FASHION FOR GOOD
SORTING FOR CIRCULARITY: INDIA

WEALTH IN WASTE

INDIA'S POTENTIAL TO BRING TEXTILE WASTE BACK INTO THE SUPPLY CHAIN

TECHNICAL APPENDIX

JULY 2022

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Study Approach and Research Methodology

Research aims and objectives

This study is the first in-depth attempt to understand the current textile waste material flow in India. Moreover, the report aims to identify technologies that can assist in mapping and sorting of waste to address the challenges in India, and then pilot the solutions to prove the efficacy of the technologies identified. The objective of the study is to build a roadmap for the implementation of these solutions along with brands, manufacturers, recyclers and other stakeholders of the industry. The study was undertaken keeping the three waste streams - pre-consumer, imported and domestic post-consumer in mind.

Team and Roles

Project Orchestrators	Study Co - Lead (Pre - Consumer)	Study Lead (Post -Consumer Domestic)	Study Coordinators Lead (Post -Consumer Imported) Co - Lead (Pre - Consumer)

The project was initiated by Fashion For Good, a global platform for innovation. FFG unites the entire fashion ecosystem, from brands, manufacturers and suppliers, to consumers, to collaborate and drive the change towards a circular industry. In this project, FFG served as an orchestrator and convener for all relevant stakeholders, while also producing communication output.

Sattva Consulting co-led the pre-consumer Waste Stream and led the imported waste streams. Sattva is an organisation driven by the mission to end poverty in our lifetime. Our work focuses on scalable solutions for sustainable social impact. They were responsible for the project coordination and consolidated analysis and reports from all workstreams and drafted the final report.

Saahas Zero Waste, a social enterprise, led the domestic post-consumer waste stream, capturing Bangalore and Delhi. They provides end-to-end waste management services and bring about environmental & social impact based on the principles of circular economy and global commitment to Sustainable Development Goals (SDG).
Reverse Resources co-led the pre-consumer, rolled out surveys and analysed data for the report. They are the innovators for the pre-consumer workstream of the project and will be working with FFG to conduct the pilot.

Research Methodology

Sattva's team conducted both primary and secondary research to understand the quantum and categories of waste. For the pre-consumer and imported waste streams, in-depth interviews were conducted with 120+ stakeholders in the value chain including traders and recyclers. The data was collected from several cities in the country including Ahmedabad, Amroha, Amritsar, Bangalore, Coimbatore, Delhi/NCR, Gandhidham, Kandla SEZ, Ludhiana, Mumbai, Panipat, Surat, Trirupur. A total of 12 re-users, 46 recyclers, 62 collectors, sorters and handlers, 12 textile manufacturers, 11 waste importers and 2 brands across all cities were interviewed for the research. For expert consultations, 8 distinguished personalities from the sector were consulted. In order to gather secondary data for imported waste streams, the UN Comtrade Database for the year 2020 was used to analyse the quantum of waste imported to the country from various parts of the world.

Saahas Zero Waste's survey team conducted desk based secondary research and reviewed existing secondary data available in the public domain such as research papers, government reports and studies, relevant laws, policies and guidelines applicable on a national and relevant state and city level, reports or scoping undertaken by credible agencies among others including data available with FFG relating to post consumer textile waste. They then identified the relevant stakeholders, conducted consumer disposal surveys and in-depth interviews along with site visits to understand the segregation levels, collection and transportation systems including primary collection from different waste generators and secondary transfer, processing and final disposal of textile waste, market linkages for end products for textile waste management systems. The data sets were reviewed and consolidated for the analysis phase.

In order to understand consumer disposal behaviour, a consumer survey of 570 consumers majorly from Delhi and Bangalore was done. Additionally , the Saahas Zero Waste team also conducted an in-depth analysis of 7999 garments collected from Residential Welfare Associations at a Saahas Zero Waste (SZW) facility, and Banashankari ward in Bangalore.

Reverse Resources used primary and secondary data to analyse the quantum and categories of pre-consumer textile waste in India. The quantitative data was collected from a sample of factories that received a link to the RR Platform from the Sattva team. The data was accumulated in the RR database and analysed accordingly.In addition to this the RR team used existing industry data and expertise to complete the data analysis and make sure it is within industry standards (as a means to compensate for the small sample size). Subsequently a data model was built covering main aspects of the Indian textile and garment industry (fibre composition usage, knit-woven industry split, waste/material ratios, et al.)

In order to understand the volume of textile material (fibre, yarn, fabric) being produced, imported, and transformed in the country RR used the UN Comtrade Database. From this database, the 2019 data was considered since it was the last full year of trading which was not affected by the Covid pandemic.

Waste/material ratios derived from the data model are then used with the secondary data to estimate the volumes of waste generated at each production process. All volumes and final estimates are represented on the Sankey diagram which displays yearly Ktons of material based on 2019 data.

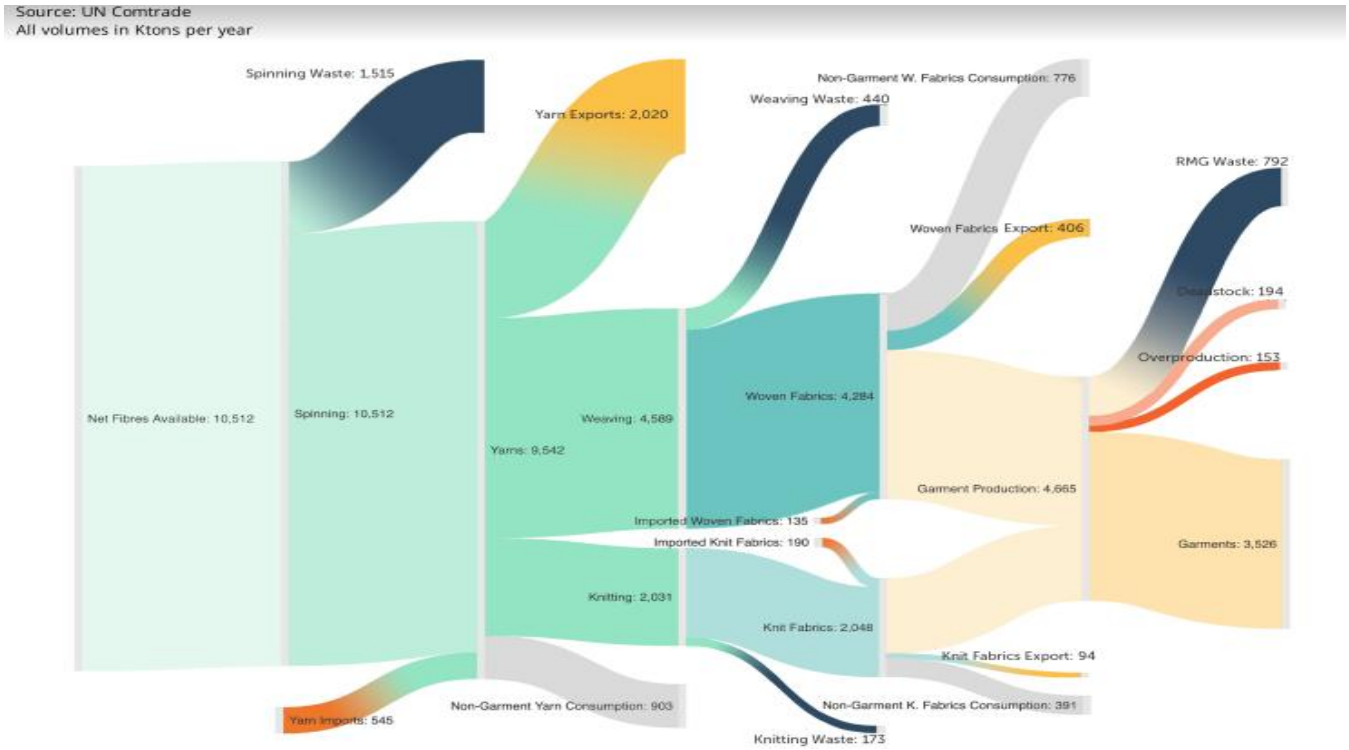
Key Research Areas

The research deep dives into the following thematic areas:

- Types and composition of textile waste
- Quantity and quality of textile waste
- Geographies of concern (waste generated, procured, sold, handled, sorted and processed)
- Market for recycled, upcycled and downcycled products
- Value chain analysis: Stakeholders involved in generating, procuring, selling, handling, sorting & processing the waste
- Analysis of waste processing technologies and infrastructure
- Supply-demand analysis of wastes
- Policy analysis: regulations, policies, state or national schemes
- Costing and price analysis
- Opportunity analysis: gaps, challenges and best practices

Calculations for total quantity of waste in India

Total textile and apparel production in India:
(Calculated through primary and secondary sources on Reverse Resources platform)



Pre-Consumer waste in India:

Pre Consumer	Ktons	Source of information	Assumptions
Spinning waste	1,515.20	Calculated based on manufacturers survey filled on Reverse Resource's platform	Based on industry understanding, 75% of the yarn production in India is of cotton and cotton blends. Cotton spinning process has an efficiency of 80% on an average, leading to waste of 18-20%. This cotton spinning waste has been added with waste generated in synthetic and man made cellulosic yarn productions. This brings the overall percentage to 14.4% of the total spinning production.
Mill waste	612.2	Calculated based on manufacturers survey filled on Reverse Resource's platform	Takes into account both knitting and weaving processes. Rejected fabrics are accounted for here but overproduction of fabrics is not seen in the industry usually at a mill level.
RMG waste	792.2	Calculated based on manufacturers survey filled on Reverse Resource's platform	Manufacturing factories quoted 15-25% of fabric is lost during the cutting process. After normalising with industry standards ~17% was taken for calculations.
Overproduction (garments)	152.5	Calculated based on manufacturers survey filled on Reverse Resource's platform	It only takes into account overproduction of apparels in the apparel manufacturing units. This includes export surplus garments. Overproduced fabrics are not included in this.

Deadstock	193.6	Calculated based on manufacturers survey filled on Reverse Resource's platform	It includes the excess fabric procured by apparel manufacturers but not used. This fabric is greater than 1m in length.
Total	**3,265.70**		

Domestic Post-Consumer waste

According to the primary research, domestic post consumer waste is collected in three major ways:

- Through door to door waste collection by municipal corporations
- Through Waghri community/informal collectors
- Through NGO donations

To calculate the total domestic post consumer waste, waste collected by each collection method has been estimated and aggregated.

Two collection methods have been kept out of scope for the study:

- Take back programs by brands: It is a very niche segment in the country today and the volumes are not expected to be high enough.
- Domestic donations to family, friends, house helps or any other individual channels: This number is difficult to measure. Also, this material is still considered to be in use and can't be classified as waste.

Waste collected by Municipal Corporations

Particulars	Quantity	Source of information	Assumptions
Total Municipal waste collected in India per day	1,50,761 tons	CPCB Annual Report on Solid Waste Management 2019-20	No assumptions
Amount of textile waste in municipal waste	5%	Secondary literature	
Amount of textile waste collected through municipal collection system (per day)	7538 tons per day	SZW and Sattva analysis	Taken at 2020 level
textile waste collected through municipal collection system (annually)	2751.37 ktons	SZW and Sattca analysis	Calculated for 365 days

Waste collected by NGOs

This report takes into account waste collected by only 6 NGOs that were studied during the project. The total collection by NGOs in India is expected to be greater than this.

Name of NGO	Estimated PCD garments collected annually	Quantity of Waste in Kgs collected annually	Quantity of Waste in kTons collected annually	Source	Assumptions
Goonj	2680000	1072000	1.28	Primary Data collected from NGOs by SZW	- Each clothing weighs 0.4 kgs - Three NGOs in each city collect waste - The sample is representative of the country - 1 kg = 0.0012 US tons - Detailed calculations for Goonj can be found in Annexure 5
Clothes collection box	521739	208695.6	0.25	Primary Data collected from NGOs by SZW	- Each clothing weighs 0.4 kgs - Three NGOs in each city collect waste - The sample is representative of the country - 1 kg = 0.0012 US tons
Sewa bharti	38488	15395.2	0.01	Primary Data collected from NGOs by SZW	- Each clothing weighs 0.4 kgs - Three NGOs in each city collect waste - The sample is representative of the country - 1 kg = 0.0012 US tons

Imagine	50000	20000	0.02	Primary Data collected from NGOs by SZW	- Each clothing weighs 0.4 kgs - Three NGOs in each city collect waste - The sample is representative of the country - 1 kg = 0.0012 US tons
Restore	10435	4174	0.005	Primary Data collected from NGOs by SZW	- Each clothing weighs 0.4 kgs - Three NGOs in each city collect waste - The sample is representative of the country - 1 kg = 0.0012 US tons
Swabhiman	52174	20869.6	0.02	Primary Data collected from NGOs by SZW	- Each clothing weighs 0.4 kgs - Three NGOs in each city collect waste - The sample is representative of the country - 1 kg = 0.0012 US tons
Total	**3352836**	**1341134.4**	**1.60936128**		

Waste collected by *Bartanwalas*

Particulars	Data Point	Source of information	Assumption
Waghri Population	653000	Secondary resources on community population	This is the only source of this community's population size. It is assumed that this is the largest community involved in this waste collection.
Average household size	5-8 members	Secondary literature	None

No of family members involved in waste collection	2	Primary research by SZW team	From primary research, it has been understood that 1-2 members from a family are involved in collections while all others are involved in sorting and selling activities.
No of garments collected by each collector per day	50	Primary research by SZW team	It was understood that 30-100 pieces are collected by each collector daily. For the calculations, 50 has been used.
Total number of garments collected by Vaghri community daily	8162500	SZW and Sattva analysis	2 out of 8 community members collect 50 garments daily
Total weight of garments collected annually (in k tons)	1190.3 k tons	SZW and Sattva analysis	365 days of collection considered. 1kg=0.0012tons and weight of garment=0.4kg

Total Domestic Post-Consumer Waste:

Waste Collected	KTons
Municipal waste	2751.3
NGOs	1.6
Bartwanwalas	1190.3
Total	**3943.3 k tons**

Imported Waste:

Particulars	Data points	% of total Imported Waste	Source of Data	Assumptions	Any other comments
Quantity of second hand clothing/worn clothing imported	184 ktons	31.5%	Comtrade Data (2020) for HSN Code 6309 (Worn Clothing)	2020 has been an exceptional year due to the pandemic. However, it has changed how the import business was structured. Hence 2020 has been considered as a data point as future trends are expected to be similar.	HSN Code 6309: Worn clothing and clothing accessories, blankets and travelling rugs, household linen and articles for interior furnishing, of all types of textile materials, incl. all types of footwear and headgear, showing signs of appreciable wear and presented in bulk or in bales, sacks or similar packings (excluding carpets, other floor coverings and tapestries). 6309 is a restricted code, allowed for imports only in regulated areas.
Quantity of mutilated Rags imported	400	68.4%	Comtrade Data (2020) for HSN Code 6310 (Mutilated rags)		HSN Code 6310: Used or new rags, scrap twine, cordage, rope and cables and worn-out articles thereof, of textile materials. However, during primary research mutilated/non wearable clothing was also seen being imported under this code.
Total imported waste	**584**				

Source: : Comtrade Data (2013-2020) for HSN Code 6309 (Worn Clothing) & HSN Code 6310 (Rags)

Total Textile waste in India:

Waste stream	KTons
Domestic pre consumer	3,265.70
Domestic post consumer	3943.3
Imported waste	584
Total	7792.98

Waste stream-wise % of total waste

Pre Consumer (Source: RR data)	Ktons	%of total pre consumer	% of total waste
Spinning waste	1,515.20	46.40	19.44
Mill waste	612.2	18.75	7.8
RMG waste	792.2	24.26	10.1
Overproduction	152.5	4.67	1.95
Deadstock	193.6	5.93	2.48
Total	3,265.70	100%	

Waste Collected	KTons	%of total domestic post consumer	% of total waste
Municipal waste	2751.37	69.76	35
NGOs	1.61	0.04	0.02
Bartwanwalas	1190.77	30.19	15.28
Total	3943.76		

End use split of textile waste in India

Pre consumer waste:

Spinning Waste: (1515.2 ktons)

Cotton spinning waste:

As suggested through Reverse Resources survey,

- Total spinning production in India is 10522.2k tons
- Given 75% of this production is cotton yarns (including cotton blend yarns), total cotton yarn production is 7891.67 k tons

As identified from secondary and primary sources following types of waste are generated in cotton spinning process:

Type of waste	% of production	Average % used for calcs	Quantity in k tons	Application	Source and assumption
Blowroom waste	3%	3%	118	Recycled into coarser yarns	Sattva primary interviews with waste traders and recyclers
Carding waste	3-10%	6.50%	237	Recycled into coarser yarns	Sattva primary interviews with waste traders and recyclers
Combing process	10-18%	14%	789	Recycled into finer quality yarns	Sattva primary interviews with waste traders and recyclers
Pneumafil waste	1.5-2.5%	2%	118	Recycled into finer quality yarns	Sattva primary interviews with waste traders and recyclers
Yarn waste	1-4%	2.50%	79	Recycled as well as downcycled	Sattva interviews and secondary research suggested that with technology upgrades, yarn waste has started getting used in OE spinning but there exist downcycling use cases as well. Hence for calculation purposes, 50% has been considered under recycling and 50% under downcycling
Sweep Waste	1%	1%	79	Downcycled into fillers	Sattva primary interviews with waste traders and recyclers

Total cotton spinning waste	-	-	1421	-	-

Remaining ~95 ktons is the waste generated from spinning of other materials and as per interviews, it is downcycled.

Cutting waste (792.2 K tons)

RMG Cutting waste is broadly divided into 2 categories:

- Bigger cut panels, end rolls and longer strips: Survey and interviews suggested that this waste ranges from 10-25% but is mostly discarded by the manufacturers as mixed cutting waste. For the purpose of this study, it has been considered to be 18% as a median value.
- Smaller cuttings form the remaining 82% of this waste.

Type of waste	% of production	Average % used for calculations	Quantity in k tons	Application	Source and assumption
Bigger cut panels, end rolls, long strips	10-25%	17.50%	138.6	Reused for making other garments or textile products	Sattva primary interviews with waste traders and recyclers
Smaller cutting	75-90%	82.50%	653.6	Has applications across	Sattva primary interviews with waste traders and recyclers. Detailed out in further sections

Smaller cutting waste:

- Recycling application: Three major clusters of this recycling were found through the study
    - Panipat:
        - Known to recycle 2000 tons of waste per day (told in interview by the owner of a recycling company in Panipat who was also the former chairman of Haryana Chamber of Commerce, Panipat chapter, and president, Northern India Roller Spinners' Association
        - Out of this 15% is from domestic pre consumer waste and rest is imported waste
        - With this calculation, Panipat recycles 90 k tons of waste annually

- Tirupur:
  - Known to recycle 1500 tons/month (told in interview by an official of Open end spinning mill association)
  - As per this calculation, Tirupur recycles 18 k tons of waste annually
- Amroha:
  - Amroha has 200 units dealing with an average of 75 tons of waste monthly (as told by the owner of a 3 recycling units in Amroha)
  - By this calculation, the city deals with 180 k tons of waste annually. However, only 20% of this waste is known to be sent for recycling into yarn.
  - Amroha recycles or sends 36 k tons for recycling
- Usha yarns:
  - It is one of the biggest recyclers in India and is not located in these clusters. It alone deals with 8.4 k tons of waste (based on their website and data collected through primary interviews)
- Sulochana yarns:
  - It is located in the Tirupur cluster but recycled through ring spinning (and not open end spinning). It is known to deal with 0.88 k tons of textile waste annually. (Based on primary interviews)

Through all these calculations, India is expected to recycle 153.28 k tons of domestic pre consumer cutting textile waste annually. This number is expected to include some amount of mutilated waste imported from Bangladesh and being recycled in Tirupur. However, it excludes the recycling happening in other parts of the country like Mohali, Rajasthan, Madhya Pradesh, etc. Hence no deductions are being made in the number and it is as a whole being considered as the domestic pre consumer cutting waste being recycled in India.

For all other end uses of waste in the industry, percentages suggested by Amroha interviews have been considered as a basis. This is so because most of the material from Amroha is going for downcycling and a similar trend is expected across the country since it is expected to be based on demand rather than supply.

End Use	Percentage	High range	Median %	Median actual value	Assumptions
Paper industry (downcycling)	7%	8%	8%	59.4	The figures are derived based on the input from recyclers in Amroha.
Bedding and automobile industry (downcycling)	46%	58%	52%	411.2	- The figures are derived based on the input from recyclers in Amroha. - Amroha caters largely to the bedding and automobile industry

Incineration	1%	1%	1%	6.6	- The figures are derived based on the input from recyclers in Amroha.
Landfills	3%	3%	3%	23.8	3% has been suggested by the pre consumer waste traders across the country

Hence for cutting waste, waste quantities based on end use are as follows:

End Use	Median actual value	% of cutting waste out of 792.2
Reuse	138.6	17.49
Recycling	153.28	19.34
Downcycling	470.6	59.40
Incineration for energy	6.6	0.83
Landfills	23.8	3.00

Overproduction and Deadstock waste (346.1 K tons)

End Use	Percentage	Actual figures from Total cutting waste	% From total waste	Source	Assumptions
Resue	100%	346.1	5.24%	Sattva Analysis	While the data was collected from Bangalore, all overproduction and deadstock is dealt with in the same manner across the country

Mill Waste (612.2 K tons)

Mill waste	% split of mill waste	Quantity of split waste	Application	Source and assumption

Yarn waste	18.40%	112.6448	Recycle and Downcycle- 50% each	Yarn waste from mills is also dealt in the same way as yarn waste from spinning. However, they are expected to be used for low grade recycling only. In spinning waste we have account for 50% of this waste in recycle and remaining in downcycle.
Fabric waste	16.60%	101.6252	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Small cut pieces	15.20%	93.0544	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Mixed mill waste	15.10%	92.4422	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Selvedge	11.90%	72.8518	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Weaving loom waste	6.80%	41.6296	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Sampling and lab test waste	6.10%	37.3442	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Rejected fabric	5.60%	34.2832	Reuse	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Dust/dropping	3.40%	20.8148	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.

Knit mill waste	0.50%	3.061	Downcycle	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.
Deadstock	0.40%	2.4488	Reuse	No recycling use case found during primary research. However, mill owners suggested that the waste is sold and incineration and landfilling % was found to be low for all pre consumer waste at traders end.

Hence, end use split of mill waste is as follows:

End use	Total quantity	% split of mill waste
Reuse	36.732	6.00%
Recycle	56.3224	9.20%
Downcycle	519.1456	84.80%
Incineration	0	0.00%
Landfill	0	0.00%

Total of Pre-Consumer Waste

End use	Fibre waste	RMG waste	Overproduction	Mill waste	Total	% of total pre-consumer waste
Reuse		138.6	346.1	36.732	521.4	15.96
Recycle	1302.5	153.28		56.3	1512.1	46.30
Downcycle	213.5	470.6		519.15	1203.2	36.84
Incineration		6.6			6.6	0.20
Landfill		23.8			23.8	0.72

* Due to percentage based calculations and round offs, the total waste is exceeded by 2 ktons.

Domestic Post Consumer

Based on the three modes of this waste collection, their individual split into various end use was considered and then consolidated to put together the total split of domestic post consumer waste.

1. Through NGOs: Total waste collected is 1.6 k tons annually

End use	% split for waste collected by NGOs	Quantity of waste collected by NGOs	Sources and assumptions
Reuse	58.6%	0.94	Primary interviews by SZW team
Recycle	1.3%	0.02	Primary interviews by SZW team
Downcycle	0%	0.00	Primary interviews by SZW team
Incineration	0%	0.00	Primary interviews by SZW team
Landfill	40.1%	0.65	Primary interviews by SZW team

2. For waste collected by municipal bodies: Total textile waste collected by them is 2751.3 k tons annually.

End use	% split for waste collected by Municipal bodies	Quantity of waste collected by municipal bodies	Sources and assumptions
Reuse	43%	1183	Primary interviews by SZW team
Recycle	0.00%	0	Primary interviews by SZW team
Downcycle	0.00%	0	Primary interviews by SZW team
Incineration	10.00%	275	Primary interviews by SZW team
Landfill	47%	1293	Primary interviews by SZW team

3. For informal waste collected by local communities: Total textile waste collected by them is 1190.3 k tons annually.

- Two patterns of disposal of this waste were observed for this waste. In Delhi, these community members themselves sell this waste in markets or aggregate it within the community and sell it. On the other hand, in Bangalore a separate stakeholder is known to aggregate these clothes from community members.
- Disposal method is known to be different in both the locations
- The assumption in these calculations is that both these cities represent a range of what might be happening across the country, hence an average of end use split for both stakeholders has been taken for estimations in this report.

End use	% split for waste collected and sold by Aggregators (Bangalore)	% split for waste collected and sold by community members (Delhi)	Average % taken for both cities and assumed to be representative of the country	Sources and assumptions for Bangalore and Delhi % splits	Quantity of waste (based on average %)
Reuse	44%	95%	70%	Primary interviews by SZW team	2013.08
Recycle	25%	0	13%	Primary interviews by SZW team	148.81
Downcycle	13%	0	7%	Primary interviews by SZW team	78.56
Incineration	18%	0	9%	Primary interviews by SZW team	379.29
Landfill	0%	5%	3%	Primary interviews by SZW team	1323.55

Total split for domestic post consumer waste:

End use	NGO	Municipal Waste(DWCC)	Aggregator/ Bartanwala	Total quantity	% of PCD waste
Quantity (annual)	**1.6**	**2751.4**	**1190.3**	3943.3	**100.00%**
Reuse	0.94	1183	829	2013.08	51.05%
Recycle	0.02	0	149	148.81	3.77%

Downcycle	0	0	79	78.56	1.99%
Incineration	0	275	104	379.29	9.62%
Landfill	0.65	1293	30	1323.55	33.56%

Imported Waste

As suggested in Annexure 1, the total imported waste in India is 584 k tons annually (based on 2020 estimates).

According to the importers and traders interviewed in KASEZ and Panipat, the material split of this material is as follows:

Material	Low end %	High end %	Median %	Quantity, if median value is considered	Assumptions/ Any other comments
Cotton	50%	70%	60%	350.4	
Acrylic	20%	30%	25%	146	Imported mostly from countries with longer winters
Wool	4%	6%	5%	29.2	Imported mostly from countries with longer winters
Polyester	5%	5%	5%	29.2	
Others			5%	29.2	

Based on this, following insights were gathered during the Sattva primary interviews:

- 50% of the worn clothing imported in KASEZ is re-exported as clothing to Africa, EU and South-east Asian countries
- These re-exports do not include acrylic and wool materials as their demand is limited in Africa and South-east Asian countries
- 15% of imports are converted to wipes for both domestic and export markets
- Imports coming from Bangladesh do not have any re-export element
- 1% of material getting incineration was quoted by recyclers and garneters in Panipat and Amroha respectively

Based on these assumptions, following quantities were found:

Particulars	Data Point	Source of information	Assumption
Total re-exports of wearable clothing from India	92 k tons	Sattva analysis	Importers in KASEZ suggested an average of 50% of their imports getting re-exported after sorting. KASEZ largely imports worn clothing under the HS Code 6309 which was equal to 184k tons in 2020. Imports done under HS Code 6310 were not reported to be re-exported. This re-exported material consists of cotton and polyester largely.
Material moving to incineration	5 k tons	Sattva analysis	Recyclers and garnetters suggested 1% of the material getting incinerated. This incineration % is not applicable for the re-exports. Hence 1% of 492 k tons was calculated.
% of cotton clothing/rags coming to India and not getting re-exported as clothing	75.80%	Sattva Analysis	Since 92k tons consists of cotton and polyester, when its % is taken from the sum of total cotton and polyester quantities imported in India, it results in 24.2%. This implies that 75.8% of both these materials are left behind after re-exports. For cotton, it means 265.6 ktons.
Wipes being made from imported waste	39 k tons	Sattva Analysis	Primary interviews with importers in KASEZ and traders in Gandhidham suggested that 15% of imports go as wipes for both international and domestic markets. These wipes are not only collected from KASEZ but are also brought from Panipat where imports of HS Code 6309 and 6310 are mixed. However, these wipes only are made from cotton rich materials due to their absorption capacity. Hence 15% of 265.6 k tons was calculated for wipes quantity. Also, 99% of this quantity was taken to account for the 1% going for incineration.
Cotton waste going for downcycling (other than wipes)	67 k tons	Sattva Analysis	Interviews with importers and traders suggested that 30% contamination is found in the imports. Based on this, from the remaining quantity of cotton after re-exports and wipes, 30% was calculated as the contaminated material that would go for downcycling. Also, 99% of this quantity was taken to account for the 1% going for incineration. Since there is no clarity on solid and printed material received in imports, contamination rate was the only available assumption to differentiate between quantity getting recycled and downcycled.

Cotton getting recycled	156 k tons	Sattva Analysis	Remaining quantity of cotton post re-exports, wipes and downcycling. This quantity seems to be in the right ballpark because India imports ~129 k tons of pre consumer cotton cuttings from Bangladesh and some quantities from Sri Lanka and Vietnam, all of which go to the recycling industry.
Wool and acrylic getting recycled	121k tons	Sattva Analysis	Wool and acrylic neither go for wipes nor are re-exported. They mostly go for recycling but considering 30% contamination and 1% of incineration, there is about 31% not going to incineration.
Wool and acrylic getting downcycled	52 k tons	Sattva Analysis	30% of 99% of wool and acrylic imports in India 1% has been considered for incineration.
Polyester and other materials getting downcycled	51 k tons	Sattva Analysis	24.2% of polyester is getting re-exported while all other moves to the Indian market. There is no known recycling of polyester and other materials in India and hence all have been considered as downcycled.

Based on the above calculations, split of imported waste in India is as follows:

	End Use	Wool (in ktons)	Acrylic (in ktons)	Cotton (in ktons)	Polyester (in ktons)	Others (in ktons)	Total (in ktons)	% of total waste
Within India	**Recycling**	20	101	156			278	**47%**
	Downcycle	9	43	106	22	29	209	**36%**
	Incinerate	5					5	**1%**
Export	**Reuse**	92					92	**16%**
	Total						584	**100.0%**

Overall End Use Split

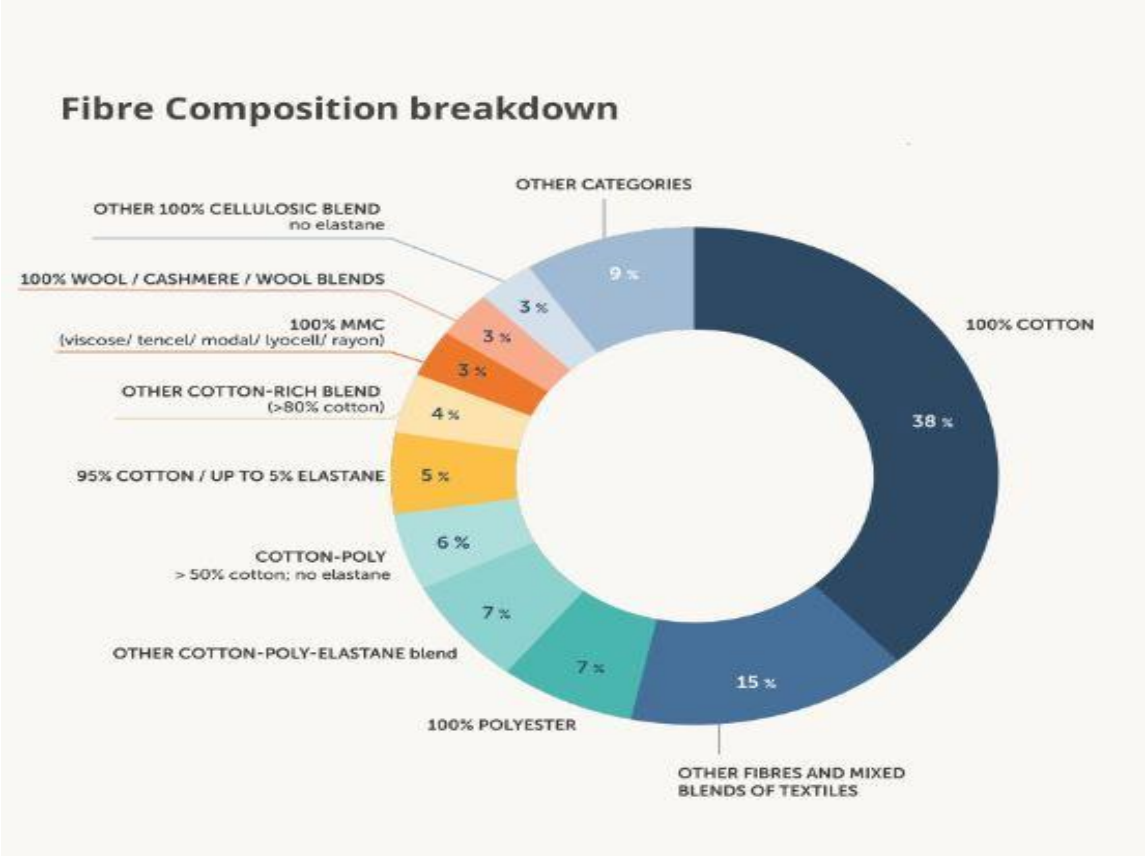
End Use	Fibre waste (in ktons)	RMG waste (in ktons)	Overproduction (in ktons)	Mill waste (in ktons)	Imported (in ktons)	PCD (in ktons)	Total (in ktons)	% of total waste in India
Reuse		138.6	346.1	36.732	92	2013.08	2626.5	**33.7%**
Recycle	1302.5	153.28		56.3	278	148.81	1938.8	**24.9%**
Downcycle	213	470.6		519.15	209	78.56	1490.7	**19.1%**
Incineration		6.6			5	379.29	390.8	**5.0%**
Landfill		23.8				1323.55	1347.4	**17.3%**
Total	**1515.5**	**792.88**	**346.1**	**612.2**	**584**	**3943.29**	**7794.1**	**100.0%**

Material composition of textile waste in India

Material composition of Pre-Consumer Detailed View:
(Based on manufacturers survey conducted on Reverse Resources platform)

Material	Percentage (from RR)	Value from total pre-consumer other than spinning)
100% Cotton	38%	665.19
Other categories	9%	157.545
other 100% cellulosic blend, no elastane	3%	52.515
100% wool/ Cashmere and wool	3%	52.515
100% MMC (viscose/tencel/modal/lyocell/rayon)	3%	52.515
Cotton rich blends (>80%)	4%	70.02
95% cotton, upto 5% elastane	5%	87.525
Cotton-poly (>50%), no elastane	6%	105.03
Cotton-poly-elastane blend	7%	122.535
100% polyester	7%	122.535
Other fibres and mixed blends of textile	15%	262.575
Total	**100**	**1750.5**

Material	Spinning waste	Total value of fibre waste
100% Cotton	75%	1136.4
Other fibres and mixed blends of textile	25%	378.8
Total	**100%**	**1515.2**



Material composition of Pre-Consumer Aggregated

Material	Percentage	Source	Assumption
Cotton and cotton rich	61	Primary data collected from RR and Sattva	The material group comprises of 100% Cotton, Cotton rich blends (>80%), Cotton-poly (>50%), no elastane,in the tables above
Polyester	4	Primary data collected from RR and Sattva	The material group comprises of 100% polyester, in the tables above
Cotton-poly-elastane	6	Primary data collected from RR and Sattva	The material group comprises of 95% cotton, upto 5% elastane, cotton-poly-elastane blendin the tables above
Wool	2	Primary data collected from RR and Sattva	The material group comprises of 100% wool/ Cashmere and wool in the tables above

Man-made cellulosic fibers	3	Primary data collected from RR and Sattva	The material group comprises of other 100% cellulosic blend, no elastane, 100% MMC (viscose/tencel/modal/lyocell/rayon), in the tables above
Others	24	Primary data collected from RR and Sattva	The material group comprises of other categories, other fibers and mixed blends of textile in the tables above
Total	**100**		

Material composition of Domestic Post-Consumer Aggregated

Material	Percentage	Source
Cotton and cotton rich	61%	Waste study conducted by SZW
Polyester	9%	Waste study conducted by SZW
Cotton-poly-elastane	19%	Waste study conducted by SZW
Wool	0%	Waste study conducted by SZW
Man-made fibres	5%	Waste study conducted by SZW
Others	5%	Waste study conducted by SZW

Material Composition	Count (Nos)
Cotton	1942
Polyester	311
Viscose	138
Rayon	41
Cotton-Elastane 50-50 (+-40%)	290
Polyester-Elastane 50-50 (+-40%)	30
Viscose-Elastane 95-5 (+-5%)	31
Cotton-Polyester-Elastane 60-35-5 (+-20% on polycotton, <10% elastane)	47
Cotton-Polyester 50-50 (+-40%)	247
Other fibres	40
Elastane mix	43
Cotton mix	55

Polyester mix	31
Polyamide mix	27
Other mix	21
No Tags	4705

The material categories have been clubbed as the following:

Material	Combination of the following material
Cotton and cotton rich	Cotton, Cotton mix
Polyester	polyester
Cotton-poly-elastane	Elastane mix, Cotton-poly (50-50), Cotton-elastane, Elastane mix,
Wool	
Man-made fibres	rayon, viscose
Others	Other fibres, others

Material composition of Post-Consumer Imported Aggregated

Material	Mid Range	Source	Assumption
Cotton and cotton blends	60%	Sattva primary interviews	Explained in annexure 2
Acrylic	25%	Sattva primary interviews	Explained in annexure 2
Wool	5%	Sattva primary interviews	Explained in annexure 2
Polyester	5%	Sattva primary interviews	Explained in annexure 2
Others (Silk etc)	5%	Sattva primary interviews	Explained in annexure 2
Total	**100%**		

Material composition of all Waste Streams Aggregated

Material	Percentage from PCD	Total figues (3943.7)	Percentage from PCI	Total figures (584)	Pre-consumer	Total figures (3265.7)	Total waste	Total Percentage (7793)
Cotton and cotton rich	61%	2405.65	60%	350.4	61%	1992.07	4748.13	61
Polyester	9.40%	370.708	5%	29.2	4%	130.62	530.53	7
Cotton-poly-elastane	19%	749.30	0%	0	6%	195.94	945.24	12
Wool	0%	0	5%	29.2	2%	65.31	94.51	1
Man-made fibers	5.40%	212.95		0	3%	97.97	310.93	4
Others	5.20%	205.07	5%	29.2	24%	783.76	1018.04	13
Acrylic	0%	0	25%	146	0	0	146	2
Total	**100%**	**3943.7**	**100%**	**584**	**100%**	**3265.7**	**7793.4**	

Average weight of a garment

Assessment conducted by SZW team:

Type of Product	Weight (gms)
Men Shirt	120
Men T shirt	340
Men Jeans	560
Women Kurta	160
Women Top	180
Women T shirt	160
Leggings	180
Women Pajama	120
Women Skirt	400
Children Skirt	200
Children T shirt	100
Children Winter wear	260
Saree	360
Bedsheet	900
Nightgown	440
3/4 pants	360
Blazer	740
Towel	280
Curtain	840
Pants	440
Sweater	300
Sweatshirt	500
Jacket	820
Avg weight of a garment	**380.9**

Calculation for textile waste collected by Goonj

Type of Waste	kgs	Pieces	Total Garments	Source
FAMILY/RAHAT KITS reached, comprising of essential items		245000	2450000	Goonj Annual Report 19-20
undergarments to women and other menstruators. (included in kits)		110,000		Goonj Annual Report 19-20
textile waste was used this year to create sujnis, asanas, MY-Pads, undergarments and hundreds of environment friendly Green by Goonj recycled products.	1,000,000		230000	Goonj Annual Report 19-20
Total for one year			**2680000**	