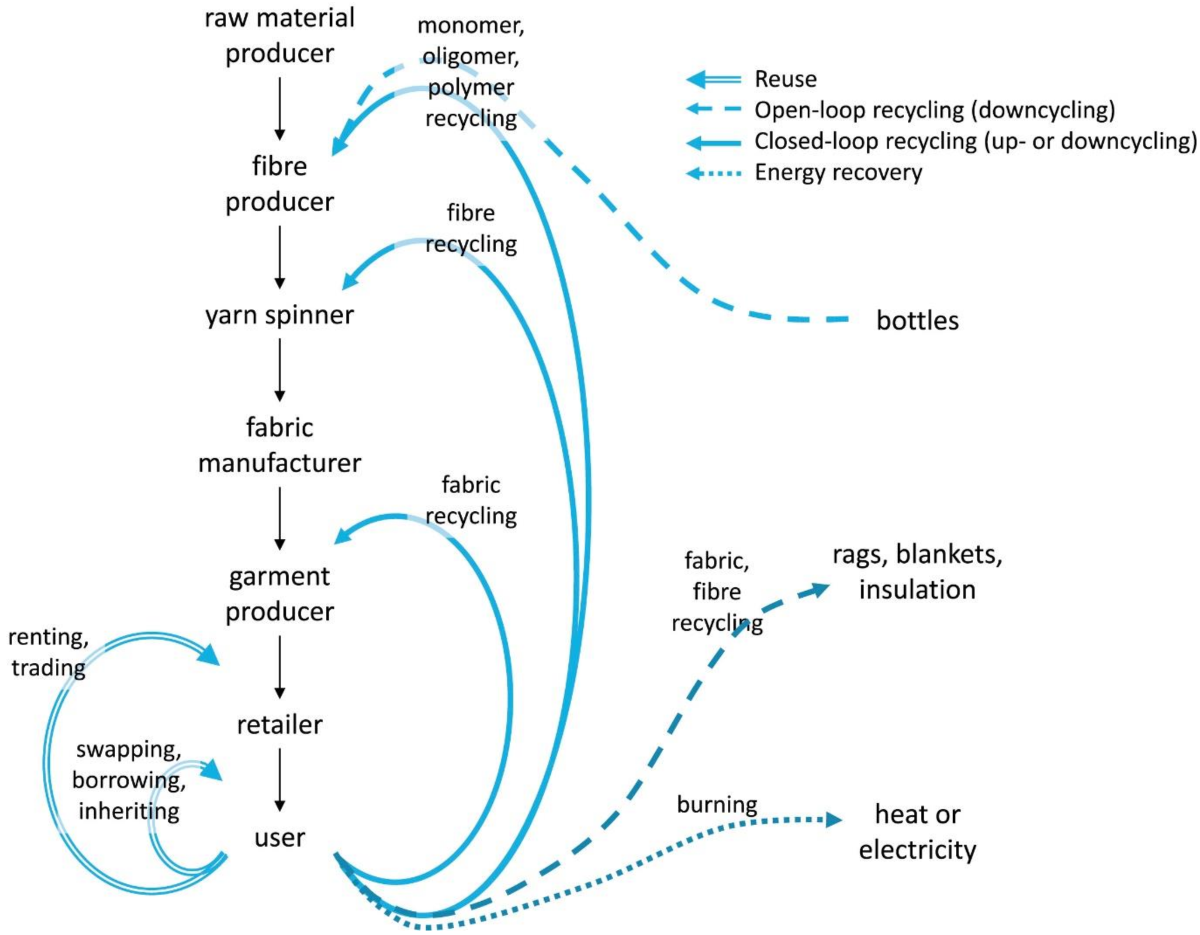
Design

Design is the most crucial stage to focus on to accelerate circular transition. Products, services, processes, business models, etc. must be designed in a way that reduction of resource intensity, recovery and reuse are enabled along all segments of industrial value chains. These include selection of the raw material, followed by resource-efficient processes, green chemicals and equipment. Apparel should be designed for the ease of recovery, dismantling, sorting and recycling. All circular economy interventions incorporate one or more of these design elements.

Design is integral to all circular business models, as shown in all the case studies below.

Raw materials

The choice of raw materials perhaps has the biggest impact on the overall environmental and social footprint of the value chain. Raw materials define downstream processes, energy, chemical use, etc. The diagram below provides an idea on how value can be maximized for any given fibre. This approach is more suitable for the West, where post-consumer recycling, life extension, etc are more relevant.



Circular Apparel material flow[1]

In the Indian context, it is also important to look at alterative raw materials, as recycling alone (even though it is important) can only have a limited efficacy in reducing impacts on manufacturing clusters and other natural resources of manufacturing countries. Cotton, the most common raw material used in India, requires anywhere between 10 – 25 thousand litres of water per kg. Pesticide and fertilizer requirements are added disadvantages.

Innovators like **AltMat**, **Algalife** and **Descatuk** are showing the way in material innovation. AltMat develops high quality fibres from natural sources such as banana and hemp, which are less resource-intensive. Algalife generates fibres from a specially cultivated algae; it does not require any chemical fertilizers or pesticides. Descatuk's model focuses on creating fibres extracted from grass.

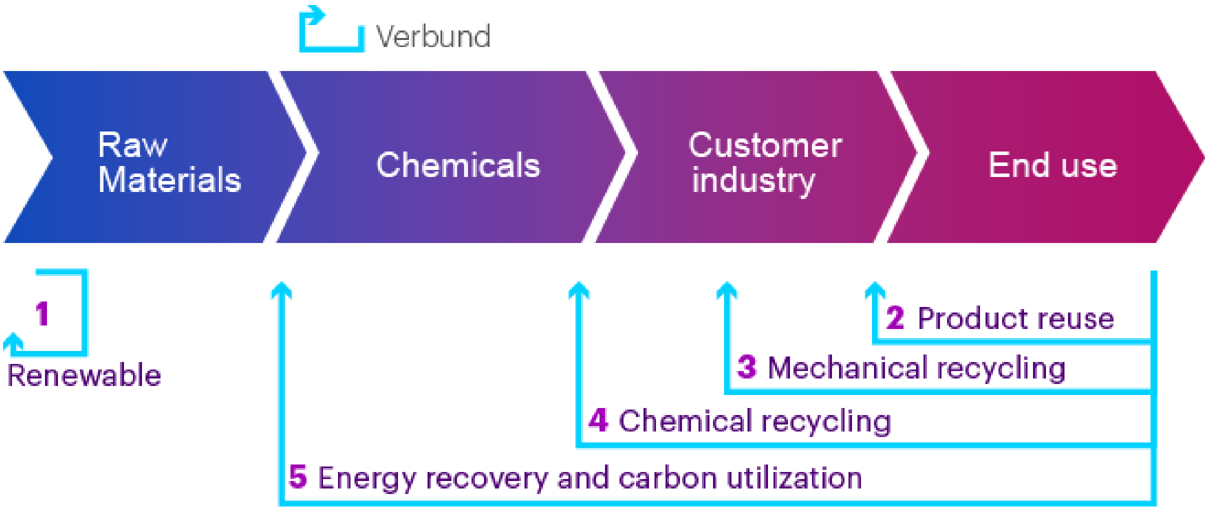
Broad policy suggestions for promoting sustainable materials:

- **Incentives to produce and market alternative raw materials**. This could promote attractive pricing for the end products, to wean away consumers from cotton and other fibres that are resource-intensive
- **Penalize burning of agricultural waste/other sources of cellulosic fibres**
- **Encourage private R&D and uptake of alternative materials with tax breaks on end products**. Currently, all commercial products (apparel) are taxed at 18% irrespective of fibre source.
- **Set up material standards to encourage use of recycled fibre/yarn/fabric in products**

[1] Sandin and Peters, 2018. https://doi.org/10.1016/j.jclepro.2018.02.266

Chemicals

Chemicals are used extensively during the life cycle of garment and textile manufacturing (over 8000 chemicals for various processes). 20% of overall industrial water pollution can be attributed to textile manufacturing. Awareness about harmful chemicals is gradually increasing and brands leading on circular practices are ensuring that certain chemicals are completely excluded from their supply chains and manufacturing processes. Healthier and greener alternatives to toxic chemicals are available but their uptake remains limited on account of low awareness, costs and performance of the chemicals.



Chemical circularity: a crucial component of material loops[2]

While recovery of chemicals and verbund (utilization of by-products) are important aspects for circular economy, a more direct intervention would be to look at alternative chemicals which are either derived from natural processes, or synthetic chemicals that break down into substances that can be assimilated safely into the environment.

Algalife produces dyes from algae, apart from fibre for textiles. When these fibres and dyes enter the surroundings through avenues like washing, disposal, etc. they break down into materials that easily absorbed by the biotic environment.

Broad policy suggestions for promoting chemical circularity:

- **Tax breaks for products using green/alternative chemicals, or chemical-free processes**
- **Promote certifications of products on the basis of chemical-use**. Zero Discharge of Hazardous Chemicals (ZDHC) norms can be consulted
- **Promote chemical recycling industry through green industrial policy**

Waste

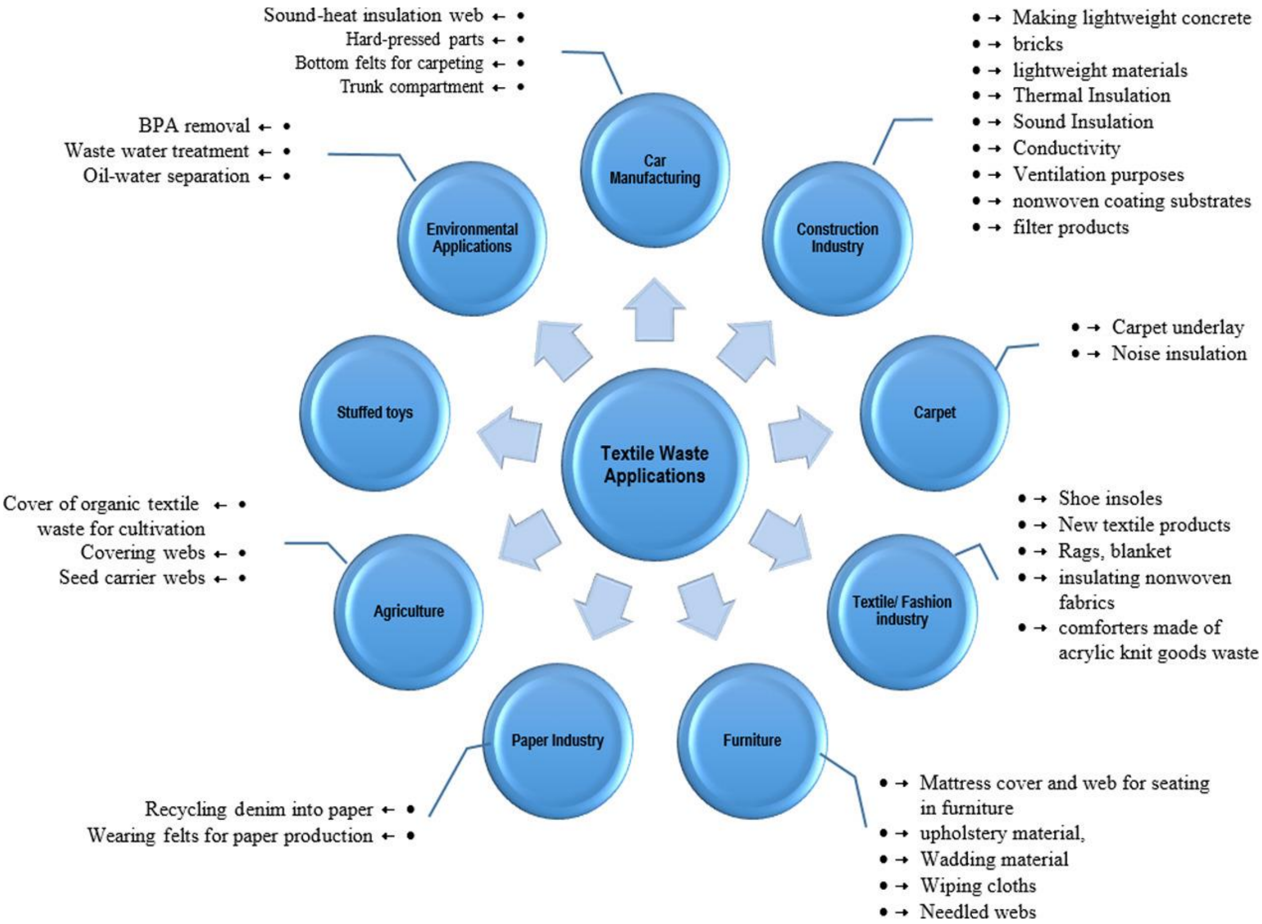
There are 3 kinds of fabric waste[3] that are largely generated: ***Pre-consumer textile waste*** – manufacturing waste that is generated by processing fibres and the production of finished yarns and textiles, technical textiles, non-wovens, garments including off-cuts, selvages, rejected material; ***Post-consumer textile waste*** – garments or household textiles that are no longer fit for use. Usually the quality of the waste is good that can be recycled or reused; ***Industrial textile waste*** – Waste generated

---

[2] Accenture. https://www.accenture.com/us-en/insight-circular-economy-european-chemical-industry
[3] http://www.homesciencejournal.com/archives/2018/vol4issue1/PartC/4-1-32-981.pdf

from industrial and commercial applications (e.g. carpets, curtains, upholstery etc.) This kind of waste is usually incinerated or disposed to landfills.

The illustration below captures many of the waste streams associated with the sector.



Waste stream from the A&T sector[4]

Innovation in A&T waste management (prevention, collection and processing) has picked up in recent years. While recycling, reuse and repurposing of waste material has always been an integral part of Indian culture and industry, many start-ups as well as established, traditional organizations are creating new businesses out of waste management.

Geetanjali Textiles import recyclable garments (mostly cotton and wool) which are processed for reuse, making recycled yarn and converted into textile/apparel, blankets, rugs, etc. **Khaloom** produces recycled yarn (cotton) while maintaining quality. **Reverse Resources** have come up with an assessment and waste exchange solution which enables stakeholders to effectively utilize waste.

Broad policy suggestions for promoting prevention, reduction and repurposing of waste:

- **Sponsor/promote waste exchange and utilization in all apparel and textile clusters**
- **Industry standard required to mandate/encourage minimum recycled material content in products**
- **Co-develop Extended Producer Responsibility (EPR) solution with the private sector.** Consumers must be nudged to increase post-consumer recycling. Several brands and manufacturers in India have already started offering incentives to return used clothes

[4] Shirvanimorghaddam et al. https://doi.org/10.1016/j.scitotenv.2020.137317

Energy

The textile industry globally lies among those with the lowest energy efficiency. Among the processes, spinning consumes about 34% of total energy while weaving consumes around 23%.[5]In Indian textile industry cotton is the predominant material, with about 60% of total energy consumption. Further, 75% of all spinning mills in India are dedicated to cotton. In 2015, the sector contributed 2102 Billion USD worth of GDP, while consuming 1.24 million TOE (Total Oil Equivalent).

Along with setting up renewable energy plants and microgrids, most of the climate-conscious and resource efficient interventions have been traditionally focused on energy efficiency. Upgrading of machinery/equipment is necessary to achieve significant energy savings per unit of product. All the case studies presented here have an energy component embedded in them; resource efficiency translates into energy savings in terms of less production and processing of virgin materials, reduced need for treating hazardous waste water, etc.

Water

The textile sector is highly water-intensive; its long-term sustainability depends on judicious water use, given that most districts in India face water scarcity in the range of 20-80%. Also, groundwater exploitation occurs much faster than natural recharge, putting strain on this precious resource. Lack of adequate effluent treatment facilities has led to pollution of soil and groundwater, impacting the quality of groundwater available to local populations for domestic purposes.[6]

Water consumption in apparel production (farm to consumer)[7]

[5]https://www.fibre2fashion.com/industry-article/3377/energy-conservation-in-textile-industries-savings

[6] Water Governance Mapping Report. https://www.siwi.org/wp-content/uploads/2017/06/Water-Governance-Mapping-Report-INDIA.pdf

[7] https://www.grinp.com/newsite/textile/water-pollution-in-textile-industry/

Process	Parcent water consumed
Bleaching	38%
Dyeing	16%
Printing	8%
Boiler	14%
Other uses	24%

Interventions aimed at water conservation can focus on two stages of water use: farm-level and factory-level. Innovators like **AltMat** and **Algalife** contribute to water savings by offering alternative raw materials that are not as water-intensive as cotton. On the factory level, innovations in various stages of wet processing would be needed (stages indicated in illustration[8]). **Dyecoo** has invented a carbon dioxide-based process where dyeing is achieved without using water. This prevents potential water pollution in the downstream, and also saves cost of water treatment and chemical recovery. **Indra Water** offers decentralized, modular systems for water treatment that be scaled and adapted for various purposes.

Broad policy suggestions for promoting water conservation:

- **Industrial policies at the state/district level should take into account local conditions and mandate using suitable solutions.** Zero Liquid Discharge (ZLD), bio-remediation, CETPs, etc are solutions that can be deployed (or not) either individually or in conjunction with other technologies, based on various factors.
- **Penalize over-extraction of ground water**. State-level regulations must change to accommodate a looming water crisis in about 70-80% of the country.

Business models and ecosystem

Circular economy transition in the A&T sector would need various support systems and ancillary businesses to be successful. Logistics, smart data management, and knowledge systems are some of the requisites. **Infinichains** help businesses with tracking and traceability services for their products and supply chains. Traceability is an important aspect of circular solutions, especially with materials like organic cotton, and tracking of products for buy-back, extended producer responsibility (EPR), etc.

A truly circular A&T sector, as understood from the lens of **Circular Economy 2.0** or a **Social Circular Economy**, would also account for social sustainability. Creation of new jobs, equitable distribution of profits. **Microspin** provides compact machinery that be operated at the farm level. It helps farmers add value to their produce (cotton) by spinning yarn; traditionally the value addition happens downstream of the value chain leading to the farmers losing out on the profits.

Broad policy suggestions for promoting an ecosystem for social circular economy:

- **Adequate worker housing and emergency facilities must be mandated at all industrial clusters (A&T sector)**
- **Market access must be equitable for farmers to gain more profits from value addition to their products**

[8] https://textilelearner.blogspot.com/2012/07/some-important-parameters-of-water-for.html

Case Studies

The case studies discussed above are presented in details below. The table summarises the interventions.

S no.	Organization	Intervention area and description
1	AltMat	Raw material – Agri-waste converted into usable fibre for textiles
2	Algalife	Raw material and chemicals – Fibre and dyes extracted from algae; goes back into environment without pollution at EOL
3	Descatuk	Raw material – processes grass-fibres for making fabric; can replace cotton to save water, reduce pesticide use
4	Dyecoo	Water conservation – CO_2 -based dyeing technique (waterless)
5	Geetanjali Textiles	Waste – upcycles post-consumer waste apparel/textile; products from recycled yarn
6	Indra Water	Water treatment – modular, scalable water treatment system; can handle variable load of waste water
7	Infinichains	Ecosystem– traceability solutions; enables circular economy
8	Khaloom	Waste and Social inclusion – handwoven fabrics using recycled yarn
9	Microspin	Ecosystem – provides compact machinery at farm level to help farmers add value to their produce
10	Reverse Resources	Waste and Ecosystem – technological solution to assess waste quantum and enables exchange of waste between relevant parties

AltMat

Operating since	2017
Geographies of operation	India
Applicable value chain phase	Raw Materials
Market Focus (Domestic/Exports)	Both Domestic and Exports
Policy Intervention Category	Standard required for material use, which will guide percentages of fibre used, quality assurance, etc.

The Problem/Issue

Textile industry is one of the biggest polluters in the world. The raw materials used currently have a huge ecological impact. Cotton requires approximately 10,000 litres of water to make 3 shirts with high amounts of pesticides and insecticides that infect the water bodies and kill biodiversity. Petroleum-based textiles on the other hand release 1900 particles of microplastics in water while depleting fossil fuels.

Solution overview

AltMat through its proprietary (provisional patented) technology converts agriculture waste (e.g. hemp, banana) into textile fibres that have better performance characteristics than cotton and crude based textiles. It is a mixture of mechanical, chemical and enzymatic process with 8-10 sequential steps. Each step has its own parameters, machines and settings that can be tweaked as per the need. This process converts agri-waste to fibre of textile grade.

Key Innovations

Patented mechanical, chemical, enzymatic process of converting agri-waste to textile fibres.

Circular Practices & Impact

Lives Materials Energy Water Economy

- **Lives**: Enhances livelihood opportunities in rural sector
- **Materials**: Agri-waste usage to anti-microbial anti-UV material
- **Water**: Uses 1/4th the water cotton requires
- **Economy**: Increase in economically distressed farmer's income

Challenges to scale

- Coarseness of the fibre
- Availability of agri-waste, especially hemp locally
- Non-competitive pricing while compared to cotton (agri-waste is usually burned or mulched)

Policy interventions that can enable replication and impact
• Incentives for farmers to use agri-waste (pricing mechanisms, access to market portals) • Reduced taxes/ tax rebate for manufacturers • Standard required for material use with a defined minimum percentage of agri-waste fibre content
References *Alt Mat Website (Link)* *A New Textiles Economy: Redesigning Fashion's future (Link)*

Algalife

Operating since	2017
Geographies of operation	Germany
Applicable value chain phase	Wet Processing
Market Focus (Domestic/Exports)	Both Domestic and Exports
Policy Intervention Category	Policy for restricted use on hazardous chemicals in the Wet processing stage of textile production.

The Problem/Issue

- Textile production includes dry and wet processes – Considerable quantity of potable water used, releasing highly contaminated wastewater
- Process includes sizing, de-sizing, sourcing, bleaching, mercerising, dyeing, printing and finishing techniques – chemicals are added for adsorption process between the colour and fibres
- Textile industry effluents released after the finishing process – toxic effect after breakdown, contaminates soil, sediment and surface water
- 20% of global freshwater pollution caused by dyeing, 10% of chemicals in clothes transfer to skin and body

Solution overview

Algalife explores a holistic and sustainable development of new materials by creating dyes and fibres from algae. Their textiles release antioxidants, vitamins and minerals that can nourish and protect our body and skin. These bio-based dyes and fibres also have a better environmental footprint than those used in traditional manufacturing and dyeing processes.

The algae used are man-made and cultivated algae to extract dye-materials of a wide range of colours. Not only are the dyes and fibres chemical-free, they're biodegradable and come from a renewable resource. There's zero waste in the supply chain.

Key Innovations

Algalife has two patents for its technology covering dye material and fibre material production from algae. The result is a bio-based textile made from innovative natural and healthy pigments and fibres, using algae. No chemicals are used in the process, just nutrients for the seawater algae.

Circular Practices & Impact

Lives Materials Energy Water Economy

- **Materials**: Biodegradable natural pigments and fibres that release antioxidant, anti-inflammatory vitamins and minerals that protect body and skin.
- **Energy**: Allows land rejuvenation, reducing carbon emissions. No carbon sink is required in the process; there's zero use of chemicals and fertilizers in cultivating algae
- **Water**: Uses 1/5th the water cotton requires. A cotton t-shirt today requires 2600 litres of water whereas a Algalife t-shirt requires only 500 litres.

Challenges to scale

- Dye capacity and scalability, can currently be done in small batches only
- Early-stage technology with limited range of colours and shades, requires R&D to scale-up
- Dyes work on all fibres but mainly are focused on synthetics and cellulosic materials
- Higher costs due to small scale dyeing
- Require more real-time testing in the apparel industry

Policy interventions that can enable replication and impact

- Incentives to use chemical free dyes
- Incentives for R&D on alternative fibres
- Incentives for R&D around new dyeing technologies
- Incentives for low water dyeing techniques
- Stringent rules for usage of hazardous chemicals and release of wastewater

References

Algalife Website (Link)

A New Textiles Economy: Redesigning Fashion's future (Link)

Guideline to prevent the use of hazardous chemicals in textile supply chains (Link)

Descatuk

Operating since	2018
Geographies of operation	India
Applicable value chain phase	Raw Materials
Market Focus (Domestic/Exports)	Both Domestic and Exports
Policy Intervention Category	Standard required for material use, which will guide percentages of fibre used, quality assurance, etc.

The Problem/Issue

- Ecological impact with raw materials – lot of water required to harvest and process in-case of natural fibres like cotton
- High amounts of pesticides and insecticides required that infect waterbodies and kill biodiversity
- Microplastics released in water by petroleum-based products – depletes fossil fuels in the manufacturing process

Solution overview

Descatuk produces grass-fibres that has a similar look to linen but has a lighter touch. They've developed a process of fibre extraction and yarn creation from wild grass that grows in the highlands of India such as Uttarakhand, Himachal Pradesh and needs neither water nor pesticides to grow.

As the fibre is heavy, a carrier fibre such as cotton is added up to 20%. The fibres are cut to length for cotton spinning up to 50 mm and for wool spinning up to 60 mm. Due to its hollow structure, it stays warm in winter and cool in summer.

Descatuk has a positive impact on livelihoods by providing fair job opportunities for locals and mobilizing women groups. Around 300 women artisans work across different villages and the process is cluster based.

Key Innovations

A mechanochemical process of extracting fibres – mechanical process is used to open the grass fibre which can be used for both hand and mill spinning, and chemical treatment is used to extract the fibre.

Circular practices and impact

Lives Materials Energy Water Economy

- **Lives**: Enhances livelihood opportunities in rural sector, around 300 women have been identified and empowered

- **Materials**: Trans-seasonal fibre/ fabric that uses grass from arid land
- **Energy**: The collection and mechanical process doesn't require electricity or other external resources
- **Water**: Wild grass grows naturally in the Himalayan range and doesn't require irrigation/ water supply, it's rain water harvested
- **Economy**: Gives jobs to clusters of women working for NGOs

Challenges to scale

- Coarseness of the bast fibre due to its staple length
- Cannot use 100% grass fibre to fabric, has to be blended with 30-40% of another fibre like cotton
- Non-competitive pricing while compared to cotton
- Hand-spun fibre, not standardized

Policy interventions that can enable replication and impact

- Incentives for farmers to grow grass fibres (to replace cotton as a viable crop)
- Reduced taxes/ tax rebate for manufacturers and brands (this could reduce price of the end products, making it more attractive to consumers)
- Standard required for material use with a defined minimum percentage of grass fibre content

References

Descatuk Website (Link)

A New Textiles Economy: Redesigning Fashion's future (Link)

Dyecoo	
Operating since	2012
Geographies of operation	Netherlands
Applicable value chain phase	Wet Processing
Market Focus (Domestic/Exports)	Both Domestic and Exports
Policy Intervention Category	Policy for restricted use on hazardous chemicals in the Wet processing stage of textile production.

The Problem/Issue

- Textile production includes dry and wet processes – Considerable quantity of potable water used, releasing highly contaminated wastewater
- Process includes sizing, de-sizing, sourcing, bleaching, mercerising, dyeing, printing and finishing techniques – chemicals are added for adsorption process between the colour and fibres
- Textile industry effluents released after the finishing process – toxic effect after breakdown, contaminates soil, sediment and surface water
- 20% of global freshwater pollution caused by dyeing, 10% of chemicals in clothes transfer to skin and body

Solution overview

DyeCoo's CO2 based technology is the world's first 100% water-free and process chemical-free textile processing solution. They provide waterless textile dyeing machines which use pure dyestuff and are highly energy efficient.

When CO2 is heated above 31 degree C and pressurized to above 74 bar, it becomes supercritical, meaning, above the critical point, CO2 has properties of both a liquid and a gas. This is advantageous for dissolving hydrophobic dyes and gas-like low viscosities and diffusion properties that can lead to shorter dyeing times compared to water. The extraction of spinning oil, dyeing and removal of excess dye can all be carried out in one plant by changing the temperature and pressure conditions.

The Dyeox equipment runs with zero-water and uses reclaimed CO2 as dye carrier. The process is suitable for woven, jersey and yarn. The system forms a closed loop where 95% of CO2 is recycled after each batch.

Key Innovations

Patented and industrial proven dyeing technology based on CO2, instead of water using chemical-free dyes.

Circular Practices & Impact

Lives Materials Energy Water Economy

- **Materials**: Pure dyes are used with 98% uptake and negligible wastage
- **Energy**: CO2 dyeing is a dry process, eliminating the need to evaporate water and short batch cycles make the tech very energy efficient
- **Water**: Doesn't require water for dyeing

Challenges to scale

- High CAPEX needed for implementation
- Technology is currently only suitable to process polyester yarns, and cannot be used to dye cotton or any other fabric
- The technology is expensive and only benefits regions where the price of water is high

Policy interventions that can enable replication and impact

- Incentives to go waterless
- Standard required for usage of hazardous chemicals
- Subsidies/ tax rebate to use waterless technology

References

Dyecoo Website (Link)

A New Textiles Economy: Redesigning Fashion's future (Link)

Guideline to prevent the use of hazardous chemicals in textile supply chains (Link)

Geetanjali Textiles	Geetanjali textiles
Operating since	1980
Geographies of operation	Baroda & Mumbai, India Ethiopia & Zambia, Africa
Applicable value chain phase	End of use
Market Focus (Domestic/Exports)	Exports
Policy Intervention Category	Materials / Textile Waste

The Problem/Issue

India is the world's leading importer of used clothing. A subset of this waste is intercepted by waste dealers who employ a vast unorganized labour force who reclaim and repair clothes that can be sold in second hand markets. The rest, however, would be landfilled, were it not for recyclers like Geetanjali Textiles.

Geetanjali Textiles is one of India's oldest and most established EOUs (export-oriented units) offering mechanical recycling of post-consumer waste.

Solution overview

Geetanjali Textiles has an import-export model — all of the waste they recycle is imported from the West and most of the recycled materials and end products are exported out of the country to global retail brands. The enterprise recycles close to 25 tons of post-consumer waste per day, most of it being woollen garments such as sweaters and overcoats. About 75% of this is recycled into yarns exported to global brands for flat-bed knitting into winter wear, and the remaining is woven in-house into blankets, scarves and throws, sold white label to global brands. Some of their biggest clients include Aeropostale, Silkeborg, Reformation, H&M, American Eagle, and others. Apart from the environmental impact, the company also has social impact in the form of livelihoods generation for tribal village women living in and around Baroda employed for the sorting, segregation, and hardware removal of the waste prior to recycling.

Key Innovations

- Specialization in post-consumer waste: Geetanjali Textiles specializes in collection and recycling of post-consumer waste, representing a solution for the huge quantities of discarded clothes.
- Manual segregation: The company's labour-intensive process of segregation by fiber composition, color and shade leads to a consistent output of about 50 colors of yarns.
- Mechanical recycling: With a large set-up of imported mechanical recycling machines, the enterprise has a capacity of shredding, carding, and spinning up to 25 tons of post-consumer waste a day.
- In-house dyeing & weaving unit: Geetanjali Textiles is able to offer end-to-end services from collection of waste to supplying end products thanks to its in-house flat-bed weaving and dyeing units that manufacture scarves, throws, and blankets using recycled yarns.

Circular Practices & Impact

Lives Materials Energy Water Economy

- Textile waste diverted from landfill: With the capacity to recycle 25 tons of waste a day, and working only with post-consumer waste exported to India by Western countries, Geetanjali is ensuring this waste does not make it to our landfills and is instead sold back to brands from the countries it originates from
- Livelihoods generation for tribal women: Unlike most factories that employ migrant workers, Geetanjali Textiles employs around 500 local tribal women who have little to no education and train them in identifying fibre composition by touch-feel.

Challenges to scale

- Global economic slowdowns: With their raw material coming from Western countries and their final product sold there as well, the company's futures are closely aligned with global economic changes. In 2014, for instance, their business declined as Europe's economic crisis led to many factories shutting down. Furthermore, as global aid diverted to Africa declined, their facilities there too were affected — for instance, while their unit in Ethiopia has the capacity to produce up to 700,000 blankets a year, they are able to make and sell only about 100,000.
- Blended fabrics: Filament yarn that composes most synthetic and nylon fabrics is not recyclable through their mechanical processes. With new textile blends being developed every day, and a little bit of nylon mix being par for the course, their business is challenged by the dependence on pure wool and cotton.
- Business diversification: Given the ups and downs of the global market and customer demands, Geetanjali Textiles has had to shift focus from its core business of mechanical recycling and making blankets to also making end to end products like scarves.
- High dependence on labour: The organisation is often challenged by labour union demands, strikes, and social-cultural issues of running a company with an almost total reliance on human labour.

Policy interventions that can enable replication and impact

- Financial benefits for organisations working with waste/recycled materials, e.g., lower GST
- Funding from EU/US
- EPR mandates on large manufacturers
- Standards required for material use, which will guide percentages of fibre used, quality assurance, etc.

References

http://geetanjaliwoollens.com/

Indra Water

Operating since	2018
Geographies of operation	India
Applicable value chain phase	Wastewater Treatment
Market Focus (Domestic/Exports)	Domestic
Policy Intervention Category	Need to reduce freshwater use; availability of free water leads to wastage - processed sewage water should be available to be used as process water. Common infrastructure capacity has to be enhanced

The Problem/Issue

Fashion is depleting the world's water resources, polluting rivers and other surface waters with chemicals and adding to ocean microplastic pollution. Textile production is responsible for high volumes of water containing hazardous chemicals being discharged into rivers and water courses. 20% of industrial water pollution globally is attributable to the dyeing and the treatment of textiles.

Solution overview

Indra Water has developed smart and decentralized water treatment systems capable of a variety of water treatment needs through innovations in electrocoagulation, electrochemical oxidation, two-phase solids separation, distillation and pollutant monitoring hardware. The design of the treatment process with built-in automation and analytics guarantees desired treated water output quality.

High scalability, dynamic treatment, modular flexibility, smart automation and monitoring through Indra's systems provide superior and quicker economic returns. Remote troubleshooting and fine-tuning help systems improve consistency and reduce downtime. Hazardous chemicals are not used and sludge management is convenient with this methodology.

Key Innovations

Indra has two patents on it's technology process innovation in method of wastewater treatment and dynamic treatment process making the systems highly efficient and effective also capable of handling shock loads and variations in inlet wastewater characteristics.

Circular Practices & Impact

Lives | Materials | **Energy** | **Water** | Economy

- **Energy**: Low energy consumption, chemical free and lower foot print. Saves more than 35% in life cycle costs
- **Water**: Upto 95% water recovery

Challenges to scale
• Challenge is to scale from smaller for larger manufacturers that require more R&D, product development and funds • Plug-in new tech to integrate with existing treatment plants in the industry • Relaxed measures on wastewater parameters and disposal of wastewater
Policy interventions that can enable replication and impact
• Incentives to adapt to better/ newer wastewater tech • Incentives to use recycled water instead of fresh water • Higher taxes on fresh water usage
References *Indra Water website (Link)* *Waste Briefing Global (Link)*

InfiniChains

Operating since	2018
Geographies of operation	India
Applicable value chain phase	Traceability and Transparency
Market Focus (Domestic/Exports)	Both Domestic and Exports
Policy Intervention Category	Standard required for material use, which will guide percentages of fibre used, quality assurance, etc.

The Problem/Issue

- No transparency of fibres/ material used – Authenticity is suspect, systems are not secure, processes are not fraud proof and scattered data makes transparency efforts difficult
- Inefficiency – Time consuming processes, error prone data, manual intervention required, multiple system silos and need redundant updating, scattered data for analysis
- No story telling – No story behind a product, expensive to engage consumers and unable to give back to the ecosystem

Solution overview

Infinichains is a leading end-to-end and trace solution helping brands and manufacturers to digitize sustainability practices. Through their core strengths of real data, efficiency and storytelling, they bridge the fragmented gaps between the different sustainability systems of farmers, manufacturers and brands. Farm data collection systems, manual data entry and auditor systems are installed at the farm level. MRP systems, excel based sustainability reporting and applications for sustainability scoring are present at the manufacturing end, while ERP systems and independent analytics are for the brands.

Key Innovations

CREDIBLE built by InfiniChains uses Blockchain technology. They have deep expertise in tractability and traceability, sustainability focused trade facilitation platform, counterfeit drug prevention and authentication of origin of materials in several industries. Apart from blockchain at the supply chain, multiple tracers and drones operate at the farm level. A platform that connects all the farmers. Tracking and tracing is accurate and easier due to these multiple data collection points.

Circular practices and impact

Lives Materials Energy Water Economy

- **Materials**:
  - Ability to trace fibre to garment, driving sustainable practices
  - Enabling quality assurance of new materials
- **Lives**: Enabling transparency around working conditions

Challenges to scale
• Cost involved to trace and install technology across the supply chain • Not much demand from suppliers and brands • No standard traceability/ transparency solution – every platform offers a stand-alone solution • Tech limitation to certain types of fibres and not enough opportunity to trace newer fibres
Policy interventions that can enable replication and impact
• Stringent regulations for supply chain to be transparent and materials to be traceable back to its origin • Benchmarking of traceability platforms • Tax incentives for investment in traceability and transparency R&D • Reporting of material transparency in Annual reports for all corporations
References *InfiniChains website (Link)* *Fashion Revolution why transparency matters (Link)* *European policy? document*

Khaloom	
Operating since	2015
Geographies of operation	India
Applicable value chain phase	End of use
Market Focus (Domestic/Exports)	Exports
Policy Intervention Category	Materials / Textile Waste

The Problem/Issue

Khaloom addresses two key problems: textile waste emerging from manufacturing units being landfilled, and lack of steady livelihoods for Indian hand weavers.

According to the Ellen Macarthur Foundation, every second, nearly a truck full of textile waste is landfilled. Textile waste recycling, while a thriving industry in India, has seen little technological innovation in the past few decades. As the second largest producer of textiles worldwide, enabling textile re-use and recycling is therefore a key priority.

Furthermore, over 40 million people in India are employed[9] at some stage of the textile value chain, and the textile industry is therefore a cornerstone of the Indian economy. Handloom plays a big role in the industry and is a national pride. However, mechanization of the economy has taken its toll as there are only 2.38 million handlooms left opposed to double the amount of weavers. Of the 4.3 million handloom workers, 57% have leveled below the poverty line, and 80% are in debt.

Solution overview

Khaloom employs traditional weavers to create handwoven fabric using recycled yarns, which is exported to international markets. Founded by Netherlands-based venture builders Enviu, Khaloom represents a business case for large-scale recycling of textile waste into apparel-grade fabrics via handcrafting. Furthermore, employing fair-wage practices, the organisation keeps its weavers at the center of its sustainability work. In this way, Khaloom addresses the twin problems of textile waste and exploitation of hand weavers.

Key Innovations

Creating a supply chain to enable the mass-scale recycling and hand weaving of textile waste into high-end apparel-grade fabric that can be sourced and used by luxury global brands.

- Use of recycled yarns
- Creating apparel-grade and luxury fabrics
- Preserving traditional craft in a sustainable and circular business model
- Supporting recycling technologies: Working with chemical recyclers to create close-to-virgin quality recycled fabric, specifically UPSET[10], another Enviu initiative

Circular Practices & Impact

[9] https://www.makeinindia.com/sector/textiles-and-garments
[10] https://reweave.enviu.org/upset/

Lives Materials Energy Water Economy

- Diverting textile waste from landfill: Sourcing high-quality textile waste from manufacturing units around the country, every 100 meters of fabric Khaloom produces prevents 92kg of Co2, utilises 30 kg of waste and represents 126,000 liters of water saved
- Preserving traditional handicrafts: Consciously working only with handweaving, Khaloom is bringing circular economy principles to the traditional Indian craft ecosystem
- Creating livelihoods: Working with a community of 18 local hand weavers in Bangalore to create hand-woven fabrics
- Supporting recycling technologies: Working with chemical recyclers to create close-to-virgin quality recycled fabric, specifically UPSET, another Enviu initiative

Challenges to scale

- Lack of maturity of chemical recycling in India: With most textile recycling in India being mechanical, and UPSET set to launch in India only next year, the organisation has had to source ready recycled yarns rather than focus on increasing recycling. Not all mechanical recyclers can produce the high-quality garment-applicable yarns needed by Khaloom, and their sourcing pool is thus limited.
- Hand weaving is inherently a slow process, thereby limiting the organisation's ability to produce fabric at scale without considerably scaling up its workforce
- This directly places a burden on Khaloom's sales and marketing spends, which seem to be focused on creating high-value partnerships, e.g., tying up with high-end designers and dressing celebrities in Khaloom garments, to showcase the potential of their product

Policy interventions that can enable replication and impact

- Financial benefits for organisations working with waste/recycled materials, e.g., lower GST
- Benefits for innovation in the space of traditional handicrafts
- Standards required for material use, which will guide percentages of fibre used, quality assurance, etc.

References

www.khaloom.com

www.enviu.org

Microspin	
Operating since	2011
Geographies of operation	Vidarbha & Karnataka
Applicable value chain phase	Raw material (cotton spinning)
Market Focus (Domestic/Exports)	Domestic
Policy Intervention Category	Energy consumption; Empowering cotton farmers

The Problem/Issue

Cotton farmers, especially those working on organic cotton, are entirely reliant on weather and market conditions for their livelihood. By the time the cotton reaches the end user, it undergoes 30 to 50-fold value addition, of which the farmer receives no share. The struggle of livelihood is similar for cotton spinners and weavers, though for different reasons. Unable to afford the traditional spinning machinery and set-up that can cost up to 100 crores, weavers are entirely reliant on large spinning mills.

Solution overview

Microspin was started with the goal of using technology to provide alternative livelihoods to cotton farmers and small weavers. The founder, Kannan Lakshminarayan, invented a smaller, cheaper and more compact machine at a fraction of the cost, which could be purchased by farmers and small spinners, and enable them to spin yarn and fabric that would fetch them a supplementary income. The yarn manufactured by the unit is either sold as yarn to wholesale customers, or in some cases it is converted into fabric and then offered for sale. The yarn has a semi-combed feel which results in creating a Khadi and linen-like fabric which is very soft and different from the ones manufactured in a conventional setup.

Key Innovations

- The Blow-card® is the secret sauce of the Microspin line that replaces power guzzling blow-room machines and difficult-to-maintain carding machines[11]
- All the machines are equipped with embedded controls. Settings are easy to configure through an app. The IoT-enabled architecture makes it easy for monitoring and support.
- The machines' energy footprint is 5x less than that of traditional machines due to their BLDC motors powered by proprietary embedded algorithms.
- The unique yarn and resultant fabric is extremely absorbent, making it better at holding dye, due to which lesser water and energy is consumed in the dyeing process. This yarn fetches a higher price margin in the market

Circular Practices & Impact

[11] A carding machine consists of rollers whose surface is covered with small "teeth" or combs. This process is needed to disentangle, clean or even mix fibres to produce a continuous web or "sliver" that makes yarn suitable for the next stage of processing.

Lives Materials Energy Water Economy

- Higher realisation per kg of cotton (Rs. 1400 as against Rs. 90) due to conversion into yarn and finished fabrics
- The yarn produced by Microspin goes under the name of Crafted Yarn™ and commands a 50-80% premium over commodity yarn, thereby enabling and empowering small weavers and farmers.
- Each unit can produce 1,000 metres of fabric or process 100-120 kg of cotton a day.
- The machines' energy footprint is 5x less than that of traditional machines due to their BLDC motors powered by proprietary embedded algorithms.
- Microspin's bio-scouring method enables almost 50% water saving in the dyeing process. They also use 90% biodegradable inputs resulting in safer effluents. The treated water is used for irrigation or agriculture.

Challenges to scale

- As a process innovation, working with Microspin has a learning curve for weavers and spinners. This requires some one-on-one hands-on training and setting up, which is a small barrier. Working with cohorts of farmers and spinner/weaver communities can help overcome this.
- The company's inherent focus is "micro", building a ground-up innovation that benefits small scale producers. However, in an agrarian economy like India, there are potentially millions of beneficiaries to scale.

Policy interventions that can enable replication and impact

- Benefits for farmers producing environmentally sustainable organic cotton and the opportunity for an alternative source of income
- Tax benefits for sale to small spinners, weavers, and farmers
- Government tie-ups and tenders to equip farmers with market linkages for their products (preferential procurement or tax-breaks for small manufacturing)

References

- *https://www.thebetterindia.com/13593/microspin-rural-innovation-cotton-farmers-become-yarn-producers-marico-siap/*
- *https://1269ed4f-d96e-4934-a87c-4d3e5e9255b0.filesusr.com/ugd/a96326_fd5f5665c4d442c48571d6ebb62d605f.pdf*
- *https://www.textileexcellence.com/news/rendezvous/india-to-my-surprise-organised-spinners-have-invested-in-microspin-machines-using-it-much-more-creatively-producing-very-different-yarns/*
- *https://qz.com/india/223010/how-to-save-indias-cotton-farmers-stop-using-a-process-invented-in-the-1700s/*
- *https://www.fibre2fashion.com/news/textile-news/newsdetails.aspx?news_id=165042*

Reverse Resources	
Operating since	
Geographies of operation	Bangladesh, Estonia, UK
Applicable value chain phase	End of use / Technology
Market Focus (Domestic/Exports)	Domestic & Exports
Policy Intervention Category	EPR / Textile waste management / Zero waste to landfill / Technology
The Problem/Issue	
Reverse Resource's assessment of the waste generated from garment manufacturing units in Bangladesh has highlighted the problems of: 1) waste spilling out of supply chains (> 25%), 2) underutilisation of waste as it is mostly downcycled, incinerated or dumped, 3) under-reporting of quantities of waste (either intentional or simply due to lack of an effective tracking mechanism), 4) loss of recoverable value from waste as over 70 kinds of wastes are mixed, and lastly the excessive presence of intermediaries distorts market prices, lowering lead times for recycled materials, preventing sharing of best practices and constraining the percentage of leftovers reaching optimum new life-cycles.	
Solution overview	
RR uses an online platform to facilitate the tracking and trading of textile waste through a "match-making" engine that connects waste producers with solution providers like recyclers. With the ability to track all transactions on the platform, they solving for the lack of transparency and data in the cycle. They have also worked extensively with factories on ground to reduce waste as well as improve its management and segregation, ensuring it does not lose its value. Their "match making" platform connects this waste directly to recyclers, thereby reducing the number of layers in the supply chain, and enhancing the purchasing power of both waste workers and recyclers. Finally, the data coming directly from factories facilitates virtual traceability of resources and digital interconnections throughout supply chains. This is crucial for building an effective circular economy as well as supporting many digital solutions of industry 4.0 globally (e.g. blockchain-based transparency).	
Key Innovations	
• Working directly with factories to enable better waste management at source and to integrate waste reduction methods like re-manufacturing to reduce waste • Enabling factories to capture and report data about the different categories of waste produced and capturing this data on a proprietary technology platform thereby ensuring transparency of information • Created a technology-driven trading platform to directly connect waste with recyclers and tracking the movement of this waste through the supply chain to ensure transparency	

Circular Practices & Impact

Lives | Materials | Energy | Water | Economy

- Enabling the smoother flow of waste in the supply chain, thereby resulting in minimal waste to landfill
- Improving the segregation of waste at source to ensure it remains usable and does not lose its economic value
- Empowering waste workers through better waste segregation at source and providing a technology platform that gives them better purchasing power and a higher price for the waste
- Empowering textile recyclers to get a steady and reliable feedstock
- Ensuring all data points are recorded and the movement of waste through the supply chain is tracked to enable greater transparency

Challenges to scale

- RR currently works directly with factories, not necessarily the brands that employ them, and therefore rely on factory buy in. Without buy in from the brands, and without incentivisation from them to the factories, the process will face limitations in scaling across the supply chain
- The technology platform currently relies on self-reporting from factories, which is in itself an unreliable process. RR would benefit from collaborating with blockchain service providers to get reliable data at source. It would also need to help factories implement better reporting mechanisms to scale and replicate the model.

Policy interventions that can enable replication and impact

- EPR policies requiring brands to empower factories to record and report data more transparently as well as employ better waste management practices at source
- Zero Discharge policies ensuring waste is not downcycled as far as possible
- Material-based policies requiring brands to incorporate at least 20% (for instance) of their production waste back into their production raw material

References

https://reverseresources.net/

https://drive.google.com/file/d/0B92xTAM6iB-rclBfeTBBYVBSdXc/view