



FASHION FOR GOOD  
SORTING FOR CIRCULARITY: INDIA

# **ANNEX 1**

# PILOT

# ACTIVITIES

**DECEMBER 2023**

## KEY TERMS AND UNITS

Units	Collective Impact
INR	Indian Rupee (1 INR = 0.0099 GBP)
GBP	G.B. Pound (1 GBP = 104 INR)
mn	Million
MTonnes	Metric Tonne = 1,000kg
KTonnes	A unit of weight or capacity equal to 1,000 metric tonnes

## 2.1 METHODOLOGY OF THE MATOHA PILOT

### Sorting Analysis Methodology

The analysis for the Sorting For Circularity India project was conducted in three phases: Preparation, Implementation and Reporting. A detailed account of the approach and the methodology for each phase can be found in the section below.

### PREPARATION

#### Co-creation of research methodology for the on-ground analysis

The methodology for the analysis held on-ground was done in collaboration with our knowledge partners, Circle Economy, and was influenced and defined by the Sorting For Circularity Pilot Europe. Using this as a starting point, the Sorting For Circularity methodology was defined for India focusing on data and monitoring tailored to the Indian context. It was also heavily dependent on the participation and cooperation of the sorting facilities.

#### Co-creation of additional details on the Matoha Fabritell Application

On understanding the process of using the technology, we established that Indian post-consumer feedstock is different from that across Europe. With this in mind, Matoha supported us and added additional details in the data collection steps within their application. They added a range of new garment types for the Indian market which included Saris, Burqua's, Blouses, Kurtas, Pajamas, and Indian baby clothes. With regard to colour data, Matoha added Pink to the colours since we predicted it to be a predominant colour in our feedstock. In the disruptor section, we added the option of 'NONE' for the purpose of data collection. Lastly, we asked Matoha to allow sorters to select more than one disruptor per garment.

#### Using insights collected by our technological partners to define sorting buckets

The insights collected by our technological partners, Reverse Resources, helped us understand the perspective and needs of the various recyclers across India. They conducted interviews with 8 recyclers both within and outside of India, to assess and help us define the recycler buckets for the course of the pilot.

### **Getting recyclers on board for the purpose of testing feedstock from the pilot**

After the process of analysing the recycler buckets with Reverse Resources, we then went on to have more concrete discussions with the recyclers to ensure their participation and involvement in the pilot. This included discussing the materials they would be most interested in, the timeline for the pilot and the requirements from their end that we would require to gather insights for the industry.

### **Analysis and discussions with various types of Second-hand Marketplaces for rewearables**

Since the presence of second-hand marketplaces is scarce, we did an analysis of second-hand marketplaces in the regions where our facilities were located. This led us to find and converse with a range of second-hand stores that fell into three main categories: Online second-hand marketplaces (websites), Second-hand marketplaces run through social media platforms such as Instagram and Facebook (online), brick and mortar second-hand stores. In addition to this, we also understood the local second-hand markets in the major cities through the experience and knowledge of our sorters.

### **Testing and refining the methodology and process through a test run**

Before the pilot, a testing and trial round was conducted with SZW, involving 100 garments. This step aimed to assess the inputs from the Indian context and offer necessary revisions to the Matoha team for application improvements

### **Creation of the Sorters Manual**

Based on the Sorters manual created for the European pilot, as well as through the research conducted, we created a Sorter manual to make the processes and the method of scanning and segregation. The manual included a glossary of words, to make the sorters familiar with certain words they were going to hear and use during the course of the pilot, the entire process of using the Matoha scanners and a breakup of all the categories and details of the data to be entered on the Matoha app while scanning materials. This Manual was shared during the Sorters Training and they were given copies to familiarise their teams prior to the kick-off of the pilot in their facilities.

### **Training sorters for the implementation phase**

We conducted Sorters Training over two days on the 2nd and 3rd of February in Bangalore. The participants included the sorters, their supervisors and representatives of their respective organisations. In addition to this, we also had representatives from project partners, namely from IDH and H&M. We also had our knowledge partners, Circle Economy, to help train the sorters through the process, and from Reverse Resources, to define their role in the pilot and demonstrate the platform for the sorters and their teams. The two day training helped us identify upcoming roadblocks as well as understand how the different teams worked with the technology and gave us an opportunity to answer questions from the different stakeholders present.

### **Preparation of data collection, monitoring and other documents**

Prior to the implementation of the scanning and segregation process, we created a set of documents for the facilities that would help them understand the role of the supervisor and the data expected from their facility for the duration of the pilot, specifically when the Fashion For Good representative is not present on the ground. We created two main documents- a kickoff document, where manual data such as weight of the material, timings of the sorters, etc. was captured on a daily basis, and

a Matoha document, which was updated at the end of the week, with the exported data from the Matoha application. These documents were shared and discussed in detail with the supervisor at the kick-off week at every facility. Apart from the documents to be filled, Fashion For Good also provided two documents to be printed for the facility- a document listing the logos of brands for making the process of segregation of rewearables simpler for sorters, especially for those who could not read, and a document to be printed for the colour coding of the buckets.

Prior to kicking off sorting at the various facilities, steps were taken in order to optimise sorting and data collection. The following steps were conducted:

- **ENSURING THE FACILITY IS EQUIPPED FOR THE KICK-OFF**

All facilities were expected to have collected at least 50% of their total quantities prior to kick-off. The facility was also asked to arrange other commodities such as extension cords, fans, weighing machines, wifi access, etc. prior to the start of the scanning processes.

- **SPACE PREPARATION**

The space preparation steps took place in the week of kick-off at every facility and was facilitated by the on-ground consultant from Fashion for Good. These steps focused on not only setting up and calibration of the devices and tablets but also the space for sorting. Integral steps in this process involved the setting up of the tables and the colour coding of the buckets so that when sorting was to begin, the setup made the processes easy and the sorters comfortable.

- **STAFF TRAINING**

After the space was prepared for the sorting steps to be implemented, the staff was retrained in order to ensure there is understanding amongst the sorters. Prior to this, Fashion for Good did conduct 'Training sessions' where this training on pilot was already covered with the supervisors of the sorters. The staff and workers on-ground were trained for the entirety of the segregation and sorting steps.

- **QUALITY CONTROL**

While the sorters got familiarised with the segregation and sorting steps, the supervisor of every facility was trained to conduct on-ground monitoring and data collection. Additionally, they were also trained to do troubleshooting with regards to the Matoha devices. On the backhand, Fashion for Good was reviewing the data on a weekly basis and holding regular check-ins to address any concerns.

## **IMPLEMENTATION**

After the preparation phase of the pilot, the implementation was conducted with the kickoff of the pilot at the facilities. Since we had four sorting facilities, and a limited number of machines and the quantities were considerably high, we decided to conduct the pilot in two parts, focusing on two facilities at a time. We first conducted the pilot at Greenworms, Kerala and Saahas Zero Waste, Bangalore simultaneously, and then at Uptex, Chennai and Hasiru Dala Innovations, Bangalore.

### **Programming the machines for implementation**

After the recycler buckets had been defined as per the research phase of the pilot, the Matoha Fabritell machines needed to be programmed for scanning. This meant that the rules for scanning were defined by us on the Matoha application. This allowed us to make sure only the materials that had specific compositions would end up in the respective recycler buckets. Additionally, the devices also had LED light sensors that assisted sorting, and this was a great benefit for the implementation, since a number of the sorters could not read English. The LED lights were also programmed with the rules, and for every recycler bucket, a colour was assigned, and the sorter did not have to be able to read to understand what bucket the material was to be put into. On top of that, we colour-coded the buckets for storage, which ensured that when the LED light turned a specific colour, the corresponding bucket was also the same colour. Lastly, we created separate collections for every facility on the application, allowing the data to be captured facility-wise for the duration of the pilot

### **Provision of scanners and other materials**

A representative (consultant) from Fashion For Good transported the machines and the tablets and set them up at the facility. The machines were set up and connected by Fashion For Good, and the remaining materials were collected by the facilities prior to set up with the support of Fashion For Good.

### **Workplace preparation**

Each facility was provided with a list of things they would require for the kick off of the pilot at their facility. The sorters conducting the analysis needed to ensure that the space was sufficient for the NIR scanners and tablets. In addition to this, they needed to make sure they had smooth running internet connectivity, containers of some sort to segregate the materials based on the Matoha reading and printed documents provided by Fashion For Good. Together with the sorters, we set up the space for scanning and segregation, and storage.

### **Segregation of rewearables from the material mix**

The first step of the on-ground process was to identify and remove garments that were fit to be sold in various second-hand markets. The sorters were trained to scan the garments according to brands, and then for wear and tear. The second-hand platform we were working with also provided a guide as per their requirements and the sorters followed the guidelines to identify rewearables.

### **Scanning of materials and the capture of the garment characteristics**

The remaining materials (after the extraction of rewearables) then went onto the scanning area. The Matoha Fabritell machines were used to scan the materials, and as mentioned in the 'programming the machines for implementation' section, the sorters used the LED light reading on the device to place the garment scanned in its corresponding bucket for storage. Garments that showed a 'Low Signal' or 'Unknown' reading were also searched for a composition tag, and if present, were added manually. While the garment composition may have known for a certain section of the unscannable material, the sorters were asked to still place these materials in the 'UNKNOWN' bucket, since the purpose of the pilot was to test the technological intervention of Matoha Fabritell machines.

The detailed description of the step by step process is as follows:

1. Sorters participating in the on-ground analysis were given an overview of the process as well as practical training on how to use the Fabritell (NIR) scanners as well as how to enter and track information according to the data that was to be entered on the Matoha Application, All training material that was developed are also explained in detail in our Sorters Manual (Annex XX).
2. Items were weighed and taken to the segregation area of the facility, where it was inspected for wear and tear and branded materials, as per pre-defined instructions from Fashion for Good and resale platforms. The clothes that were identified at this step, also known as Re-wearables, were removed from the material mix.
3. The materials left, also known as non-rewearables, were then scanned by the hand held Fabritell (NIR) scanners and details of the garments were collected on the application. This included the data entries of the characteristics of the garment. In the case of multi-layered garments, the previous steps were repeated and 'saved to previous'
4. If the result of the scan was unknown, the fibre composition was manually entered using the item's label.
5. Age, category, colour and the presence of disruptors were tracked by the sorters on the Matoha application on the tablet provided, after scanning. The process of scanning and adding the data has been conducted at an average speed of 19.5 seconds per scan.
6. The sample was placed in the bucket with the corresponding colour from the LED light on the Matoha device.
7. The data was extracted from the Matoha application in .csv format weekly
8. The data was analysed by fibre type, colour, multi v/s mono layer and was supported by manually provided volume monitoring from the sorting facilities.

### **Data monitoring and quality control**

The materials were monitored daily by the facility supervisor. At the start of every day, the garments going into the segregation area were weighed for reference. In the same manner, at the end of the day, the material was then weighed in its respective buckets, to collect weighing data in real-time, and to ensure the volumes going for scanning were benign and accounted for daily. In addition to this, the Matoha data was extracted weekly and monitored both at the end of the sorting facility, as well as at Fashion For Good. In terms of quality control, the supervisors were advised to keep a check on the sorting activities daily, and regularly, at random, test materials from the buckets, ensuring the materials are being placed in the right bucket.

### **Connecting sorters to recyclers**

Closer to the end of their scanning phase, Fashion For Good started introducing the recyclers to the supervisors of the facilities. This helped both sides understand their requirements and capabilities. Additionally, the sorters also started having conversations with the recyclers about composition and volumes that could be sent to them, and the commercial aspect of the pilot. The commercial conversations were done without the presence of Fashion For Good.

### **Transporting the materials from sorters to recyclers**

The end of the implementation phase was to transport the materials from the various sorting facilities to the various recycling factories. Fashion For Good supported the transfer of material commercially. Once the conversations between sorters and recyclers had been done, we had an idea of volumes going

to the different recyclers. The complexity of this phase came from the fact that all four of our sorters were located in the south of India, whereas a majority of recyclers are placed in the north, making transportation expensive, especially for the smaller quantities of the pilot. For the commercial viability of the pilot, we aggregated all the material from the facilities at the Saahas Zero Waste facility in Bangalore and sent out the material together from there. The materials were sent to Kaygee Enterprises, Kakkar Spinning Mills and smaller quantities were also sent to Usha Yarns and Vardhman Textiles.

## **REPORTING**

### **Conversion of data from data points into weight equivalents**

The average weights of the garment types that were utilised in this study were supported largely by the average weights calculated in the Sorting For Circularity Europe pilot by Circle Economy. Furthermore, for the new categories added for Indian wear, the average was calculated using a sample size of 10 garments selected at random from the garment category. You can find the average weights used in the pilot in Annex x. Once the average weights had been calculated for every category, using the data collected from the Matoha devices, we were able to convert the data points to their weight equivalents.

### **Data analysis from the Matoha data**

The Matoha data was extracted from the application in the form of .csv files at the end of the implementation phase at every facility.

### **Creation and utilisation of Sorter Profiles on the Reverse Resources Platform**

Each sorting facility created Sorter Profiles on the Reverse Resources platform once the scanning of the material had concluded. On their profiles, they were able to add the details and bifurcation of materials as well as the destination of the materials. On the other end, recyclers were able to view these quantities of materials once they were dispatched.

### **Collection of Sorter Feedback**

After the materials had been sent out from the facilities, Fashion For Good created sorter surveys, which aimed at collecting insight and feedback from the sorters from every stage of the pilot from collection to transportation. This was then followed up with individual follow-up calls with them, allowing us to dive deeper into the difficulties and opportunities they identified over the course of the pilot.

### **Collection of Recycler Feedback**

Once the materials were transported to recycler facilities, we conducted detailed feedback sessions with each recycler to collect insight into the quality of feedstock received from the pilot. The recycler feedback also provided feedback about the quality of sorting and preprocessing, as well as the accuracy of the technology.

### **Consolidation of learnings and data into the Sorting For Circularity Post Consumer Report**

The learnings from the stakeholders involved as well as through the analysis of data, the Sorting for Circularity Post-Consumer Report was put together, with the aim to provide insight to the industry.

## 2.2 ESTIMATED ON AVERAGE WEIGHTS PER PRODUCT TYPE FOR MATOHA PILOT

Avg weight as per eu data + indian garment weights		Average weight	
Details	Garment Type	Children	Adult
Tops	Coat	0.59	1.06
	Heavy Jackets	0.45	0.75
	Light jackets	0.35	0.31
	Sweater/hoodies	0.17	0.31
	Jacket (Denim)	0.45	0.71
	Polo shirts	0.01	0.25
	Blouse/shirt	0.01	0.16
	T shirt	0.01	0.16
	Rainwear	0.53	0.8
	Blouse (Indian wear)	0.17	0.2
	Kurta (Indian wear)	0.14	0.17
Bottoms	Shorts	0.15	0.2
	Skirt	0.18	0.24
	Trousers	0.22	0.36
	Sports trousers	0.22	0.21
	Shorts (Denim)	0.23	0.32
	Skirt (Denim)	0.22	0.34
	Trousers (Denim)	0.28	0.51
	Long skirts (Indian wear)	0.55	0.65
	Pajama (Indian wear)	0.21	0.34
Underwear	Bra- Lingerie	0.03	0.09
	Swimwear	0.06	0.12
	Underwear	0.03	0.09
	Socks	0.02	0.03
Overall	Jumpsuits	0.21	0.36
	Overall (Denim)	0.19	0.67
	Dress	0.22	0.18
	Home wear	0.34	0.34
	Reflective safety	0.35	0.35
	Costume	0.26	0.43
	Nightgowns (Indian)	0.19	0.27
	Burqa (Indian wear)	0.37	
	Saris (Indian wear)	0.84	
Babies	Baby clothes	0.16	
	Baby underwear	0.16	
	Baby clothes (Indian wear)	0.16	



Avg weight as per eu data + indian garment weights		Average weight	
Details	Garment Type	Children	Adult
Accessories	Medium accessories	0.48	
	Small accessories	0.03	
	Gloves	0.04	
	Headwear	0.1	
Others	Fabrics	0.25	
	Household linen	0.35	
	Other	0.35	

## 2.3 DETAILED DESCRIPTION OF MATOHA



### COMPOSITION, CATEGORIES AND PROPERTIES WITHIN MATOHA DURING THE SCANNING PROCESS






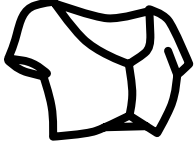
#### COMPOSITION:


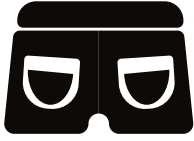


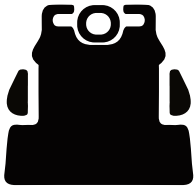

As per the Matoha FabriTell devices, the following materials can be identified: cotton, polyester, elastane, acrylic, wool, acetate, polyamide (nylon). Additionally, 17, 2-component blends of these materials can also be read by the machine.




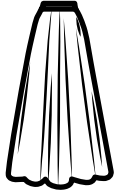


#### GARMENT CATEGORY



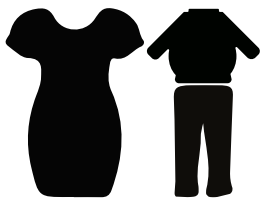



As per the Matoha Application, a first selection will require a choice of age : Adult, Children (4 to 14 years old), Babies ( 0 to 4 years old), Accessories, Other. This will lead the sorter in the app to a second and third choice in terms of the product category of the article being sorted (as indicated in the table below).


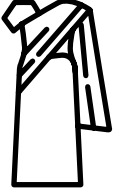





Age	Category Label	Product Category	List Of Products Within Category
Adults	Tops	 Coats	Coat, large jacket type coat, cape, poncho, duffle-coat, canadian, overcoat, pea coat, parka, winter jacket (bomber, teddy, etc) - excluding denim
Adults	Tops	 Lightweight Jackets	Windstoppers, blazers, light jacket, waistcoat under jacket, ultralight down jacket, poncho jacket, workwear jackets - excluding denim






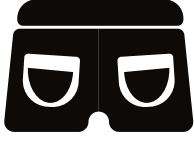
Age	Category Label	Product Category	List Of Products Within Category
Adults	Tops	 Heavy Jackets	Ski jacket, big puffer jacket (short, long, with or without sleeves), ski suit, quilted jackets, leather jackets - excluding denim
Adults	Tops	 Denim Jackets	Only denim jackets, blazers, overcoats
Adults	Tops	 Shirts, Blouses (woven)	Shirt, blouse, blouse, tunic, other woven top
Adults	Tops	 T-shirts and Polos (knits)	T-shirt (whatever its shape: wrap, top with straps, halter top, V-neck, round neck, tank top, etc.), polo shirt (long and short sleeves), rugby polo shirt, undershirt, sports jersey, technical T-shirt (thermal / UV) or other knitted t-shirts (eg. jersey, morley, piqué).
Adults	Tops	 Waterproof Rainwear	Waterproof trench coat, rain cape, rain poncho
Adults	Tops	 Sweaters (knits)	Heavy or light knit sweater (long sleeves, short sleeves, sleeveless, poncho sweater, turtleneck, V-neck, round neck), sweatshirt, bolero, fleece hoodies, cardigans, jumpers, tracksuit top, jogging top - excluding large jacket types coat
Adults	Tops	 Blouses	Indian wear blouses but not limited to- sari blouses, cholis, corset style blouses.







Age	Category Label	Product Category	List Of Products Within Category
Adults	Tops	 <p>Kurtas</p>	Men and womens kurtas. Kurtis (both long and short), kaftans, angarakha, tunic, anarkalis.
Adults	Bottoms	 <p>Sports Trousers (knits)</p>	Sweatpants or jogging pants, leggings, jeggings, tregging, tapered pants, long johns - excluding denim
Adults	Bottoms	 <p>Trousers (woven)</p>	Pants, capris, knickers, jodhpurs, fatigues, chinos, harem pants - excluding denim
Adults	Bottoms	 <p>Denim Trousers</p>	Pants, capris, knickers, jeans, jodhpurs, fatigues, chinos, harem pants - all in denim
Adults	Bottoms	 <p>Skirts</p>	Skirt, culottes, petticoat - including tulle skirt (tutu type)
Adults	Bottoms	 <p>Shorts, Bermuda Shorts</p>	Shorts, Bermuda shorts up to knee length - excluding denim

Age	Category Label	Product Category	List Of Products Within Category
Adults	Bottoms	 Denim Skirt	Skirt, culottes - all in denim
Adults	Bottoms	 Denim Shorts	Shorts, Bermuda shorts up to knee length - all in denim
Adults	Bottoms	 Pajamas	Includes any indian bottom wear for both women and men- pajamas, salwar, churidar, dhoti, lungi, palazzos, shararas
Adults	Bottoms	 Lehenga	Lehenga, long skirts, petticoats
Adults	Underwear	All Bottoms	Panties, briefs, thongs, boyshorts, hipster, bodysuit, boxer shorts, boxer briefs - including sheathing, sheath, panty, shaping jumpsuit, period panties - excluding long underwear
Adults	Underwear	 Bras and Lingerie	Bra (half cup, push-up, full cup, bandeau, shell, brassiere, etc), top with integrated bra, corset, waist cinche, bustier, camisoles, garter belt, leotards
Adults	Underwear	 Swimwear	Swim brief, swimming trunks, one-piece swimsuit including neoprene, two-piece swimsuit, tankini, neoprene top, neoprene jacket - excluding T- UV and off shirt Full neoprene suit (only)







Age	Category Label	Product Category	List Of Products Within Category
Adults	Underwear	 <p>Socks and Hosiery</p>	socks, hosiery
Adults	Overall	 <p>Jumpsuits, Overalls (including workwear)</p>	Jumpsuit, short jumpsuit, overalls, one piece workwear (overalls, jumpsuits, aprons) -excluding denim and ski suits
Adults	Overall	 <p>Denim Dresses, Overalls and Jumpsuits</p>	Long, short, midi dress, ceremony dress, cocktail dress, evening dress, Jumpsuit, short jumpsuit, overalls, one-piece workwear (overalls, jumpsuits, aprons) - all in denim
Adults	Overall	 <p>Home Wear</p>	Kimono, negligee, night gown, pajama sets, nightgown, loungewear
Adults	Overall	 <p>Dresses</p>	Long, short, midi dress - including sweater dress -, ceremony dress, cocktail dress, evening dress - including wedding dress
Adults	Overall	 <p>Reflective Safety Wear</p>	Reflective safety waistcoats, jackets, pants, jumpsuits







Age	Category Label	Product Category	List Of Products Within Category
Adults	Overall	 Costumes and Disguises	Costumes and disguises (e.g. halloween costumes and accessories)
Adults	Overall	 Sari	Sari
Adults	Overall	 Burqa	Burqa
Adults	Overall	 Night Gowns	Nighties, gowns
Children	Tops	 Coats	0-14 years old. Coat, large jacket type coat, cape, poncho, duffle-coat, canadian, overcoat, pea coat, parka, winter jacket (bomber, teddy, etc) - excluding denim
Children	Tops	 Lightweight Jackets	0-14 years old. Windstoppers, blazers, light jacket, waistcoat under jacket, ultralight down jacket, poncho jacket, workwear jackets, blousons - excluding denim
Children	Tops	 Heavy Jackets	0-14 years old. Ski jacket, big puffer jacket (short, long, with or without sleeves), ski suit, quilted jackets, leather jackets - excluding denim



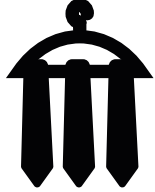

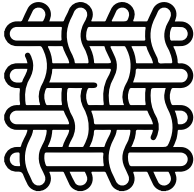
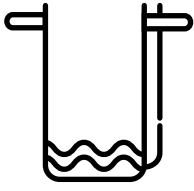
Age	Category Label	Product Category	List Of Products Within Category
Children	Tops	 Denim Jackets	0-14 years old. Only denim jackets, blazers, overcoats
Children	Tops	 Shirts, Blouses (woven)	0-14 years old. Shirt, blouse, blouse, tunic, other woven top
Children	Tops	 T-shirts and Polos (knits)	0-14 years old. T-shirt (whatever its shape: wrap, top with straps, halter top, V-neck, round neck, tank top, etc.), polo shirt (long and short sleeves), rugby polo shirt, undershirt, sports jersey, technical T-shirt (thermal / UV) or other knitted t-shirts (eg. jersey, morley, piqué).
Children	Tops	 Waterproof Rainwear	0-14 years old. Waterproof trench coat, rain cape, rain poncho
Children	Tops	 Sweaters (knits)	0-14 years old. Heavy or light knit sweater (long sleeves, short sleeves, sleeveless, poncho sweater, turtleneck, V-neck, round neck), sweatshirt, bolero, fleece hoodies, cardigans, jumpers, tracksuit top, jogging top - excluding large jacket types coat
Children	Bottoms	 Sports Trousers (knits)	0-14 years old. Sweatpants or jogging pants, leggings, jeggings, regging, tapered pants, long johns - excluding denim

Age	Category Label	Product Category	List Of Products Within Category
Children	Bottoms	 Trousers (woven)	0-14 years old. Pants, capris, knickers, jodhpurs, fatigues, chinos, harem pants - excluding denim
Children	Bottoms	 Denim Trousers	0-14 years old. Pants, capris, knickers, jeans, jodhpurs, fatigues, chinos, harem pants - all in denim
Children	Bottoms	 Skirts	0-14 years old. Skirt, culottes, petticoat - including tulle skirt (tutu type)
Children	Bottoms	 Shorts, Bermuda shorts	0-14 years old. Shorts, Bermuda shorts up to knee length - excluding denim
Children	Bottoms	 Denim Skirt	0-14 years old. Skirt, culottes, petticoat - all in denim
Children	Bottoms	 Denim Shorts	0-14 years old. Shorts, Bermuda shorts up to knee length - all in denim
Children	Underwear	All Bottoms	0-14 years old. Panties, briefs, boyshorts, bodysuits, boxers, boxers



Age	Category Label	Product Category	List Of Products Within Category
Children	Underwear	 Bras and Lingerie	0-14 years old. Bras for little girls
Children	Underwear	 Swimwear	0-14 years old. Swim brief, swimming trunks, one-piece swimsuit including neoprene, two-piece swimsuit, tankini, neoprene top, neoprene jacket - excluding T- UV and off shirt Full neoprene suit (only)
Children	Underwear	 Socks and Hosiery	0-14 years old. socks, hosiery
Children	Overall	 Jumpsuits, overalls (including workwear)	0-14 years old. Jumpsuit, short jumpsuit, overalls -excluding denim and ski suits
Children	Overall	 Denim dresses, overalls and jumpsuits	0-14 years old. Jumpsuit, short jumpsuit, overalls -excluding denim and ski suits
Children	Overall	 Home wear	0-14 years old. Kimono, negligee, night gown, pajama sets, nightgown, loungewear

Age	Category Label	Product Category	List Of Products Within Category
Children	Overall	 <p>Dresses</p>	0-14 years old. Long, short, midi dress - including sweater dress -, formal dress
Children	Overall	 <p>Reflective safety wear</p>	0-14 years old. Reflective safety waistcoats, jackets, pants, jumpsuits
Children	Overall	 <p>Costumes and disguises</p>	0-14 years old. Costumes and disguises (e.g. halloween costumes and accessories)
Babies	-	Clothes	0-3 years. Jumpsuit, pilot, over-pajamas, coat, shirt, t-shirt, romper, sweater, bloomers, blouse, waistcoat, sweatshirt, dress, overalls, pants, shorts, leggings, polo shirt , jogging, growsuits, pajamas, bodysuits
Babies	-	 <p>Underwear and Accessories</p>	0-3 years. Panties, bib, hat, scarf, cloth diapers, slippers, socks, tights, gloves
Babies	-	 <p>Indian Baby Wear</p>	0-3 years. Indian clothes for babies
Accessories	-	 <p>Medium Accessories</p>	Scarf, shawl, scarf, stole, chèche, snood, choker, sarong

Age	Category Label	Product Category	List Of Products Within Category
Accessories	-	 Hats and Headwear	Hat, beret, bob, cap, toque, balaclava, visor, beanie, chapka and headgear in general
Accessories	-	 Gloves and Mittens	Gloves for protection against the cold, fashion accessory, gardening, sport, welding, or mittens for use as washcloth - including exfoliant, oven mitt, potholder, cleaning glove (microfibre or other), scrub glove
Accessories	-	 Small Accessories	Tie, bow tie, mock collar, mock cuff, fabric belt, pocket square, mantilla, suspenders, handkerchief
	-	 Medium Accessories	Chunni/Dupatta/Shawl
Other	-	 Fabrics by the Metre	Fabrics by the metre for clothes (3 yards = 1 pcs) or for curtains, mosquito net, bed linen, bath linen, table linen (3 metres = 1pcs)
Other	-	 Household Linen	Covers, Duvet covers, Bed linen, Table linen, Curtains, Sheets, Pillow/bolster cases and protective covers, Bath linen and carpet (wet area), Towels, Tablecloths, Napkin, Placemats, Shades
Other	-	Other	Articles that do not fit any of the categories above

## COLOURS ON THE APPLICATION

There are 12 choices of colour programmed in the Matoha app: Black, Blue, Brown, Green, Grey, Orange, Purple, Red, White, Yellow, Pink and Multi-colour.

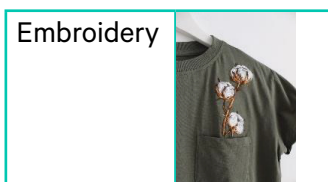


## PRESENCE & MATERIAL OF DISRUPTORS

The following trims and hardware are considered disruptors to recycling and if present, should be tracked according to what material they are made of (Plastic, Metal, Textile, Other). If no disruptors are present, this step should be skipped (press SKIP). If there are multiple disruptors, you can choose more than one material for one garment. If there are different disruptors made of different material, the disruptors are tracked as Other. The following tables illustrate different types of disruptors.

### EMBROIDERY

#### DISRUPTORS EXAMPLE



**METAL**

DISRUPTORS EXAMPLES

Zipper		Hook and eye	
Button/Snap button		Underwire (bra)	
Rivet		Eyelet or Ring	
Hook		and bar Sequin	
Fastener		Lurex Thread	
Carabiner		Charm	
Buckle			








**PLASTIC**

DISRUPTORS EXAMPLES

Reflective		strip Pearl	
Button		Foam	
Zipper		Fastener	
Epaulette		Buckle	
Collar support			






**FABRIC**

DISRUPTORS EXAMPLES

Elastic		Pompom	
String		Inset/Yolk (if another fabric than main)	
Ribbon		Pocket (if another fabric than main)	
Patch			

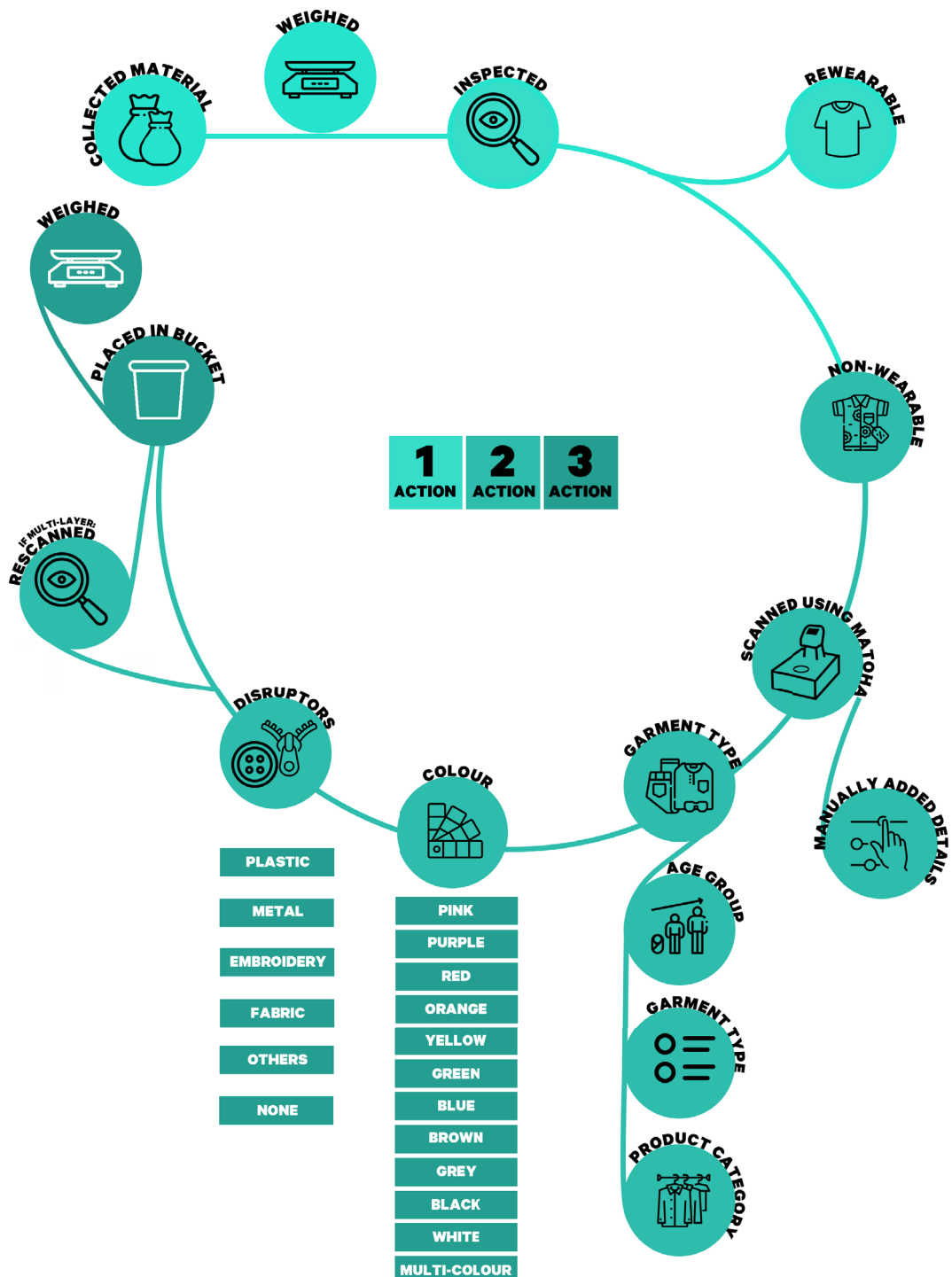
**FABRIC**

DISRUPTORS EXAMPLES

Leather		Print	
Fur		Brandenburg trim (wood)	
Pendant (multiple materials)			

## 2.4 DETAILED DESCRIPTION OF THE SORTING INFRASTRUCTURE

The sorting process was broken down from start to end into three main actions: sorting rewearables and non-rewearables, data collection using the scanners and application and lastly placing the garment into the bucket. This section highlights the detailed steps under these 3 actions in the implementation step of the pilot.





## **ACTION 1: SORT THE REWEARABLES AND NON REWEARABLES**

The first step is to sort the rewearables and non-rewearables as per the definitions and discussions in training. The rewearables without tags will not be accepted. The details for the process for this segregation can be found below in the rewearables section.

At the early stages of the pilot, we researched and spoke with second-hand platforms such as Kiabza in India to understand their requirements so we could ensure accurate segregation of rewearables and non-rewearables. Once this insight was collected we observed these were the requirements for non-rewearables to be eligible for the second hand platforms:

What was accepted as resellable:

- Authentic Branded clothing
- Clothing of Brands as per the Approved Brand List
- Clothes in great condition, without any visible wear, tear or damage
- Clothes without any stains or marks of any kind
- Clothes in their original shape and size
- Clothes with their original colours intact
- Clothes which have been washed and are clean
- Mens & Womens western wear

What made a garment ineligible for resale:

- Fakes or Replicas
- Clothes not as per the Approved Brand List as per the reseller
- Innerwear or Nightwear
- Clothes with artificial leather
- Clothes with visible wear & tear, holes, loose threads etc
- Clothes with stains or with marks of any kind
- Clothes which have lost shape or where the fabric is overstretched / has shrunk
- Clothes with missing or damaged essentials like zippers, buttons, sequins etc
- Clothes altered or resized in any way
- Clothes which have lost colour or have faded
- Dirty, unwashed, or foul smelling clothes
- Kids Fashion
- Ethnic wear
- Clothes over 2XL size

For the purpose of the pilot, we found it important to train the sorters in the steps to identify a rewearable from a non-rewearable. The following instructions were followed in the process of identifying rewearables:

1. The sorters were provided with a list of brand logos that were found to be sold in the second hand markets in India. The first step of sorting was to check the garment for a garment tag or main label. If the garment did not contain a tag, the garment was considered a non wearable in most cases. In the case that a facility already worked with local second hand markets, they created their own methodology to identify if it could be sold. If the garment has a tag, the sorters checked if the brand

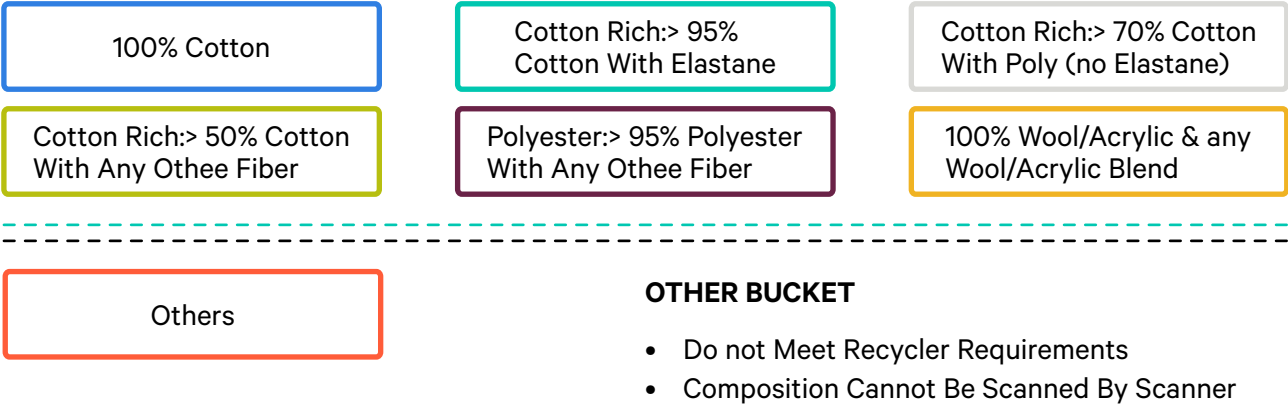
was on the list provided to them and went on to the next step of identification

2. The second step was to check the garment for wear and tear. This process was different for different types of garments. For example, they would inspect tops for wear in tear in specific areas such as the armpit area, and the behind/under the collar and back area. Whereas when it came to bottoms, the front rise/back rise or the bottom hem of the garment for fraying or wear and tear. However, it is important to note that while the sorters were trained for this process, it is subjective to every sorter.

**RECYCLER BUCKETS:**

For the non wearables section, we have identified recycler buckets as per the demand in the Indian recycling market. Below is the list of material compositions along with the corresponding colours of the Matoha scanners (LED lights) to optimise your sorting process.

As mentioned in the Methodology section of this report, the recycler buckets were created using the feedback and discussions held prior to the pilot, with recyclers. Along with our technological partners,



Reverse Resources, we spoke to various recyclers to understand what materials each of them were interested in, and created the recycler buckets using the insights received from them.

During the course of the pilot, the 'Other' bucket was further bifurcated into two categories. The first was 'Unknown', which meant the scanner was unable to identify the material composition of that

particular garment. The second was 'Other', which meant that the scanner did identify the material, but the composition does not meet any recycler requirements. This bucket was predominantly found to contain materials such as nylon, viscose, silk and acetate.

## **ACTION 2 : DATA COLLECTION USING SCANNERS AND APPLICATION**

To scan and identify the composition of an item using the NIR scanner, follow the actions below:

**STEP 1 :** Identify the garment is mono layer of multi layer

**STEP 2 :** Select the correct collection name being scanned. For the intention of this pilot, we are defining collections by the sorting facility you are sorting in. The different collections must be defined in



the operational protocol and must also be added to the Matoha app.

**STEP 3 :** Bunch the fabric and place over the sensor of the NIR scanner. The screen will display the composition of the item (i.e. 100% cotton or 57% acrylic/43% cotton). See image below.

**STEP 4 :** When the scanner identifies the composition, it automatically appears on the tablet (see image below). If the composition is not detected, scan again. If it still doesn't give a result, keep the garment aside.

**STEP 5/6/7:** Here, the product categories must be tracked and saved on the Matoha app. Product characteristics like type of garment or item, colour and presence of disruptors (See Annex 1 for more information) are captured in the app through a predefined multiple choice survey. In case the necessary characteristic is not predefined in the app, the sorter can insert the information in an adaptable field.

## Tops

Coat | Heavy Jackets | Light jackets | Sweater/hoodies | Jacket | Polo shirts | Blouse/shirt | T shirt | Rainwear | Blouse | Kurta

## Bottoms

Shorts | Skirt | Trousers | Sports trousers | Shorts | Skirt | Trousers | Long skirts | Pajama

## Underwear

Bra- Lingerie | Swimwear | Underwear | Socks

## Overall

Jumpsuits | Overall | Nightgowns | Dress | Home wear | Reflective safety | Costume | Burqua | Saris

## Babies

Baby clothes | Baby underwear | Baby clothes

## Accessories

Medium accessories | Small accessories | Gloves | Headwear

## Others

Fabrics | Household linen | Other

Garment Category

Type of Garment

The first action within this step of adding the product type data is to add garment age- Baby, Children or Adult. Once one of the options are selected, the next step is to add the garment type Tops, Bottoms, Overall, Accessories or Others. The last step then requires the sorter to choose the garment in detail from a range of options (**see table XX below**).

Once the garment is scanned **Add Properties** Age Group -> Garment Type -> Garment items as shown above followed by **Add colour** of the garment as per your judgement , lastly **Add disruptors** present on the garment (you can select multiple disruptors). You can find the detailed description for these data entries in Annex 2.

Once these details have been entered, you must press **SAVE** in order for the garment to be saved in your collection. In the case of multi-layered garments, the sorter is to scan the top layer as instructed in the steps above. Once the top layer was saved, the next layer can be scanned, at which point they must press **SAVE TO PREVIOUS**, which allows the garment to be saved as one garment. For the purpose of our pilot, we limited the number of layers to 3.

In addition to the steps mentioned above, it is important to note:

1. If the scanned item provides an “unknown” result on the NIR scanner’s display screen, the sorters and/ or volunteers must input the composition claims manually on the Matoha app, as seen on the care label of the item. If the care label is missing or not legible, only the product category information must be tracked on the Matoha app.
2. Elements such as garment, size and washing instruction tags as well as pockets are not to be considered as disruptors for the purpose of data collection
3. Some considerations for data collection and items:
  - Wet garments must not be scanned and should not be included in the fraction analysed.
  - Items that are heavily broken or stained must be included and scanned, however, if an item is too small to be classified as a specific garment, they must be removed from the sample.

### **ACTION 3: PLACING OF THE GARMENT IN THE BUCKET**

Once scanned, based on the composition detected the led will change colour. After adding the details (mentioned in Action 2), place the garment in the corresponding colour bucket as per the colour of the LED lights on the scanners.

In the case of multi-layered garments, sorters were asked to place the garment in the bucket designated to the top layer of the material. For example, if the top layer scanned as 100% Cotton, and the second layer scans as 100% Polyester, the garment would be placed in the 100% cotton bucket. Please do keep in mind however, that as mentioned in the XX section below, only about 3.7% of the total materials were found to be multi-layer.

## 2.5 PRE-IMPLEMENTATION PROCESSES

To ensure the implementation of the predefined operational protocol and methodology, it was important to train, guide, and monitor the data collection process throughout the full duration of the on-the-ground analysis. A consultant from Fashion for Good supported the sorters in the setup of their spaces. To plan for staff requirements, we asked the supervisors from each facility to consider the following:

- Estimated productivity could be 40 seconds per item, which leads to approximately scanning and

## 2.6 METHODOLOGY OF THE PICVISA PILOT

The PICVISA pilot is a bespoke feasibility study, which was conducted in three phases: Preparation, Implementation and Reporting. A detailed account of the approach and the methodology for each phase is given in the section below.



### PREPARATION

#### Designing the framework of the pilot

The Picvisa pilot was designed as a part of the Sorting for Circularity India project. It was an opportunity to extend the learnings of the Matoha Pilot to assess the feasibility of fully automated sorting technology in India. While projects and pilots generally involve bringing in the technology to the probable user for assessment, here that was not a suitable option considering the high costs associated with the technology and its transport. Thus, a reverse approach was adopted here to evaluate the technology.

The features of this course were as follows:

- Shortlisted and interested stakeholders from India visit the facility housing the PICVISA technology
- Non-re-wearable post-consumer textiles are made available at the site from their local market (European)
- Stakeholders evaluate the efficiency, accuracy, and feasibility of the technology through various curated sorting tests

segregating 50 garments of textiles per person, per hour. This time was spent mostly on manually entering information about each garment, the actual NIR scan time is 1 second per scan.

- Estimated time for training and practising is 2 hours. The training to staff/workers needs to be conducted before the actual sorting activities on-ground.
- Include time for breaks. Bear in mind that some time is also lost when changing the type of fraction or bale being sorted. This is why appointing one individual to manage logistics, such as changing and weighing bales is crucial.

Prior to the start of the setting up for the sorting infrastructure, the facilities needed to ensure:

1. Collection of post consumer materials was already underway. If the facility was conducting their own collection, they were expected to have already collected at least half of their total material quantity for the purpose of productivity during the kick off week
2. Each facility was given a set of documents that were to be printed and stuck on the walls for the sorters to make the process of sorting easier and in turn, faster. The first document was a list of brands that were eligible for resale. The other document was the recycler bucket tags, which were colour coded for the process.
3. The facility were requested to keep the following ready prior to the setting up of the sorting infrastructure
  - Extension Cords (at least 2)
  - Internet access (for a minimum of 8 devices at once with a speed of 2.4 GHz)
  - Containers for segregation (18)
  - Tables (4)
  - Weighing machine
  - Fans
  - Bags for storage
4. Tablets and Scanners would be provided to them by Fashion for Good during kick off week, and a consultant from Fashion for Good would be transporting and setting them up at the facilities.

## **SPACE PREPARATION**

The workplace had to be set up to enable staff to use the hardware required to conduct the analysis. The hardware was provided by Fashion for Good, and included the following:

- The **NIR scanners** which are used to scan the garments and items
- **Tablets** which are used to categorise each scanned item based on characteristics such as type of garment, colour, and disruptors using the Matoha app downloaded on the tablets
- Assorted **post consumer textile waste** required for sorting as per discussions

To prepare for the workplace, following actions are recommended and will take around one hour to complete

1. Connect the tablets and NIR scanners to the internet. Ensure that the internet connection is not disturbed for the entire analysis process as the data must be stored on the cloud.
2. Plug the NIR scanners into a power socket to turn them on (they must be plugged throughout the entire time of the analysis)
3. Calibrate the NIR scanners using the calibration device (a small white plastic calibrator is provided by Fashion for Good, and this one time calibration will be administered by the Fashion for Good consultant)
4. Open the Matoha app on the tablets, and connect each device to the respective scanner (one tablet per scanner)
5. Prepare and label (colour code) the bins in accordance to the list provided to you by Fashion for Good. Place them in a central area in your facility for each sorter or table
6. Following the safety and cleaning guidelines for the machines and tablets- cleaning of the machines in the case of dust settling, and turning off all devices during breaks and at the end of each day. All devices were to be stored safely at the end of each day, and no devices were to leave the proximity of the facility at any time without the permission of Fashion for Good
7. Follow health and safety guidelines for sorters, for example, by providing orthopaedic mats or chairs as they are required to stand for long hours or by ensuring the height of the tables does not cause back pain. Giving breaks to the sorters so that they can rest their eyes

To prepare the materials to be sorted, following actions are recommended:

1. Prior to the start of segregation, a mix of both rewearables and non-rewearables with pre-defined volumes should be collected at the facility.
2. Appoint one individual to manage the logistics (the logistics varies per facility). This individual must bring in new bales to be sorted, pick up and weigh\* the sorted bales. This avoids the chance of double-counting of certain fractions, and enables an optimised and efficient sorting process

\*Please note that individual garments will not be weighed during the analysis, only the total bales will be weighed.

## **STAFF TRAINING AT THE START OF THE PROCESS**

After preparing the workplace for on-the-ground analysis, the sorters/staff must be trained to use the NIR scanners and tracking of product categories within the Matoha app. Some considerations at this stage were:

- The training approximately takes one hour to complete, this is based on a training given by the consultant that leads to a maximum of 5 sorters at one time
- The training includes: run through of acts and data collection steps (see section XX to add details on scanner), tracking of product categories/colours and disruptors on Matoha app.
- Ensure that sorters are provided with Annex 2 to understand how to categorise garment categories, colours and disruptors.
- Allow some time for the sorters to familiarise with the sorting process as a test round for approximately a few hours on the first day. During this test round, monitor the physical sorting process and the digital data stored in the cloud. Based on this monitoring, adjustments can be



made. For instance, in the physical sorting space, examples of adjustments include height of tables, appropriate lighting, and the placement of new and sorted bales. While examples for the digital aspect include understanding productivity rate and checking for any mistakes with product categorisation.

- The process of tracking product categories is a matter of subjective judgement of each individual sorter/worker.

## **QUALITY CONTROL**

As data is being collected, it is important for one to routinely monitor the data in real-time to spot and resolve any mistakes or inconsistencies immediately. Some of the recurring mistakes, but not limited to, in the pilot could be mostly human errors:

- Incorrect categorisation
- Data saved under the wrong fraction name
- Inconsistencies between the two layers of one garment

Data collection could also be disrupted by external factors and in that case support from Matoha or the facility was fundamental to resolve them:

- Internet connection failures
- Cloud uploading issues
- Hardware failures of the tablets or scanners
- Electricity issues

Resolving such issues immediately was one way of controlling the quality of the data.

- Drawing correlations to the Indian market scenario from the observations made in a European set-up with Western garments.

Shortlisted for pilot at Picvisa facility









	Priority 1-3								
Region	1	Kandla	Bangalore	Chennai	Kerala	Bangalore	Mumbai	Gujarat	Chandigarh
Profile	1	Sorter	Sorter	Sorter	Sorter	Sorter	Recycler	Recycler	Recycler
Waste Stream	3	Imported material	Dry Waste Collection centres	Brand Buy Back Primary - pre-consumer	Residential Collection Drives - Rural	Residential + Corporate Collection Drives	Imported material	From sorters	Primarily post industrial from factories
Facility	1	Unknown	Rented	Rented - 1500 sqft	Own - 2500 sqft	Rented facility	Own facility	Own facility	Own facility
Collection Capacity	2	Imported Materials (Qty : Unknown)	Access to 300 apartment complexes	Inconsistent	100 tonnes/month	7 to 8 tonnes/month (3-5 tonnes currently)	High	TBC	Don't have any post consumer collection
Highlight	1	-	TBC	Skilled workforce, Automation in cutting and baling	Expanding sorting facility	Good facility dedicated to textiles	Already in talks w/ Picvisa, stalled due to expense	Increasing sorting and recycling capacity	Already in talks w/ Picvisa, stalled due to expense
Interest Shown	3	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

Figure X: Decision table for shortlisting stakeholders

## Shortlisting stakeholders

The stakeholders who participated in the Matoha pilot were considered for participation in the PICVISA pilot.

Based on interviews and an understanding of their interest in automated sorting technology, four sorters and two recyclers were initially shortlisted for the pilot.

Finally, as per the availability of representatives from the shortlisted stakeholders, three sorters, one recycler, and one innovation partner participated in the sorting trials with PICVISA technology, these are:

- Sorters - Saahas Zero Waste, Green Worms, Enviu (Uptex)
- Recycler - Arvind
- Innovation Partner - Reverse Resources.

The profiles are given in the earlier sections of this report.

The role of the participating stakeholders was to actively participate in the PICVISA sorting trials and related discussions, and further contribute to Business case assessment for automated sorting technologies and Picvisa learnings via interviews and reviews.

## Curating material sorting tests

The material sorting tests were designed based on the following:

- Initial results from the Matoha pilot
- Capability and infrastructure availability at the PICVISA test centre
- Discussions with stakeholders to understand the feedstock's colour and composition requirements.

The tests were divided into two categories per the initial results of the Matoha pilot and inputs received from sorting and recycling stakeholders.

- Test A/ composition and colours of common recyclable material
- Test B/ composition and colours of specific material

The infrastructure at the test centre had four hoppers on the evacuation belt - which means one could sort four outputs at a time. Thus, to sort the material into more categories, the material had to be passed in multiple rounds. For the 15 outputs or sorting categories that were defined for this pilot, the material was sorted in four rounds as given below.

Test	Input	Output				
		Bucket 1	Bucket 2	Bucket 3	Bucket 4	Rejects
Test A, Round 1	Qty =1.5 tonnes	Cotton, Cotton-rich, Polyester, Polyester-rich, Wool, Viscose, Acrylic, etc.	100% cotton; black	100% cotton; white	100% cotton; brown, green, blue	100% PET; white, black Rejects '1'
Test A, Round 2	Rejects '1'	100% cotton; red, pink	70/30 cotton/ PET; black, blue green, brown	70/30 cotton/ PET; white	30/70 Cotton/ PET; black, blue, green, brown	Rejects '2'
Test B, Round 3	Rejects '2'	Cotton/ acrylic	100% wool	100% nylon	Cotton/ viscose	Rejects '3'
Test B, Round 4	Rejects '3'	>70% cotton; black, blue, green, brown	100% viscose; white and beige	100% viscose; black, blue, green, brown	-	Rejects '4'
Test C	To accommodate any on-the-spot classification request (as possible by ECOSORT)					

## **IMPLEMENTATION**

After the preparation phase of the pilot, the implementation was conducted at PICVISA's test centre in Calaf, Spain. The two-day sorting trial involved stakeholders like sorters and recyclers who gained hands-on experience in automated textile sorting using PICVISA's technology. The objective of the visit is to test the Picvisa machinery for automated sorting efficiency and accuracy and discuss the technical and financial feasibility. This additionally was aimed at facilitating knowledge transfer and collaboration between Picvisa and Indian sorters/recyclers.

### **Arrangement of Non-rewearable Post-consumer Textile Waste**

The garment types that make up the Non-rewearable Post-consumer Textile waste were noted from the Matoha pilot and those from the European market were noted from the Sorting for Circularity Europe report. It was found that the Western garment types in India and those in Europe were alike. Especially, the prominent compositions were very similar enabling us to carry out the PICVISA pilot with European material.

For this pilot, the material was provided by Moda Re, which is also part of the Spanish charity Caritas and runs Spain's biggest second-hand clothing chain.

The PICVISA team were informed about the tests that we intended to carry out and they ensured arrangements of the non-wearable post-consumer textile waste accordingly.

### **Running the Material Tests at the PICVISA Test Centre**

The sorting process involved four main actions: (a) setting, (b) feeding the material to the sorter, (c) automated sorting on ECOSORT, and (d) storing the sorted material. Each action also involved data collection.

- a. Setting - The technical expert at PICVISA sets the sorting outputs at the start of each round. This was done on the dashboard by first selecting the hopper number, followed by the composition and the colour(s) of the garment that should be segregated in that hopper. This is repeated for all the hoppers. The dashboard is easy to use and test set-up is very quick.
- b. Feeding - The pre-sorted material is weighed to note the initial weight of the material. It is brought to the start of the conveyor where one or two persons feed the material to the sorter. When two people feed the material in the conveyor, care must be taken that the placement is in sync and that the two garments are not placed together.
- c. Sorting - Automated sorting was carried out by PICVISA's ECOSPORT as explained in Chapter 4 of this report.
- d. Storing - The sorted material was weighed to note the final sorted weight of the output. This was further used for calculating the percentage of the specific composition and colour garments in the total mix. The output was stored in bags with proper labelling.

### **Evaluation of the Fibre Compositions**

The selected samples for fibre composition were brought back to India for fibre composition testing at NimkarTek Technical Services. The test report can be seen in the [link here](#). Both microscopic and chemical analyses were performed on each of the samples.

## REPORTING

### Data Analysis

We obtained the data from ECOSORT's dashboard and analysed it offline. Furthermore, we shared the fibre composition test results with the PICVISA team to obtain feedback and for their internal evaluation.

### Data Collection for Business Case Assessment

The objective of the business case assessment is to study the viability of automated sorting of non-wearable post-consumer textile waste in India. The report compares the automated, semi-automated and manual sorting cases. The business case assessment report will serve as a model for the implementation of automated sorting technology for sorters/ recyclers/ waste collectors. All the sorters and recyclers contributed to the business case assessment via interviews.

### Dissemination of the learnings

This involves dissemination of the learnings of business case assessment and sorting trials, and discussing the technical and commercial feasibility with the relevant industry stakeholders.

The objective is to build awareness amongst the industry stakeholders on developing collection and sorting infrastructures, technical interventions for effective outcomes, and creating quality feedstock for recyclers via the learnings of the pilot and business case assessment.

### Consolidation of learnings and data into the Sorting For Circularity Post-consumer Report

The learnings from the stakeholders involved as well as through the analysis of data, the Sorting for Circularity Post-Consumer Report was put together, with the aim of providing insight into the industry.

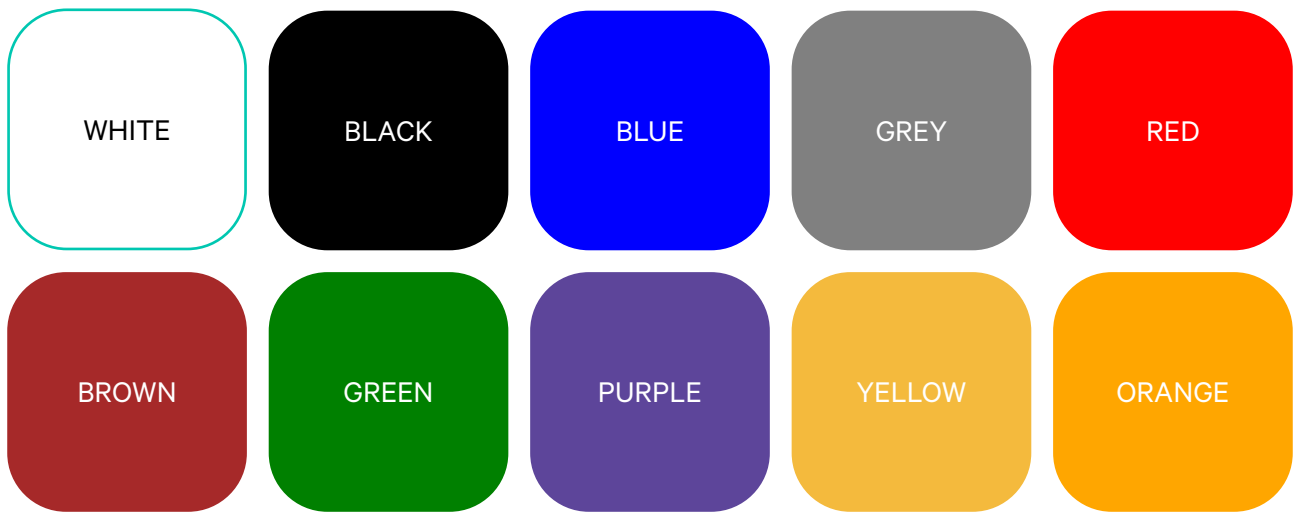
## 2.7 MATERIAL COMPOSITION AND COLOUR LIBRARY

### COMPOSITION

The database already available includes the following:

Natural & Regenerated Fibres	Synthetic Fibres	Blends
Cotton	Polyester	75-90% Cotton with Polyester or 65-75% Cotton with Polyester
Hemp	Polyamide	90% Cotton with Viscose
Viscose	Acetate	95% Polyester with other fibre
Silk	Polyurethane	90% Polyester with Viscose
Wool		
Leather		

## COLOUR CHART



## 2.8 PICVISA ECOSORT: TECHNOLOGY AND LAYOUT

### OPTICAL SORTER

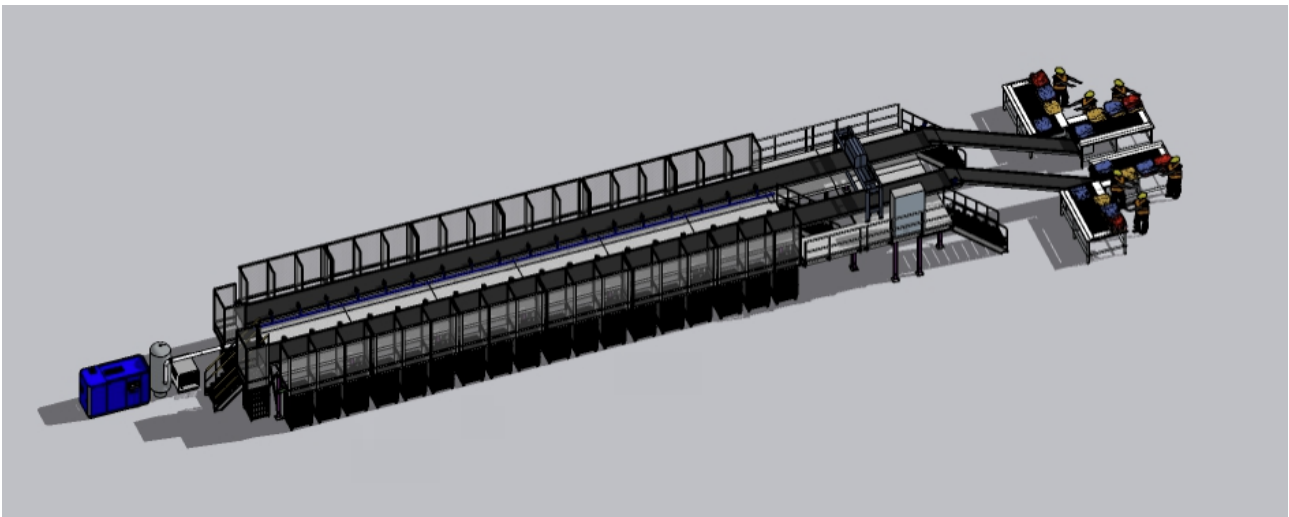
The sorting systems are based on spectroscopic technology such as Near Infrared (NIR), Visible Spectrum (VIS), Raman, Mid-infrared (MIR), Terahertz, and Nuclear Magnetic Resonance (NMR). Near Infrared Spectroscopy (NIR) is widely used for composition identification in automated sorting systems within the textile industry. Visible Spectrum Spectroscopy (VIS) or Red-Blue-Green (RGB) cameras are used to determine the colour of the garment and any other information such as shape and texture. NIR camera is used to analyse the fibre composition. It is a hyper-spectroscopic technique based upon molecular absorptions measured in the near-infrared part of the spectrum. It is sensitive to organic constituents and can provide both chemical and physical information. NIR is based on the fact that molecules absorb specific frequencies that are characteristic of their structure. RGB camera is used to analyse the colour composition. The camera has a hyperspectral sensor of the push broom type. These sensors continuously scan a line across the conveyor belt acquiring information about whatever is in the conveyor belt, for each point (pixel) of this line we can obtain a spectral response and with this information, we can analyse what type of material it is. This allows you to scan the entire contents of the conveyor belt as the belt moves forward.

### LAYOUT

The team at PICVISA helps the client understand their requirements and space availability to suggest the best possible layout. The set-up can be customised to have the desired number of sorting categories, and thus corresponding hoppers and air nozzles. ECOSORT TEXTIL is designed to work on 1000mm belts and can be combined with both a side-blowing system and a robotic arm such as ECOPICK to separate the different textile categories.

The conveyor can be on an elevated platform - for automatic feeding and automatic output - when there is baling.

The diagram shown below depicts the placement of two conveyor belts and hoppers laterally.



Top-view



Front-view



Side-view

They also provide continuous support to co-develop and enhance their offering to best suit the client. PICVISA offers bespoke consultancy service, to gain a detailed understanding of the specific nature of customers' production processes, with the goal of assessing the feasibility of a potential improvement project, from a technical and return-of-investment standpoint.



## 2.9 LAB TEST RESULTS FOR MATOHA SAMPLES

### TEST REPORT



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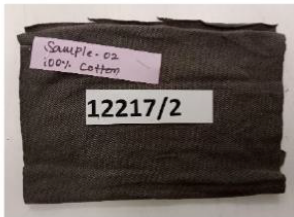
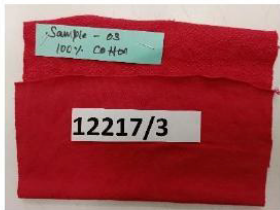
Test Report No: 23-24/12217

Report Date: 12/10/2023

**Background:**

Fashion for Good (FFG) has submitted 30 fabric swatches to NimkarTek Laboratory for fiber identification test. The fabric cuttings were classified as 100% Cotton, 70% Cotton with Polyester, 50% Cotton with any other fiber, 50% Polyester with any other fiber, 100% Polyester, 100% Wool, 100% Acrylic.

Our Laboratory has analysed all the fabrics swatches as per International Test Standards and reported them in the Table below.

Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
1	<p>23-24/12217-1 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
2	<p>23-24/12217-2 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
3	<p>23-24/12217-3 Sample Knitted Fabric</p> 	ISO 1833-1 (Annex B) : 2020	100 % Cotton	<p>97.7 % Cotton 2.3 % Elastane</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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Test Report No: 23-24/12217

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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
4	<p>23-24/12217-4 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
5	<p>23-24/12217-5 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
6	<p>23-24/12217-6 Sample Woven Fabric</p> 	ISO 1833-11: 2017	71 % Cotton 29 % Polyester	<p>71.7 % Cotton 28.3 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
7	<p>23-24/12217-7 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	74 % Cotton 26 % Polyester	<p>67.5 % Cotton 32.5 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
8	<p>23-24/12217-8 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	70 % Cotton 30 % Polyester	<p>71.1 % Cotton 28.9 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
9	<p>23-24/12217-9 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	77 % Cotton 23 % Polyester	<p>79.6 % Cotton 20.4 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
10	<p>23-24/12217-10 Sample Woven Fabric</p> 	ISO 1833-11: 2017	72 % Cotton 28 % Polyester	<p>71.1 % Cotton 28.9 % Polyester</p> <p>(Note: Traces of viscose were observed in red color yarn)</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
11	<p>23-24/12217-11 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	51 % Cotton 49 % Polyester	<p>50.8 % Polyester 49.2 % Cotton</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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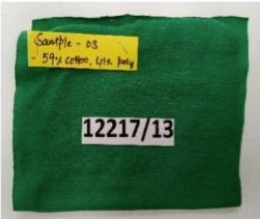


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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
12	<p>23-24/12217-12 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	50 % Cotton 50 % Polyester	<p>51.4 % Cotton 48.6 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
13	<p>23-24/12217-13 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	59 % Cotton 41 % Polyester	<p>59.4 % Cotton 40.6 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
14	<p>23-24/12217-14 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	62 % Cotton 38 % Polyester	<p>61.4 % Cotton 38.6 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
15	<p>23-24/12217-15 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	54 % Cotton 46 % Polyester	<p>51.6 % Cotton 48.4 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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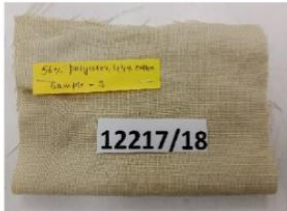
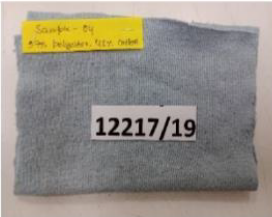
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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
16	<p>23-24/12217-16 Sample Woven Fabric</p> 	ISO 1833-11: 2017	63 % Polyester 37 % Cotton	<p>67.2 % Polyester 32.8 % Viscose</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
17	<p>23-24/12217-17 Sample Woven Fabric</p> 	ISO 1833-11: 2017	67 % Polyester 33 % Cotton	<p>66.9 % Polyester 33.1 % Viscose</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
18	<p>23-24/12217-18 Sample Woven Fabric</p> 	ISO 1833-11: 2017	56 % Polyester 44 % Cotton	<p>63.4 % Polyester 36.6 % Viscose</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
19	<p>23-24/12217-19 Sample Knitted Fabric</p> 	ISO 1833-2: 2020	57 % Polyester 43 % Cotton	<p>53.4 % Polyester 45.2 % Cotton 1.4 % Elastane</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
20	<p>23-24/12217-20 Sample Knitted Fabric</p> 	ISO 1833-11: 2017	58 % Polyester 42 % Cotton	<p>52.5 % Polyester 47.5 % Cotton</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
21	<p>23-24/12217-21 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Polyester	100 % Polyester
22	<p>23-24/12217-22 Sample Woven Fabric</p> 	ISO 1833-1: 2020	100 % Polyester	100 % Polyester
23	<p>23-24/12217-23 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Polyester	<p>100 % Polyester (Excluding Maroon Stripe) (Note: Maroon Stripe – Polyester/Acrylic blended yarns)</p>

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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
24	<p>23-24/12217-24 Sample Woven Fabric</p> 	ISO 1833-1: 2020	100 % Polyester	100 % Polyester
25	<p>23-24/12217-25 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Polyester	100 % Polyester
26	<p>23-24/12217-26 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Acrylic	100 % Acrylic
27	<p>23-24/12217-27 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Wool	100 % Wool

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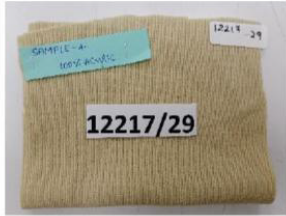

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Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
28	<p>23-24/12217-28 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Acrylic	100 % Acrylic
29	<p>23-24/12217-29 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Acrylic	100 % Acrylic
30	<p>23-24/12217-30 Sample Knitted Fabric</p> 	ISO 1833-1: 2020	100 % Acrylic	100 % Acrylic

**Authorized Signatory**

**Neeta Kokamkar**

**\*\*End of the Test Report\*\*<sub>MA</sub>**

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## 2.10 LAB TEST RESULTS FOR PICVISA SAMPLES

### TEST REPORT



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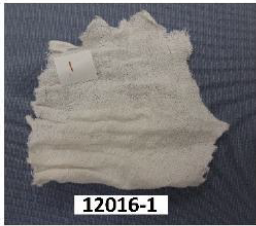

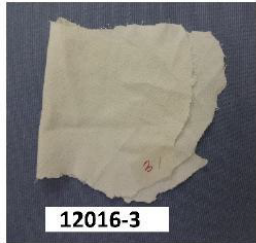
Test Report No: 23-24/12016

Report Date: 26/09/2023

**Background:**

Fashion for Good (FFG) has submitted 25 fabric cuttings to NimkarTek Laboratory for fiber identification test. The fabric cuttings were classified as 100% Cotton, 100% Polyester, 100% Wool, 70% Cotton/30% Polyester and 70% Polyester/30% Cotton.

Our Laboratory has analysed all the fabrics swatches as per International Test Standards and reported them in the Table below -

Sr. No.	Sample Identification	Test Methodology	Declared Fibre Content	Laboratory Findings (Fiber Content)
1	<p>23-24/12016-1</p>  <p>12016-1</p>	ISO 1833-1 (Annex B) :2020	100 % Cotton	51.9 % Cotton 48.1 % Flax (Linen)
2	<p>23-24/12016-2</p>  <p>12016-2</p>	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
3	<p>23-24/12016-3</p>  <p>12016-3</p>	ISO 1833-1: 2020	100 % Cotton	100 % Cotton

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4	<p>23-24/12016-4</p> 	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
5	<p>23-24/12016-5</p> 	ISO 1833-1: 2020	100 % Cotton	100 % Cotton
6	<p>23-24/12016-6</p> 	ISO 1833-1: 2020	100 % Polyester	100 % Polyester
7	<p>23-24/12016-7</p> 	ISO 1833-1: 2020	100 % Polyester	100 % Polyester

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8	<p>23-24/12016-8</p>  <p>12016-8</p>	ISO 1833-12: 2020	100 % Polyester	<p>91.1 % Polyester 8.9 % Elastane</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
9	<p>23-24/12016-9</p>  <p>12016-9</p>	ISO 1833-1 (Annex B) :2020	100 % Polyester	<p>58.0 % Nylon 42.0 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
10	<p>23-24/12016-10</p>  <p>12016-10</p>	ISO 1833-1: 2020	100 % Polyester	100 % Nylon
11	<p>23-24/12016-11</p>  <p>12016-11</p>	ISO 1833-1: 2020	100 % Wool	100 % Wool

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12	<p>23-24/12016-12</p> 	ISO 1833-4: 2017	100 % Wool	<p>89.1 % Wool 10.9 % Nylon</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
13	<p>23-24/12016-13</p> 	ISO 1833-1 (Annex B) :2020	100 % Wool	<p>96.7 % Wool 3.3 % Nylon</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
14	<p>23-24/12016-14</p> 	ISO 1833-1: 2020	100 % Wool	100 % Wool
15	<p>23-24/12016-15</p> 	ISO 1833-1: 2020	100 % Wool	100 % Wool

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Test Report No: 23-24/12016

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<p>16</p>	<p>23-24/12016-16</p> 	<p>ISO 1833-11: 2017</p>	<p>70 % Polyester 30 % Cotton</p>	<p>50.5 % Cotton 49.5 % Polyester <i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
<p>17</p>	<p>23-24/12016-17</p> 	<p>ISO 1833-11: 2017</p>	<p>70 % Polyester 30 % Cotton</p>	<p>64.8 % Polyester 35.2 % Cotton <i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
<p>18</p>	<p>23-24/12016-18</p> 	<p>ISO 1833-11: 2017</p>	<p>70 % Polyester 30 % Cotton</p>	<p>62.9 % Polyester 37.1 % Cotton <i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
<p>19</p>	<p>23-24/12016-19</p> 	<p>ISO 1833-11: 2017</p>	<p>70 % Polyester 30 % Cotton</p>	<p>63.9 % Polyester 36.1 % Cotton <i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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20	<p>23-24/12016-20</p> 	ISO 1833-11: 2017	70 % Polyester 30 % Cotton	<p>59.1 % Polyester 40.9 % Cotton</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
21	<p>23-24/12016-21</p> 	ISO 1833-11: 2017	70 % Cotton 30 % Polyester	<p>51.9 % Cotton 48.1 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
22	<p>23-24/12016-22</p> 	ISO 1833-11: 2017	70 % Cotton 30 % Polyester	<p>50.4 % Polyester 49.6 % Cotton</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>
23	<p>23-24/12016-23</p> 	ISO 1833-11: 2017	70 % Cotton 30 % Polyester	<p>53.7 % Viscose 46.3 % Polyester</p> <p><i>Remark: Result based on dry weight basis with addition of moisture regain.</i></p>

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# TEST REPORT



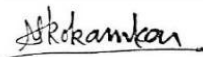
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Test Report No: 23-24/12016

Report Date: 26/09/2023

24	 <p>23-24/12016-24</p>	ISO 1833-11: 2017	70 % Cotton 30 % Polyester	80.3 % Cotton 19.7 % Polyester <i>Remark: Result based on dry weight basis with addition of moisture regain.</i>
25	 <p>23-24/12016-25</p>	ISO 1833-1: 2020	70 % Cotton 30 % Polyester	100 % Cotton

## Authorized Signatory



Neeta Kokamkar

**\*\*End of the Test Report\*\***<sub>MA</sub>

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## NimkarTek Technical Services Pvt. Ltd.

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