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Institutionalizing Resource Efficiency in Indian Textile Sector

teri school of advanced studies

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"Institutionalizing Resource Efficiency in Indian Textile Sector"

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Abbreviations

ATUFS	Amended Technology Up Gradation Fund Scheme
CEAP	Circular Economy Action Plan
CMAI	Clothing Manufacturers Association of India
EEA	European Environment Agency
EPR	Extended Producer Responsibility
EU	The European Union
GHG	Green House Gas
GOI	Government of India
IPDS	Integrated Processing Development Scheme
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment Forests and Climate Change
MSME	Ministry of Micro, Small & Medium Enterprises
OECD	Organization for Economic Co-operation and Development
PM (MITRA)	Mega Integrated Textile Regions and Parks
PRO	Producer Responsibility Organization
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
SAMARTH	Scheme for Capacity Building in Textile and Apparel Sector
SITP	Scheme for Integrated Textiles Park
SPI	Sustainable Product Initiative
T & A	Textiles and Apparel
TVC	Textile Value Chain
WEF	World Economic Forum
ZDHC	Zero Discharge of Hazardous Chemicals
ZLD	Zero Liquid Discharge

1. Introduction

As per Ellen MacArthur Foundation[1] with changing demographics and growing economy, the consumption of textiles and clothing has gone up by more than 60 per cent and the clothing production has almost doubled, as compared to year 2000 (Johnsen, 2020). As per Invest India[2] the textile sector has a share of 2% in India's GDP, contributes 12% to export earnings and provides direct employment to 45 million people in the country. Among natural fibres, cotton contributes the highest share for fabric production in India.

The main cotton growing States (or 'Cotton Basket of India')) includes Maharashtra, Gujarat, Andhra Pradesh and Telangana that contribute approximatelt two - thirds of cotton production.

Synthetic fibres are produced from crude oil while cellulosic fibres are from wood pulp. The main varieties of synthetic staple fibres include polyester, acrylic and polypropylene. Presently the man-made fibre and natural fibre mainly cotton blends are quite popular. Among natural fibres, cotton contributes the highest share for fabric production in India. The estimated production of the various fibres according to the Ministry of Textiles is given in *Figure 1*.

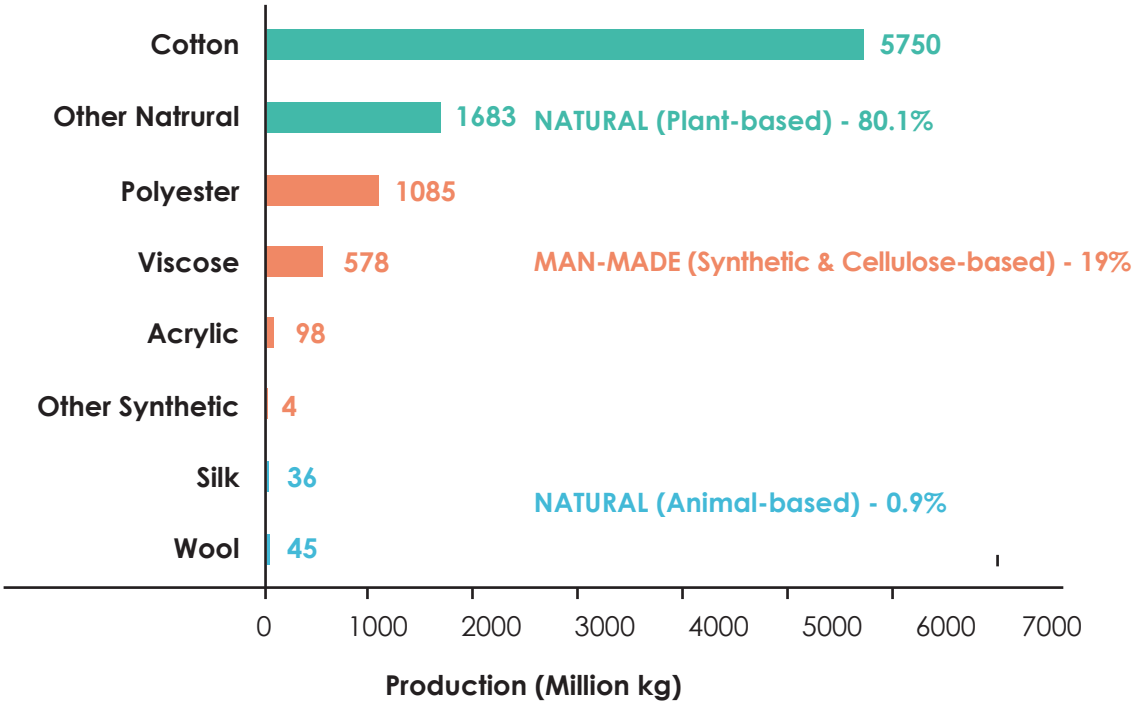

Figure 1: *Textile fibre production across India in financial year 2020 (prepared based on Statista, 2021)*

India is the second largest producer of man-made fibres (MMF) in the world with presence of large plants having state-of-the art technology (Ministry of Textiles, 2019b). Presently India produces over 1,441 million kg of man-made fibres and over 3,000 million kg of man-made filaments (Ministry of Textiles, 2019b), India's total spun yarn production is 5,713 million kg as in 2019-2020. The details of yarn production are given in *Table 1*. India is a leading producer of both fibre and yarn in the world.

Table 1: *Indian Yarn Production (million Kg) as in 2019-2020*

Yarn	Production
Cotton	3,996
Blended & 100% non-cotton	1,663
Total spun	5,713
Polyester	3,934
Polyester Filament Yarn	3,934

(Data Source: Office of Textile Commissioner, Govt. of India, 2021)

India's fabric production is split into two sectors, namely, mill and decentralised as shown in *Figure 2*

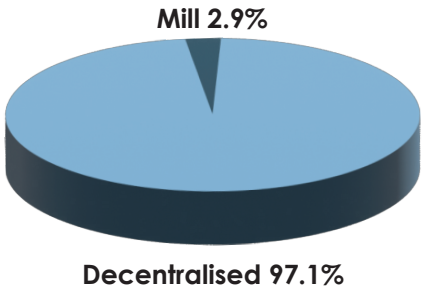

Figure 2: *Share of fabric production by mills and decentralised units (Data source: Ministry of Textiles, 2019)*

In India, 97.1% of fabric production is contributed by the decentralised units that comprise of micro, small and medium enterprises (MSMEs) with small scale production systems. Hence, huge capital investments and centralised production systems with common effluent treatment plants are a challenge.

With the increasing demand in textile products, there is an increasing use of resources that can lead to severe environmental impacts. In the textile production systems, the environmental degradation occurs due to pollution of land, air, and water during the procurement and use of natural resources, industrial processes and activities, and the product use and disposal (Hasanuzzaman and Bhar 2016). The various phases of the textile value chain (TVC) for both cotton and MMF are shown in *Figure 3*. In each stage of production of the textile value chain, natural resources are consumed in the form of raw materials, water, energy and fuel and emissions, footprints are created which result in environmental degradation.

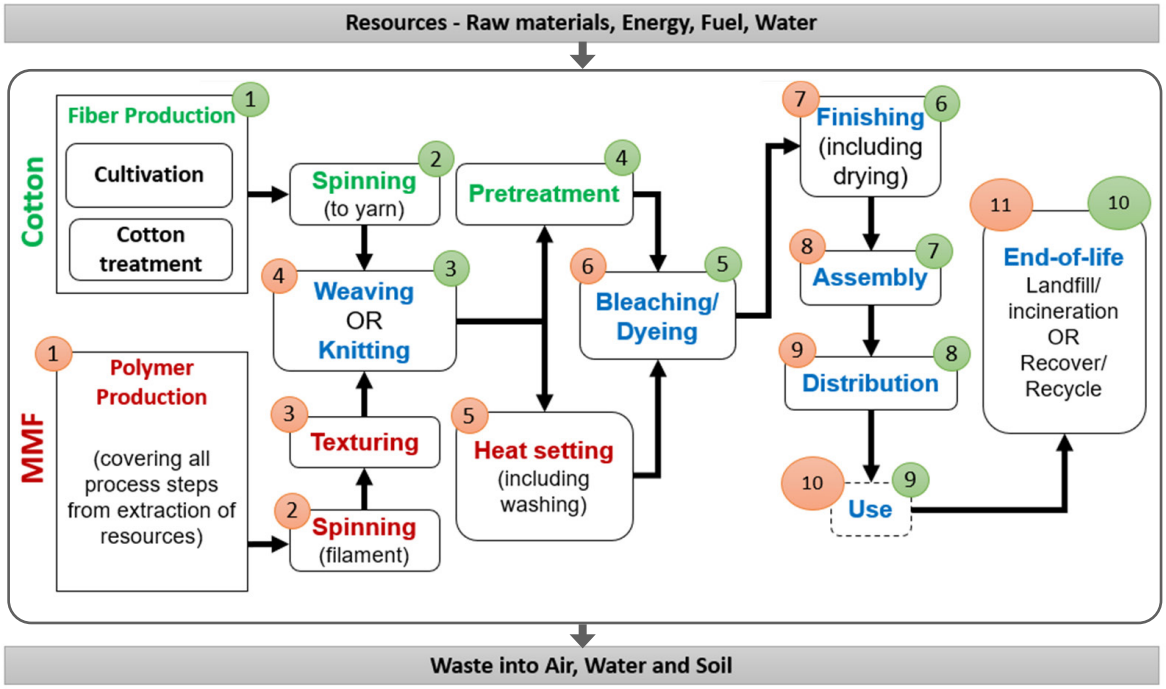

Figure 3: *Phases in textile value chain of cotton and MMF (Green: Cotton only, Brown: MMF only, Blue: Common)*

1.1 Sustainability in Textile Sector

It has always been a challenge for the industry to balance between the sustainability goals and mainstream targets of production. The current dominant approach of resource consumption without considering sustainability, reuse and recycle of resources is adversely impacting the environment, society, and the future of the textiles industry itself. The strategy of reducing the impact of global climate change is through introduction of sustainable end products and this is highlighted in the sustainable product framework so that the GHG emissions, energy footprint, and water footprint may be reduced[3] .

The study aims to assess the textile landscape of India including government policy and industry initiatives to capture the resource use profile in the textile value chain. Identify hotspots in the textile value chain where action needs to be taken to institutionalize resource efficiency and reduce environmental impact. Mapping of existing policies across life cycle stages of the Indian textile value chain and their intersection with other sectors like agriculture and environment have been analyzed based on their role in promoting resource efficiency. Policy gaps have been identified based on the current role of the existing policy framework and identify the need for new policy, reforms/additions in existing policies and initiatives to institutionalizing resource efficiency and achieve circularity in the textile industry.

1.2 Methodological Framework

This study, considering various stages of TVC, has been divided into two modules: ***1)*** Policy mapping and gap analysis of Indian textiles, and ***2)*** Impact assessment of resource consumption in the textile sector in terms of GHG emissions, energy footprint and water footprint. Following these, roundtable discussions as an industry-academia interaction have been organised with the aim of obtaining primary data/validation from the industry experts along with the best practices being followed and the stakeholder perspective for policy recommendations. Thus, the textile resource efficiency is investigated through a science-policy interface as shown in *Figure 4*.

Policy mapping and gap analysis: Extensive literature review has been conducted to perform the policy mapping. Accordingly, the criterion of mapping includes ***a)*** *Various stages of TVC*, ***b)*** *Policy instrument* (legislation, acts, regulation, standards, subsidies, plans, guidelines, and strategies), and ***c)*** *Basis* (*level of innovation, maturity, geographical reach, and scope*). The mapping of Indian policies considered all related ministries, while, for the European and EU polices, all relevant policies of textile sector and the EU market context are taken into consideration. Policy development in the European Union and some European nations have been studied as they have been pioneers in instituting policy mechanisms and reforms to achieve sustainable textile value chain. The EU as a principal destination for the Indian apparel export industry has a host of progressive policies to institutionalize resource efficiency provides an engaging framework focused on reduction of waste generated, disposal of waste and eco design measures.

The various stages of TVC include preproduction to production stages of fibre, yarn, finishing, consumption, and post consumption phases. Gap analysis considered the factors, namely, circularity, sustainability, transparency, and standards which are considered as focus areas for reducing waste and reuse on secondary raw material as per major EU policies. The techniques of gap analysis include commenting on what the present state is and how one could get to a desired state.

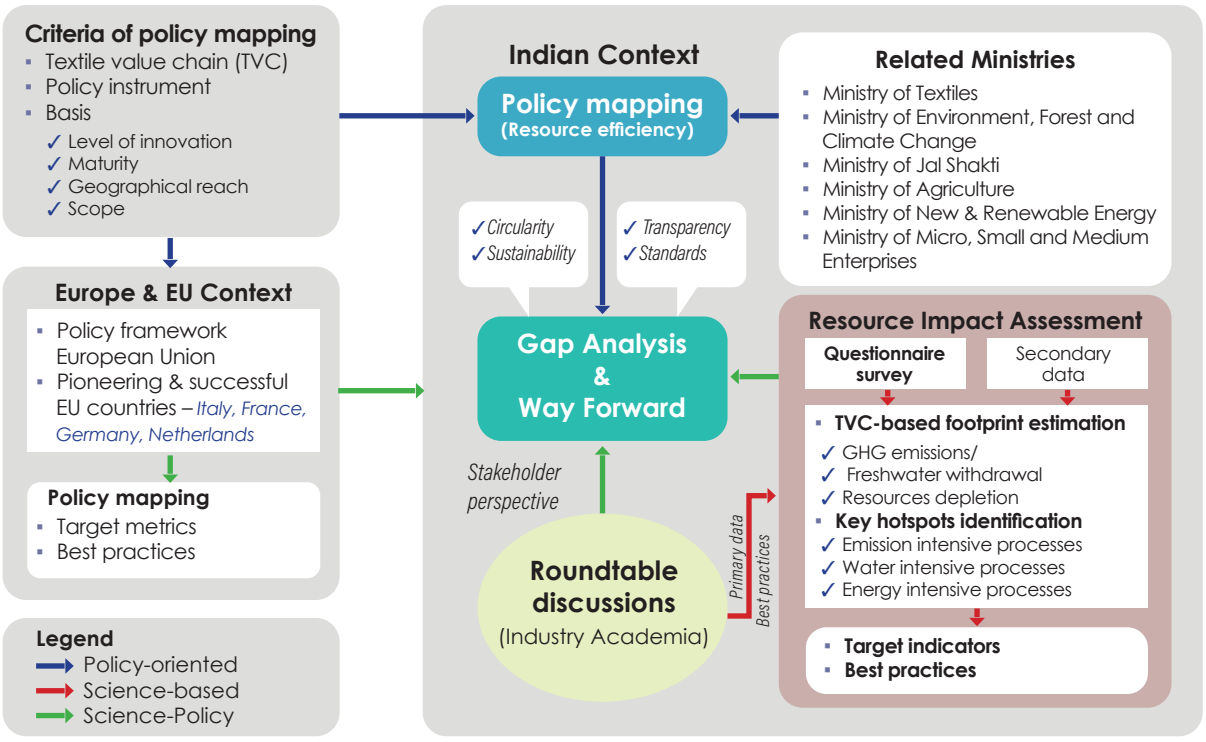

Figure 4: *Proposed methodology of science-policy interface of textile resource efficiency assessment*

Resource Impact Assessment: Impact of resource use on climate change (GHG emission), freshwater withdrawal (water footprint) and resource depletion (energy footprint) has been estimated for each stage in TVC. The data collection included questionnaire survey and secondary data sources. Following this, key hotspots have been identified from the various stages of TVC as emission intensive, water intensive and energy intensive processes to suggest best practices for resource saving. This stage also includes suggesting the target indicators and the industry best practices to be followed.

Roundtable Discussions: The main objective of the roundtable discussions was to enable an industry-academia interaction to understand the industry-level best practices, primary data of resources consumption and to obtain a stakeholder perspective towards policy recommendations. Thus, the scientific attributes like primary data and best practices have been incorporated into the resource impact assessment, while the stakeholder perspective from the industry experts have been included in the policy gap and recommendations.

2. Policy Mapping & Gap Analysis Towards Sustainability In Textile Sector

The textile value chain in India, begins with the cultivation of cotton (natural raw material), then moves to production of fibre, yarn, fabric and then finally to the finished product. The finished textile product is meant for domestic market and foreign exports. An integrated approach is needed for the TVC to be sustainable and resource efficient, the textile industry is governed by many policies which are under the purview of different ministries. To achieve circularity and sustainability across the various processes in the entire TVC, policy mapping involving various line ministries has been envisaged.

2.1 Indian Policy Framework

Policy integration would mean different stakeholders are involved in understanding the ecosystem of the textile value chain and coordinate to help integrating the measures for pollution load reduction on freshwater, land resources and GHG emissions, in the key hot spots of the TVC. The textile yarn and fabric production fall under the purview of the Ministry of Textiles, the legislation and incentives for sustainable cotton cultivation (the raw material) is with the Ministry of Agriculture. The impact of chemical fertilizers (used for cotton cultivation) on freshwater resources and the pollution caused by the dyeing and finishing units of textile industry aggravate both carbon and energy footprints, these aspects are governed by the Ministry of Environment, Forest and Climate Change (MoEFCC). Similarly, the policy interventions by the Ministry of New and Renewable Energy (MNRE) in the energy sector are targeted towards the use of renewable energy and energy efficiency in the industry sector. However, most of the textile industry clusters are micro, small, and medium industries and for them the Ministry of Micro, Small & Medium Enterprises (MSME) and MSME policy interventions have far reaching consequences. Since different ministries oversee different sectors/aspects, through different policy mechanisms with potential impact across the TVC, there is little coordination between the ministries leading to fragmented policy response *(Table 2)*.

2.2 Relevant European & EU Policies

The EU has via **Green Deal (2019)** presented a growth strategy "to move to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution", with the intent to formalize sustainable transition and irreversibly shift sustainable production to a legal requirement for doing business with the EU[4]. It recognized EU Strategy for Sustainable Textiles under the Circular Economy Action Plan as a priority area, alongside Sustainable Products Policy, and a 'zero-pollution' ambition for a toxin free environment[5]. The EU Sustainable Textiles strategy planned to be adopted in the first quarter of 2022[6], fits in with other EU initiatives on sustainability and consumer transparency, including the Circular Economy Action Plan (CEAP)[7], the Sustainable Product Initiative (SPI)[8], and the New Consumer Agenda and brings cohesion, clarity, and support.

The primary sets of measures[10] in strategy are listed below:

- The European Union (EU) has given a policy direction for inclusion of resource efficiency in the production value chain including the textile value chain. It is based on the principle of better design which includes use of less raw material, use of less harmful chemicals, less waste production during the stages of production, longevity of product and reuse.

The EU has recognized the need to bring in sustainability in the highly linear apparel and footwear industry. To this end they advise innovative changes in various stages of the textile value chain (TVC) which will reduce waste and introduce circularity in the industry. The EU textile strategy position paper by The Policy Hub initiative released in August 2021 advocates the incentivization of environmental performance of textile products at every stage of production, and innovative circular business models through a policy framework, to accelerate the transition to circular system. The EU and country specific policies have been analyzed *(Table 3***) based on the sustainable product framework devised by the European Commission focused on reduction of waste generated, disposal of waste and eco-design measures.**

Table 2: *Current Textile Policy Landscape across Life Cycle Stages in India*

CURRENT TEXTILE POLICY LANDSCAPE ACROSS TEXTILE VALUE CHAIN IN INDIA						
INDIAN POLICIES (Policy Name, Year, Ministry)		**TYPE OF POLICY INSTRUMENT**	**TEXTILE VALUE CHAIN**			
			Pre- Production	***Production***	***Consumption***	***End of Life***
Draft National Resource Efficiency Policy, 2019 *(Ministry of Environment, Forest and Climate Change, Government of India (GoI), 2019)*		Regulation/ Legislation	Over-arching Policy			
Short description	The Draft National Resource Efficiency policy aims at enhancing resource efficiency and promoting the use of secondary raw material in a number of manufacturing industries					
Geographical coverage	All over India					
Maturity	It is in draft stage					
Level of innovation	Reuse of secondary raw material and resource efficiency added in the policy draft					
Rashtriya Krishi Vikas Yojana, 2007 *(Ministry of Agriculture & Farmers Affair, GoI)* Policy now renamed as Remunerative Approach for Agriculture & Allied sector Rejuvenation		Incentive to individual farmers				
Short description	It is a state plan scheme aimed for comprehensive development of agriculture and allied sectors by incentivizing states for increasing their investment in them					
Geographical coverage	All over India					
Maturity	Effective since 2007					
Level of innovation	Incentive to improve agriculture productivity					
Paramparagat Krishi Vikas Yojana, 2015 *(National Mission for Sustainable Agriculture, Ministry of Agriculture & Farmers Affair, GoI)*		Regulatory				
Short description	Through this scheme the farmers will be given financial benefits by the government to convert from conventional farming methods to sustainable models of organic farming through a mix of traditional wisdom and modern science					
Geographical coverage	All over India					
Maturity	Ongoing					
Level of innovation	Switch to organic farming for improvement in soil health					
Pesticide Management Bill, 2020 *(Ministry of Agriculture & Farmers Affair, GoI)*		Fiscal & Non Fiscal				
Short description	This bill is aimed at regulating the manufacture, import, sale, storage, distribution, use, and disposal of pesticides in order to ensure safety of humans and environment					
Geographical coverage	All over India					
Maturity	To be implemented					
Level of innovation	Regulate chemical use and reduce chemical pollution					

CURRENT TEXTILE POLICY LANDSCAPE ACROSS TEXTILE VALUE CHAIN IN INDIA						
INDIAN POLICIES (Policy Name, Year, Ministry)		**TYPE OF POLICY INSTRUMENT**	**TEXTILE VALUE CHAIN**			
			Pre- Production	*Production*	*Consumption*	*End of Life*
India's National Fibre Policy, 2010-2011 *(Ministry of Textiles, GoI)*		Fiscal & Non Fiscal				
Short description	The policy is aimed at strengthening the fibre economy of India making textile sector competitive in the long run, including manmade textiles					
Geographical coverage	All over India					
Maturity	Ongoing					
Level of innovation	Incentives for both natural and manmade fibres					
PM (MITRA) Mega Integrated Textile Regions and Parks, 2021 *(Ministry of Textiles, GoI)*		Public Private Partnership (PPP), Remunerative/ Fiscal				
Short description	The scheme aims to integrate the entire textile value chain from spinning, weaving, processing/dyeing, printing to garment manufacturing at one location					
Geographical coverage	All over India					
Maturity	To be implemented between 2021-2028					
Level of innovation	All stages of manufacture at one location, innovation in technology, material use, reuse may be instituted					
National Technical Textiles Mission, 2020 *(Ministry of Textiles, GoI)*		Mission steering group established for research and development (R&D) of technical textiles				
Short description	The mission aims at positioning the country as a global leader in Technical Textiles through manufacturing man made textile of different grades suited for different applications					
Geographical coverage	All over India					
Maturity	2020-2024					
Level of innovation	R&D					
Amended Technology Upgradation Fund Scheme (ATUFS) 1999, upgraded in 2021 *(Ministry of Textiles, GoI)*		Technical Advisory-cum-Monitoring, Enabling Ease of doing Business, Bolstering exports and fuelling employment				
Short description	This scheme aims at the adoption and modernization of technological upgradation within the textile industry in India, to improve exports					
Geographical coverage	All over India					
Maturity	Updated in 2021					
Level of innovation	Focussed on textile machinery upgradation					

CURRENT TEXTILE POLICY LANDSCAPE ACROSS TEXTILE VALUE CHAIN IN INDIA						
INDIAN POLICIES (Policy Name, Year, Ministry)		**TYPE OF POLICY INSTRUMENT**	**TEXTILE VALUE CHAIN**			
			Pre- Production	*Production*	*Consumption*	*End of Life*
Integrated Processing Development Scheme (IPDS), 2014 *(Ministry of Textiles, GoI)*		Fiscal				
Short description	This scheme aims to enable the textile processing sector to meet environmental standards through appropriate technology for water supply and effluent treatment including Zero Liquid Discharge and technology upgradation					
Geographical coverage	For common facilities in existing textile clusters in India					
Maturity	2014 and ongoing					
Level of innovation	For small and medium textile units, for green and brown fields					
Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016 *(Ministry of Environment, Forest and Climate Change, GoI)*		Regulatory				
Short description	The rules distinguish between Hazardous Waste and other wastes, specify Waste Management hierarchy in the sequence of prevention, minimization, reuse, recycling, recovery, co-processing; and safe disposal. It governs waste generated in the dyeing industry					
Geographical coverage	All over India					
Maturity	Enforced since 2016					
Level of innovation	Governs waste generated in the dyeing units and others					
Textile Policy of Maharashtra, 2018 *(Cooperation, Marketing and Textile Department, Government of Maharashtra)*		Incentives				
Short description	Includes special incentives for textile projects to implement solar and wind energy projects. Special subsidy for spinning mills, power loom units to set up green projects					
Geographical coverage	Maharashtra					
Maturity	2018-2023					
Level of innovation	Net metering for renewable energy projects in textile units					
No Policies or Scheme in this segment						
Plastic Waste Management Rules 2016, amended in 2018 *(Ministry of Environment, Forest and Climate Change, GoI)*						
Short description	Rules for conversion of plastic waste to oil, road construction, waste to energy. Since the process involves pelletization of plastic waste like PET bottles so indirectly recycled plastic provides a way for the textile sector to shed some emissions every year. (As per some sources, 10 plastic bottles can produce1 pound of polyester fibre[11])					
Geographical coverage	All over India					
Maturity	In action since 2018					
Level of innovation	Secondary raw material in TVC					

Table 3: *Over-Arching EU Policies across the Textile Value Chain*

EU POLICIES (Policy Name, Year)		TYPE OF POLICY INSTRUMENT	TEXTILE VALUE CHAIN			
			Pre- Production	*Production*	*Consumption*	*End of Life*
Sustainable Products Initiative, 2022 *(European Commission)*		Proposed Regulation				
Short description	Focus on making products placed in EU market more sustainable by introducing additional legislative measures where necessary and revising the Ecodesign Directive					
Geographical coverage	Valid for EU member states					
Maturity	To be adopted between April-May2022					
Level of innovation	Product centric					
EU Strategy for Sustainable Textiles, 2021 *(European Commission)*		Strategy				
Short description	The strategy focuses on strengthening industrial competitiveness and innovation in the sector by improving the business and regulatory environment for sustainable and circular textiles, providing incentives and support to product as-service models, circular materials and production processes, and increasing transparency					
Geographical coverage	Valid for EU member states					
Maturity	Adopted on 30th March 2022					
Level of innovation	Identifies textiles as a priority sector in which the EU can pave the way towards a carbon neutral, circular economy					
Circular Economy Action Plan (CEAP), 2020 *(European Commission)*		Both legislative and non legislative in nature (broaden ecodesign framework, regulatory measures like extended producer responsibility)	Over-arching Policy			
Short description	It is one of the main building blocks of the EU Green Deal, with initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented, and the resources used are kept in the EU economy for as long as possible					
Geographical coverage	Valid for EU member states					
Maturity	Adopted in 2020					
Level of innovation	Entire Life Cycle of products considered					
EU Green Deal, 2019 *(European Commission)*		Strategy- set of legislations and policies to be developed in future for net zero emissions	Over-arching Policy			
Short description	Overarching Growth strategy to move to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution.					
Geographical coverage	For EU member states					
Maturity	Introduced in 2019					
Level of innovation	EU to be climate neutral continent by 2050					

EU POLICIES (Policy Name, Year)		TYPE OF POLICY INSTRUMENT	TEXTILE VALUE CHAIN			
			Pre- Production	*Production*	*Consumption*	*End of Life*
Revised European Waste Framework Directive (WFD), 2018 *(European Commission)*		Legislation for member countries, enforcement through taxation and fines				
Short description	As per the directive member states are obligated to collect textile wastes separately by 1 January, 2025. WFD has been enforcing directives since its inception in 2008.					
Geographical coverage	Valid for EU member states					
Maturity	Adopted in 2008, amended in 2018					
Level of innovation	Revised WFD establishes concepts and definitions related to waste management, recycling and recovery					
Textile Regulation (EU) No 1007/2011 *(European Parliament, Council of the European Union)*		Regulatory in nature on fibre composition in textile products				
Short description	The EU has aligned laws in all EU countries with Textile Regulation (EU) No 1007/2011 on fibre names and related labelling and marking of the fibre composition of textile products. According to the Regulation, textile products must be labelled or marked indicating of the fibre composition of a product whenever they are available in the market for EU member states					
Geographical coverage	Valid for EU member states					
Maturity	Introduced in 2011, amended in 2018					
Level of innovation	Clearly established regulation and fully operational					
REACH Regulation, 2007 (European Parliament, Council of the European Union)		Regulatory in nature				
Short description	European Chemical Agency addresses the information availability on the properties and hazards of substances and sets restrictions on the use of chemicals in process and products. As per the regulation, textile companies have to comply with a number of provisions including, limitation in the use of substances, exchange of information across the value chain, registration of substances (occasionally) and communication to customers for EU member states and countries from which importing. Clearly established regulation and fully operational					
Geographical coverage	Applicable in EU, has implication on global network connected to import of products to EU					
Maturity	In effect since 2007					
Level of innovation	To ensure a high level of protection of human health and the environment					
Green Button (Germany), 2019 (Federal Ministry for Economic Development and Cooperation, Germany)		Voluntary, Social & Environmental Compliance Standard				
Short description	Government-awarded certification label for making sustainably produced clothing easily recognizable					
Geographical coverage	Germany					
Maturity	Introduced in 2019					
Level of innovation	Covers 46 stringent social and environmental criteria					

EU POLICIES (Policy Name, Year)		TYPE OF POLICY INSTRUMENT	TEXTILE VALUE CHAIN			
			Pre- Production	*Production*	*Consumption*	*End of Life*
The Partnership for Sustainable Textiles (Germany) 2014 *(The Federal Ministry for Economic Cooperation and Development, Germany)*		Partnership/ Multi stakeholder Initiative				
Short description	It's a commitment to implementing due diligence in the textile industry and work on improving the social and environmental production conditions across the entire supply chain					
Geographical coverage	Germany *(Close to 130 member organisations from five stakeholder groups -German Federal Government, business, nongovernmental organisations, trade unions and standards organisations)*					
Maturity	Established in 2014					
Level of innovation	Strategic Cooperation across global supply chains					
Anti-waste law and the circular economy (France), 2020 *(France)*		Legislation enabling reduction in wasteful production and disposal				
Short description	This law requires producers to donate, unsold non-food goods that do not pose a health or safety risk. It also has a polluter pays clause, which requires companies to finance the destruction of waste that they create					
Geographical coverage	France					
Maturity	Adopted in 2020					
Level of innovation	Requires companies to finance the destruction of waste that they create					
The Triman Pictogram (France), 2014 *(French Decree No. 2014-1577)*		French Decree No.2014-15733, mandatory marking of all recyclable products including clothing textiles				
Short description	Guiding and informing consumers on the sorting rules a product is subjected to and indicating the type of self-deposit collection points to use					
Geographical coverage	France					
Maturity	Introduced in 2014, from January 2022 the Triman Logo needs to be printed on all packaging in France					
Level of innovation	Mandatory					
Extended Producer Responsibility (EPR), 2007 *(France)*		Regulatory				
Short description	Managing post-consumer textiles by boosting textile sorting, re-use and recycling via regulatory measures as EPR					
Geographical coverage	France					
Maturity	Present in France since 2007, proposed to enter in Netherlands by 2023					
Level of innovation	Involving textile producers to assume the costs of collecting, treating, and recycling their end-of-life products					

EU POLICIES (Policy Name, Year)		TYPE OF POLICY INSTRUMENT	TEXTILE VALUE CHAIN			
			Pre- Production	*Production*	*Consumption*	*End of Life*
Circular economy in the Netherlands by 2050, 2016 *(Ministry of Infrastructure & Water Management, Ministry of Economic Affairs & Climate Policy)*		Innovative, Regulatory Plan	Over-arching Policy			
Short description	Includes smart design, conscious use, more and better reuse, 50% less raw material in 2030 for Netherlands, amongst pioneering EU nations where it had been instituted initially					
Geographical coverage	Valid for Netherland					
Maturity	Adopted in 2016					
Level of innovation	Government wide Circular Economy Programme					
VANG Domestic Waste Value Chain Approach, 2016 *(Dutch Ministry of Infrastructure and the Environment, Netherlands)*		Policy				
Short description	Proposed to extend to textile sector by 2025 addressing textile waste disposal					
Geographical coverage	Valid for Netherlands					
Maturity	Adopted in 2016					
Level of innovation	Primarily aimed at reducing the use of raw materials					
ITALY National Bioeconomy Strategy, 2017 *(Presidency of the Council of Ministers, Italy)*		Strategy, Research & Development in the field of Bio textiles and bio based apparel	Over-arching Policy			
Short description	Overarching strategy for reconnecting economy with environment and society and reconciling technological advances with conservation of ecosystems (Research and development focus)					
Geographical coverage	Valid for Italy					
Maturity	Adopted in 2017, updated in 2019					
Level of innovation	In line with EU Bioeconomy action plan					

2.3 Policy Gaps

The Indian textile industry can benefit immensely from a fundamental restructuring towards a low-emission, climate-resilient, resource-efficient, and socially inclusive approach. The value chain approach has been used to evaluate the policies and strategies. Starting from the production of cotton and MMF through the various stages of textile production, natural resources are consumed. Energy consumption and hazardous chemicals consumption are a part of various processes; hotspots have been identified through the stages of production to assess environmental impact.

The various policy initiatives discussed under Indian policies are primarily in the first two stages of the life cycle namely fibre production and textile production stages as observed from the tables in the previous section. This is because India is the global leader in these two stages and its policy focus has been on increasing fibre yield and textile production for fostering economic growth. Initiatives like better cotton **(BCI)** address reduction in environmental impact in cotton fibre production to an extent as the water use efficiency and reduction in chemical fertilizer consumption. Similarly, some policies on **ZLD** exist in the textile industry to reduce pollution in the adjoining streams and rivers.

Better Cotton Initiative (BCI) is a multistakeholder group with presence in 21 countries which grow cotton and the initiative works with cotton growing farmers to promote water use efficiency, soil health, minimise impact of harmful pesticides, fertilizers through organic substitutes, preserve fibre quality.

Zero Liquid Discharge (ZLD) is a good practice introduced due to the policy initiative of MoEFCC in 2015 to create a balance between water consumption and waste water recycle and reuse in the textile industry in India. This is to be practiced in units which generate waste water quantity greater than 25 kilolitres per day (KLD), Tirupur cluster is one of the first to have adopted it.

Policies exist at state level to implement renewable energy initiatives and agriculture residue to energy conversion initiatives; however, a sustainability framework which covers the textile value chain from end to end is the need of the hour. There are certain private initiatives like Greenco rating from confederation of industries (CII), the rating has been developed to capture initiatives on improving environmental performance of industries.

The Greenco rating system is a voluntary rating system initiated in 2016 which aims to promote conservation of natural resources in different industrial units where companies based on their environmental performance across nine parameters, which include energy efficiency, water conservation, renewable energy use, waste management are given a rating.

As per European Environment Agency (EEA) Report on Sustainability transitions: policy and practice, fundamental transformation of core societal systems is imperative for long-term sustainability transitions. The Indian Policy space may take inputs from the report and strive at creating an integrated and systemic policy framework while acknowledging multi-causality and systemic causes in the sustainability challenges. Tackling the core drivers of environmental degradation requires a broad policy mix[56], involving enabling innovation, experimentation, diffusion and networking, as well as facilitating structural economic change. An Integrated Approach to building circular systems across the textile value chain (by aligning policy goal with local contexts) is not visible in the Indian textile industry. This would involve designing an effective policy framework by addressing upstream and downstream dimensions of textile production. A comparison of the broad policy framework in India and EU is presented in *Table 4*. Through remarks it highlights the gaps in existing Indian policies and contributions that can be from EU policy framework.

Table 4: *Comparison of Indian and EU policies along with gaps identified*

Phase	India		EU	
	Policies	**Remarks**	**Policies**	**Remarks**
Over-arching	Draft National Resource Efficiency Policy, 2019 **Action Plan**: Not available	▪ Textile sector yet to be included ▪ Target indicators yet to be decided	EU Green Deal, 2019 **Action Plan**: Circular Economy Action Plan (CEAP)	Target metrics specified
Pre-Production	**Fibre production: India's National Fibre Policy 2010-11** **Allied:** ▪ Agriculture: ✓ Rashtriya Krishi Vikas Yojana, ✓ Paramparagat Krishi Vikas Yojana ✓ National Mission for Sustainable Agriculture ▪ Environment: Pesticide Management Bill **Action Plan**: Not available	▪ Cotton cultivation is part of the mission, not exclusively dealt with. ▪ Sustainable cotton production is the main theme. ▪ No focus on labelling and marking of fibre composition of textile products.	▪ **EU strategy for sustainable textiles, 2021** ▪ **Sustainable Products Policy** ▪ **REACH Regulation** (Registration, Evaluation, Authorisation and Restriction of Chemicals)	Focus on labelling fibre composition including recycling fibre use as part of ecodesign.
Production	**PM (MITRA) Mega Integrated Textile Regions and Parks, 2021** **National Technical Textiles Mission, 2020** 1. **ATUFS** (Amended Technology Up Gradation Fund Scheme) 2. **PowerTex India** (adoption of modernization and technological up gradation) 3. **SAMARTH** (Scheme for Capacity Building in Textile and Apparel Sector) 4. **Integrated Processing Development Scheme (IPDS)** **Hazardous Waste Management Rules, 2016**	▪ All stages of TVC shall be at one place. ▪ Setting up of renewable energy facilities, CETP and waste recycling facility. ▪ Reduction in pollution and improvement in surrounding ecosystem ▪ Application of cleaner production technologies. ▪ Use of less hazardous chemicals	▪ **REACH Regulation**	REACH is a legislative instrument in EU Green Button is government certification
Consumer	**GreenCo Rating, CII, 2016**	No government rating systems like Star rating Scheme (for energy efficiency) with a focus on manufacturing sector	▪ **The Partnership for Sustainable Textiles** (Germany) **2014** ▪ **Green Button** (Germany) ▪ **The Triman Pictogram** (France)	Commitment to implementing due diligence in the textile industry and work on improving the social and environmental production.
End of Life	**Plastic Waste Management Rules, 2016, amended in 2018**	Devised to reduce plastic waste going to landfills and focuses on recycling and reuse of plastics, as yet not adopted for textile waste.	**Revised European Waste Directive Framework 2018** **VANG Domestic Waste value chain approach-** (Netherlands)	▪ EU member states are obligated to collect textile wastes separately by 1 January 2025. ▪ The EU Waste Directive plans to cut down textile waste to half by 2030 via the Green Deal.

3. Impact Assessment Of Resources Utilization In Indian Textile Production Systems

The fibre used to produce textile fabric is primarily derived from cotton cultivation and MMF (predominantly polyester from petrochemical producers). Though there is a rise in blended fabric manufacturing, yet the two mentioned are the most common sources of fibre. The textile industry is essentially spread across Maharashtra, Gujarat, Tamil Nadu, Punjab, Haryana and Rajasthan (*Figure 5*).

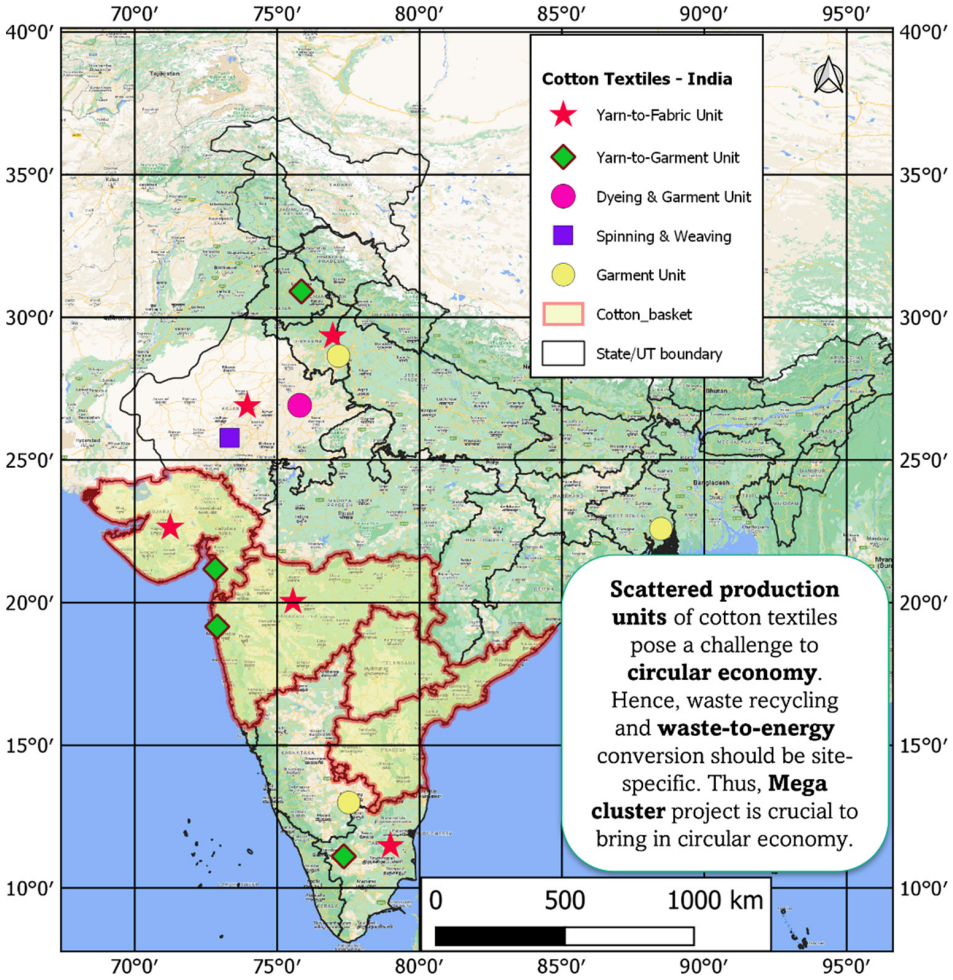

Figure 5: *Cotton cultivation and textile units in India (based on inputs from IBEF, 2021[12])*

The yarn manufacturing (spinning industry) is mostly found in Maharashtra which is an energy intensive industry while weaving and dyeing and finishing (water intensive and energy intensive) is decentralised and located in the other mentioned states. In order to assess the need for resource efficiency - analysis of energy footprint, water footprint and GHG emissions are presented in the subsections below.

3.1 Energy Footprint

Through secondary literature review, some primary data sources and stakeholder roundtable, it emerged that the resource requirement is different in different stages of production. The yarn stage is energy intensive, though the exact number of spinning mills in Maharashtra is not known, however, use of solar power and agriculture residue like rice husk for energy are known to reduce the energy uptake from thermal power plants and thus reduce its carbon footprint. Similarly, weaving and chemical processing and finishing stages are also energy intensive. The total energy footprint during the production phase of textiles can vary from **160 - 450 MJ/kg** depending on the density of yarn, as reported from secondary literature and stakeholder consultation. This needs to be further validated through more rounds of consultation with stakeholders from geographically different parts of the country.

Good practices like use of solar energy, wind energy, low sulphur diesel, agriculture residue exist in different phases of the production cycle have been introduced as evident from primary data collected from different phases of the textile industry, however, there is no fixed proportion or quantities set on the use of renewable energy or agriculture residue. As an example of good practice, quantification of agriculture residue needed for conversion to energy, may be estimated to maintain regularity in from agriculture surplus states to agriculture deficient states like Gujarat and Rajasthan for agriculture residue supply chains to be established. Though energy consumption in the cotton cultivation phase is available, the energy consumption in the petrochemical producer's phase is not available and thus it is not included or compared.

3.2 Water Footprint

In case of the water consumption, 60% cotton is grown in rainfed areas (south and central India) with low productivity. With irrigation, the cotton yield has increased in states like Gujarat and Andhra Pradesh and in these areas water consumption is high. The largest cotton growing state is Maharashtra in terms of area, Gujarat, Telangana and Andhra Pradesh are the other major cotton growing states. The water consumption for growing cotton is known to vary between **7000-8000 L/kg** of cotton fibre, depending upon water use efficiency. The consumption of water in the petrochemical refinery to produce manmade fibres is not known clearly, though literature suggests that it is quite high.

The water consumption in yarn production stage, mechanical spinning and weaving stage is low and varies from **2.25 - 5.5 L/kg** (if with ZLD and recycling coexist as collected from industry stakeholder). The water consumption in textile production is highest for wet processing and dyeing and known to vary from **80 - 225 L/kg in wet processing including dyeing** but better technology and management may reduce it to **15 L/kg** (with reuse, recycling, CETP and ZLD in place as collected from industry stakeholder). In case of MMF fabric the consumption is similar, except that in case of polyester dyeing it needs a little less water.

3.3 Carbon Footprint

The carbon footprint of cotton fibre is **5-6 kg CO_2eq /kg**[13], the equivalent MMF fibre carbon footprint is not known in India. The carbon footprint of cotton fabric in production stage may vary from **8-22 kgCO_2eq /kg**, with **5.6 kg CO_2eq /kg** reported as best practice[14]. The carbon footprint of polyester fabric is known to be higher that cotton fabric from industry sources (exact figures could not be found from the industry). This information was obtained through secondary literature review, and consultations with a few industries involved in different stages of production in different geographical locations and are hot spots of the production process.

The above figures have been chosen as they have introduced good practices either to reduce their water footprint, introduced green chemistry to reduce harmful effects of chemicals or have introduced renewable energy and waste to energy mechanisms to reduce their energy footprint. Reduction of both water and energy (produced by burning coal in thermal power plants) footprints reduces carbon footprint too. However, most industries in the TVC are not measuring GHG emissions/carbon footprint yet. Validation of the hotspots and challenges to sustainability initiatives had been provided during the roundtable with industry stakeholders. Challenges in the TVC in India are related to the different processes of the TVC being located at different geographical locations, with different water resources allocation, different energy incentives and differing availability of raw material. In order to arrive at more decisive values of the footprints a few more round of stakeholder workshops, participation from different hotspots in TVC and government is needed.

4. Policy Recommendations And Way Forward

The textile cluster map of India (*Figure 5*) highlights the distributed nature of the Indian Textile Industry and how any resource efficiency policy framework must introduce circularity in these areas specifically. The power consumption, water consumption and the raw material consumption are also the highest in these four-five states.

There is a need for mandating resource efficiency targets with monitoring and reporting systems in the various stages of production in the TVC. In order to do so it is important to measure the energy use, water use and carbon footprint of each stage of production. The textile waste at each stage of fibre, yarn and fabric production must re-enter the TVC at that stage itself. Some studies say that material waste of 25% is generated at each stage of production and it must be reduced to 5%. The draft national resource efficiency policy, 2019 which is an overarching policy on resource efficiency does not include textile sector as yet. It is recommended that the textile sector is included on priority basis so that textile waste generated at each stage may be reutilised as secondary raw material. The coherence in policy may be achieved if MoEFCC works in close coordination with the Ministry of Textiles and the industry stakeholders. *Figure 6* below highlights the policies which will help in introducing circularity in the TVC in different phases of the TVC.

Circular Economy for Sustainability

Linearity in Indian textile sector needs **cross-cutting initiatives at all stages:**

- **PM (MITRA) Mega Integrated Textile Regions and Parks, 2021**
  - ✓ All stages shall be at one place.
  - ✓ Setting up of waste recycling facility.
  - ✓ Application of cleaner production technologies.
  - ✗ Geographically scattered production units pose a challenge in setting up.
- **Plastic Waste Management Rules, 2016, amended in 2018**
  - ✓ Recycling of MMF fabric.
  - ✗ Mainly focuses on plastics.
- **GreenCo Rating, CII, 2016**
  - ✓ Supports circularity through improved resourced efficiency.
  - ✗ No fiscal benefits yet for following GreenCo rating, voluntary and awarded by CII.

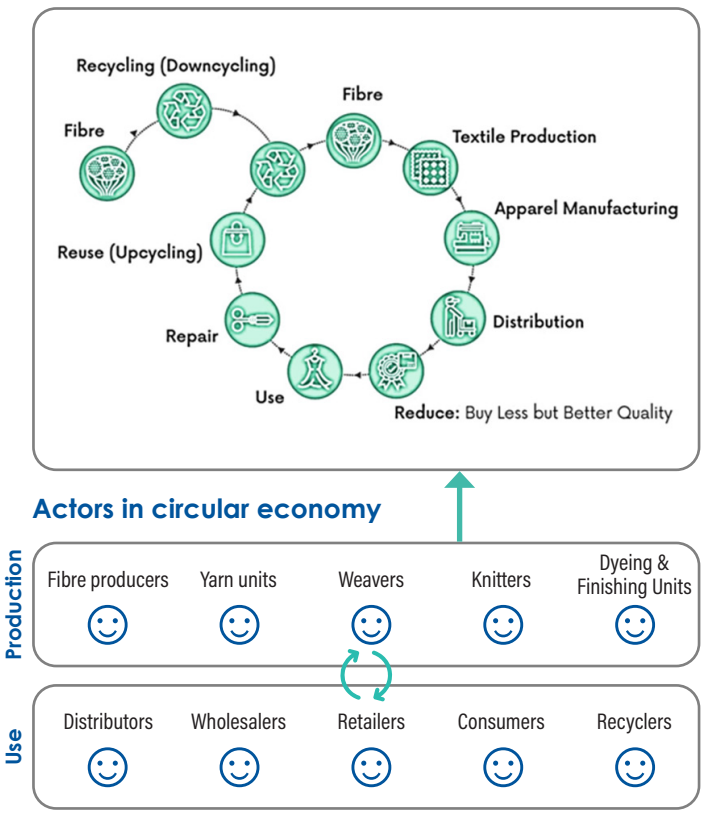

Figure 6: *Role of circular economy and polices for sustainability in Indian textiles (based on inputs from Ethical Fashion[15])*

Some processes in the TVC are energy intensive while others are water intensive or both and they are all connected to carbon emissions. The footprint estimations have been reported on per kg of fibre and per kg of fabric basis, exact estimates on the mill capacity and the total footprint will be significant. In order to reduce footprint of the industry and reduce material waste at each stage of production, circularity may be introduced by increasing uptake of waste as secondary raw material. More multistakeholder consultations are needed in different regions and in different stages of the TVC to understand the challenges to sustainability transitions and devising sustainability transition plans supported by government policy. For example, adoption of cleaner technologies for dyeing and finishing industry will need funding support from the government or creation of a green financing mechanism.

There is also a need for policy initiatives for Recycling and Reuse in the Textile sector which can bring about natural resources conservation through resource reuse and recycling. The policy will show the road map for industry level audits in different stages of the TVC. Performance indicators for measuring resource efficiency in the TVC is needed in India and a few like energy use efficiency, water use efficiency, renewable energy use, water recycling and reuse, waste to energy, recycling of pre consumer textile waste have been identified through a few primary data collected from industries which have adopted best practices. A monitoring mechanism also needs to be set up.

The geographically distributed nature of the textile industry means that cluster sustainability plans (to be suggested within the state textile policy) are needed to address introduction of new and renewable energy sources for the various stages of production. Since the state textile policies help in implementation of the state's vision for the textile industry and they are generally for a five year period, incentives may be introduced for renewable energy use, waste to energy use and adoption of

cleaner technology, consent from all industries to participate in the ZLD-CETP facility for wastewater treatment and reuse.

The spinning mills and the dyeing and finishing processes cluster need continuous power supply and the alternate power sources (through agriculture residue, waste to energy and solar/wind) would need to be identified and planned capacities would need to be developed before phasing out coal based and oil-based power plants. Technology upgradation for such systems would need to be incentivised and well received by all industries in the cluster. The ZLD and CETP plan for dyeing industries is known to be successful in the Tirupur cluster of Tamil Nadu for recycling and reuse of water (wherein no effluent is allowed to be discharged in the river) and will help the Noyyal river basin to be restored by 2030. The adoption of sustainability plans in clusters of west and south India will reduce carbon footprint significantly. Plans till 2030 should be devised clearly giving guidelines for reduction in emissions adopting/enhancing waste to energy models substantially by 2050.

It is recommended that in order to reduce the post-consumer textile waste reaching the landfill in big cities (at present there is no policy to prevent or reduce the textile waste reaching the landfill), the plastic waste management rules, 2016 include textile waste, this will help reduce the burden of polyester fabric reaching the landfill (this is needed as it is not biodegradable) and allow/ incentivise its reuse in the TVC

Announcement of PM MITRA is a progressive step for setting up new integrated textile parks, but upgradation of existing clusters with cleaner technology, reuse of textile waste will be needed to reduce their carbon footprint.

This study has looked at various policies and resource consumption in those stages of the TVC which are identified as hotspots in terms of environmental impacts. The way forward would be to take the recommendations of this report as the starting point for carrying further studies region wise and sector wise in the TVC. The various footprints, namely, carbon footprint, GHG emissions, water footprint and energy footprint need to be measured, monitored, only then target footprint may be set. The various recommended policy initiatives will then help in achieving circularity and sustainably in the TVC.

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