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CHALLENGES AND OPPORTUNITIES OF WASTE MANAGEMENT IN TEXTILE MANUFACTURING IN COIMBATORE

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ABSTRACT

Textile Industry is providing one of the most basic needs of people and the holds position of preserving continued growth for improved quality of life, from the manufacture of raw supplies to the delivery of finished products, with substantial value-addition at each point of processing; it is a major contribution to the country's economy. It is essentially disturbed with the enterprise, manufacture, and supply of textiles yarn, cloth, and clothing, the raw material natural textile engineers, desirable R&D, technical sales, quality control, production control, and corporate management. Trends are the rising desire for natural fibers and fabrics. The quick extension of normal fibers is a pouring influence in the development of the textile industry. The fabric industry theatres a noteworthy role in the Indian budget by providing straight service to an appraised 35 million people, contributing 4 percent of GDP, and accounting for thirty- five percent of gross export earnings. The main aim of the study contributes that, waste management in the textile industry and the types of Textile industry in Coimbatore. To explore textile waste, challenges of the textile trade, and their use of methods in textile.

Keywords: Waste, Textile, Manufacturing, Clothes

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1. INTRODUCTION

The Indian textile industry currently contributes around fourteen percent to industrial production, 4 percent to GDP, 17 percent to the country's exports, and 21 percent to employment. Indian products are preferred for their fine design, embellishment, and craft. At present industry is growing at 9-10 percent with the Indian economy. Indian textile industry currently possesses a share of 4.7% in the world market of textiles and clothing Transformation.

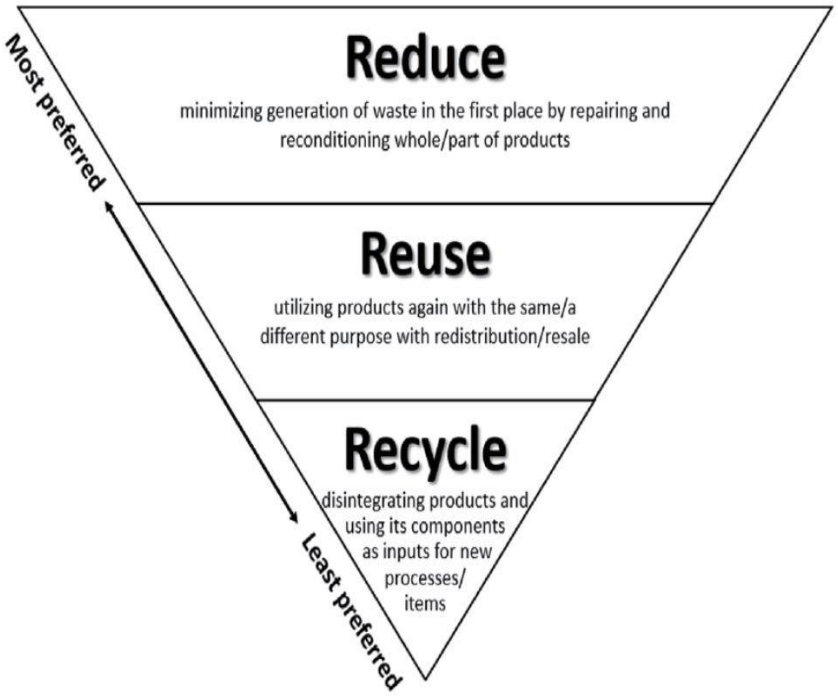

Figure - 1: Waste Management Methods in the Textile Industry

MANUFACTURING SCENARIO

The domestic textiles industry stood at $152 bn in 2021, growing at a CAGR of 12% to reach $225 bn by 2025.The textiles and apparel industry in India has strengths across the entire value chain from fibre, yarn, and fabric to apparel. India's ready-made garment exports are to see a CAGR of 12-13% and surpass $ 30 bn by 2027.

The domestic textiles and apparel industry stood at $150.5 bn in 2019-2020.

- India's Textiles Exports were uppermost ever in FY 2021-22, voyage US$ 44 Bn
- India is the largest cotton producer (23%) in the ecosphere and has the highest area under cotton cultivation (39% of the world area). Cotton plays a major role in sustaining the livelihood of an estimated 5.8 million cotton farmers.
- India produced 90 Lakh bales of raw jute in FY 2021-22

India scaled its highest-everdisseminates tally at $ 44.4 Bn in Textiles and Apparel (T&A) including Handicrafts in FY 2021-22, a substantial increase of 41% and 26% over corresponding figures in FY 2020-21 and FY 2019-20.

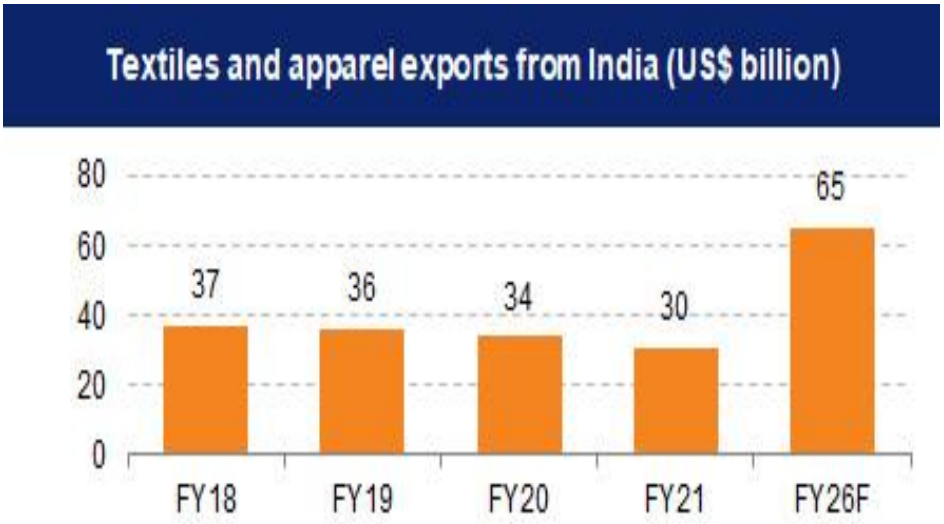

Figure - 2: Indian Textile and Apparel Industry

The Indian textile and apparel industry is expected to grow at 10% CAGR from 2019-20 to reach US$ 190 billion by 2025-26. India has a 4% share of the global trade in textiles and apparel. India is the world's largest producer of cotton. Estimated production stood at 362.18 lakh bales through the cotton season 2021-22. Internal feasting for the 2021-22 cotton term is assessed to be at 338 lakh bales. Yarn manufacture in India is predictable to reach 7.2 million tonnes (~43 million bales of 170 kg each) by 2030, ambitious by growing request from consumers. India's textile and apparel exports (including handicrafts) stood at US$ 44.4 billion in FY22, a 41% increase YoY. India's textile and apparel exports to the US, its single largest market, stood at 27% of the total export value in FY22. Exports of expedient styles counting cotton decorations stood at US$ 6.19 billion in FY22.India's textiles manufacturing has everywhere 4.5 crore working counting 35.22 lakh handloom work forces transversely the country.

2. REVIEW OF LITERATURE AND RESEARCH GAP

Technological upgradation, enhancement of productivity, quality consciousness arrangements, and maximizing employment opportunities, (Ministry of Textiles, 2000). The pattern shows an increase in value due to government initiatives like industry partnerships. Modernization and innovations are the key driver (Teli, 2008) T&C industry in growth and development strategies in developing countries. Keane (2008) employment provides material on energy-efficiency knowledges and measures applicable Hasanbeigi (2010) subsequently, energy-efficiency enhancement occasions obtainable Baskaran et al (2012) is a critical one for both categories of suppliers in the case of garment manufacturers, clothing is an integral part of our lives and green Eryuruk (2012) manufacture, and logistics up to discarding. Acquah and Oduro (2012) challenge and business opportunities in companies to better assist the shop.

Pang & Abdullah (2013) the current scenario with respect to textile industry effluent in Malaysia and technologies available for the treatment of the effluent dedicated to the treatment of fabri care also reviewed in detail organization Lohari and Gopal (2013) studied the human resource challenges facing the textile industry sub-sector Aboagyewaa et al (2016) potential commercial chances the principle of 'reduce, reuse and recycle' is at the heart of the CE-based business model. Take, make, distribute, use and recover are the five functions that can reduce the use of raw materials and prompt reuse and recycle outputs Ormazabal, Prieto-Sandoval, Jaca & Santos (2016). Determinants of competitiveness imply the supportability of Indian silk and handloom sector (Londhe and Gupte, 2017).

Textile industry maintain good solvency in order to meet Chitra and Nithyadevi (2018) quick term and stretched-term obligations of the organization Koszewska (2018) challenges confronted by the clothing and textile industry modelincrease of organizational commitments toward sustainable development, Barbosa-Póvoaet al. (2018) new technologies demanding high reserves, relocation arbitrage on labor costs, provincial business isolationism, volatile shopper partialities, Tudor (2018) need for new decision-making skills.

The textile industry is one of the most global industries in the world Muñoz-Torres (2018), innovative opportunities by the global value chain indicate a higher autonomous advanced movement earnings place by developing countries through marginal or low innovative movement occurs with scanty use of knowledge sourced within the global value chain and scarce use of an external source of learning De Marchi et al (2018)infrastructure, finances, labor laws, import policy, research and development, land acquisition, and exports (Rana et al., 2018).

Yalcin-Enis (2019) management collaborative exertions, information distribution in sustainability management across the value chain, and marketization Krishnendu Saha (2020) of waste salvaging, mid others, are ain sufficient actions the investors. Especially in global economic environments, has Koberg (2019) been gaining momentum in the last decades, the superiority of a product based on predetermined standards, product name, and realm of origin. Quality consciousness and brand consciousness of client influences the purchase decision involvement Jaiswal and Ha-Brookshire (2019) Multinational enterprises of textile and clothing industry.

Affordinfo for officials Li, Xin; Wang, Laili; Ding, Xuemei (2020) in the 16-textile industry. Prakash et al (2020) improvement in logistic performance etc, the international market. Sustainability management implies along the supply chains, emphasizing the need to advance in a consistent and science-based integration of global Muñoz-Torres (2021) conservational contests, environmental flashpoints at the sectoral level, obtained assistance international restraint performers and other administrations discourse this challenge**.**Okafor (2021) Emphasis is built on eco-design to encourage a proper waste management system to support recovery, reprocessing, reuse, and recycling of textile and clothing products. All supply chains must address waste management since it is a crucial step toward a sustainable world. Dursun, Ulker, and Gunalay (2022) probable of blockchain expertise in WM by intent on the fabric segment, infecting industries, understand productions' waste organization performs and sustainability creativities and then to realize how practitioners perceive the enactment of blockchain technology to waste management.

2.3 RESEARCH GAP

Most of the studies have been passed out on founding Sharma (2016) the factors between GDP, exchange rate, labor, capital and technology with ethe export recital of the textile industry. Most of the researchers originate a confident association amid the above said variables and textile exports. So that research gap is to full fill the "Challenges and opportunities of waste management in textile manufacturing in Coimbatore".

3. OBJECTIVE

i) To determine the waste management in the textile industry and the t**ypes of Textile industry in Coimbatore.**

ii) To explore the textile waste, challenges of the textile industry, and theiruse of methods in textiles.

4. RESEARCH METHODOLOGY

A conceptual framework has been drawn to analyze the Indian textile industry challenges and opportunities in Coimbatore. The questionnaire survey was conducted from Jan to Feb 2023. A list with 200 companies in Coimbatore city, First, potential respondents are identified from the target population and based on the information provided by the respondents. Thus, the Random sampling method is used for collecting the data information from the defendants. After obtaining consent to contribute in the survey from a plant owner, A questionnaire was sent by e-mail, and the respondents were asked to collect the information from the relevant persons in the company and to return the completed questionnaire by e-mail. The data was collected following a random sampling technique and different numbers of employees from different textiles were allowed to partake in the investigation. Descriptive research has been implemented in the study. Type of data collection was primary data collection was collected through a questionnaire (survey method); Secondary data is collected from different sources are international journals, Annual reports, Websites, Reports of international agencies, and Books / edited books. The structured questionnaire has been constructed on the foundation of prior studies. The survey method has been employed for conducting this study and data have been gathered from respondents randomly through a structured questionnaire it has distributed among 113 respondents.

5. FINDINGS ND RESULTS

Table - 1: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	Number of Items
.739	40

Table - 1 characterizes the reliability of the questionnaire

5.2 Percentage Analysis

Table - 2 denotes the percentage analysis of the respondents; Male category is working in textile industry 67 percent and their age should be in approximately 30- 49 years of the people. Post Graduates are highly working in the industry 40% and the average number of salary 52 percent. High number of post graduates having high designation of the company.

Table - 2: Profile of the Respondents

Category	Frequency	%
Gender		
Male	64	56.6
Female	49	43.4
Age		
20-29 Years	13	11.5
30-49 Years	50	44.2
50-59 Years	14	12.4
Above 60 Years	36	31.9
Education Qualification		
Diploma	35	31.0
Under Graduate	32	28.3
Post Graduate	46	40.7
<5 years	5	4.4
6-10 years	30	26.5
11-15 years	26	23.0
16-20 years	24	21.2
Above 20 years	28	24.8
Job Role		
Textile Designer	7	6.2
Intermediate Designer	4	3.5
Supervisor	9	8.0
Pattern Developer	34	30.1
Costume Designer	59	52.2
Monthly Salary		
Rs.30,000 to Rs.50,000	52	46.0
Rs.50,001 to Rs.80,000	59	52.2
Rs.80,001 to Rs.1,00000	2	1.8
Area of Residency		
Rural	44	38.9
Urban	69	61.1
Size of the Company		
Small	39	34.5
Medium	38	33.6
Large	36	31.9

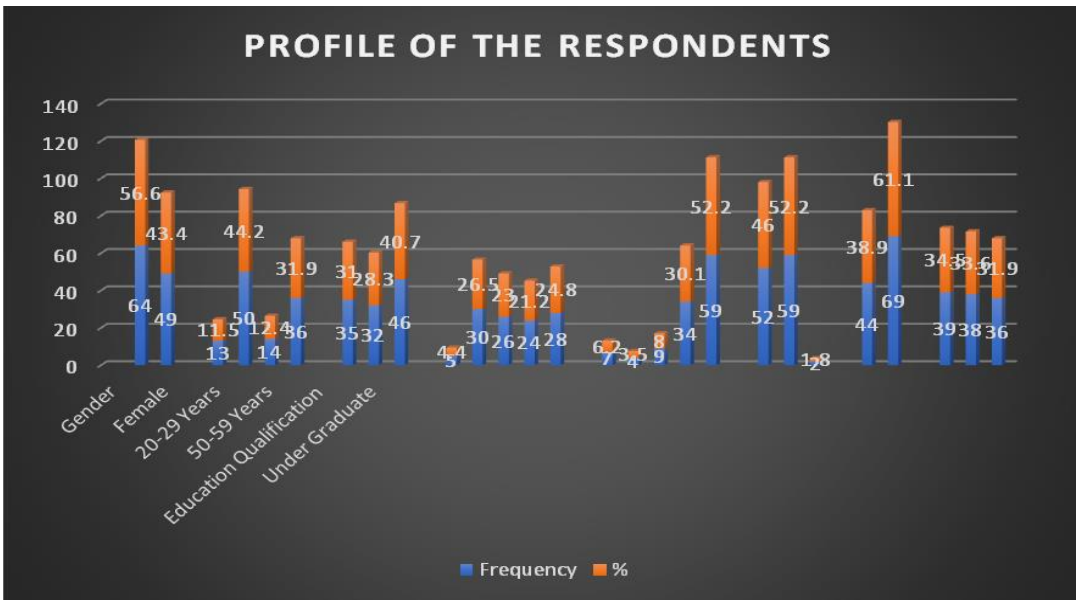

Figure - 3: Respodents Profile

Figure three represents the profile of the characteristics in the study, Bluecolor denotes the frequency of the people during the investigation.

5.3 Descriptive Statistics - Mean (Rank)

Table - 3: Rank the Wms

Waste Management System	N	Range	Mean	SD	Rank
Regeneration	113	4	4.27	.909	II
Composting	113	4	3.99	1.022	III
Textiles with technical applications	113	4	3.98	1.018	IV
Source Reduction	113	4	3.91	.978	V
Dumping grounds	113	1	4.85	.359	I
Valid N (listwise)	113		21	4.286	

Above table represents the Mean value of the rank in WMS in the Textile Industry, dumping grounds are the first rank of the defendants in the study, the second rank denotes the regeneration in the waste management system. Composting is the third rank Textile with technical applications is the fourth rank and finally, Source Reduction is the last rank

5.4 Cross-Tabulation

Table - 4: Relationship between the Textile Industry and the Job Role

Types of Textile Industry * Job Role Crosstabulation						
Types of Textile Industry	Job Role					Total
	Textile Designer	Intermediate Designer	Supervisor	Pattern Developer	Costume Designer	
Animal Textiles	0	2	0	5	3	10
Plant Textiles	6	1	1	16	22	46
Mineral Textiles	0	0	0	7	7	14
Synthetic Textiles	1	1	8	6	27	43
Total	7	4	9	34	59	113

Table - 4 symbolizes the relationship between the job role of the respondents and the types of textile industry, Animal textile in the textile designer and supervisor has no worker or labour in the industry, intermediate designers have only two, and the plant all the job role indicates at least one in the categories. Mineral textiles only have a pattern developer and a costume designer. Synthetic Textiles has all the designated job role candidates in the industry.

Figure - 4 embodies the count of each textile industry in the job role of the respondents.

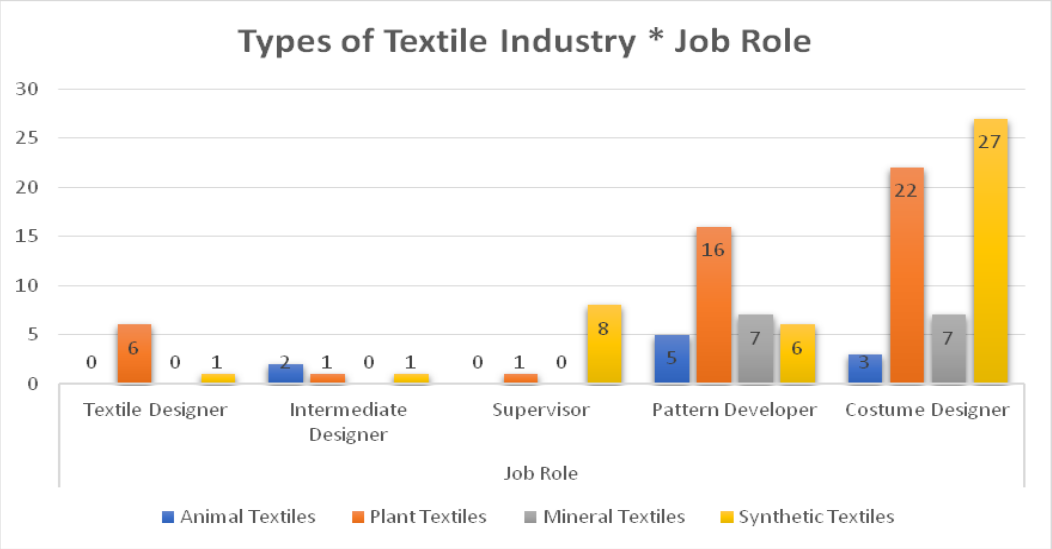

Figure - 4: Designation of the Respondents in the Textile Industry

Chi-Square Tests			
	Value	**DF**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	33.809[a]	12	**.001**
Likelihood Ratio	32.842	12	.001
Linear-by-Linear Association	2.339	1	.126
Number of Valid Cases	113		

Pearson Chi-Square value 33.809 denoted that the sig value is .001 so the null premise is rejected.

5.5 Ordinal Regression

Table - 5.5.1 Model Fitting Information

Model Fitting Information				
Model	**-2 Log Likelihood**	**Chi-Square**	**DF**	**Sig.**
Intercept Only	187.882			
Final	213.571	**.000**	38	1.000
Link function: Logit.				

Table 5.5.1 indicates the Model fitting information, the model is intercepted only in 2 Log Likelihood is 187.882, and the final is 213.571. The chi-Square value is .000.

Table - 5.5.2: Goodness-of-Fit

Goodness-of-Fit			
	Chi-Square	DF	Sig.
Pearson	269638351.709	98	**.000**
Deviance	242.566	98	**.000**
Link function: Logit.			

Tale 5.5.2 indicates the goodness of fit, in the Growth of the Textile Industry therefore sig value is less than 0.05, which is significant of the growth in the textile industry.

Table - 5.5.3: R-Square

Pseudo R-Square	
Cox and Snell	**.000**
Nagelkerke	**.000**
McFadden	**.000**
Link function: Logit.	

The above table measures the Pseudo R- Square value in factors of growth in the textile industry. Cox and Snell, Nagel kerke, and McFadden, all values determine .000.

5.6 Correspondence Analysis

Table - 5.6.1: Correspondence Table

Job Role	Monthly Salary			
	Rs.30,000 to Rs.50,000[a]	Rs.50,001 to Rs.80,000	Rs.80,001 to Rs.1,00000	Active Margin
Textile Designer	3	4	0	4
Intermediate Designer	2	2	0	2
Supervisor	5	4	0	4
Pattern Developer	15	17	2	19
Costume Designer	27	32	0	32
Active Margin		59	2	61
a. Supplementary column				

Table 5.6.1 denotes the correspondence of the job role and the Monthly salary of the respondents.

Table 5.6.2: Summary

Summary							
Dimension	Singular Value	Inertia	Chi-Square	Sig.	Proportion of Inertia		Confidence Singular Value
					Accounted for	Cumulative	Standard Deviation
1	.274	.075			1.000	1.000	.095
Total		.075	4.571	.334[a]	1.000	1.000	
a. 4 degrees of freedom							

The summary indicates the dimension of a single value, inertia is .075 and the chi-square value is 4.51 and their sig is .334.

Table - 5.6.3: Overview Row Points

Overview Row Points[a]						
Job Role	Mass	Score in Dimension	Inertia	Contribution		
		1		of Point to Inertia of Dimension	of Dimension to Inertia of Point	
				1	1	Total
Textile Designer	.066	.352	.002	.030	1.000	1.000
Intermediate Designer	.033	.352	.001	.015	1.000	1.000
Supervisor	.066	.352	.002	.030	1.000	1.000
Pattern Developer	.311	-.778	.052	.689	1.000	1.000
Costume Designer	.525	.352	.018	.237	1.000	1.000
Active Total	1.000		.075	1.000		
a. Symmetrical normalization						

Row point analysis, Mass of Textile Designer.066, Mass of Intermediate Designer.033, Supervisor 0.066, Pattern Developer.311, and Costume Designer0.525. Inertia 0.01 to 0.052.

Table - 5.6.4: Overview Column Points

Overview Column Points[a]						
Monthly Salary	Mass	Score in Dimension	Inertia	Contribution		
		1		of Point to Inertia of Dimension	of Dimension to Inertia of Point	
				1	1	Total
Rs. 30,000 to Rs. 50,000[b]	.852	.095	.015	.000	.138	.138
Rs. 50,001 to Rs. 80,000	.967	.096	.002	.033	1.000	1.000
Rs. 80,001 to Rs. 1,00000	.033	-2.842	.072	.967	1.000	1.000
Active Total	1.000		.075	1.000		
a. Symmetrical normalization						
b. Supplementary point						

Column point refers to the Monthly Salary Mass of Rs.30, 000 to Rs.50, 000 is .852, Rs.50, 001 to Rs.80, 000 is .967 and Rs.80, 001 to Rs.1, 00,000 is 0.033. Inertia having 0.002 to 0.072.

5.7 ANOVA

Table - 5.7.1: Association between the Company Size and the Types of Textile Waste

Anova						
Types of Textile Waste		**Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig.**
Spinning Waste	Between Groups	8.324	2	4.162	2.039	.135
	Within Groups	224.543	110	2.041		
	Total	232.867	112			
Weaving Waste	Between Groups	3.150	2	1.575	1.620	.203
	Within Groups	106.974	110	.972		
	Total	110.124	112			
Knitting Waste	Between Groups	2.442	2	1.221	3.213	**.044**
	Within Groups	41.806	110	.380		
	Total	44.248	112			
Dyeing Waste	Between Groups	6.285	2	3.142	8.517	**.000**
	Within Groups	40.583	110	.369		
	Total	46.867	112			
Clothing Waste	Between Groups	5.429	2	2.714	8.329	**.000**
	Within Groups	35.846	110	.326		
	Total	41.274	112			
Consumer Waste	Between Groups	6.765	2	3.383	9.332	**.000**
	Within Groups	39.872	110	.362		
	Total	46.637	112			

There is no significant difference between the types of Textile Waste and the Company Size of the respondents working in the textile industry. Out of 6 factors, except two factors not reject, remaining all factors rejected the hypothesis. Spinning Waste, and Weaving Waste is not rejected by the premise so that a need to improve both wastes in the textile industry.

5.8 FACTOR ANALYSIS

Challenge of the Textile Industry

Table - 5.8.1 Kmo and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.621
Bartlett's Test of Sphericity	**Approx. Chi-Square**	900.952
	DF	55
	Sig.	**.000**

KMO value of 0.621 indicates that the degree of common variance among the variable is moderatelygiant, therefore factor analysis can be conducted.

Table - 5.8.2: Communalities

Communalities		
	Initial	**Extraction**
Shortage of raw materials and Low productivity of labour	1.000	.264
Noise pollution inside the manufacturing plants	1.000	.344
High wastage	1.000	.917
Health issues	1.000	.771
Use of Hazardous Substances	1.000	.940
Infrastructure bottlenecks	1.000	.686
Low productivity	1.000	.700
Lack of skilled labour	1.000	.575
A fragmented industry	1.000	.685
Energy supplies at risk	1.000	.934
Lack of modern equipment and machinery	1.000	.936
Extraction Method: Principal Component Analysis.		

Expounds the adjustment of the 11 variables ranging from .264 to .940. It shows that the fourteen variables exhibit a

considerable variance from 64 percent to 94 percent. Hence it is finalized that these entire elevenquantities are proficient of segmenting themselves with respect to the factors including the Challenge of The Textile Industry.

Table - 5.8.3: Total Variance Explained

Total Variance Explained									
Component	**Initial Eigen values**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.105	28.228	28.228	3.105	28.228	28.228	2.997	27.243	27.243
2	2.008	18.258	46.486	2.008	18.258	46.486	1.958	17.797	45.040
3	1.514	13.766	60.252	1.514	13.766	60.252	1.622	14.745	59.785
4	1.125	10.224	70.477	1.125	10.224	70.477	1.176	10.692	70.477
Extraction Method: Principal Component Analysis.									

Eigen values are greater than one for four factors. From this one, it is confirmed that the eleven variables are gathered into four factors. The alternated sum of squared loading should be greater than 70 percent. The eleven variables were reduced into four predominant factors with an individual variance of 27.243, 45.040, 59.785, 70.477, It is also found that the total variance of the eleven variables is found to be 70 percent which is greater than the benchmark value of 94 percent. Moreover, it confirms that the factor segment is the meaningful one.

Table - 5.8.4: Rotated Component Matrix

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
Energy supplies at risk	.954			
Lack of modern equipment and machinery	.954			
A fragmented industry	.775			
Lack of skilled labour	.736			
High wastage		.957		
Use of Hazardous Substances		.956		
Health issues			.870	
Low productivity			.776	
Noise pollution inside the manufacturing plants			.423	
Infrastructure bottlenecks				.825
Shortage of raw materials and Low productivity of labour				.489
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 5 iterations.				

The rotated sum of the square value indicates the cumulative percentage of the variance is 70.477. Hence factorization is more suitable for the cost involved in the challenge of the textile industry. Explain the value of the rotated component matrix for the Textile industry. Shows factor loadings of four factors extracted through factor analysis. The first factor consists of four sub-factors; Energy supplies are at risk, and Lack of modern equipment and machinery, A fragmented industry, Lack of skilled labor. The first factor is named the "Industrial Factor".

The second factor contains two sub-factors; High wastage, Use of Hazardous Substances. Hence, it is named the "Wastage Factor". The third factor contains another three factors Health issues, Low productivity, and Noise pollution inside the manufacturing plants; hence the factor is named the "Problem Factor". Finally, the fourth factor contains three sub-factors Infrastructure bottlenecks, Shortage of raw materials, and Low productivity of labor, henceforward the factor is named the "Infrastructure factor". It is therefore concluded that the challenges of the textile industry give much importance to eleven variables.

6. SUGGESTIONS AND CONCLUSION

Waste management is very important in the fabric and clothing industry. Realizing globular corporate models, using greener materials, and sustainable technologies. Textile sector waste brooks should be measured independently. When the properties of the separate streams are recognized, it is conceivable to regulate which torrents should be joint to progress treatability and boost reuse replacements improved environmental performance but also in significant savings for individual textile enterprises. To overcome the contests and to spread the assessed the textile industry and implementations to boost the textile industry even further. One of the implementations is increasing focus on technology upgradation and increasing the weaving capacity in order to increase productivity. With the upsurge in throwaway income, the request for products in the Indian fabric industry has augmented creating a huge

request in the national as well as the international market. Major evolution in the trade sector, funds, and accurate support from the administration textile industry holds anauspicious future.

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