

Barriers to Textile Recycling in India

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Post-consumer wastes from the textile industry are generally landfilled or incinerated. The dumping of large amounts of textile waste has resulted in severe environmental problems. Advancements in technologies have called for textile recycling; however, the level of embracement made by the textile industry towards textile recycling is hampered by myriad factors. Sstudy indicates a lack of successful recycling business models, poor demand for recycled textiles goods, recycled products may not replace new products, lack of support for waste management in the industry, and absence of tax relief and rewarding policies as the top five barriers to textile waste recycling. This insight could help influence the decision of future policymakers in the field. Another aspect of the issue of pollution in the textile industry is the recent trend of fast fashion and the enormous amount of waste produced by overconsumption. The Sustainability Development Goal (SDG) 12 which is to ensure responsible production and consumption plays a key role in this sector.

Keywords: textile recycling ; clothing ; fashion industry ; sustainability ; circular economy

1. Introduction

Consequences such as climate change and increasing carbon emissions are considered the result of conventional, i.e., linear practices followed by the industrial community. Growing concerns about industrial activities have necessitated the transition of the industrial community from linear practices to circular economy (CE) practices. Thus, the manufacturing community is in a situation to adopt CE practices to ensure sustainable industrial practice ^[1]. The need to adopt CE practices has been more compelling for the textile industry as it is the second most polluting industrial sector in the world ^[2]. The toxic substances released during the processing activities of the textile industry pollute the air, water, and soil heavily. Further, the processing activities of the textile industry consume more quantity of water ^[3]. Apart from this, the amount of post-consumer textile waste is also increasing at an alarming rate. The CE practices provide an opportunity for recycling or reusing textile waste, which can reduce consumption and demand for virgin materials. A recent fashion trend, called fast fashion, is growing in many parts of the world. This trend offers fashionable clothes at low cost, hence creating a mentality that clothes are affordable ^[4]. Brands such as Zara offer 24 different apparel offerings in a year, while H&M offers 12 to 16 collections ^[5]. This business model largely benefits big fashion retailers. However, fast fashion culture has resulted in the generation of a huge quantity of textile waste. Hence, this model is being criticized for its wide range of environmental and social adversities.

Most of the textile materials, post-consumption, are thrown into landfills. Here, CE practices provide an opportunity where the discarded waste from one process can be used as input in other manufacturing processes such as spinning, weaving, stitching, and cutting. By following conventional linear industrial practices, it is not possible to recover value from the waste, and hence, it is mandatory for the textile industry to adopt CE practices. A survey by the Boston consulting group has estimated that global textile waste could reach 148 million tons by 2030 and that would be 62% higher than the waste generated in 2015 ^[6]. Earlier, waste was considered an unnecessary burden. Now, with the advent of CE practices, waste is viewed as a resource. Hence, it is evident that the textile industry has enormous potential for recycling through CE practices. The absence of effective, and underutilized recycling practices accounts for a loss of more than USD 500 billion of textile waste every year ^[7]. Being a highly resource-dependent industrial sector, the adoption of CE practices will largely benefit the textile industry ^[8]. Though recycling the waste at pre- and post-consumption stages benefits the textile industry to a large extent, regularizing and incorporating the recycling practices is hindered by many barriers.

Compared to conventional forward supply chain activities, the uncertainties in the reverse supply chain are quite high. Unlike the forward supply chain, in the reverse supply chain, it is difficult to meet the demand ^[9]. The raw material is an important factor in determining the cost of the textile product. It has to be noticed that it is difficult to process the raw materials used in the textile industry without any waste. This pre-consumed industrial waste can be used by the textile industry. Further, the post-consumed waste can also be used as the input material by the textile industry ^[10]. However, the

amount of textile waste discarded may vary from time to time and hence, it is difficult to ensure a consistent supply of textile waste to the recycling facility. The importance of recycling clothing is often talked about and even supported by fashion retailers, but it is only part of the solution to attain a level of sustainability in this incredibly significant yet highly polluting industry. Reducing customer consumption and promoting a more sustainable way of living is especially important [11]. The Sustainable Development Goal (SDG) 12, which is to ensure sustainable consumption and production patterns, works hand in hand with achieving a CE in this industry. SDG 12 emphasizes a sustainable consumption pattern, with the intention of minimizing resource consumption and waste generation [12][13]. Consumer unawareness and the reckless attitude of the textile industry towards the environment are some of the major reasons for the poor recycling of textile waste. Despite efforts to retain value from the waste, only 1% of the textile waste is recycled [14].

India, being a highly populated country, consumes more apparel and generates a huge quantity of textile waste. More than 1 million tons of textile waste are thrown away every year in India [15][16]. According to [17], India is the sixth-largest exporter of textiles and apparel in the world. Moreover, the Indian textile industry contributes more than 35% of the country's total export earnings [9]. To sustain the growth of the textile industry and also manage textile waste. The Indian textile industrial sector needs to adopt a recycling process [18]. Following the recycling process may benefit the textile industry by reducing the raw material cost involved and processing time [19]. However, the textile industry is faced with numerous barriers to the adoption of recycling practices. Accordingly, Many research works identified barriers to textile recycling [1][20][21]. However, it is also critical to understand the interrelationship among the barriers.

2. Recycling the Textile Waste in India

2.1. Current Scenario of Textile Recycling

Globalization has urged the textile industry to manufacture more apparel at a low cost and time. Such kind of necessity has led to the fast fashion trend which is characterized by mass production, variety, and affordability. The fast fashion trend has resulted in increased sales and consumption of apparel which consequently increased the quantity of textile waste [22]. Thus, textile waste turned out to be a menace to society. Recovering value from waste has been suggested as an effective waste management method, and it may also help in maintaining social and economic sustainability. As there is an increase in social pressure, adopting recycling practices has become imperative for the industrial community [23]. Further, to combat the environmental menace of textile waste, individual countries have devised certain strategies and have also asked the textile industry of the respective countries to recover value from the textile waste. Accordingly, in January 2022, Sweden launched an Extended Producer Responsibility (EPR) policy, and the United Kingdom is planning to launch such a policy by 2025. After introducing a dedicated policy for waste management, the textile industry in France recycled 35% of textile waste and reused 60% of textile waste [24]. Similarly, New Zealand introduced a product stewardship scheme, where all the stakeholders involved in product development are responsible for social and environmental impact throughout the product lifecycle [25]. By launching the Used Clothing Recycling Program (UCRP) in 2013, the fast fashion retailer company, H & M collected 20,649 tons and 29,005 tons of textile waste in 2018 and 2019 and recycled, respectively. Likewise, UNIQLO, another fashion brand, from September 2019 to January 2021, collected and recycled nearly 620,000 leather jackets [26]. The recycling programs have been well-received in developed countries, whereas the scenario is quite different in developing countries.

Owing to the lack of awareness of the role of recycling in sustainable development, recycling initiatives have received only lukewarm responses in developing countries [10]. As a result, in developing countries such as India, recycling occurs on a small scale. There are Small- and Medium-sized Enterprise (SME) hubs for recycling disposed textiles from industries in Tirupur, Tamil Nadu, and in Panipat, Haryana. They are also famous for recycling discarded clothing imported from Western countries. For more comprehensive recycling practices, the number of recycling facilities has to be scaled up [27]. Further, taking advantage of cheap labor costs, most of the renowned fashion companies are outsourcing production activities to developing countries which significantly affects social sustainability [28]. In Sri Lanka, recycling activities are limited to industrial textile waste (cutting waste, quality rejections, and spare fabrics) only [14]. Unlike in developed countries, there is no formal mechanism to collect and regularize post-consumer textile waste in developing countries. The reason for the failure of recycling practices in developing countries starts from the first mile itself, i.e., the collection of used textile materials from individual consumers [29].

2.2. Barriers to Textile Recycling

Being a critical problem, scholarly research works have focused on analyzing the barriers to textile waste recycling [30][31][32]. Some research works have underscored the disparity in the level of technology adoption between developed and developing economies as the main barrier to textile waste recycling [33][34]. However, apart from technological limitations,

some fundamental challenges are decelerating the progress in textile waste recycling. Lack of technical knowledge about recycling practices is a prominent challenge in textile waste recycling. Because of limited technical knowledge, problems arise in waste collection and sorting ^[1]. Further, difficulty in developing uniformity and standardization of recycling practices results in diversified unrecognized recycling practices. Apart from this, managerial issues are slowing the progress of recycling practices. At the managerial level, reaching a consensus among the various stakeholders is very critical. However, owing to poor understanding and lack of knowledge about recycling practices, most stakeholders are reluctant to adopt recycling practices. Additionally, there has been no standard system for performance assessment of the adopted recycling practices ^[1]. Furthermore, the recycling facility centers are facing difficulty in separating textile waste from solid municipal waste and recycling technology in developing countries is still in the infant stage only ^[6].

Market demand for a product directly influences the investor's interest in a product. In the case of textile recycling, the market demand for recycled textile products is very low. The market space for recycled textile products is curtailed by the fast fashion trend as it offers a variety of clothes at affordable costs ^[14]. Moreover, some countries have banned the import of used textiles or recycled textile products ^[22]. Such kinds of restrictions limit the market viability for recycled textile products. Then, the absence of sufficient skilled labor is a major issue in textile recycling. Though, in India, it is easy to avail enough workforce for cheap wages, there is a scarcity of technically skilled labor for textile recycling practices ^[35]. One significant challenge in the success of the recycled textile product is the high price. In general, the cost of recycled textile products is higher than that of fresh textile products. The price of the recycled textile product is determined by the cost involved in the recycling process. Most of the recycling processes are costly and hence the price of recycled textiles is high. It affects the market penetration of recycled textile products ^[36].

References

1. Kazancoglu, I.; Kazancoglu, Y.; Kahraman, A.; Yarimoglu, E.; Soni, G. Investigating Barriers to Circular Supply Chain in the Textile Industry from Stakeholders' Perspective. *Int. J. Logist. Res. Appl.* 2022, 25, 521–548.
2. Thinakaran, S.; Chandravelu, P.; Ponnambalam, S.G.; Sankaranarayanan, B.; Karuppiyah, K. Analyzing the Challenges to Circular Economy in Indian Fashion Industry. *IEEE Access* 2023, 11, 711–727.
3. Tomar, S.; Shahadat, M.; Ali, S.W.; Joshi, M.; Butola, B.S. Treatment of Textile-Wastewater Using Green Technologies. In *Green Chemistry for Sustainable Water Purification*; Wiley: Hoboken, NJ, USA, 2023; pp. 129–156.
4. Chaturvedi, P.; Kulshreshtha, K.; Tripathi, V. Investigating the Determinants of Behavioral Intentions of Generation Z for Recycled Clothing: An Evidence from a Developing Economy. *Young Consum.* 2020, 21, 403–417.
5. Mishra, S.; Jain, S.; Malhotra, G. The Anatomy of Circular Economy Transition in the Fashion Industry. *Soc. Responsib. J.* 2021, 17, 524–542.
6. Schmutz, M.; Som, C. Identifying the Potential for Circularity of Industrial Textile Waste Generated within Swiss Companies. *Resour. Conserv. Recycl.* 2022, 182, 106132.
7. Brydges, T.; Henninger, C.E.; Barbu, L.; Lupu, R. Designing for Longevity and Neutrality: Investigating How the Swedish Children's Clothing Industry Implements Circular Economy Principles. *Fash. Pract.* 2022, 1–23.
8. Hasanbeigi, A.; Price, L. A Technical Review of Emerging Technologies for Energy and Water Efficiency and Pollution Reduction in the Textile Industry. *J. Clean. Prod.* 2015, 95, 30–44.
9. Raichurkar, P.; Ramachandran, M. Recent Trends and Developments in Textile Industry in India. *Int. J. Text. Eng. Process.* 2015, 1, 2395–3578.
10. Chaka, K.T. Beneficiation of Textile Spinning Waste: Production of Nonwoven Materials. *J. Nat. Fibers* 2022, 19, 9064–9073.
11. Khairul Akter, M.M.; Haq, U.N.; Islam, M.M.; Uddin, M.A. Textile-Apparel Manufacturing and Material Waste Management in the Circular Economy: A Conceptual Model to Achieve Sustainable Development Goal (SDG) 12 for Bangladesh. *Clean. Environ. Syst.* 2022, 4, 100070.
12. Bag, S.; Yadav, G.; Dhamija, P.; Kataria, K.K. Key Resources for Industry 4.0 Adoption and Its Effect on Sustainable Production and Circular Economy: An Empirical Study. *J. Clean. Prod.* 2021, 281, 125233.
13. Bag, S.; Yadav, G.; Wood, L.C.; Dhamija, P.; Joshi, S. Industry 4.0 and the Circular Economy: Resource Melioration in Logistics. *Resour. Policy* 2020, 68, 101776.
14. Sinha, P.; Dissanayake, D.G.K.; Abeysooriya, R.P.; Bulathgama, B.H.N. Addressing Post-Consumer Textile Waste in Developing Economies. *J. Text. Inst.* 2022, 113, 1887–1907.

15. Chen, J.Y.; Polston, K.; Nicols, E.; Phung, B. A Study on Textile Recycling in College Student Residence Areas. *J. Text. Inst.* 2022, 113, 1854–1861.
16. Leal Filho, W.; Ellams, D.; Han, S.; Tyler, D.; Boiten, V.J.; Paço, A.; Moora, H.; Balogun, A.-L. A Review of the Socio-Economic Advantages of Textile Recycling. *J. Clean. Prod.* 2019, 218, 10–20.
17. Radhakrishnan, S. Sustainable Cotton Production. In *Sustainable Fibres and Textiles*; Elsevier: Amsterdam, The Netherlands, 2017; pp. 21–67.
18. Tuninetti, M.; Tamea, S.; Dalin, C. Water Debt Indicator Reveals Where Agricultural Water Use Exceeds Sustainable Levels. *Water Resour. Res.* 2019, 55, 2464–2477.
19. Bairagi, N. Recycling of Post-Consumer Apparel Waste in India: Channels for Textile Reuse. *J. Text. Sci. Eng.* 2018, 8, 331.
20. Bening, C.R.; Pruess, J.T.; Blum, N.U. Towards a Circular Plastics Economy: Interacting Barriers and Contested Solutions for Flexible Packaging Recycling. *J. Clean. Prod.* 2021, 302, 126966.
21. Huang, Y.-F.; Azevedo, S.G.; Lin, T.-J.; Cheng, C.-S.; Lin, C.-T. Exploring the Decisive Barriers to Achieve Circular Economy: Strategies for the Textile Innovation in Taiwan. *Sustain. Prod. Consum.* 2021, 27, 1406–1423.
22. Juanga-Labayen, J.P.; Labayen, I.V.; Yuan, Q. A Review on Textile Recycling Practices and Challenges. *Textiles* 2022, 2, 174–188.
23. Xu, B.; Chen, Q.; Fu, B.; Zheng, R.; Fan, J. Current Situation and Construction of Recycling System in China for Post-Consumer Textile Waste. *Sustainability* 2022, 14, 16635.
24. Persson, O.; Hinton, J.B. Second-Hand Clothing Markets and a Just Circular Economy? Exploring the Role of Business Forms and Profit. *J. Clean. Prod.* 2023, 390, 136139.
25. Degenstein, L.M.; McQueen, R.H.; Krogman, N.T.; McNeill, L.S. Integrating Product Stewardship into the Clothing and Textile Industry: Perspectives of New Zealand Stakeholders. *Sustainability* 2023, 15, 4250.
26. Shao, P.; Lassleben, H. Determinants of Consumers' Willingness to Participate in Fast Fashion Brands' Used Clothes Recycling Plans in an Omnichannel Retail Environment. *J. Theor. Appl. Electron. Commer. Res.* 2021, 16, 3340–3355.
27. Eppinger, E. Recycling Technologies for Enabling Sustainability Transitions of the Fashion Industry: Status Quo and Avenues for Increasing Post-Consumer Waste Recycling. *Sustain. Sci. Pract. Policy* 2022, 18, 114–128.
28. Abbate, S.; Centobelli, P.; Cerchione, R.; Nadeem, S.P.; Riccio, E. Sustainability Trends and Gaps in the Textile, Apparel and Fashion Industries. *Environ. Dev. Sustain.* 2023, 1–28.
29. Jäämaa, L.; Kaipia, R. The First Mile Problem in the Circular Economy Supply Chains—Collecting Recyclable Textiles from Consumers. *Waste Manag.* 2022, 141, 173–182.
30. Jia, F.; Yin, S.; Chen, L.; Chen, X. The Circular Economy in the Textile and Apparel Industry: A Systematic Literature Review. *J. Clean. Prod.* 2020, 259, 120728.
31. Kant Hvass, K.; Pedersen, E.R.G. Toward Circular Economy of Fashion. *J. Fash. Mark. Manag. An Int. J.* 2019, 23, 345–365.
32. Norris, L. Urban Prototypes: Growing Local Circular Cloth Economies. *Bus. Hist.* 2019, 61, 205–224.
33. Han, S.L.C.; Chan, P.Y.L.; Venkatraman, P.; Apeagyei, P.; Cassidy, T.; Tyler, D.J. Standard vs. Upcycled Fashion Design and Production. *Fash. Pract.* 2017, 9, 69–94.
34. Zhuravleva, A.; Aminoff, A. Emerging Partnerships between Non-Profit Organizations and Companies in Reverse Supply Chains: Enabling Valorization of Post-Use Textile. *Int. J. Phys. Distrib. Logist. Manag.* 2021, 51, 978–998.
35. Paras, M.K.; Pal, R.; Ekwall, D. An Exploratory Study of Swedish and Romanian Organisations to Investigate Upcycling Practice in the Clothing Industry. *Res. J. Text. Appar.* 2023; ahead-of-print.
36. McCauley, E.; Jestratišević, I. Exploring the Business Case for Textile-to-Textile Recycling Using Post-Consumer Waste in the US: Challenges and Opportunities. *Sustainability* 2023, 15, 1473.