

TOWARDS A SUSTAINABLE FASHION MARKET: A REVIEW OF CIRCULAR MODELS, TEXTILE WASTE, TECHNOLOGY, AND CONSUMER DYNAMICS

Pawanpreet Kaur

Khalsa College for Women, Amritsar

Gurleen Kaur

Khalsa College for Women, Amritsar

Sharina Mahajan

Associate Professor
Khalsa University, Amritsar

ABSTRACT

The fashion market is one of the world's most influential industries, but it also creates serious environmental, social, and economic challenges. This review paper examines recent research on sustainability in the fashion market, focusing on circular economy models, textile waste management, consumer behaviour, technology, marketing, and policy support. The review shows that although sustainability is widely discussed, its application in the fashion market is still uneven and incomplete. Most studies concentrate on environmental benefits, such as reducing waste and emissions, while social and economic impacts receive far less attention. Circular economy models are increasingly used by fashion brands, either as core business strategies or as additions to existing systems. However, these models should be seen as tools that guide change rather than final solutions, especially because fashion supply chains are complex and difficult to transform quickly. Textile waste is identified as one of the biggest sustainability problems in the fashion market. Research highlights the importance of reuse, recycling, upcycling, and extending the life of garments through repair, resale, and rental services. Designers, manufacturers, retailers, consumers, and policymakers all play an important role in building a more circular textile system. Technology supports this transition through digital design tools, artificial intelligence, traceability systems, and online circular platforms. Consumer studies show that many people are aware of sustainability issues and express positive attitudes toward sustainable fashion. However, a clear gap exists between awareness and actual purchasing behaviour. High prices, limited availability, convenience, and social influence often prevent consumers from choosing sustainable options. Digital marketing and social media strongly influence buying decisions, sometimes encouraging conscious consumption but also increasing impulse buying. Problems such as greenwashing reduce consumer trust and highlight the need for transparent communication and reliable certification. Overall, this review concludes that sustainability in the fashion market requires coordinated action across design, production, consumption, technology, marketing, and regulation. Greater focus on social and economic impacts, along with consumer education and policy support, is essential to achieve a more sustainable and circular fashion market.

Keywords: Sustainability; Fashion market; Circular economy; Textile waste; Consumer behaviour

1. INTRODUCTION

The textile and fashion sector is widely regarded as one of the most environmentally harmful industries globally due to its heavy consumption of natural resources and significant levels of pollution (Niinimäki et al., 2020; Ellen MacArthur Foundation [EMF], 2017). The industry utilizes enormous amounts of water, energy, and raw materials while producing considerable greenhouse gas emissions and large quantities of textile waste (European Environment Agency [EEA], 2017). The swift expansion of fast fashion has exacerbated these effects, with global clothing production rising dramatically even as the average lifespan of garments continues to shorten (Brydges, 2021; EMF, 2017). Consequently, vast amounts of clothing are thrown away after limited use, with a majority of textile waste ending up in landfills or incinerators, while only a small fraction is recycled into new garments (Juanga-Labayen et al., 2022). These environmental issues span the entire fashion value chain, from fiber production and textile manufacturing to consumer usage and final disposal, emphasizing the inadequacies of the conventional linear "take-make-dispose" model (Ghisellini et al., 2016). In light of these challenges, the circular economy has emerged as a potential alternative framework for enhancing sustainability in the fashion sector (Geissdoerfer et al., 2017). Circular fashion seeks to prolong product lifecycles through methods such as reuse, repair, recycling, and material recovery, while also reducing reliance on virgin resources and minimizing waste generation (Bukhari et al., 2018). While interest in circular models has grown among researchers, policymakers, and industry players, their practical implementation is still limited (Vehmas et al., 2018; Shirvanimoghaddam et al., 2020). Obstacles such as fragmented supply chains, a lack of transparency, financial and technological limitations, and consumer habits that favor low-cost, short-lived clothing impede advancement (Kazancoglu et al., 2020; Jia et al., 2020). Recent developments in recycling technologies and digital tools like blockchain, the Internet of Things (IoT), and life cycle assessment (LCA) present new chances to bolster circular practices (Rusinek et al., 2018; Zhang et al., 2020). Meanwhile, consumer awareness, attitudes, and purchasing behaviors are crucial in determining the effectiveness of sustainable fashion initiatives (McNeill & Venter, 2019). Thus, a thorough review of circular economy models, textile waste management techniques, technological innovations, and consumer dynamics is vital for understanding present challenges and identifying pathways toward a more sustainable fashion market.

2. REVIEW METHODOLOGY

This study takes a narrative review approach to bring together existing research on sustainability in the fashion industry. We analyzed peer-reviewed journal articles, industry reports, and authoritative publications to explore various perspectives on circular fashion, textile waste management, enabling technologies, and consumer behavior (Busalim et al., 2022). The literature chosen was focused on its relevance to sustainability and the principles of a circular economy within the fashion and textile sectors. Special attention was given to studies that addressed environmental impacts, technological innovations, and consumer-related aspects to provide a well-rounded and interdisciplinary understanding of the topic.

3. ENVIRONMENTAL IMPACT OF THE FASHION AND TEXTILE INDUSTRY

The fashion and textile industry is widely recognized as one of the most resource-heavy and environmentally damaging sectors in the world (Niinimäki et al., 2020). This industry plays a major role in contributing to greenhouse gas emissions, excessive water use, chemical pollution, and the generation of solid waste throughout the entire product life cycle (McKinsey & Company, 2020). In particular, the processes involved in textile production,

such as dyeing and finishing, are significant culprits of industrial water pollution due to their reliance on harmful chemicals and fossil fuels (Kant, 2012). The cultivation of fibers, particularly cotton and synthetic materials, poses a serious threat to freshwater resources, land usage, and local ecosystems (Zhang et al., 2015). The rise of fast fashion has exacerbated these environmental issues by promoting rapid production cycles, cheap clothing, and a culture of constant replacement (Park et al., 2017). While clothing consumption has surged, the rates of reusing and recycling these garments remain disappointingly low, with most discarded textiles ending up in landfills or incinerators (EEA, 2017). Complicated production processes, the blending of different materials, and insufficient waste management systems make recycling challenging, resulting in a trend towards downcycling rather than effective recovery of materials (Payne, 2015). These patterns underscore the urgent need for comprehensive reforms in how we design, produce, consume, and dispose of fashion items.

4. CIRCULAR ECONOMY MODELS IN FASHION

4.1 Concept and Principles of the Circular Economy

The circular economy (CE) is widely recognized as a framework for reducing the environmental footprint of the fashion industry by replacing linear production systems with closed-loop models (Ghisellini et al., 2016). Circular systems emphasize resource efficiency, waste reduction, and continuous material use throughout the product life cycle (Geissdoerfer et al., 2017). In the fashion context, circularity involves strategies such as eco-design, reuse, repair, resale, rental, recycling, and material recovery, all of which aim to extend product lifespans and reduce dependence on virgin resources (Moorhouse & Moorhouse, 2017).

4.2 Circular Business Models

Circular business models shift value creation from single-use consumption to multiple value cycles, enabling products and materials to remain in use for longer periods (Linder & Williander, 2017). Reducing resource consumption is often identified as the most critical step, followed by reuse and recycling initiatives (Provin et al., 2021). Research emphasizes that effective circularity requires collaboration across the entire value chain, including designers, manufacturers, retailers, recyclers, policymakers, and consumers (Allen et al., 2021). Despite growing experimentation, fully integrated circular models remain relatively rare, as many initiatives focus on isolated stages such as take-back schemes or recycling programs rather than systemic transformation (Brydges, 2021).

4.3 Barriers and Drivers

The adoption of circular fashion models is constrained by several barriers, including high initial investment costs, technological limitations, lack of standardized recycling infrastructure, fragmented supply chains, and limited transparency (Kazancoglu et al., 2020). Organizational resistance, skills shortages, and insufficient stakeholder collaboration further restrict progress, particularly for small and medium-sized enterprises (Kristoffersen et al., 2021). Conversely, drivers such as increasing consumer demand for sustainable products, regulatory pressure, resource scarcity, and policy instruments such as extended producer responsibility schemes encourage companies to explore circular approaches (EEA, 2017).

5. TEXTILE WASTE MANAGEMENT AND RECYCLING TECHNOLOGIES

Textile waste management is a central issue in circular fashion research. Textile waste is commonly categorized as pre-consumer, post-consumer, or industrial waste, each with different recovery potentials (Radhakrishnan, 2017). Recycling routes include mechanical,

chemical, thermal, and biological processes, with varying environmental and economic outcomes (Baloyi et al., 2023). Mechanical recycling is widely used but often degrades fibre quality, whereas chemical recycling can recover fibres or polymers of quality comparable to virgin materials, albeit at higher cost and technological complexity (Valerio et al., 2020).

Recent studies highlight the growing potential of advanced recycling and valorisation techniques, including enzymatic hydrolysis, glycolysis, ammonolysis, pyrolysis, gasification, and hydrothermal treatments (Mishra et al., 2022). These approaches enable the conversion of textile waste into fibres, fuels, chemicals, construction materials, and other value-added products. Reuse is consistently identified as the most environmentally beneficial strategy, particularly when garments are reused with minimal processing and for extended periods (Sandin & Peters, 2018). However, inadequate collection systems, limited consumer participation, and shrinking second-hand markets in some regions continue to constrain reuse-based models (WRAP, 2017).

6. ROLE OF TECHNOLOGY IN ENABLING CIRCULAR FASHION

Technological innovation plays a crucial role in enabling circular economy implementation within the fashion industry (Koksall et al., 2017). Digital technologies such as blockchain, IoT, artificial intelligence (AI), machine learning, big data analytics, and digital product passports enhance transparency, traceability, and operational efficiency across supply chains (Swan, 2015; Wang et al., 2019). Blockchain technology, in particular, provides secure and immutable records of material origins, production processes, certifications, and end-of-life routes, addressing key data gaps that hinder circular practices (Pautasso et al., 2019).

When integrated with IoT devices and life cycle assessment tools, blockchain systems facilitate real-time data collection and environmental impact monitoring (Zhang et al., 2020). AI and machine learning further support circularity by optimizing product design, improving demand forecasting, reducing overproduction, and enhancing inventory management (Choi et al., 2020). Despite their potential, technological solutions face challenges related to cost, scalability, standardization, and skills availability, highlighting the need for further research and investment (Deloitte, 2017).

7. CONSUMER DYNAMICS AND SUSTAINABLE FASHION BEHAVIOUR

Consumer behaviour plays a decisive role in determining the success of circular fashion initiatives (McNeill & Venter, 2019). Sustainable and slow fashion concepts emphasize mindful consumption, product longevity, quality, and ethical considerations, contrasting sharply with the disposability associated with fast fashion (Fletcher, 2007). Practices such as upcycling, second-hand purchasing, rental, swapping, and sharing have emerged as important mechanisms for extending garment lifespans (Armstrong et al., 2015).

Although consumer awareness of sustainability issues has increased, sustainable fashion adoption remains inconsistent (Jacobs et al., 2018). Social norms, emotional attachment to fashion, price sensitivity, and convenience strongly influence purchasing decisions (Diddi et al., 2019). Education, awareness campaigns, community engagement, and digital platforms are frequently identified as effective tools for promoting sustainable consumption and responsible disposal behaviours (de Klerk et al., 2019). However, concerns over greenwashing and selective sustainability disclosures undermine consumer trust, emphasizing the importance of transparency and credible certification (Delmas & Burbano, 2011).

8. RESEARCH GAPS AND FUTURE DIRECTIONS

Despite substantial progress in understanding the environmental impacts of fashion, circular economy principles, recycling technologies, and consumer behaviour, significant gaps remain. Limited research integrates circular strategies across the entire fashion value chain or critically evaluates the real environmental benefits of emerging technologies (Brydges, 2021). Social and behavioural dimensions of circular fashion remain underexplored, and certain subsectors, such as fashion accessories, receive limited academic attention. Future research should focus on developing holistic, scalable, and measurable frameworks that integrate circular business models, technological innovation, consumer engagement, and policy support to advance a truly sustainable fashion market.

CONCLUSION

This review demonstrates that while sustainability has become a prominent theme in the fashion market, its practical implementation remains fragmented and incomplete. Circular economy models, textile waste management strategies, technological innovations, and consumer engagement collectively offer pathways toward sustainability; however, no single solution is sufficient. Achieving a sustainable fashion market requires coordinated action across design, production, consumption, technology, marketing, and regulation. Greater emphasis on social and economic dimensions, alongside consumer education and supportive policy frameworks, is essential to enable a meaningful transition toward a circular and sustainable fashion system.

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