Study of Fabric Waste Generated in the Woven Garments Industries in Bangladesh

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Abstract— The work reported in this paper is the study of waste generated in various stages of making five different types of woven garments. The three types of wastes that considered were e.g. i. waste of fabric, which were just left unused after completion of the order and is useable for making new apparels, ii. Net waste of fabrics which cannot be used at all may be regarded as hard waste and iii. Waste of completed garments. The study was conducted in five different garments industries. All the factories are located around Dhaka city. The products that were studied were Long Pant, Long Shirt, Short Cargo, Girl's Tops and Blouse. Information regarding above mentioned waste were collected using a data sheet and then analyzed to get three types of wastes of the five different factories separately. The wastes were then expressed as percentages of total quantity of fabric involved in that particular order. It was observed that on average 3.59% fabric remains unused, 1.99% completed apparel was wasted and hard waste was 2.15%. The wastes were found to vary to some extent among factories as well as among garments products. An important aspect about the wastes was that the unused fabric and completed garments wastes are sold in the local market at a very nominal price. The hard waste is the actual waste that is matter even then these wastes are sold to local people who converts these wastes into some other products like handicrafts, table mats etc. The wastes of usable fabric and completed garments are posing a threat to the competitiveness of local weaving industries. Development of an online database is proposed to monitor the imported woven fabrics.

Index Terms: Woven garments, Fabric waste, leftover fabric, left over garments, net waste, denim and non denim.

1 INTRODUCTION

Bangladesh is one of the leading exporters of readymade garments (RMG) products in the world. Export oriented RMG products can mainly be divided into two sub sectors namely a) Woven garments b) Knit Garments. For knit RMG export, 100% raw materials i.e. yarn and knit fabrics are being produced locally. However, in majority of the cases, the woven garments factory depends largely on the imported fabrics. As a result, a large amount of foreign currency goes to the fabric supplying countries.

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industry leaves lot of wastage in form of fabric form whereas garments waste is not a large waste stream by weight or volume but has significant environmental impact connected to garments production [2]. F. Tabassum [3] found that every parts of garments wastes are valuable, recyclable and reusable where 70-80% are sold as jhuta. Textile Today[4], a leading textile magazine of Bangladesh published an article on 'Jhuta' (Waste) processing of Bangladesh's clothing industry, and mentioned that everyday approximately 550 tones garments wastes are exported which are mainly generated from fabric cutting in the garments industries. Elena Tomovska [5] mentioned that due to lack of workforce, technology, market and considering cost the management shows negligence about apparel waste. Nick [6] found that only 10.5 million tones clothing ends in landfills per year which is 6% of total garbage in New York. Parellax Limited [7], a medium size woven factory in China, studied on how to stop waste in their garment factory, they found that the amount of their waste is almost HK $ 1,480, 000 in a year. Mayedul Islam [8] mentioned that 10-15 % unavailable wastage occurs during cutting and marker making though in marker for larger pattern pieces marker efficiency and fabric consumption increases but for extreme large sizes (3XL) marker efficiency decreases but fabric consumption increases [9]. A study on clothing waste [10] reported that standard wastage percentages are 10-15%, 3-5% and 1-3% in the cutting, rejection and special operations respectively in knit apparel industries. Kasemset [11] showed that cutting waste

counts for as high as 16.36% of total material where 6.37% of waste was leftover from sewing and 0.09% from quality control. Another study found that waste from production lies between 10% to 30% of the intake materials, and that leftover percentage not less than 10% [12]. The two main authors [13] of the present papers found in a previous study on waste % in knit garments industry that on average more than 26.50 % waste is generated at various stages of which 13.57 % in the cutting section, 6.91% is in panel checking, 4.31% is in sewing section and 1.72% in the finishing section.

The present study has been conducted in woven garments to see exactly how much waste is generated at various stages of processing. The studies were conducted in five woven garments industries and information were collected for five different woven garments products. After careful observation of all wastes; three type of wastes were categorized e.g. (i) leftover waste as fabric, these were actually original but unused fabric, (ii) leftover waste as completed garment pieces, and (iii) Net waste or scrape -these are cut pieces of various sizes and shapes generated in the cutting table. Figure-1(a) -1 (e) shows wastes; how they look like?

Figure 1(a) Leftover waste as fabric roll

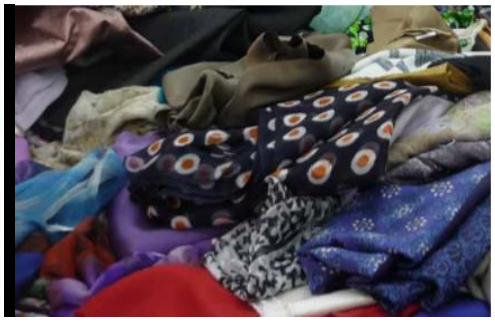

Figure 1(b) Leftover waste as yardage waste

Figure 1(c) Leftover waste as completed garments.

Figure 1(d) Net waste (scrap) as damaged parts

Figure 1(e) Net waste (scraps) as cutting waste

2. MATERIALS AND METHODS

2.1 Factories and product selection and data collection

As was mentioned, five different garment industries were selected from greater Dhaka. The factories have been producing various types of woven garments products, among them five different types of woven products were selected e.g. 1) Long Pant, 2) Long Shirt, 3) Short Cargo, 4) Girl's Tops, 5) Blouse. Primary information obtained from the five factories were given below in tables 1-5.

TABLE 1: DETAILS INFORMATION ABOUT FABRIC WASTE IN FACTORY 1

01	Factory Name	Factory 1				
02	Buyer Name	Garcia	Garcia	Renner	Renner	Renner
03	Item Name	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse
04	Order Quantity (Pieces)	12000	8000	18000	6000	14000
05	Quantity with 5 % Extra (Pieces)	12600	8400	18900	6300	14700
06	Production Capacity/Day (Pieces)	700	800	500	1100	950
07	Price Per Pieces ($)	6.50	4.95	5.25	4.25	3.80
08	Calculated Fabric Requirements (Yards)	20790	12180	30240	8190	16905
09	Calculated Waste Taken (%)*	5	5	5	5	5
10	Source of Fabric-Imported (%)	0	100	100	0	100
11	Source of Fabric-Local (%)	100	0	0	100	0
12	Fabric Input to Cutting (Yards)	20592.00	12064.00	29952.00	8112.00	16744.00
13	Cutting Output (Pieces)	12383	8248	18561	6198	14461
14	Wastage in Cutting (%)	0.78	0.87	0.85	0.67	0.68
15	Sewing Input (Pieces)	12383	8248	18561	6198	14461
16	Sewing Output (Pieces)	12302	8196	18440	6171	14392
17	Wastage in Sewing (%)	0.65	0.63	0.65	0.44	0.48
18	Washing Input (Pieces)	12302	8196	18440	6171	14392
19	Washing Output (Pieces)	12204	8167	18317	6152	14351
20	Wastage in Washing (%)	0.80	0.35	0.67	0.30	0.28
21	Finishing Input (Pieces)	12204	8167	18317	6152	14351
22	Finishing Output (Pieces)	12137	8147	18212	6138	14308
23	Wastage in Finishing (%)	0.55	0.25	0.57	0.23	0.30
24	Final Inspection Input (Pieces)	12137	8147	18212	6138	14308
25	Final Inspection Output (Pieces)	12052	8129	18125	6109	14240
26	Wastage in Final Inspection (%)	0.70	0.21	0.48	0.48	0.48
27	Final Packing (Pieces)	12000	8108	18036	6036	14156
28	Excess/Shortfall (Pieces)	+52	+21	+89	+73	+84
29	Reject Recovery (Leftover) (Pieces)	195	76	236	70	178

30	Total Leftover (Pieces)	247	97	325	143	262
31	Total Leftover (%)	2.05	1.22	1.81	2.38	1.87
32	Finally Used Fabric (Yards)	19885.26	11787.70	28999.78	7941.43	16375.48
33	Excess/Shortfall in Fabric (Pieces)	905	392	1240	249	530
34	Excess/Shortfall in Fabric (%)	4.35	3.22	4.10	3.04	3.13
35	Net Waste in Scrap (Pieces)	234	114	359	61	142
36	Net Waste in Scrap Fabric (Yards)	545.95	270.67	828.46	133.67	277.25
37	Net Waste in Scrap Fabric (%)	2.63	2.22	2.74	1.63	1.64

TABLE 2: DETAILS INFORMATION ABOUT FABRIC WASTE IN FACTORY 2

01	Factory Name	Factory 2				
02	Buyer Name	Gorge	Gorge	Lee	Gorge	Lee
03	Item Name	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse
04	Order Quantity (Pieces)	8000	12000	12000	9000	6000
05	Quantity with 5 % Extra (Pieces)	8400	12600	12600	9450	6300
06	Production Capacity/Day (Pieces)	800	900	600	1200	1100
07	Price Per Pieces ($)	6.00	5.05	5.50	3.95	4.40
08	Calculated Fabric Requirements (Yards)	14280	18270	19530	11813	6930
09	Calculated Waste Taken (%)*	5	5	5	5	5
10	Source of Fabric-Imported (%)	100	100	100	100	100
11	Source of Fabric-Local (%)	0	0	0	0	0
12	Fabric Input to Cutting (Yards)	14144.00	18096.00	19344.00	11700.00	6864.00
13	Cutting Output (Pieces)	8258	12376	12386	9301	6203
14	Wastage in Cutting (%)	0.75	0.83	0.75	0.63	0.60
15	Sewing Input (Pieces)	8258	12376	12386	9301	6203
16	Sewing Output (Pieces)	8201	12290	12297	9251	6172
17	Wastage in Sewing (%)	0.68	0.70	0.72	0.54	0.50
18	Washing Input (Pieces)	8201	12290	12297	9251	6172
19	Washing Output (Pieces)	8130	12253	12211	9216	6153
20	Wastage in Washing (%)	0.87	0.30	0.70	0.38	0.30
21	Finishing Input (Pieces)	8130	12253	12211	9216	6153
22	Finishing Output (Pieces)	8087	12210	12146	9189	6138
23	Wastage in Finishing (%)	0.53	0.35	0.53	0.29	0.25
24	Final Inspection Input (Pieces)	8087	12210	12146	9189	6138
25	Final Inspection Output (Pieces)	8038	12182	12086	9157	6113
26	Wastage in Final Inspection (%)	0.60	0.23	0.50	0.35	0.40
27	Final Packing (Pieces)	8024	12108	12048	9081	6060
28	Excess/Shortfall (Pieces)	+14	+74	+38	+76	+53

29	Reject Recovery (Leftover) (Pieces)	132	124	161	117	76
30	Total Leftover (Pieces)	146	198	199	193	129
31	Total Leftover (%)	1.83	1.65	1.66	2.14	2.15
32	Finally Used Fabric (Yards)	13665.42	17663.82	18732.81	11445.96	6724.41
33	Excess/Shortfall in Fabric (Pieces)	615	606	797	367	206
34	Excess/Shortfall in Fabric (%)	4.30	3.32	4.08	3.10	2.97
35	Net Waste in Scrap (Pieces)	150	174	233	86	51
36	Net Waste in Scrap Fabric (Yards)	361.01	402.71	505.97	181.57	97.31
37	Net Waste in Scrap Fabric (%)	2.53	2.20	2.59	1.54	1.40

TABLE 3: DETAILS INFORMATION ABOUT FABRIC WASTE IN FACTORY 3

01	Factory Name	Factory 3				
02	Buyer Name	COM	COM	Trampoline	Go-Sports	Go-Sports
03	Item Name	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse
04	Order Quantity (Pieces)	8000	5000	15000	4000	8000
05	Quantity with 5 % Extra (Pieces)	8400	5250	15750	4200	8400
06	Production Capacity/Day (Pieces)	950	1000	750	1300	1100
07	Price Per Pieces ($)	6.25	5.25	5.75	4.30	4.20
08	Calculated Fabric Requirements (Yards)	13860	7875	25200	5250	9660
09	Calculated Waste Taken (%)*	5	5	5	5	5
10	Source of Fabric-Imported (%)	100	100	0	100	100
11	Source of Fabric-Local (%)	0	0	100	0	0
12	Fabric Input to Cutting (Yards)	13728.00	7800.00	24960.00	5200.00	9568.00
13	Cutting Output (Pieces)	8249	5158	15478	4135	8268
14	Wastage in Cutting (%)	0.85	0.80	0.78	0.60	0.63
15	Sewing Input (Pieces)	8249	5158	15478	4135	8268
16	Sewing Output (Pieces)	8197	5120	15362	4114	8230
17	Wastage in Sewing (%)	0.63	0.75	0.75	0.50	0.45
18	Washing Input (Pieces)	8197	5120	15362	4114	8230
19	Washing Output (Pieces)	8124	5100	15252	4098	8203
20	Wastage in Washing (%)	0.89	0.38	0.72	0.40	0.33
21	Finishing Input (Pieces)	8124	5100	15252	4098	8203
22	Finishing Output (Pieces)	8085	5084	15168	4085	8184
23	Wastage in Finishing (%)	0.48	0.32	0.55	0.32	0.23
24	Final Inspection Input (Pieces)	8085	5084	15168	4085	8184
25	Final Inspection Output (Pieces)	8030	5070	15099	4068	8147
26	Wastage in Final Inspection (%)	0.68	0.27	0.45	0.42	0.46
27	Final Packing (Pieces)	8024	5024	15040	4060	8048
28	Excess/Shortfall (Pieces)	+6	+46	+59	+8	+99
29	Reject Recovery (Leftover) (Pieces)	123	54	217	56	96

30	Total Leftover (Pieces)	129	100	276	64	195
31	Total Leftover (%)	1.61	2.01	1.84	1.60	2.44
32	Finally Used Fabric (Yards)	13250.12	7605.31	24159.18	5084.55	9368.71
33	Excess/Shortfall in Fabric (Pieces)	610	270	1041	165	291
34	Excess/Shortfall in Fabric (%)	4.40	3.42	4.13	3.15	3.02
35	Net Waste in Scrap (Pieces)	167	76	284	36	77
36	Net Waste in Scrap Fabric (Yards)	392.77	175.96	648.33	76.41	148.30
37	Net Waste in Scrap Fabric (%)	2.83	2.23	2.57	1.46	1.54

TABLE 4: DETAILS INFORMATION ABOUT FABRIC WASTE IN FACTORY 4

01	Factory Name	Factory 4				
02	Buyer Name	H & M	Kmart	O'Stin	Kmart	O'Stin
03	Item Name	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse
04	Order Quantity (Pieces)	7800	14000	5000	22000	4500
05	Quantity with 5 % Extra (Pieces)	8190	14700	5250	23100	4725
06	Production Capacity/Day (Pieces)	750	800	550	1050	950
07	Price Per Pieces ($)	5.50	6.15	4.95	3.85	4.05
08	Calculated Fabric Requirements (Yards)	13923	21315	8138	30030	5434
09	Calculated Waste Taken (%)*	5	5	5	5	5
10	Source of Fabric-Imported (%)	0	100	100	0	100
11	Source of Fabric-Local (%)	100	0	0	100	0
12	Fabric Input to Cutting (Yards)	13790.40	21112.00	8060.00	29744.00	5382.00
13	Cutting Output (Pieces)	8047	14429	5157	22720	4650
14	Wastage in Cutting (%)	0.80	0.90	0.83	0.70	0.65
15	Sewing Input (Pieces)	8047	14429	5157	22720	4650
16	Sewing Output (Pieces)	7991	14335	5122	22629	4631
17	Wastage in Sewing (%)	0.70	0.65	0.67	0.40	0.40
18	Washing Input (Pieces)	7991	14335	5122	22629	4631
19	Washing Output (Pieces)	7924	14288	5083	22554	4613
20	Wastage in Washing (%)	0.83	0.33	0.77	0.33	0.38
21	Finishing Input (Pieces)	7924	14288	5083	22554	4613
22	Finishing Output (Pieces)	7878	14246	5059	22493	4598
23	Wastage in Finishing (%)	0.58	0.29	0.47	0.27	0.33
24	Final Inspection Input (Pieces)	7878	14246	5059	22493	4598
25	Final Inspection Output (Pieces)	7827	14204	5032	22392	4578
26	Wastage in Final Inspection (%)	0.65	0.30	0.53	0.45	0.43

27	Final Packing (Pieces)	7824	14120	5024	22240	4500
28	Excess/Shortfall (Pieces)	+3	+84	+8	+152	+78
29	Reject Recovery (Leftover) (Pieces)	119	141	69	258	59
30	Total Leftover (Pieces)	122	225	77	410	137
31	Total Leftover (%)	1.57	1.60	1.53	1.87	3.04
32	Finally Used Fabric (Yards)	13306.37	20595.35	7799.83	29109.82	5265.15
33	Excess/Shortfall in Fabric (Pieces)	617	720	338	920	169
34	Excess/Shortfall in Fabric (%)	4.43	3.38	4.15	3.06	3.10
35	Net Waste in Scrap (Pieces)	166	215	99	229	43
36	Net Waste in Scrap Fabric (Yards)	391.85	502.43	220.82	506.35	84.51
37	Net Waste in Scrap Fabric (%)	2.81	2.36	2.71	1.69	1.56

TABLE 5: DETAILS INFORMATION ABOUT FABRIC WASTE IN FACTORY 5

01	Factory Name	Factory 5				
02	Buyer Name	Zara	C & A	Zara	Corona	C & A
03	Item Name	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse
04	Order Quantity (Pieces)	13500	3500	15000	4000	9300
05	Quantity with 5 % Extra (Pieces)	14175	3675	15750	4200	9765
06	Production Capacity/Day (Pieces)	850	1000	600	1250	1100
07	Price Per Pieces ($)	7.20	5.27	5.83	4.05	3.95
08	Calculated Fabric Requirements (Yards)	23389	5513	24413	5250	10742
09	Calculated Waste Taken (%)*	5	5	5	5	5
10	Source of Fabric-Imported (%)	100	100	100	0	100
11	Source of Fabric-Local (%)	0	0	0	100	0
12	Fabric Input to Cutting (Yards)	23166.00	5460.00	24180.00	5200.00	10639.20
13	Cutting Output (Pieces)	13925	3609	15475	4133	9604
14	Wastage in Cutting (%)	0.82	0.85	0.80	0.65	0.70
15	Sewing Input (Pieces)	13925	3609	15475	4133	9604
16	Sewing Output (Pieces)	13841	3581	15367	4114	9563
17	Wastage in Sewing (%)	0.60	0.78	0.70	0.47	0.43
18	Washing Input (Pieces)	13841	3581	15367	4114	9563
19	Washing Output (Pieces)	1372[1]4	3567	15252	4099	9530
20	Wastage in Washing (%)	0.85	0.40	0.75	0.35	0.35
21	Finishing Input (Pieces)	13724	3567	15252	4099	9530
22	Finishing Output (Pieces)	13655	3557	15175	4089	9503
23	Wastage in Finishing (%)	0.50	0.27	0.50	0.25	0.28
24	Final Inspection Input (Pieces)	13655	3557	15175	4089	9503
25	Final Inspection Output (Pieces)	13569	3548	15092	4073	9467

26	Wastage in Final Inspection (%)	0.63	0.25	0.55	0.38	0.38
27	Final Packing (Pieces)	13500	3500	15036	4000	9330
28	Excess/Shortfall (Pieces)	+69	+48	+56	+73	+137
29	Reject Recovery (Leftover) (Pieces)	201	37	205	47	117
30	Total Leftover (Pieces)	270	85	261	120	254
31	Total Leftover (%)	2.00	2.44	1.74	3.00	2.73
32	Finally Used Fabric (Yards)	22388.89	5322.10	23392.44	5091.69	10413.41
33	Excess/Shortfall in Fabric (Pieces)	1000	190	1020	158	328
34	Excess/Shortfall in Fabric (%)	4.27	3.45	4.18	3.02	3.05
35	Net Waste in Scrap (Pieces)	270	55	303	40	88
36	Net Waste in Scrap Fabric (Yards)	636.01	128.21	663.17	83.57	171.19
37	Net Waste in Scrap Fabric (%)	2.72	2.33	2.72	1.59	1.59

2.2 Data analysis

Information shown in all the five tables were further studied and analyzed and three type of wastes were identified e.g. (i) Leftover waste as fabric, these were actually original but unused fabric, (ii) Leftover waste as garment pieces, and (iii) Net waste or scrape -these are cut pieces of various sizes and shapes generated in the cutting table. Figure-1 shows scrapes how they look like. Data about the three types of waste in the 5 different factories were extracted from tables 1-5 for five different items were summarized and shown in table 6. As was mentioned, the leftover waste was generated as fabric, completed garment pieces and scraps or net waste. Tables 7 shows the amount leftover fabric per day and table 8 shows the leftover fabric per year. The footnote shown below table 8 shows the details about how we got 295 days. Tables 9 shows the amount leftover garment per day and table 10 shows the leftover garments per year. The footnote shown below table 10 shows the details about how we got 295 days. Table 11 shows the net waste or scrap as percentage.

TABLE 06: PRODUCT WISE LEFTOVER WASTES (%) IN FIVE DIFFERENT FACTORIES

.

Item Name	Leftover Waste (%)	Factory 1	Factory 2	Factory 3	Factory 4	Factory 5	Average
Long Pant	Leftover (Fabric)	4.35	4.30	4.40	4.43	4.27	4.35
	Leftover (Pieces)	2.05	1.83	1.61	1.57	2.00	1.81
	Net Waste (Scrap)	2.63	2.53	2.83	2.81	2.72	2.70
Long Shirt	Leftover (Fabric)	3.22	3.32	3.42	3.38	3.45	3.36
	Leftover (Pieces)	1.22	1.65	2.01	1.60	2.44	1.78
	Net Waste (Scrap)	2.22	2.20	2.23	2.36	2.33	2.27
Short Cargo	Leftover (Fabric)	4.10	4.08	4.13	4.15	4.18	4.13
	Leftover (Pieces)	1.81	1.66	1.84	1.53	1.74	1.72
	Net Waste (Scrap)	2.74	2.59	2.57	2.71	2.72	2.67
Girl's Tops	Leftover (Fabric)	3.04	3.10	3.15	3.06	3.02	3.07
	Leftover (Pieces)	2.38	2.14	1.60	1.87	3.00	2.20
	Net Waste (Scrap)	1.63	1.54	1.46	1.69	1.59	1.58
Blouse	Leftover (Fabric)	3.13	2.97	3.02	3.10	3.05	3.05
	Leftover (Pieces)	1.87	2.15	2.44	3.04	2.73	2.45
	Net Waste (Scrap)	1.64	1.40	1.54	1.56	1.59	1.55

TABLE 7: FABRIC LEFTOVER IN THE FIVE DIFFERENT FACTORIES PER DAY (IN YARDS).

Factory	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse	Average
Factory 1	50	37	33	43	34	40
Factory 2	59	43	38	47	36	44
Factory 3	69	51	50	51	38	52
Factory 4	56	39	35	42	34	41
Factory 5	60	52	39	47	37	47

TABLE 8: FABRIC LEFTOVER IN THE FIVE DIFFERENT FACTORIES PER YEAR (IN YARDS).

Factory	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse	Total
Factory 1	14,750	10,915	9,735	12,685	10,030	58,215
Factory 2	17,405	12,685	11,210	13,865	10,620	64,900
Factory 3	20,355	15,045	14,750	15,045	11,210	76,700
Factory 4	16,520	11,505	10,325	12,390	10,030	60,675
Factory 5	17,700	15,340	11,505	13,865	10,915	69,325

** 295 working days in a year (approximately). [Friday= 52; Government holiday= 8; others holiday= 10]

TABLE 9: COMPLETED GARMENTS LEFTOVER IN THE FIVE DIFFERENT FACTORIES PER DAY

Factory	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse	Average
Factory 1	14	9	9	25	17	15
Factory 2	14	14	9	24	23	17
Factory 3	15	19	13	20	26	19
Factory 4	11	12	8	19	28	16
Factory 5	16	23	10	36	29	23

TABLE 10: COMPLETED GARMENTS LEFTOVER IN THE FIVE DIFFERENT FACTORIES IN A YEAR.

Factory	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse	Average
Factory 1	4,130	2,655	2,655	7,375	5,015	4,425
Factory 2	4,130	4,130	2,655	7,080	6,785	5,015
Factory 3	4,425	5,605	3,835	5,900	7,670	5,605
Factory 4	3,245	3,540	2,360	5,605	8,260	4,720
Factory 5	4,720	6,785	2,950	10,620	8,555	6,785

** 295 Working days in a year (approximately). [Friday= 52; Government holiday= 8; Others holiday= 10]

TABLE 11: NET WASTE IN THE FIVE DIFFERENT FACTORIES AS PERCENTAGE.

Factory	Long Pant	Long Shirt	Short Cargo	Girl's Tops	Blouse	Average
Factory 1	2.63	2.22	2.74	1.63	1.64	2.17
Factory 2	2.53	2.20	2.59	1.54	1.40	2.05
Factory 3	2.83	2.23	2.57	1.46	1.54	2.13
Factory 4	2.81	2.36	2.71	1.69	1.56	2.23
Factory 5	2.72	2.33	2.72	1.59	1.59	2.19

3. RESULTS AND DISCUSSION

3.1 Leftover of Usable fabric

Table 6 shows the percentage of fabric leftover in the five different factories. It shows that for five different products the leftover of useable fabric varies between 2.97% and 4.43%. Table 7 shows the quantity of leftover fabric per day and it was multiplied by 295 (working day) to get the leftover fabric per year (shown in Table 8) in the five different factories. Therefore, there will be 3,29,815 yards of leftover fabric only in the five different factories in a year. The figures will be as high as 18,28,49,436 yds if the total number of factories are considered which are at present approximately 2772 units (source BGMEA). 100% leftover fabric is sold in the local market at a very nominal price for local consumption. It was reported that the leftover fabrics are sold in the local market at a very nominal price, which pose tremendous impact on the competency of the local fabric manufacturers. It is also widely believed that many industries imports much excess fabric than required and many importers imports fabric but in reality do not export anything just sell in the local market. It was also a matter of interest to see how the cost imported fabric can be so low? To study this it will be necessary to gather information from the supplying countries.

3.2 Leftover as garment pieces

It can be seen in table 6 that the leftover as garments pieces are between 1.22 and 3.05 percent. Like fabric, the leftover pieces per day and per year has been shown in table 9 and table 10. Like leftover fabric, the quantity of leftover garments per day average 18 and per year 5310 garments per factory and will be 14,719,320 pcs (for 2772 factories) are also huge if it is considered round the year. 100% leftover garments are also sold in the local market at a very nominal price.

3.3 Net waste

It can be seen in table 6 that the leftover as garments pieces is between 1.40 and 2.83 percent. These waste are also called hard waste and are sold in the local market for converting them to various types of usable products e.g. wearable shorts, tops for kids; recyclable yarn for fabric production, inner materials of mattress and cushion etc.

3.4 Impact of leftover useable fabric and completed garments

The leftover fabrics and garments shown in the tables 6-10 are estimation from five different factories, though the exact data varies among factories but probably the overall scenario are not very unrealistic. The data shown in various table were only leftover data but it is widely believed that many garments business owners import in the name of garments and then just sell the fabric in the local market. This aspect of unusual practice was not considered in the paper. The leftover fabrics and garments have changed the economy of the domestic weaving industries to a great extent. It may be mentioned that left fabric are good quality fabric and are consumed by the solvent consumers whose buying capacity is very good. Though they buy these at a nominal prices but it has great impact on the competitiveness of the domestic woven fabric manufacturers. This is because due to the fact that the woven fabric are sold in the domestic market at a very lower price than even manufacturing cost at the local weaving industries. It is also widely believed that lots of garments manufacturers import fabric in the name of garment and then sold in the local market. It may be mentioned that fabric is import for garment without any tax or vat. It was also learned that the fabric importers also enjoys advantages from supplier's side due to their own country's export policy under the umbrella of dual currency policy. Thus the import of woven fabric is to some extent relieving for the local consumers but a harsh suffocation for the local weaving industries. A suffocation that led to

breakdown of the backbone of the domestic (non denim) weaving sector of Bangladesh. Md. Masum [14], mentioned that the local suppliers can only meet 40% demands of woven fabric and 60% are imported. However in the recent years the scenario has been changed due to advancement of denim industries. It is a matter of interest that the locally produced denims are highly competitive as compared to the imported fabrics and local industries (both denim weaving and garmenting) have been doing excellent as compared competitor countries. It is also a matter of interest to study why the denim is so successful but non-denim weaving is not? It may be worth noting that the local consumption of denim is much lower in Bangladesh. Only certain young male populations are consuming denim trousers in a limited extent.

Due to import of large quantity of woven fabric for export market, huge amount of foreign currency goes to the fabric supplying countries. Apart from this the domestic demand of woven fabric is also very high though there is no exact data. However it seems that the local demand met by imported fabric is not less than that (woven fabric) are exported as completed garments. It seems that, in order to promote local weaving industries, the imported fabric must not be allowed to use in the domestic market. This means, the importers have to export everything they import. This is possible if they do it as stock lot or the importers sell their fabric to the smaller garments factories that can make and export as small lots. Though it will not be very easy to implement such policy but it seems that an online central server may be maintained. Whenever any fabric is imported it will be recorded in the server by the concerned users as well as Govt. agencies, and this type of data entry should be followed at every stage and finally the data about amount of excess fabric and completed garments may also be recorded. Though it will not be possible to prevent everything but it seems that if properly monitored then it will be possible to control to a great extent. Once if the domestic industries can stand in their own feet, the woven RMG export may reach new heights because import of the basic raw materials is always associated with some uncertainties.

4. CONCLUSION

Three types of waste e.g. leftover as fabric, leftover as garments and net waste were studied and reported. A very large amount of useable woven fabric and completed garments are generated as waste, however these waste fabric and garments are sold in the domestic market at a nominal price which affect the competiveness of the local weaving industries. In order to save the local weaving industries, the imported fabric and garments made from it should not be allowed to enter into the local market and these should be exported as stock lots. An online central server system can be introduced to monitor the excess fabric imported by the woven garments industries. Thus, it is only the net waste that is real waste, though in real sense that is not a waste either because these are again converted to other useable non-apparel, decorative or fancy products, but the impact of leftover fabrics and garments on the local industries needs to be studied and dealt with to safeguard the local weaving industries. Apart from this, if for any reasons like covid 19, supply chain is affected then the whole woven garments industries as well as the local consumers have to suffer severely due to hampering of import. Finally an important study may be carried out in the future to know why are local weaving factories cannot compete with imported fabric, though denim is competing very successfully.

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* In Bangladesh maximum factory assumed 5 % extra fabric during their fabric consumption calculation