

Recycling Of Old Garments: Opportunities, Barriers And Future Prospects

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Abstract: The global apparel industry has been growing rapidly, and consumers are purchasing and discarding garments more frequently due to low-cost “fast fashion”. As a result, more used clothing is being discarded, harming the environment and creating problems for individuals and communities. Although recycling used clothing helps reduce these negative effects and make fashion more sustainable, many garments remain challenging to recycle effectively due to practical and technological barriers. Additionally, many garments are never recycled because there are not enough effective procedures in place to collect, sort, and process used textile material. These systems are also very expensive to operate and lack the buildings or equipment required to manage all the waste. Many people lack basic knowledge about how to recycle properly, and government support for recycling is often weak. Improving textile recycling in various areas is made more difficult by these policy gaps. Even though recycling clothing is hard, there are several innovative ideas that could improve and simplify the process. The development of new devices and systems that can automatically sort and decompose used clothing into useful materials. Some technologies convert into new ones using chemical or enzymes, while others use computers and intelligent robots to separate different types of fabric faster and more accurately. Improvement of this nature raises hopes for the future recycling and repurposing of additional garment waste. Furthermore, strong regulatory initiatives that hold apparel manufacturers accountable for their products can also help move fashion toward a more sustainable industry. Better recycling of used clothing can be made faster by involving the cooperation and assistance of consumers, workers, the government, and brands. This review paper summarises the challenges and opportunities for recycling, providing suggestions for enhancing the recycling system and achieving long-term sustainability goals.

Keywords: Garment Recycling, Textile Waste, Barriers, Opportunities, Textile Waste Components, Extended Producer Responsibilities.

Introduction

Over the past few decades, the world's textile consumption has increased significantly due to factors such as population growth, rising living standards, and the explosive growth of the “fast fashion” industry (Niinimäki et al., 2020). The emphasis on inexpensive, frequent turnover, and seasonal patterns in current fashion garment manufacturing has greatly shortened garment lifespans and accelerated the development of post-consumer textile waste (Claxton, 2023). Consequently, only a small segment of post-consumer textile waste is officially recycled or reused, making textile waste one of the fastest-growing components of municipal solid waste streams globally (Ajwani-Ramchandani, 2025)

Moreover, only a small percentage of post-consumer waste is recovered and recycled into new fibres of comparable quality, even though textiles are nearly entirely recyclable in theory (Stanescu, M. D, 2021). Rather, most second-hand clothing ends up in landfills or incineration, and is shipped to developing nations, where uncontrolled disposal causes environmental and societal issues, or is downcycled into lower-value products (Philemon, P. 2025). These results undermine the potential sustainability benefits of recycling and exacerbate the apparel sector's already significant ecological footprint, which significantly contributes to greenhouse gas emissions, water use, and other environmental impacts.(Panet al.,2023)

Therefore, recycling discarded garments is essential to advancing a more circular and sustainable textile industry that reduces waste, conserves resources, and lessens ecological damage (Pranta, A. D et al 2025). Textile recycling includes various methods, from complex chemical and fibre-to-fibre technologies that regenerate high-quality raw materials, to reuse markets and mechanical recycling (such as shredding and re-spinning into low-grade fibres) (Fernández et al., 2025). Despite commitments to sustainability, several technological, financial, social, and policy-related obstacles limit the efficiency of wide-scale clothing recycling (Bendell et al., 2015). From Assembly and sorting to processing and industry adoption, these problems affect each stage of the recycling process and require concrete implication efforts from businesses, legislators, and consumers (Rahimifard et al., 2009).

Modern clothing is difficult to recycle because it is very challenging. Cotton and polyester are two examples of the blended materials used to make many garments. Additionally, they include fasteners such as zippers, buttons, and special coatings. These factors make it considerably more difficult to effectively separate and recycle the materials (Abteu et al. 2025). The recycled materials' poor quality and processing costs have increased due to the difficulty of effectively separating diverse fibres and removing non-textile components (Seifali Abbas-Abadi et al., 2025). Moreover, normal mechanical recycling frequently shortens the fibres, and real circular recycling is weak. These staple fibres cannot be reused repeatedly; it is only be utilised in affordable, low-value items (Celep et al. 2022).

In addition, technological limitations, recycling is also affected by serious economic and infrastructure challenges (Reuter, M. A., 2011). Running recycling operations on a large scale is not simple. It requires proper processing units, organised sorting systems, and an efficient collection network for textiles. However, in many regions, these basic facilities are still not fully developed, which makes effective recycling difficult (Dissanayake et al., 2021).

Often, the high fixed cost of developing advanced recycling technologies, especially chemical processes and systems for regenerating fibre make it difficult for these approaches to be adopted widely (Krauklis et al 2021). This problem becomes even worse when the demand for recycled fibres is unpredictable or seen as less valuable than new materials. Without strong laws and financial support, companies that recycle textiles find it hard to stay in business (McCauley et al.,2023)

Social norms and consumer behaviour also play a big role in textile recycling. Even though more people are becoming aware of the growing environmental harm caused by clothing waste, many areas still lack an effective recycling system. Many consumers do not know how or where to recycle their clothes, and they often see the process as inconvenient (Harris et al 2016). As a result, many individuals prefer to donate or resell their clothing through informal networks rather than using official recycling channels. At the same time, the growing popularity of inexpensive, short-lived fashion items-often designed to be worn only a few times- continues to generate more textile waste than existing recycling systems can manage (Kilbridge, R.2025).

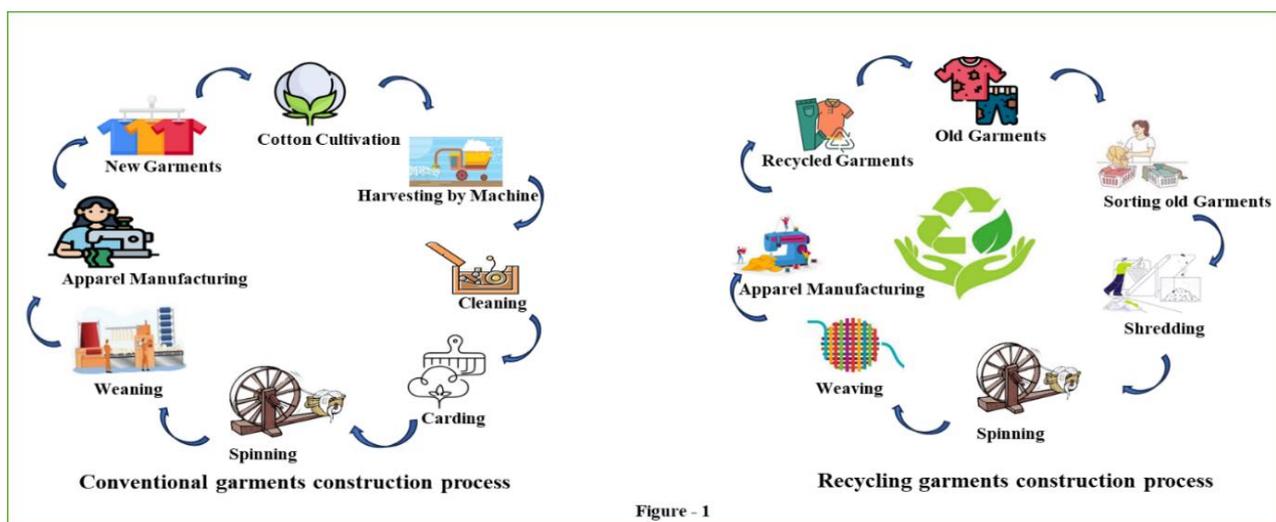
Even with these challenges, there are increasing opportunities to move the textile industry towards a more circular model. Recent developments in automated sorting technologies are particularly promising. For instance, a system that combines artificial intelligence with advanced imaging methods can help identify and separate different types of fibres more accurately, addressing technical difficulties that have limited garment recycling in the past (Sun et al., 2023). Extended Producer Responsibility (EPR) requires manufacturers to design products that are easier to recycle and to support recycling systems. Governments promote this policy to make sure companies take responsibility for their products after consumers stop using them. At the same time, brands that follow circular practices can attract more customers because many people prefer ethically made clothing and show interest in sustainability (D'Adamo et al., 2022).

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Moreover, improving the system for recycling clothes has important benefits for society beyond the environment. Strengthening recycling efforts can create new jobs in areas like collecting, sorting, and up-cycling textiles, which help support local economies and give people more employment opportunities (Dissanayake et al., 2025). In a developing nation where the textile industry plays a major role in the economy, efforts that combine technological innovation with active involvement from local communities could help bridge the gap between formal recycling systems and informal networks for reducing clothing (Wanniarachchi et al., 2020).

The main aim of this research is to identify new ways to support efficient, scalable recycling methods while examining the persistent difficulties in recycling used clothing. In the section that follows, we review recent research to give a clear picture of how to achieve real progress in reducing textile waste and completing the recycling cycle. This includes examining technological developments, economic frameworks, consumer behaviour and the role of government action (Saif et al., 2024)



Reducing Textile Waste Components-

Sustainability- Companies need sustainability approaches that balance economic growth, social fairness, and environmental protection across the entire supply chain, from scouring raw materials to final disposal. Studies show that the textile industry accounts for about 21% of industrial water pollution and 10% of global CO₂ emissions (Muñoz-Torres et al., 2022). Manufacturers can reduce this impact by using eco-friendly fibres such as organic cotton, hemp, and recycled materials. Closed-loop dyeing can recycle up to 80% of the water used. Using renewable energy and adopting circular models that prioritise reuse, upcycling, and biodegradable materials can reduce waste from fast fashion. Safe working conditions and fair wages are also important, especially for workers in supply chains in South Asia (Mani et al., 2016). The UN “sustainable development goals” (SDGs) promote technologies like enzymatic recycling and bio-based materials to help achieve carbon-neutral production by 2050. However, high cost and regulation still make it difficult to scale these solutions (Wiseman et al., 2016).

Upcycling – upcycling textile waste into high-quality, sustainable products that help reduce environmental impact and promote the objectives of the circular economy. Leftover textiles can be transformed into sustainable, useful materials rather than ending up in landfills (Négrier et al., 2023). Furthermore, according to certain research, upcycling can be integrated into traditional



fashion production processes, allowing a significant portion of production fabric waste to be incorporated into new products and reducing the demand for virgin materials. For instance, studies have shown that around 52% (and in some cases even higher) of textile manufacturing waste can be repurposed into new garments, thereby minimising waste generation. In addition, because upcycling typically involves less energy-intensive processing than conventional recycling methods, it is considered a more practical and environmentally sustainable approach to repurposing textile waste (Sung et al.,2015).

Upcycling is reducing fabric waste in the clothing industry's manufacturing facilities. It does not require any virgin materials and only requires small-scale energy input, such as a home sewing machine or manual skills, for customers who might choose to participate in do-it-yourself projects. Additionally, the final upcycled goods may be reused and upcycled repeatedly into a distinctive, higher-value product than the original (Shi et al.,2022).

Recycling–textile recycling has become an essential part of sustainable waste management in the worldwide fashion and apparel business; there are still several obstacles in its way (Ponnambalam et al., 2023). A systematic review of 44 peer-reviewed studies shows that recycling accounts for approximately 85% of research on end-of-life textile practices, with fibre recycling the most studied method, particularly for cotton and polyester, reflecting their predominance in global fibre production. These estimates show that fewer than 1% of pre-consumer and post-consumer textile material is re-entered the fibre-to-fibre recycling method, meaning that a small part of textile waste is successfully recycled into new textile goods (Rotimi et al.,2021).

Recycling can substantially reduce the negative environmental impacts compared to incineration or landfilling. However, the benefits of recycling vary depending on replacement rates and energy sources employed in recycling operations. Additionally, the advancement and expansion of cutting-edge recycling technologies, such as chemical and enzymatic processes, improve the quality of recycled fibres, but require greater innovation and investment to overcome existing challenges (Kamboj et al.,2025). Furthermore, their current application underscores the need for coordinated technology innovation, regulatory support, and enhanced infrastructure to achieve circularity on a significant scale. (Srivastava et al.,2025).

1. Opportunities for Effective Recycling of Old Garments-

1.1 Education and Awareness- Research shows that education and awareness campaigns are very important because many do not know how to recycle or dispose of clothes properly. Teaching people about recycling helps them understand the process and encourages positive attitudes towards old clothes. Studies also show that consumers recycle more when they know the right method and understand the environmental impact of textile waste. When people learn what to recycle and why it matters, they are more likely to take action. (Daneshvary et al., 1998). Research indicates that teaching environmental topics in schools and helping clear information campaigns, people take part in clothing recycling. These efforts also encourage individuals to recycle more regularly and stay involved in recycling activities (Grodzinska et al., 2006).



1.2 Emphasise Environmental Benefits-

Recycling discarded clothing has a major positive impact on the environment because it lessens the need to produce new textiles, which preserves natural resources like energy and water that are crucial for the production of clothing and fibre (Hole et al., 2019). Studies have shown significant CO₂ and water savings when textile recycling rates increase, suggesting that increased textile-to-textile recycling can reduce greenhouse gas emissions and help mitigate climate change. Additionally, recycling clothing helps preserve the ecosystem, reduces the strain on water and land required for the production of virgin fibres, and lowers pollution (Farhana et al., 2022).

1.3 Transparent and Trustworthy Labels-

Research indicates that eco-labels and certifications can influence consumer perception and behaviour by clearly communicating the product's material and environmental characteristics at the point of purchase, making it easier for buyers to select clothing that is truly recycled (Nyremo et al., 2021). Credible eco-labels with strong life-cycle standards (such as the global recycled standard) boost customer confidence in sustainability promises and enhance well-informed fashion purchasing decisions (Taufique et al., 2014). Research further reveals that trustworthy labelling systems must be clear, dependable, and verifiable to overcome consumer misunderstanding and allow consumers to discern real recycled content claims from greenwashing. Enhancing the transparency, clarity, and credibility of textile eco-labels is therefore a crucial opportunity to build consumer trust and encourage more sustainable clothing use and recycling practices (Rochikashvili et al., 2014).

1.4 Improved Design and Aesthetics-

Sustainable products are more attractive to customers. According to research on user-centred recycling fashion design, appealing design elements and emotionally engaging design features enhance satisfaction with recycled products and promote voluntary involvement in recycling (Wever et al., 2008). Additionally, visually appealing recycled goods can compete more successfully in the fashion industry and bridge the gap between consumers' priorities and sustainability. Thus, emphasising innovative, superior design and

aesthetics is a major chance to increase demand for recycled clothing and promote efficient textile recycling (Pettersen et al., 2008).

1.5 Community Engagement and Social Norms-

Community engagement and strong social norms can significantly increase participation in apparel recycling because when people see others in their locality taking part, they are more likely to adopt similar habits. According to research, local involvement and community leaders raise awareness of the value of recycling and support long-term recycling initiatives by organising citizens and normalising group action. Peer pressure and shared environmental ideals can help recycling practices spread by influencing people's intentions and behaviours regarding sustainable textile disposal (Berry et al., 1998).

1.6 Government Policy and Support-

Extended producer responsibility (EPR) established a framework that holds producers accountable for the collection, sorting, and recycling of clothing at the end of its useful life. EPR is essential to raising textile recycling rates (Brown et al., 2023). Additionally, Strong regulatory frameworks, such as mandated recycling regulations and harmonised standards, are required to decrease landfill disposal and encourage circular activities throughout the textile value chain, according to studies on textile waste governance. The regulation can also promote investment, expand reuse and markets, and foster innovation by shifting part of the responsibility and costs of waste management from the public system to manufacturers. (Altaf et al.,2021)

2. Barriers for Effective Recycling of Old Garments-

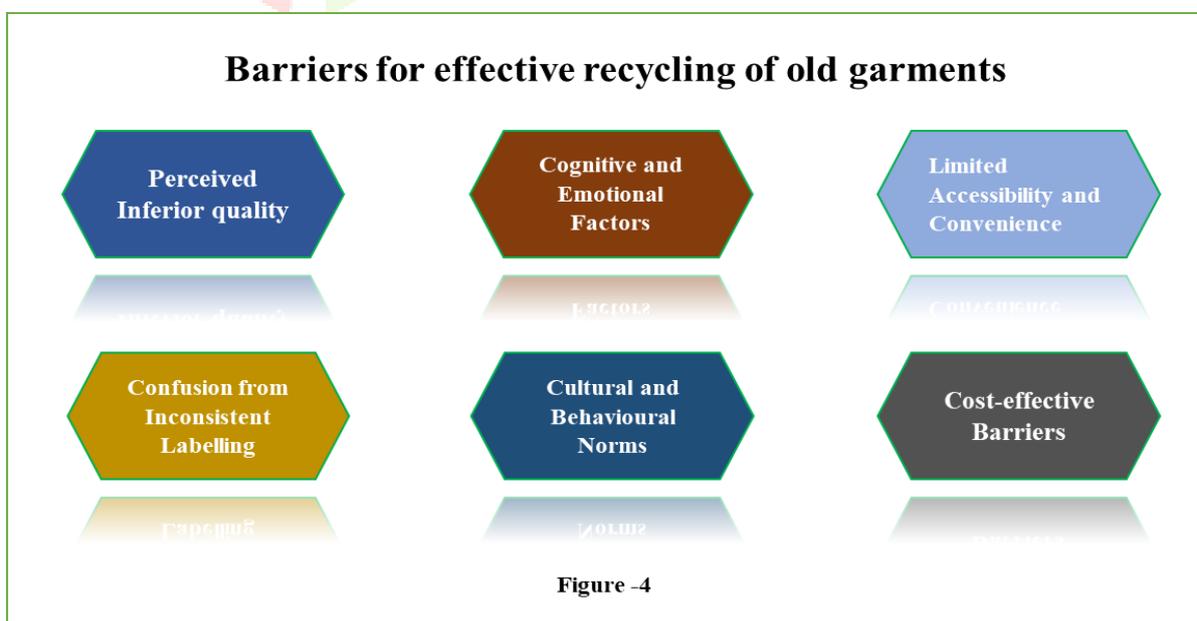
2.1 Perceived Inferior Quality –

Many consumers and stakeholders view recycled textile products as lower in quality than those made from virgin materials, which reduces their acceptance and demand in the marketplace. Even though quality can be improved with technology, studies shown that recycled materials are frequently viewed as “not as good” in terms of durability and utility. Consumer perceptions limit purchasing intention and recycling uptake. (Stankevičienė et al., 2025)

2.2 Cognitive and Emotional Factors –

Emotional reaction and attitudes significantly influence recycling behaviour, as customers may avoid buying recycled or buy recycled goods if they believe recycled fabrics are contaminated, unclean, or associated with second-hand use, which can decrease their willingness to recycle or purchase recycled products (Pretner et al.,2021).

Furthermore, psychological obstacles between intention and behaviour are reflected in the value-action gap, which occurs when good environmental attitudes do not necessarily convert into action (Barr, S.2006).



2.3 Limited Accessibility and Convenience-

Accessibility and convenience of recycling programmes play a crucial role in whether customers engage in recycling. Research shows that consumers are less likely to participate if recycling options are not widely available or clearly provided. Providing convenient collection points and simple processes significantly increases people's participation in recycling; the absence of an easily accessible and straightforward option discourages involvement (Taberero et al 2016).

2.4 Confusion from Inconsistent Labelling-

Unclear labels about recycled fabrics and their environmental features reduce consumer trust. When buyers cannot easily understand the materials and how to recycle them, they are less likely to participate in recycling and buy recycled products (Pretner et al.,2021).

2.5 Cultural and Behavioural Norms –

Cultural norms and societal attitudes affect how people see and accept recycled clothing. Individuals avoid recycling or buying recycled clothes because society links them with low status, dirtiness, or stigma. These social influences also shape how people use, disposal and recycle clothing (Wagner et al., 2020).

2.6 Cost-Effective Barriers-

Financial challenges slow down recycling efforts. Weak market demands, low profits, and the high cost of recycled materials make it hard for consumers and manufacturers to participate. Recycled textiles often compete with cheaper new fibre, and without strong financial incentives, recycling systems struggle to grow and operate efficiently (Rahimifardet al.,2009).

Conclusion

In this review, recycling used clothing is made difficult by various issues; it is found that new technology, improved clothing design and manufacturing techniques, and appropriate government schemes present genuine opportunities to overcome these obstacles. Continue to advance technology, collaborate across sectors, and involve people more. In addition to strengthening the clothing recycling system, this would bring the textile industry closer to a truly circular and sustainable textile economy.

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