



# From Fiber to Fashion: A Roadmap towards Sustainability in Textile and Apparel Industry

Ms.Kirti Ghosh<sup>1</sup>, Dr.Ashwini Kumar Dash<sup>2</sup>,

<sup>1</sup>Assistant Professor, Department of Fashion and Apparel Technology, OUTR, Bhubaneswar

<sup>2</sup>Associate Professor, Department of Textile Engineering, OUTR, Bhubaneswar

## Abstract

Over the last couple of years, the term 'sustainability' has become the talk of the town around the globe and has been merely a debatable concept. The textile and garment industries have been criticized of being unsustainable due to resource misuse, massive waste output, and environmental contamination. The apparel supply chain is diverse and complex, involving various stages including spinning, weaving, dyeing, printing, cutting, sewing and final garment construction. However, a variety of sustainable design strategies and environmentally sound methods for extracting natural dyes from specified resources are moving towards a sustainability roadmap to counteract this detrimental impact on the environment. This chapter gives a quick explanation of what the term 'sustainable fashion' means. It also discusses recent developments in sustainable practices in the textile and fashion industry, as well as challenges and future prospects.

**Keywords:** Eco-friendly, fast fashion, handloom, recycling, sustainability

## 1. Introduction

In general, the textile and fashion industries are highly resource-intensive and have indeed experienced significant ecological ramifications associated with short production cycles, excessive usage of resources, massive waste production, and environmental pollution. The fast fashion model, characterized by quick production turnaround times and rapidly changing trends, encourages overconsumption and leads to the disposal of vast amounts of clothing[1,2].

Nowadays, knowledge of sustainability has expanded significantly and several approaches and research on sustainable production have been introduced. Consumers are increasingly aware of the movement for environmentally conscious brands and positive consumer thinking towards environmentally conscious sustainable brands, business plans and techniques[3,4]. In recent years, the textile and apparel industry has undergone significant modifications in terms of sustainability, moving from a choice to a necessity. However, it is important to note that there is an increasing awareness and a growing movement within the industry to address these challenges and transition towards more sustainable practices. Sustainable fashion initiatives, circular economy approaches and responsible sourcing are gaining traction. Brands, manufacturers, consumers and policymakers are increasingly collaborating to drive positive change and mitigate the environmental and social impacts of the textile and fashion industry.

## 2. Ecological Footprint of Textile and Apparel Industry

The world of fashion seems elegant, glamorous and exciting, but its impact on the environment is worsening day by day. Every phase of a garment's life cycle, from spinning to disposing of it (the so-called "cradle to grave"), threatens our planet and social living standards[4]. The stages and the possible environmental impacts are shown in Figure 1.



Figure 1. The Lifecycle of Apparel Production[5]

Due to rapid industrialization and advanced production techniques that are being used to meet the growing demands of consumers, have also raised the issues like environmental pollution, ozone layer depletion and the shrinking of green spaces. Under the present scenario, it is obvious to adopt techniques that are effective for cleaner production and waste reduction [5-8]. Fundamental changes to the business model are required, such as slow fashion production and sustainable supply chain practices.

### 3. Roadmap towards Sustainability Strategy

Considering the current situation in the textile and apparel industry, it's clear that everyone in the supply chain needs to work together to make sure the environment is safe and healthy for both current and future generations. Designers and brands are working hard to create sustainable products, but it's important to understand how many products are actually needed. Understanding the demand and supply of products is equally vital to reducing the quantity of trash that ends up in landfills through reduction, recycling, and reuse of textiles, fibres, and waste materials. In addition to corporate social responsibility, the next decade will bring social responsibility for sustainable fashion[8-10]. The implementation of textile waste treatment strategies, such as reduction, recycling and reusing (as illustrated in Figure-2), is an effective way to promote sustainability in the clothing sector.

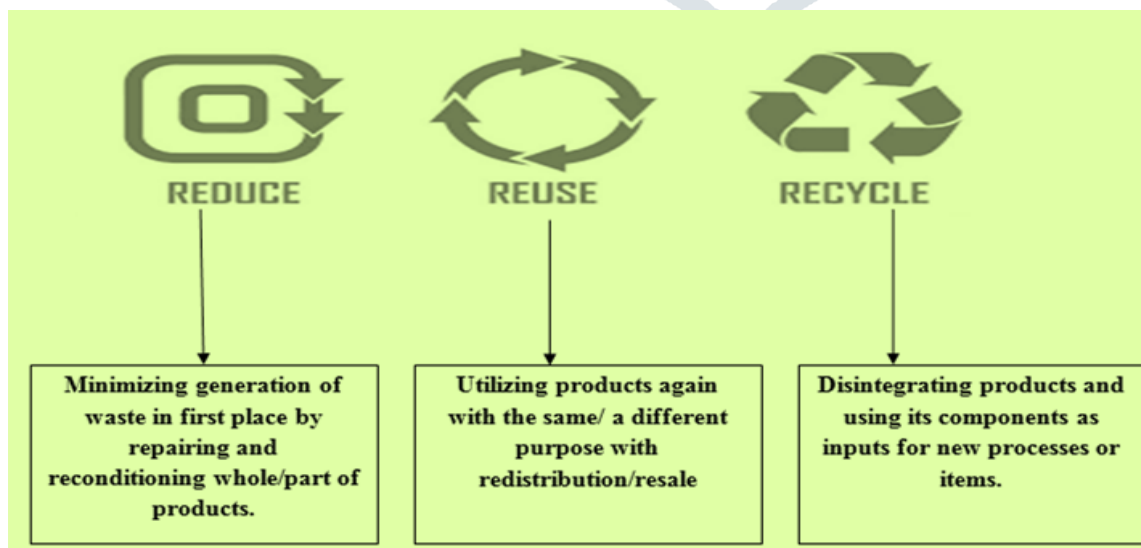


Figure 2. Textile Waste Management Strategies (3R Concept)

For the efficient use of textile waste, various sustainability strategies are being developed. Manufacturers must take a proactive approach towards textile recycling with the goal of reusing and reprocessing clothes, fibres and scraps in the most effective way to achieve sustainability. Some textile waste recycling options are stated below:

### 3.1 Composting

Manufacturers now have a lot of opportunities to consider compostable textiles because of the detrimental effects of non-degradable nonwovens and disposals. It would be wonderful if researchers in the textile business could concentrate on natural materials that entirely decompose when tossed into landfills after their life cycle [11].

### 3.2 Technical Textiles

In the current situation, technical textiles are now framed from recycled fibres, involving creativity and innovation, with environmental objectives. Recycled fibres are used in filtration, upholstery, agro-textiles, geotextile reinforcement, acoustics, textiles for building construction, package textiles and car interiors[8,10].

### 3.3 Paper Making

The old fabric residues are used in paper manufacturing. The eco-friendly paper manufacturing industry is an emerging industry that has discovered that old fabrics are a great binding material. Biomass, agro-waste and old cotton fabrics help in forming the matrix in handmade paper. The recycled fibres used in paper manufacturing are also used in making tea bags, carry bags, envelopes, etc[10].

### 3.4 Restyling/ Reconstruction

Restyling / Reconstruction is a business that specializes in the transformation of old garments and fabrics through the re-cutting and fabrication of new and beneficial products [10]. Examples of such products are illustrated in figure-3.



Figure 3. Restyling of old sarees: (A) Dupatta (B) Over-Coat (C) Gown (D) Lehenga (E) Scarf (F) Masks (G)Potli bag (H) Bedcover and pillow cover (I)Table runner (J)Curtain

The majority of handloom clusters residing in rural areas utilize post-industrial or post-consumer textile and apparel wastage to create useful and innovative products as shown in Figure-4.



**Figure 4. A sustainable approach to create multiple ranges of by-products by using (A) waste fabrics (B) waste threads [1]**

#### 4. Fashion Brands Working Towards Sustainability

Many fashion brands have recognized the importance of sustainability and have been actively working towards integrating sustainable practices into their operations. Global retail manufacturers like Patagonia, H&M, PUMA, Runway, Stella McCartney, Hoffman, etc. have grown to be greater, targeted to move towards fashion morally and explicitly through the implementation of ethical practices [11-13].

The fashion industry as a whole is undergoing a shift towards more sustainable practices, and these brands are leading the way by implementing innovative approaches to reduce their environmental impact and promote ethical practices throughout the supply chain.

#### 5. Conclusion

The textile and apparel industry indeed has made progress towards sustainability, but several challenges still need to be addressed to achieve full sustainability. By adopting sustainable practices such as the use of organic cotton, recycled fibres and low-impact dyes, the industry can reduce its environmental footprint, promote social well-being and work towards a more circular and ethical future. The development of novel fabrics and technological progress increases the durability and availability of the garment, however, the cost of these garments must also be taken into account in order to create a product that is more consumer-friendly and cost-effective. Technology must be environmentally friendly and beneficial to humanity. Hence, apparel manufacturers should invest in research and development of sustainable technologies and innovations that can transform the industry. This includes exploring alternatives to traditional manufacturing processes, implementing digitization and automation and adopting block chain and traceability systems to ensure transparency and accountability.

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