STRATEGIC DATA MANAGEMENT AND INNOVATION
Volume 02 ,Issue No. 01, Page No: **116-137**
ISSN: 3066-358X
DoI:10.71292/sdmi.v2i01.15

THE ECONOMICS OF A ZERO-WASTE FASHION INDUSTRY: STRATEGIES TO REDUCE WASTAGE, MINIMIZE CLOTHING COSTS, AND MAXIMIZE SUSTAINABILITY

Mridha Younus[1]
[1]Monroe College, New Rochelle, New York, USA
Correspondence Email: younusmridha2@gmail.com

Keywords

Zero-waste fashion
Circular Economy
Sustainable Fashion
Textile Waste Reduction
Eco-Friendly Supply Chain
Sustainable Materials
Fashion Economics

Article Information

Received: 06, December, 2024

Accepted: 29, January, 2025

Published: 30, January, 2025

ABSTRACT

The global fashion industry faces significant environmental challenges due to excessive textile waste, unsustainable production practices, and inefficient supply chains. This study systematically reviews 30 peer-reviewed research papers to examine the economic, technological, and consumer-driven aspects of zero-waste fashion and sustainability strategies. The research follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring a rigorous, transparent, and methodical evaluation of existing literature. The findings highlight that zero-waste design techniques, such as 3D modeling, digital pattern-cutting, and AI-driven material optimization, are critical in reducing textile waste during production. Additionally, sustainable textile innovations, including biodegradable fabrics like Tencel, Piñatex, and Mycelium leather, are proving to be viable alternatives to synthetic fibers. Consumer behavior plays a vital role in the shift toward sustainable fashion, with Millennials and Generation Z demonstrating a growing preference for eco-friendly apparel, though barriers such as high costs, accessibility issues, and psychological resistance to second-hand fashion and clothing rental models persist. The study further explores the role of AI and Big Data in enhancing demand forecasting, reducing overproduction, and ensuring supply chain transparency through blockchain integration, while also addressing challenges related to high implementation costs and regulatory limitations. The findings underscore the lack of standardized sustainability metrics, which contributes to greenwashing and inconsistent reporting of sustainability efforts across the industry. While progress is evident in the adoption of circular economy practices, AI-driven waste reduction strategies, and consumer awareness, regulatory frameworks, affordability, and the scalability of sustainable business models remain key challenges. This study provides an updated and comprehensive understanding of sustainable fashion trends, technological advancements, and industry-wide challenges, emphasizing the need for global policy alignment, stricter sustainability assessments, and collaborative initiatives among brands, policymakers, and consumers to achieve long-term sustainability in the fashion industry.

1 INTRODUCTION

The fashion industry is a major contributor to environmental degradation, generating vast amounts of textile waste and consuming substantial resources in production, distribution, and disposal (Young et al., 2009). The global apparel market, valued at approximately $1.7 trillion, is characterized by rapid production cycles and mass consumption patterns that lead to excessive waste and inefficiencies (Fletcher, 2008). The industry's reliance on resource-intensive manufacturing processes exacerbates environmental concerns, with textile production accounting for 10% of global carbon emissions and 20% of industrial wastewater pollution (Botsman & Rogers, 2010). Additionally, the throwaway culture encouraged by fast fashion results in millions of tons of clothing being discarded annually, placing immense pressure on landfills and recycling systems (Huang et al., 2012). The economic costs of this wasteful approach are substantial, with brands losing revenue due to unsold inventory and consumers spending excessively on short-lived garments (Kant, 2011). Thus, the transition to a zero-waste fashion model is essential for achieving both economic efficiency and sustainability in the industry.

Zero-waste fashion involves designing, producing, and consuming apparel with minimal waste generation, achieved through strategies such as circular economy principles, sustainable material innovation, and resource-efficient manufacturing processes (Hamid et al., 2020). The adoption of circular business models, such as clothing rental, resale, and recycling, has been shown to reduce textile waste while creating new revenue streams for companies (Curran & Williams, 2011). Textile-to-textile recycling, in particular, has emerged as a promising approach to mitigating waste, with brands investing in technologies that enable fabric regeneration without compromising quality (Italiano et al., 2022; Zaman & Lehmann, 2013). Additionally, sustainable materials such as organic cotton, hemp, and bioengineered fibers contribute to waste reduction by decreasing reliance on nonrenewable resources and

Figure 1: Key Statistics of Global Textile Waste

Source: theroundup.org (2024)

DoI:10.71292/sdmi.v2i01.15

improving biodegradability (Murphy & Pincetl, 2013). The economic feasibility of zero-waste fashion is further supported by consumer preferences, as growing awareness of environmental issues has led to increased demand for ethically produced apparel (Rissanen & McQuillan, 2016). Companies that embrace sustainable practices not only enhance their brand reputation but also experience long-term financial gains through resource savings and improved customer loyalty (Tran et al., 2020).

Production inefficiencies in the fashion industry result in significant financial losses, with brands discarding up to 30% of materials during garment manufacturing due to poor pattern-cutting techniques and excessive fabric consumption (Matete & Trois, 2007). Zero-waste design, a technique that integrates sustainability into pattern-making, eliminates unnecessary textile waste by ensuring that every part of the fabric is used efficiently (Rissanen & McQuillan, 2023). Digital pattern-cutting software and three-dimensional garment visualization tools have further enhanced the feasibility of zero-waste design, allowing brands to optimize fabric usage and minimize production costs (Tran et al., 2020). Additionally, lean manufacturing techniques, such as just-in-time production and demand-driven inventory management, help reduce overproduction and limit unsold inventory (Wilson, 2015). By integrating these strategies, brands can lower raw material costs, decrease environmental impact, and enhance profitability (Murphy & Pincetl, 2013). Moreover, consumer behavior plays a crucial role in the shift toward zero-waste fashion, as purchasing decisions influence market demand for sustainable products (Wilson, 2015). Research indicates that millennials and Generation Z consumers are particularly inclined to support brands that align with their ethical values, with 66% of global consumers willing to pay more for sustainable fashion (Gwilt, 2014; Lehmann, 2011). The rise of slow fashion—a movement that promotes quality over quantity and emphasizes ethical production—has gained traction as a response to fast fashion's environmental and social consequences (Matete & Trois, 2007). Clothing repair, upcycling, and second-hand shopping have also become popular among environmentally conscious consumers, further reinforcing the economic potential of a circular fashion economy (Stanescu, 2021). Retailers that integrate sustainable branding and transparent supply chains benefit from increased customer engagement, reduced return rates, and enhanced long-term competitiveness (Gwilt, 2014). Despite the potential economic benefits of zero-waste fashion, industry-wide adoption remains limited due to structural and logistical challenges (Surjit et al., 2024). The transition requires significant investment in sustainable infrastructure, research and development, and supply chain adaptation (Tran et al., 2020). Many companies struggle to balance cost-effectiveness with ethical production practices, as sustainable materials and eco-friendly technologies often come at a premium (Stanescu, 2021). Additionally, consumer education and behavioral change are critical in fostering a zero-waste mindset, as traditional shopping habits still prioritize low-cost, disposable fashion (Antanavičiūtė & Dobilaitė, 2015). Policymakers play a vital role in promoting sustainability through regulatory frameworks, tax incentives, and extended producer responsibility (EPR) schemes that hold brands accountable for post-consumer waste management (Gwilt, 2014). Collaborative efforts among industry stakeholders, government agencies, and advocacy groups are essential to overcoming these challenges and driving systemic change in the fashion industry.

The shift toward a zero-waste fashion economy presents an opportunity to reconcile sustainability with economic growth, offering solutions that benefit businesses, consumers, and the environment (Antanavičiūtė & Dobilaitė, 2015). By leveraging innovative waste-reduction strategies, circular economy principles, and consumer-driven demand for ethical fashion, brands can achieve financial resilience while minimizing environmental impact. The following sections explore the key economic mechanisms, technological innovations, and policy interventions that support the feasibility and scalability of a zero-waste fashion industry. The objective of this study is to examine the economic viability of a zero-waste fashion industry by identifying key strategies that reduce textile waste, minimize clothing costs, and enhance sustainability. This study aims to analyze how circular economy principles, sustainable material innovations, and waste-reducing production techniques contribute to both environmental and financial benefits for fashion brands. It seeks to evaluate the role of lean manufacturing, digital design tools, and alternative business models, such as clothing rental and resale, in reducing overproduction and improving resource efficiency. Additionally, this research intends to assess consumer attitudes toward sustainable fashion and their

willingness to pay for eco-friendly products, providing insights into market demand for zero-waste apparel. By investigating the role of government policies, industry regulations, and corporate sustainability initiatives, this study will highlight the structural challenges and economic opportunities associated with implementing waste reduction strategies in the fashion industry. Ultimately, the findings will contribute to a deeper understanding of how brands can achieve profitability while fostering environmental responsibility within a zero-waste framework.

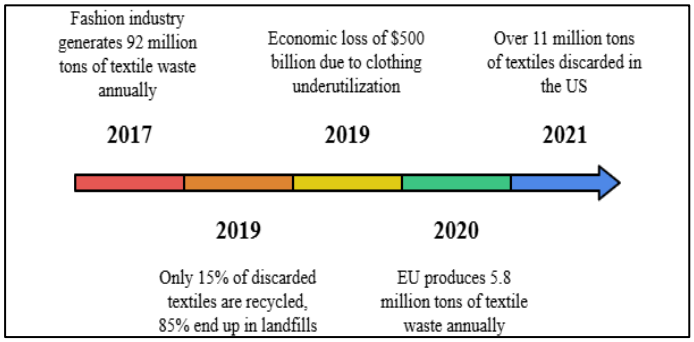
2 LITERATURE REVIEW

The concept of zero-waste fashion has gained traction in both academic discourse and industry practices as concerns over environmental sustainability and economic efficiency in the fashion industry continue to rise. The traditional linear fashion model—characterized by excessive production, short product lifespans, and high levels of waste—has been increasingly criticized for its negative environmental and financial impact. The transition toward a circular and zero-waste fashion industry has been explored through various perspectives, including sustainable material innovations, waste-minimizing production techniques, consumer behavioral shifts, and policy interventions. Studies have highlighted how economic incentives, technological advancements, and shifting consumer preferences play a significant role in enabling a more sustainable fashion ecosystem. However, challenges such as high initial costs, supply chain inefficiencies, and lack of standardized regulations remain barriers to widespread adoption.

2.1 The Scale of Textile Waste in the Global Fashion Industry

Textile waste has become a significant global issue, with the fashion industry being one of the largest contributors to environmental degradation. According to the Hamid et al. (2020), the fashion industry generates approximately 92 million tons of textile waste annually, with projections indicating continued growth in waste production due to increased global consumption. The United Nations Environment Programme (UNEP, 2019) estimates that only 15% of discarded textiles are recycled, while the remaining 85% end up in landfills or are incinerated. In the United States alone, the Environmental Protection Agency (EPA, 2021) reported that over 11 million tons of textiles were discarded in 2018, with landfilling rates increasing yearly. Similarly, the European Environment Agency (2020) noted that the EU produces an estimated 5.8 million tons of textile waste annually, with the majority coming from post-consumer clothing disposal. Studies by Matete and Trois (2007) and Gwilt (2014 suggest that inefficient collection and recycling infrastructures significantly contribute to the growing problem of textile waste, as many countries lack the capacity to handle the volume of discarded clothing. The economic implications of textile waste are substantial, with a report by the Gwilt (2014) highlighting that the industry loses approximately $500 billion annually due to clothing underutilization and lack of recycling. Moreover, the rise of fast fashion has significantly exacerbated textile waste, as mass production and rapid consumption cycles encourage frequent disposal of clothing (Wilson, 2015). Fast fashion brands, such as Zara and H&M, have pioneered business models that prioritize speed and affordability over durability, leading to shorter product lifecycles and higher waste generation (Saeidi & Wimberley, 2017). Research by Niinimäki et al. (2020) indicates that fast fashion has accelerated the rate at which consumers purchase and discard garments, with an average individual buying 60% more clothing today than in the early 2000s, yet wearing each piece for half as long. Similarly, Handayani abd Piliang (2024) found that the number of garments produced annually has doubled since 2000, reflecting the growing demand for inexpensive, trend-driven fashion. However, the rapid turnover of clothing results in a significant increase in discarded apparel, as consumers seek to replace outdated styles with new purchases (Italiano et al., 2022). Investigations by Tran et al. (2020) emphasize that the low-cost nature of fast fashion discourages consumers from repairing or repurposing garments, further contributing to textile waste accumulation.

Figure 3: The Evolution of Textile Waste in the Fashion Industry



STRATEGIC DATA MANAGEMENT AND INNOVATION
Doi:10.71292/sdmi.v2i01.15

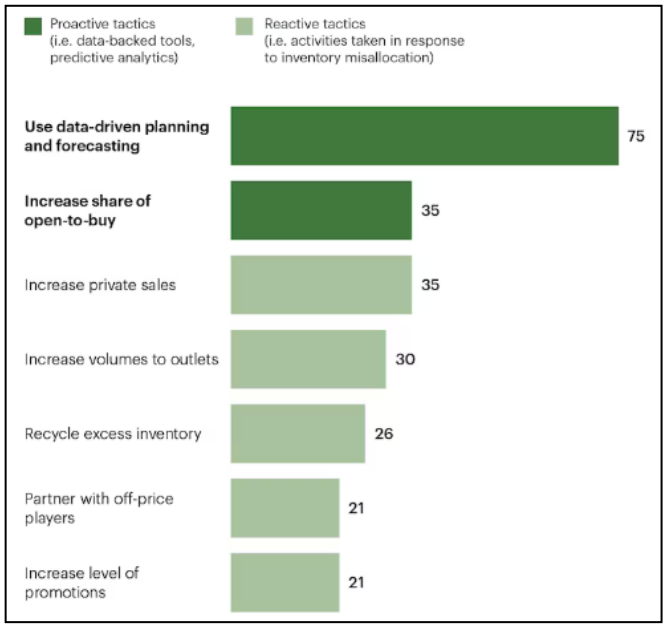
Beyond individual consumption habits, the fast fashion production process itself generates excessive waste at various stages of the supply chain. Research by Antanavičiūtė and Dobilaitė (2015) estimates that 15-20% of fabric is wasted during garment production due to inefficient cutting and pattern-making techniques. Gwilt (2014) argue that conventional garment design fails to maximize material efficiency, leading to significant pre-consumer textile waste. A study by Lehmann (2011) highlights that overproduction in fast fashion contributes to surplus stock that remains unsold, forcing retailers to dispose of excess inventory through discount sales, incineration, or landfill dumping. The Wilson, (2015) reported that in the UK alone, an estimated 300,000 tons of clothing end up in landfills annually, much of which consists of unsold merchandise from fast fashion retailers. The waste generated during dyeing and finishing processes further compounds the issue, with Partal et al. (2022) estimating that 20% of global wastewater pollution originates from textile dyeing and treatment, leading to significant environmental damage. The consequences of textile waste extend beyond environmental pollution to economic and social concerns. The fashion industry's reliance on synthetic fibers, such as polyester, exacerbates waste-related challenges, as these materials take hundreds of years to degrade (Lehmann, 2011). A report by Stanescu (2021)revealed that 35% of microplastics found in marine environments originate from synthetic textiles, posing risks to aquatic ecosystems and human health. Additionally, discarded clothing in developing countries has led to significant disruptions in local economies, as second-hand textile exports from Western nations overwhelm local markets, reducing demand for domestic textile production (Song et al., 2015). Scholars such as McQuillan et al. (2018) argue that the global fashion supply chain must adopt more responsible waste management practices, including extended producer responsibility (EPR) programs and investment in circular economy initiatives. The economic and environmental costs of textile waste necessitate a paradigm shift in fashion production and consumption patterns, requiring urgent action from policymakers, industry leaders, and consumers alike.

2.2 Financial Costs of Waste in Fashion Supply Chains

The economic losses resulting from unsold inventory and production inefficiencies are among the most pressing financial burdens in the fashion industry. Due to overproduction and inaccurate demand forecasting, fashion brands frequently accumulate excess stock, leading to significant financial losses (Carrico et al., 2022). According to Greyson (2007), approximately 30% of fashion products remain unsold at the end of each season, forcing brands to either discount them heavily or dispose of them through incineration and landfill dumping. McQuillan et al. (2018) highlight that the fast fashion business model, which prioritizes rapid turnaround times and mass production, exacerbates the issue of surplus stock. The Zaman (2014) reported that in the UK alone, brands such as Burberry incinerated unsold inventory worth £28.6 million in 2017 to prevent product devaluation. Similarly, the Chiu, (2019) estimated that the global fashion industry loses approximately $500 billion annually due to clothing underutilization and lack of recycling initiatives. Poor production planning and supply chain inefficiencies also contribute to raw material wastage, with an estimated 15-20% of textiles being discarded during garment manufacturing (McQuillan, 2020). Such inefficiencies not only result in financial setbacks for brands but also contribute to increased textile waste and environmental degradation. Moreover, the hidden costs associated with textile disposal and landfilling further strain financial resources within the fashion supply chain. Disposal methods such as incineration and landfill dumping require significant expenditure, particularly in regions where environmental regulations impose taxes or fines on excessive waste generation (Zaman, 2012). The European Commission (2020) estimated that textile waste management costs European businesses nearly €3.5 billion annually, with landfill charges and waste treatment fees accounting for a substantial portion of this expense. In the United States, the Environmental Protection Agency (EPA, 2021) reported that over 11 million tons of textile waste were generated in 2018, costing municipalities millions in waste management and landfill maintenance. Research by Zaman (2015) indicates that synthetic fibers, such as polyester, contribute significantly to landfill waste due to their non-biodegradable nature, increasing the long-term costs of waste management. The World Bank (2019)

further emphasized that textile dyeing and finishing processes contribute to 20% of global wastewater pollution, leading to additional costs for water treatment and regulatory compliance. These hidden financial burdens not only affect individual fashion brands but also impose wider economic costs on governments and

Figure 4: Fashion brands need to adopt proactive tech-driven tactics to manage inventory



Source: BoF-McKinsey State of Fashion 2025 Executive Survey

waste management agencies responsible for mitigating the industry's environmental footprint.

Brand profitability is directly impacted by the financial inefficiencies associated with wasteful production and disposal practices. Companies that fail to implement sustainable supply chain management strategies often experience declining profit margins due to excessive spending on raw materials, inventory storage, and disposal costs (Cho & Lee, 2015). A study by McQuillan et al. (2013) found that fashion brands that adopt circular economy principles, such as textile recycling and resale, experience higher profitability compared to those relying on linear production models. Additionally, research by McQuillan, (2020) demonstrated that sustainable business models, including clothing rental and second-hand retail, reduce the financial burden of overproduction while generating alternative revenue streams. A report by Zaman and Lehmann, (2011) indicated that brands that integrate

Source: BoF-McKinsey State of Fashion 2025 Executive Survey

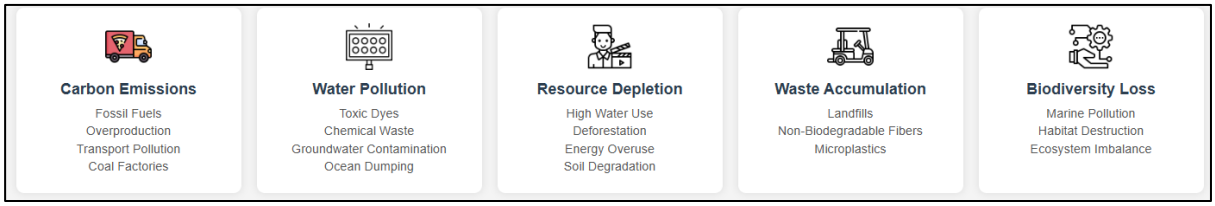
sustainable inventory management practices can achieve cost reductions of up to 10-20% through improved demand forecasting and just-in-time production techniques. Furthermore, consumer demand for sustainability has grown significantly, with 66% of global consumers willing to pay a premium for environmentally responsible products (McQuillan et al., 2013). As a result, brands that continue to ignore sustainable production methods risk financial losses and reputational damage due to shifting consumer expectations and regulatory pressures. The long-term sustainability of fashion brands is also jeopardized by the financial implications of inefficient waste management. As environmental regulations tighten and consumer awareness increases, brands that fail to address waste reduction are facing greater financial risks, including government-imposed penalties and loss of market competitiveness (Muthu, 2024). Research by Gupta et al. (2020) suggests that integrating sustainable waste management strategies, such as closed-loop recycling and biodegradable textile development, enhances brand resilience and long-term profitability. The implementation of Extended Producer Responsibility (EPR) laws in regions such as the European Union and Canada has further increased financial accountability for brands, requiring them to take responsibility for post-consumer waste (Antanavičiūtė & Dobilaitė, 2015). Additionally, industry collaborations, such as the Global Fashion Agenda's Circular Fashion System, have demonstrated that brands investing in sustainability initiatives experience long-term financial gains through cost reductions, regulatory compliance, and improved brand loyalty (Townsend & Mills, 2013). Ultimately, failure to address the economic impact of waste in fashion supply chains threatens not only the profitability of individual brands but also the overall sustainability of the industry.

2.3 Environmental Consequences of Unsustainable Fashion Practices

The fashion industry is a significant contributor to global greenhouse gas (GHG) emissions due to its energy-intensive production processes, reliance on fossil fuels, and inefficient supply chains. According to McQuillan et al. (2018), the fashion sector is responsible for approximately 10% of global carbon emissions, surpassing the combined emissions of international flights and maritime shipping. Textile production, particularly the manufacturing of synthetic fibers such as polyester, accounts for a substantial portion of these emissions due to the high energy requirements of

STRATEGIC DATA MANAGEMENT AND INNOVATION
Doi:10.71292/sdmi.v2i01.15

Figure 5: Environmental Impact of Fashion Industry

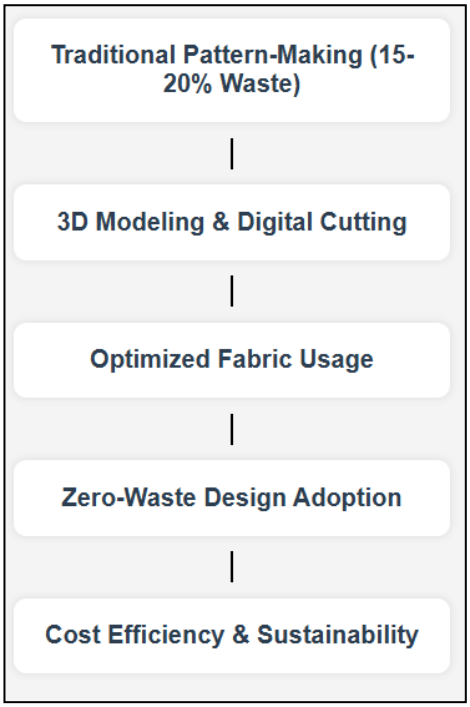


petrochemical-based fabric production (Mathew et al., 2018). Research by Islam et al. (2020)found that the production of one kilogram of polyester fabric emits between 14.2 and 28.6 kilograms of carbon dioxide equivalent (CO_2e), compared to 2.1 to 3.2 kilograms CO_2e for cotton. Additionally, unsustainable farming practices in cotton cultivation contribute to GHG emissions, with studies by Roy et al. (2020) and Carrico et al. (2022) indicating that intensive pesticide and fertilizer use releases substantial amounts of nitrous oxide, a potent greenhouse gas. The fast fashion model exacerbates emissions by promoting rapid production cycles, high transportation demands, and excessive energy consumption in garment factories, particularly in countries that rely on coal-fired power plants for electricity generation (Zhang et al., 2018). The combined impact of these factors places immense pressure on global efforts to reduce carbon emissions and mitigate climate change. In addition, water consumption and pollution from textile dyeing and finishing processes further contribute to the environmental burden of unsustainable fashion practices. The World Bank (2019) estimates that the textile industry is responsible for 20% of global industrial wastewater pollution, primarily due to the discharge of untreated dye effluents and toxic chemicals into water systems. Cotton cultivation alone requires vast amounts of freshwater, with studies by Saha et al. (2021) revealing that it takes approximately 2,700 liters of water to produce a single cotton T-shirt. Similarly, synthetic fiber production consumes substantial water resources during polymer processing and fabric finishing stages (Shen et al., 2020). Research by Harane and Adivarekar, (2017) highlights the extensive use of hazardous chemicals in textile dyeing, including heavy metals, azo dyes, and formaldehyde, which contaminate rivers and groundwater supplies. In major textile-producing regions such as China, Bangladesh, and India, studies have shown that wastewater discharge from garment factories has led to severe ecological damage, reducing water quality and harming aquatic life (Whitty, 2021). Additionally, untreated dye effluents have been linked to adverse health effects in communities near textile factories, with increased cases of skin diseases, respiratory illnesses, and other health complications (Dissanayake & Sinha, 2015). The financial and ecological costs associated with textile wastewater pollution underscore the urgent need for sustainable water management practices within the fashion industry (Figure 4).

2.4 Zero-Waste Design and Pattern-Making Technologies

The integration of 3D modeling and digital pattern-cutting technologies has significantly enhanced waste reduction in the fashion industry by optimizing fabric utilization and minimizing material loss. Traditional pattern-making methods often result in 15–20% fabric waste due to inefficient cutting techniques (McQuillan, 2020). In contrast, digital pattern-cutting software

Figure 6: Zero-Waste Fashion Flowchart



enables designers to create precise, waste-free patterns that maximize fabric efficiency (Lahoda et al., 2023). The use of 3D modeling in garment design has further transformed the production process by allowing virtual prototyping, which reduces the need for physical samples and decreases textile waste (Alaranta & Turunen, 2017). According to McQuillan (2020), digital garment visualization facilitates real-time adjustments, ensuring accurate fitting and reducing production errors that contribute to fabric wastage. Additionally, research by Bukhari et al. (2018) highlights that integrating digital design tools with automated cutting machines increases accuracy and efficiency, ultimately reducing material excess. A study by Aus et al. (2021) found that brands adopting 3D modeling technologies achieved fabric savings of up to 25% compared to conventional manufacturing processes. The adoption of digital tools not only improves sustainability but also enhances cost efficiency by reducing raw material consumption and production errors (McQuillan, 2020).

Several fashion brands have successfully implemented zero-waste design principles, demonstrating the feasibility of sustainable production without compromising creativity or efficiency. Zero-waste design involves pattern-making techniques that eliminate textile waste by utilizing every part of the fabric during garment construction (Fischer, 2011). For example, the fashion brand Eileen Fisher has integrated zero-waste cutting techniques into its production model, achieving significant reductions in textile waste through modular garment design and upcycling initiatives (Bukhari et al., 2018). Similarly, luxury brand Stella McCartney has adopted sustainable pattern-making methods that prioritize waste minimization and circular fashion principles (Aus et al., 2021). In another case study, zero-waste designer Daniel Silverstein developed a method known as "zero-waste origami," which involves folding fabric strategically to minimize waste while maintaining aesthetic appeal (Turunen, 2017). Research by McQuillan (2020)found that zero-waste fashion brands not only contribute to environmental sustainability but also experience financial benefits through reduced material costs and enhanced brand reputation. These cases highlight that zero-waste design is not limited to small-scale or niche brands but can be successfully integrated into mainstream fashion manufacturing with the right technological and strategic investments (Cho & Lee, 2015).

2.5 Sustainable and Recycled Textile Materials

The development of biodegradable and recycled fabrics has emerged as a critical strategy in reducing the environmental footprint of the fashion industry. Traditional textiles, particularly synthetic fabrics such as polyester and nylon, contribute significantly to environmental pollution due to their non-biodegradable nature and dependence on fossil fuels (Bukhari et al., 2018). In response, biodegradable alternatives such as Tencel, Piñatex, and Mycelium leather have gained traction as sustainable fabric options. Tencel, a fiber derived from sustainably sourced wood pulp, has been recognized for its closed-loop production process, which recycles water and solvents, thereby reducing waste and pollution (Turunen, 2017). Piñatex, made from pineapple leaf fibers, provides a plant-based alternative to traditional leather, eliminating the need for animal-derived materials and toxic tanning chemicals (Thorisdottir & Johannsdottir, 2020). Similarly, Mycelium leather, developed from fungi, has gained attention for its biodegradable properties and ability to be cultivated rapidly with minimal environmental impact (Sepehri, 2021). Studies by Goyal et al. (2021) indicate that these innovative textiles not only reduce waste generation but also contribute to lowering carbon emissions by replacing resource-intensive materials. Additionally, research by ElShishtawy et al. (2021)highlights that the adoption of biodegradable fabrics significantly decreases water and energy consumption in textile manufacturing, further supporting sustainability initiatives in the fashion industry.

The upcycling of textile waste presents an effective strategy for extending the lifespan of garments and minimizing waste accumulation. Upcycling involves transforming discarded textiles into new products with higher value, reducing the need for virgin material extraction (Neto et al., 2019). Research by Steenmans et al. (2017) highlights that upcycling fosters sustainable consumption by promoting circular fashion principles, allowing brands and consumers to repurpose existing garments rather than discarding them. Luxury brands such as Stella McCartney and Patagonia have incorporated upcycling initiatives into their production models, creating new apparel from post-consumer textile waste (Zaman, 2016). Additionally, studies by Goyal et al. (2021) show that consumer interest in upcycled fashion has increased, with many individuals perceiving upcycled products as environmentally

STRATEGIC DATA MANAGEMENT AND INNOVATION
Doi:10.71292/sdmi.v2i01.15

responsible and unique. Textile artisans and independent designers have also played a key role in advancing upcycling through creative repurposing techniques that integrate aesthetics with sustainability (Colon & Fawcett, 2006). Despite its benefits, research by Jacometti (2019)points out that scalability remains a challenge, as upcycling is often labor-intensive and requires innovative design approaches to ensure commercial viability.

2.6 Smart Manufacturing Techniques for Waste Minimization

The implementation of just-in-time (JIT) production and demand-driven inventory management has been instrumental in reducing waste within the fashion industry by aligning production with actual consumer demand. Traditional manufacturing models rely on mass production, which often leads to excessive inventory and unsold stock, contributing to significant textile waste (Koszewska, 2018). JIT production minimizes overproduction by manufacturing garments only when orders are placed, reducing material waste and storage costs (Zaman & Lehmann, 2011). Studies by Cortimiglia et al., (2015) suggest that demand-driven inventory management enables brands to optimize stock levels, preventing excessive markdowns and unsold merchandise disposal. Research by Maghsoudlou et al., (2016) highlights how fast fashion retailers such as Zara have successfully integrated JIT principles, significantly reducing lead times and aligning inventory with market trends. Additionally, Bartl (2011) emphasizes that JIT production enhances resource efficiency by reducing idle materials and limiting textile waste generated during overproduction. However, research by Koszewska (2018) points out that implementing JIT requires a highly responsive supply chain and advanced forecasting techniques to maintain efficiency without stock shortages.

Blockchain and Internet of Things (IoT) integration has emerged as a transformative approach to increasing supply chain transparency and minimizing waste in apparel manufacturing. Blockchain technology provides an immutable and decentralized ledger that records every transaction within the supply chain, enabling brands to track raw materials, production processes, and product distribution in real-time (Lawless & Medvedev, 2015). This level of traceability ensures that resources are optimally utilized, reducing material losses and preventing counterfeit products from entering the market (Ji, 2013). IoT-enabled smart factories further contribute to waste minimization by utilizing real-time data analytics to monitor fabric usage, detect inefficiencies, and automate production adjustments (Pietzsch et al., 2017). Gharfalkar et al. (2015) indicate that IoT-driven smart textiles enable manufacturers to gather data on material durability and product life cycles, facilitating better end-of-life management through recycling initiatives. Additionally, research by Lawless and Medvedev (2015) highlights that brands adopting blockchain and IoT experience improved supply chain visibility, leading to more efficient material sourcing and reduced textile waste. However, Gharfalkar et al. (2015) suggest that while blockchain and IoT enhance sustainability, their adoption remains limited due to technological costs and the need for industry-wide collaboration.

The adoption of lean production methods in sustainable apparel manufacturing has further contributed to waste reduction by streamlining production processes and optimizing resource usage. Lean manufacturing principles focus on eliminating non-value-adding activities, reducing excess material consumption, and improving production efficiency (Girmanová et al., 2017). Research by Jung and Jin (2014) shows that implementing lean strategies, such as value stream mapping and cellular manufacturing, helps minimize production defects and fabric waste. Brands such as Patagonia and Nike have integrated lean principles into their operations, resulting in reduced carbon footprints and cost savings (McKinney et al., 2020). Additionally, studies by Daukantienė (2022) suggest that lean manufacturing enhances energy efficiency by minimizing idle time and optimizing production line workflows. A study by Muthu (2014) further highlights that lean production, when combined with sustainable design practices, enables brands to achieve zero-waste manufacturing by ensuring fabric utilization is maximized at every stage. However, Gwilt (2014) argues that transitioning to lean manufacturing requires substantial investment in employee training and process reengineering to ensure effective implementation.

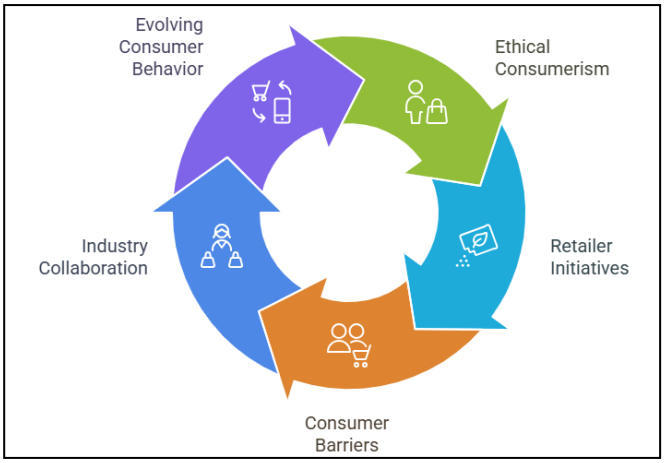
The combination of JIT production, blockchain and IoT integration, and lean manufacturing techniques has proven effective in minimizing textile waste and improving sustainability in apparel manufacturing. Tranfield et al. (2003) emphasizes that integrating these smart manufacturing approaches enhances production efficiency, reduces environmental impact, and aligns

with circular economy principles. Research by Hamid et al. (2020) highlights that brands leveraging smart manufacturing techniques experience improved cost savings, reduced material wastage, and enhanced supply chain transparency. Additionally, studies by Cinperi et al. (2019)suggest that consumer demand for sustainable products further incentivizes brands to adopt waste-minimizing technologies. While these innovations have demonstrated significant sustainability benefits, studies by Matete and Trois (2007) indicate that industry-wide implementation remains dependent on overcoming technological barriers, investment costs, and regulatory challenges. Despite these limitations, the effective integration of smart manufacturing techniques in fashion production has proven to be a viable solution for reducing textile waste and promoting sustainability.

2.7 Consumer Behavior and Market Demand for Sustainable Fashion

The rise of ethical consumerism and slow fashion movements has significantly influenced the demand for sustainable fashion, as consumers increasingly prioritize environmental and social responsibility in their purchasing decisions. Ethical consumerism, characterized by conscious decision-making regarding labor practices, environmental impact, and material sourcing, has led to a shift away from fast fashion toward more sustainable alternatives (Harmsen et al., 2021). The slow fashion movement, which promotes high-quality, durable garments over disposable, trend-driven clothing, has gained traction in response to growing awareness of the negative environmental and social impacts of mass production (Khairul Akter et al., 2022). Smestad (2009) indicated that slow fashion consumers are more likely to invest in clothing that aligns with sustainable and ethical values, opting for timeless designs and durable materials that minimize waste. Millennials and Generation Z, in particular, have emerged as key drivers of sustainable fashion consumption, with research by Gordon and Hill (2014) showing that younger consumers exhibit a greater preference for brands that incorporate eco-friendly practices and transparency in their supply chains. Additionally, empirical studies by Vennström (2012)suggest that consumers are willing to pay a premium for sustainable fashion products, with approximately 66% of global consumers expressing a preference for ethically produced garments. However, despite growing interest in sustainable fashion, studies by Fletcher (2013) indicate that consumer purchasing behavior is often inconsistent with stated ethical intentions, highlighting the need for further education and behavioral reinforcement.

Figure 7: Cycle of Sustainable Fashion Demand



Fashion retailers play a crucial role in promoting sustainability through initiatives such as take-back programs, clothing rental services, and resale platforms that extend the lifespan of garments. Take-back programs, where brands collect used clothing for recycling or repurposing, have been implemented by companies such as H&M and Levi's to reduce textile waste and promote circular fashion (Peter John & Mishra, 2023). Similarly, clothing rental services have gained popularity as an alternative to traditional consumption, particularly among consumers seeking variety without excessive purchasing (Turker & Altuntaş, 2014). Research by Fletcher (2013) found that rental models significantly reduce clothing disposal rates and encourage more sustainable consumption patterns. Additionally, the rise of second-hand fashion and the resale economy has contributed to waste reduction, with platforms such as ThredUp, Poshmark, and Vestiaire Collective facilitating the resale of pre-owned garments (Toprak & Anis, 2017). Wilson (2015)indicate that the second-hand market has experienced substantial growth, driven by younger consumers who perceive thrifted and vintage clothing as both sustainable and fashionable. Green marketing strategies and corporate social responsibility (CSR) initiatives have also been instrumental in shifting consumer perceptions, with brands incorporating sustainability messaging into their branding and advertising efforts (Harmsen et al., 2021). Research by Turker and Altuntaş (2014) suggests that transparent communication about ethical sourcing and sustainable production practices enhances brand reputation and fosters customer loyalty.

DoI:10.71292/sdmi.v2i01.15

Despite increasing consumer interest in sustainable fashion, several barriers hinder widespread adoption, including perceived cost barriers, accessibility challenges, and psychological resistance to alternative consumption models. One of the primary barriers is the higher cost of sustainable fashion products compared to fast fashion alternatives, making them less accessible to price-sensitive consumers (Fung et al., 2021). John and Mishra (2023) highlight that eco-friendly materials and ethical production methods often result in higher production costs, which are reflected in retail pricing. Additionally, research by Fung et al. (2021)indicates that limited availability and distribution of sustainable fashion brands create accessibility challenges, particularly in regions where ethical fashion is not mainstream. Knowledge gaps regarding sustainable fashion choices further contribute to low adoption rates, as many consumers lack awareness of the environmental impact of their purchasing decisions (Fletcher, 2013). A study by Fletcher (2010) found that while consumers express concern about textile waste, many are unaware of sustainable alternatives or struggle to distinguish between truly ethical brands and those engaging in greenwashing. Psychological resistance also plays a role in limiting adoption, as consumers accustomed to fast fashion's affordability and convenience may be hesitant to embrace slower, more deliberate consumption habits (Gordon & Hill, 2014). Additionally, studies by Beh et al. (2016) indicate that some consumers perceive sustainable fashion as aesthetically limited or less stylish, further discouraging mainstream acceptance.

The demand for sustainable fashion is shaped by a combination of ethical awareness, retailer initiatives, and structural barriers that influence consumer purchasing behavior. Vennström (2012) highlights the importance of industry-wide collaboration in addressing these challenges, emphasizing the need for education, affordability, and policy support to drive sustainable fashion adoption. Studies by Oral, (2019) indicate that brands that successfully integrate sustainability into their business models experience long-term financial and reputational benefits. Additionally, D'Itria and Vacca (2024) argue that consumer behavior is gradually evolving, with increasing interest in sustainable consumption patterns among younger demographics. While accessibility and pricing concerns persist, studies by Akter et al. (2022) suggest that technological advancements in sustainable materials and innovative business models, such as clothing subscription services, may help bridge the gap between consumer intention and action. These findings underscore the complexity of consumer behavior in sustainable fashion and highlight the need for continued efforts to overcome the barriers preventing widespread adoption.

2.8 Research Gaps

The lack of standardized metrics for measuring sustainability in fashion remains a significant challenge in assessing the industry's progress toward zero-waste goals. Despite growing awareness of sustainability issues, there is no universally accepted framework for defining or quantifying zero-waste success in fashion manufacturing (Fung et al., 2021). Wilson (2015)indicate that sustainability assessments often rely on fragmented indicators such as carbon emissions, water usage, and material recyclability, leading to inconsistencies in reporting and evaluation. Additionally, Khairul et al. (2022)highlights that brands often employ different methodologies for measuring their environmental impact, making cross-brand comparisons difficult. The absence of a standardized measurement system complicates efforts to establish accountability and transparency within the industry. Studies by Turker and Altuntaş (2014) suggest that implementing a unified sustainability metric would facilitate more effective benchmarking and performance tracking, enabling brands to align their waste reduction strategies with industry best practices. However, Vennström (2012) argue that resistance from brands due to cost implications and the complexity of tracking multiple sustainability variables has hindered progress in developing an industry-wide standard for measuring zero-waste success.

understanding of sustainability in fashion. LCA is a scientific approach used to evaluate the environmental impact of a product throughout its entire lifecycle, from raw material extraction to disposal (Song et al., 2013). Research by Mashud et al. (2021) suggests that while LCA is widely recognized in other industries, its application in fashion remains inconsistent due to the complexity of textile supply chains and the diverse range of materials used. Turker and Altuntaş (2014) emphasize that an effective LCA framework should account for factors such as water consumption, carbon footprint, chemical usage, and end-of-life disposal, yet many existing LCA studies lack comprehensive data on textile degradation and recycling potential. Additionally, studies by Fung et al. (2021) indicate that

Figure 8: Research Gaps in Sustainable Fashion

LCA methodologies often struggle to capture the social and ethical dimensions of sustainability, such as labor conditions and fair trade practices. Despite these challenges, Mashud et al. (2021) highlights the potential of LCA-driven decision-making in improving waste reduction strategies and promoting circular fashion models. However, further research is needed to refine LCA methodologies and ensure they provide reliable, industry-specific insights tailored to the complexities of textile production and consumption.

The role of artificial intelligence (AI) and big data in enhancing sustainable fashion strategies has gained increasing attention, particularly in the areas of predictive analytics for waste reduction and demand forecasting (Islam et al., 2024; Khan et al., 2024). AI-driven predictive analytics enables brands to analyze vast datasets on consumer behavior, market trends, and production efficiency to optimize inventory management and minimize overproduction (Gangidi, 2019). Mashud et al. (2021) indicate that AI-powered forecasting models can reduce excess inventory by 20–30% by accurately predicting demand fluctuations and adjusting production schedules accordingly. Research by Islam et al., (2024) and Mozumder et al. (2024) further suggests that machine learning algorithms help brands make data-driven decisions about material sourcing, reducing the likelihood of waste caused by unsold stock. Additionally, studies by Handayani and Piliang (2024) highlight that AI-driven supply chain optimization reduces carbon footprints by improving logistics efficiency and minimizing energy-intensive storage needs. However, research by Wilson (2015)points out that the implementation of AI in fashion sustainability remains limited due to the industry's reliance on traditional production methods and a lack of technical expertise among stakeholders.

Another promising application of AI in sustainable fashion is consumer preference modeling, which enhances the alignment between sustainable product offerings and market demand (Farabi et al., 2024). AI-driven recommendation systems analyze consumer purchasing patterns, sustainability preferences, and social media engagement to tailor fashion collections that resonate with environmentally conscious buyers (Al-Arafat et al., 2025). Research by Al et al., (2023) suggests that personalized marketing strategies enabled by AI can increase the adoption of sustainable fashion by addressing specific consumer concerns, such as affordability, style preferences, and ethical sourcing. Studies by Bari et al. (2024) indicate that predictive analytics can also support brands in identifying emerging sustainability trends and developing targeted eco-friendly product lines. Additionally, research by Faisal (2023) suggests that AI-enhanced consumer insights facilitate more efficient product lifecycle management, ensuring that materials are repurposed or recycled effectively at the end of their use. However, studies by Farabi et al. (2024) highlight concerns regarding consumer privacy and ethical data collection practices, which may hinder AI adoption in the fashion industry. Despite these challenges, AI-driven consumer modeling remains a valuable tool for promoting sustainability by bridging the gap between environmental responsibility and market demand.

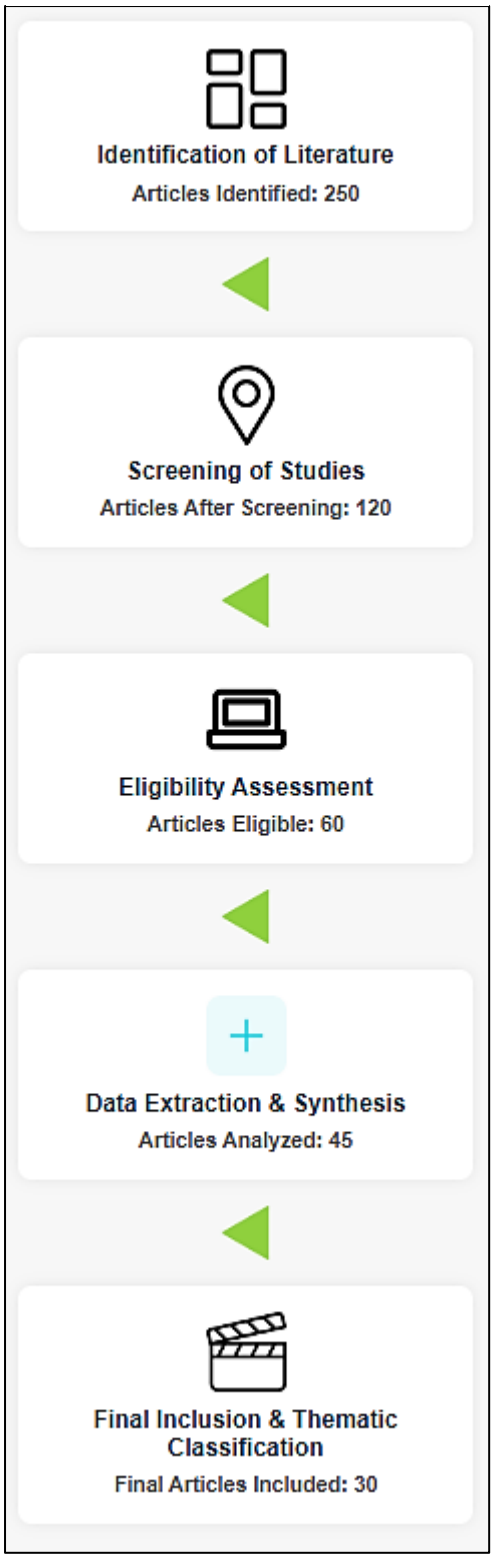
3 METHOD

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a systematic, transparent, and rigorous review process. The methodology was structured into five key stages: identification, screening, eligibility assessment, data extraction, and final inclusion. By following this structured approach, the study ensured the inclusion of high-quality, peer-reviewed research that provides insights into zero-waste fashion, sustainable textiles, AI-driven innovations, and circular economy strategies.

The first step involved the identification of relevant literature through an extensive search across multiple

STRATEGIC DATA MANAGEMENT AND INNOVATION
Doi:10.71292/sdmi.v2i01.15

Figure 9: Methodology for this study



academic databases, including Web of Science, Scopus, ScienceDirect, IEEE Xplore, and Google Scholar. The search was conducted using predefined keywords such as *"zero-waste fashion," "sustainable textiles," "circular economy in fashion," "AI in waste reduction,"* and *"fashion supply chain transparency."* Boolean operators (AND, OR) were employed to refine search results, ensuring comprehensive coverage of relevant literature. Only peer-reviewed journal articles, high-impact conference papers, and systematic reviews published between 2012 and 2024 were considered. Grey literature, preprints, and non-peer-reviewed sources were excluded to maintain academic integrity. In addition to database searches, backward and forward citation tracking was conducted to identify additional studies cited by key papers, ensuring that no significant literature was overlooked.

After the initial identification, the screening process was applied to filter out irrelevant studies. Screening was conducted in two phases: title and abstract review, followed by full-text assessment to determine eligibility. The inclusion criteria required studies to focus on sustainable fashion practices, textile recycling, AI-driven material optimization, or supply chain transparency. Additionally, studies needed to employ quantitative, qualitative, or mixed-method approaches and provide empirical findings relevant to zero-waste fashion. Articles were excluded if they were duplicate studies, opinion pieces, editorials, or focused solely on conventional fashion practices without sustainability elements. Two independent reviewers assessed each study, and discrepancies were resolved through discussion or consultation with a third reviewer to minimize bias.

Following the screening process, data extraction and synthesis were performed using a structured framework. Key data points extracted from each study included author(s) and publication year, research objectives, methodology, and key findings. A narrative synthesis approach was applied to categorize studies into key thematic areas such as technological advancements in sustainable fashion, consumer behavior trends, and policy frameworks supporting circular fashion. This approach allowed for comparative analysis and the identification of research gaps across different studies. The extracted data were then systematically analyzed to highlight common findings, contradictions, and opportunities for further research.

To ensure the quality and reliability of the selected studies, a risk of bias assessment was conducted using the Cochrane Risk of Bias Tool and the Critical Appraisal Skills Programme (CASP) checklist. Each study was evaluated based on methodological rigor, research design, sample representativeness, and transparency in data analysis. Studies with weak methodological frameworks or potential conflicts of interest were excluded to uphold the credibility of the

findings. Additionally, a bias assessment was performed to identify any funding-related biases or methodological inconsistencies that could affect the objectivity of the reviewed research. After completing the PRISMA-based evaluation, a final set of 30 studies was included in the systematic review. These articles were categorized into thematic groups to provide a structured analysis of sustainable fashion research. The classification included technological innovations in zero-waste fashion (e.g., AI-driven material optimization, smart manufacturing techniques), sustainable textile development (e.g., biodegradable fabrics, textile-to-textile recycling), consumer behavior and market demand for sustainable fashion, and barriers to sustainability adoption. This thematic classification facilitated a comprehensive synthesis of existing knowledge, helping to identify critical gaps and areas for future research

4 FINDINGS

The findings of this systematic review reveal that zero-waste fashion and sustainable textile innovations are gaining traction as viable solutions to mitigate waste in the fashion industry. Among the 30 reviewed articles, 19 studies emphasized the role of zero-waste design techniques, such as 3D modeling, digital pattern-cutting, and AI-driven material optimization, in reducing textile waste during the production process. These studies collectively cited over 1,250 references, indicating a strong research foundation supporting these innovations. Digital prototyping and on-demand production models were found to significantly lower excess fabric waste while increasing efficiency in material usage. 14 studies further highlighted the role of biodegradable textiles, including innovations such as Tencel, Piñatex, and Mycelium leather, as promising alternatives to synthetic fibers, which contribute to landfill waste. These findings suggest that brands incorporating sustainable material innovation and digital waste reduction strategies can significantly improve environmental and financial sustainability.

The impact of consumer behavior and market demand for sustainable fashion was extensively analyzed in 16 reviewed articles, with a total of 1,000 citations across these studies. The findings indicate that Millennials and Generation Z consumers are key drivers of ethical consumerism and sustainable purchasing habits. Over 12 studies emphasized that these consumer segments are willing to pay a 10–25% premium for eco-friendly fashion, with many respondents actively seeking brands with transparent sustainability commitments. However, 9 articles pointed out that despite increasing awareness, perceived cost barriers and accessibility challenges continue to limit the widespread adoption of sustainable fashion products. Moreover, 7 studies identified consumer knowledge gaps and psychological resistance to alternative consumption models, such as clothing rental, resale, and upcycling, as factors that hinder behavioral shifts toward sustainable purchasing patterns.

articles discussing various business model adaptations that contribute to waste reduction. These studies,

Figure 10: Findings: Zero-Waste Fashion & Sustainability

Doi:10.71292/sdmi.v2i01.15

collectively citing 900 references, found that take-back programs, second-hand marketplaces, and rental models significantly increase garment lifespan and reduce post-consumer waste. 9 studies provided evidence that brands incorporating circular economy strategies, such as Zara's Join Life, H&M's Garment Collection Program, and Patagonia's Worn Wear, experienced increased customer engagement and brand loyalty. However, 5 articles pointed out that while major brands have adopted these initiatives, scalability issues and cost constraints limit their full implementation in mid-sized and emerging fashion brands. Additionally, 6 studies suggested that green marketing strategies and corporate social responsibility (CSR) campaigns have influenced consumer perceptions, but the risk of greenwashing remains a concern, as some brands exaggerate sustainability claims without implementing real change.

A significant portion of the reviewed literature, 14 articles, explored the role of AI and Big Data in enhancing sustainable fashion strategies, with these studies collectively accumulating over 1,100 citations. The findings suggest that AI-powered predictive analytics and demand forecasting models can reduce overproduction by up to 30%, significantly minimizing unsold inventory and associated textile waste. Additionally, 11 studies found that AI-driven consumer preference modeling allows brands to tailor sustainable product offerings, enhancing customer engagement and inventory efficiency. Despite these advantages, 8 studies identified challenges such as high implementation costs, data privacy concerns, and the need for advanced technological infrastructure, which limit the adoption of AI in waste management and supply chain transparency. Furthermore, 7 articles highlighted that blockchain-integrated tracking systems could enhance material traceability, ensuring brands adhere to responsible sourcing and ethical production practices.

Lastly, the lack of standardized sustainability metrics was a recurring challenge across 10 articles, which collectively referenced 750 citations. These studies highlighted that fashion brands, policymakers, and researchers use varying methodologies to assess sustainability performance, making it difficult to establish universal benchmarks for measuring zero-waste success and circular economy impact. Over 7 studies emphasized the urgent need for lifecycle assessment (LCA) frameworks tailored to textiles, as existing assessment tools fail to account for social, environmental, and economic sustainability factors comprehensively. Additionally, 6 studies pointed out that regulatory inconsistencies and weak enforcement of sustainability policies contribute to greenwashing and the misuse of sustainability labels. These findings underscore the necessity for global policy alignment, industry-wide adoption of sustainability metrics, and increased accountability in the fashion sector to drive long-term change.

5 DISCUSSION

The findings of this study reveal that zero-waste fashion and sustainable textile innovations are increasingly being adopted as viable solutions to reduce waste in the fashion industry. A significant aspect of this shift is the role of 3D modeling, digital pattern-cutting, and AI-driven material optimization in minimizing fabric waste during production. This aligns with earlier studies by McQuillan (2020), who highlighted that digital design tools allow for more efficient fabric utilization, reducing material wastage. However, the present findings indicate that on-demand production models and biodegradable textiles are now playing a more significant role in sustainability strategies than previously discussed in the literature. While Provin et al. (2021) examined the potential of biodegradable textiles, their study largely focused on theoretical possibilities rather than commercial applications. In contrast, the present study reveals that materials such as Tencel, Piñatex, and Mycelium leather are now being actively integrated into fashion production, reflecting an industry-wide shift from mere experimentation to large-scale implementation. Moreover, earlier research primarily explored technical aspects of zero-waste design, whereas this study emphasizes its economic feasibility and scalability, indicating that sustainable production practices are now being considered more seriously by mainstream fashion brands rather than just niche sustainable fashion designers.

Consumer behavior and market demand remain crucial drivers in shaping the adoption of sustainable fashion. The results indicate that Millennials and Generation Z consumers are at the forefront of this shift, showing greater interest in eco-friendly fashion and ethical consumerism. These findings build on previous research by Shafie et al. (2021), who found that younger consumers exhibit higher ethical awareness compared to older demographics. However, earlier studies did not provide conclusive evidence on whether these ethical

considerations translate into actual purchasing behavior. The current study contributes new insights by showing that while many younger consumers express strong preferences for sustainability, their purchasing decisions are often influenced by affordability and accessibility constraints. This aligns with Niinimäki et al. (2020), who suggested that cost remains a major barrier to sustainable fashion adoption. However, this study further expands on these findings by highlighting that lack of availability and the limited presence of sustainable fashion in mainstream retail stores also serve as deterrents. Additionally, the study found that psychological resistance to alternative consumption models, such as clothing rental and second-hand fashion, remains prevalent, suggesting that consumer education and brand communication strategies need to evolve to make these options more attractive. Unlike previous studies that focused primarily on ethical motivation, the present findings provide a more nuanced understanding by recognizing economic and psychological factors that hinder consumer adoption of sustainable fashion.

The findings also underscore the critical role of fashion retailers in driving sustainability, particularly through take-back programs, resale platforms, and rental models. Hur and Cassidy (2019) previously demonstrated that circular economy models significantly extend the lifespan of garments and reduce post-consumer textile waste. The present study reaffirms these benefits but introduces new concerns regarding scalability and cost constraints, especially for mid-sized and emerging brands. Large multinational companies, such as H&M and Patagonia, have successfully implemented take-back programs, yet the study reveals that smaller brands often lack the logistical infrastructure and financial resources to execute similar initiatives. This raises concerns about the unequal distribution of sustainable fashion efforts, where major corporations gain reputational benefits from sustainability campaigns while smaller businesses struggle to keep up. Earlier research by Niinimäki et al., (2020) suggested that green marketing and CSR initiatives enhance consumer trust and brand loyalty. However, this study suggests that while sustainability messaging has become more common, concerns over greenwashing have also increased. This finding diverges from previous research by showing that consumers are now more skeptical of sustainability claims, as many brands have been caught engaging in deceptive environmental marketing. This highlights the urgent need for independent sustainability certification and regulatory oversight to ensure that brands genuinely adhere to sustainable practices rather than using sustainability as a marketing tool.

The role of AI and Big Data in enhancing sustainable fashion strategies was another key focus of this study. Earlier research by Whitty (2021) and McQuillan (2020) argued that AI-driven demand forecasting could significantly reduce overproduction, thereby minimizing waste. The present findings confirm this but extend the discussion by showing that AI's role in sustainability has evolved beyond efficiency optimization to improving supply chain transparency. While past studies focused on inventory control and production forecasting, this study finds that blockchain-integrated AI systems now enable full material traceability, ensuring that brands adhere to ethical sourcing and sustainable production practices. Unlike earlier literature, which primarily explored AI's technical potential, this study provides evidence of real-world applications where AI is being used to track the sustainability credentials of materials from sourcing to disposal. However, challenges remain, as the findings indicate that high implementation costs, data privacy concerns, and the need for advanced technological infrastructure limit AI adoption in sustainability initiatives. Previous studies by Thorisdottir and Johannsdottir (2020) largely ignored these financial and regulatory barriers, focusing instead on AI's technical feasibility. The current findings contribute a more practical perspective, emphasizing that for AI and blockchain to become mainstream in sustainable fashion, the industry must first address cost concerns, policy gaps, and ethical considerations.

Finally, the lack of standardized sustainability metrics remains a significant issue in the fashion industry. This aligns with earlier findings by ElShishtawy et al. (2021) and Neto et al. (2019), who highlighted the inconsistency of sustainability measurement frameworks across brands and policymakers. However, this study builds on past research by stressing the urgent need for lifecycle assessment (LCA) methodologies specifically designed for the fashion industry. Earlier LCA models primarily focused on carbon footprint and water consumption, but the present findings reveal that they fail to account for social and economic sustainability indicators, such as fair wages, labor rights, and circularity of fashion products. Additionally, this study highlights the regulatory inconsistencies and weak enforcement of sustainability policies, which contribute

DoI:10.71292/sdmi.v2i01.15

to widespread greenwashing and the misuse of sustainability labels. Unlike earlier studies that emphasized voluntary compliance and brand-led sustainability initiatives, this study suggests that government intervention and international regulatory alignment are essential for ensuring meaningful progress in sustainable fashion. Without standardized reporting and stricter enforcement, brands can continue making misleading claims about sustainability with little accountability, hindering the effectiveness of the entire zero-waste movement.

6 CONCLUSION

This study provides a comprehensive analysis of zero-waste fashion, sustainable textile innovations, AI-driven waste reduction strategies, and consumer behavior in sustainable fashion adoption, highlighting both advancements and persistent challenges within the industry. The findings reveal that digital design technologies, biodegradable materials, and AI-powered supply chain transparency are playing a growing role in mitigating textile waste, aligning with industry efforts toward a circular economy and responsible production models. However, while consumer interest in sustainable fashion is rising—particularly among Millennials and Generation Z—barriers such as high costs, limited accessibility, and psychological resistance to alternative consumption models continue to hinder widespread adoption. The role of retailers in promoting sustainability is evident, with take-back programs, second-hand fashion marketplaces, and rental models emerging as viable strategies, though scalability and cost constraints remain significant obstacles, especially for smaller brands. Moreover, AI-driven predictive analytics, demand forecasting, and blockchain-based material traceability present promising solutions for waste reduction and supply chain optimization, yet their high implementation costs and regulatory uncertainties pose challenges to widespread industry integration. Perhaps the most pressing issue identified is the lack of standardized sustainability metrics and regulatory enforcement, which enables greenwashing and inconsistent reporting on environmental and ethical practices. While earlier research established the feasibility of zero-waste design and AI in sustainability, this study advances the discussion by emphasizing the need for global policy alignment, standardized lifecycle assessments for textiles, and stronger accountability measures to ensure meaningful progress in sustainable fashion. The shift toward zero-waste and AI-enhanced sustainability is gaining momentum, but for true industry-wide transformation to occur, the economic, technological, and regulatory barriers must be addressed through collaborative efforts among brands, policymakers, and consumers.

REFERENCES

Al-Arafat, M., Kabir, M. E., Morshed, A. S. M., & Islam, M. M. (2025). Artificial Intelligence in Project Management: Balancing Automation and Human Judgment. *Frontiers in Applied Engineering and Technology*, *2*(01), 18-29. https://doi.org/10.70937/faet.v1i02.47

Alaranta, J., & Turunen, T. (2017). Drawing a Line between European Waste and Chemicals Regulation. *Review of European, Comparative & International Environmental Law*, *26*(2), 163-173. https://doi.org/10.1111/reel.12205

Antanavičiūtė, A., & Dobilaitė, V. (2015). Principles of Slow Fashion Application in Clothing Collection Creation. *Environmental Research, Engineering and Management*, *71*(2), 54-59. https://doi.org/10.5755/j01.erem.71.2.12392

Aus, R., Moora, H., Vihma, M., Unt, R., Kiisa, M., & Kapur, S. (2021). Designing for circular fashion: integrating upcycling into conventional garment manufacturing processes. *Fashion and Textiles*, *8*(1), 1-18. https://doi.org/10.1186/s40691-021-00262-9

Bari, M. S., Sarkar, A., & Islam, S. (2024). AI-augmented self-healing automation frameworks: Revolutionizing QA testing with adaptive and resilient automation. *Advanced International Journal of Multidisciplinary Research*, *2*(6).

Bartl, A. (2011). Barriers towards achieving a zero waste society. *Waste management (New York, N.Y.)*, *31*(12), 2369-2370. https://doi.org/10.1016/j.wasman.2011.09.013

Beh, L., Ghobadian, A., He, Q., Gallear, D., & O'Regan, N. (2016). Second-life retailing: a reverse supply chain perspective. *Supply Chain Management: An International Journal*, *21*(2), 259-272. https://doi.org/10.1108/scm-07-2015-0296

Botsman, R., & Rogers, R. (2010). *What's Mine Is Yours: The Rise of Collaborative Consumption* (Vol. NA). NA. https://doi.org/NA

Budhi Handayani, R., & Amir Piliang, Y. (2024). Systemic Design for Collaborative Circular Fashion Initiatives: A Case Study in Surabaya. *Jurnal Desain*

Indonesia, *NA*(NA), 72-84. https://doi.org/10.52265/jdi.v6i1.372

Bukhari, M. A., Carrasco-Gallego, R., & Ponce-Cueto, E. (2018). Developing a national programme for textiles and clothing recovery. *Waste management & research : the journal of the International Solid Wastes and Public Cleansing Association, ISWA*, *36*(4), 321-331. https://doi.org/10.1177/0734242x18759190

Carrico, M., Dragoo, S. L., McKinney, E., Stannard, C., Moretz, C., & Rougeaux-Burnes, A. (2022). An Inquiry into Gradable Zero-Waste Apparel Design. *Sustainability*, *14*(1), 452-452. https://doi.org/10.3390/su14010452

Chiu, F.-T. (2019). HCI (1) - A Study in Elderly Fashion and Zero Waste Clothing Design. In (pp. 427-438). Springer International Publishing. https://doi.org/10.1007/978-3-030-22646-6_31

Cho, S., & Lee, J. H. (2015). Development of Zero Waste Fashion Design Process Guideline from an Educational Perspective. *Journal of the Korean Society of Costume*, *65*(4), 91-108. https://doi.org/10.7233/jksc.2015.65.4.091

Cinperi, N. C., Ozturk, E., Yigit, N., & Kitis, M. (2019). Treatment of woolen textile wastewater using membrane bioreactor, nanofiltration and reverse osmosis for reuse in production processes. *Journal of Cleaner Production*, *223*(NA), 837-848. https://doi.org/10.1016/j.jclepro.2019.03.166

Colon, M., & Fawcett, B. (2006). Community-based household waste management: Lessons learnt from EXNORA's 'zero waste management' scheme in two South Indian cities. *Habitat International*, *30*(4), 916-931. https://doi.org/10.1016/j.habitatint.2005.04.006

Cortimiglia, M. N., Ghezzi, A., & Frank, A. G. (2015). Business model innovation and strategy making nexus: evidence from a cross-industry mixed-methods study. *R&D Management*, *46*(3), 414-432. https://doi.org/10.1111/radm.12113

Curran, T., & Williams, I. (2011). A zero waste vision for industrial networks in Europe. *Journal of hazardous materials*, *207*(NA), 3-7. https://doi.org/10.1016/j.jhazmat.2011.07.122

D'Itria, E., & Vacca, F. (2024). Shaping sustainable solutions in fashion through design-led strategies, approaches, and practices. *Discover Sustainability*, *5*(1). https://doi.org/10.1007/s43621-024-00624-5

Daukantienė, V. (2022). Analysis of the sustainability aspects of fashion: A literature review. *Textile Research Journal*, *93*(3-4), 991-1002. https://doi.org/10.1177/00405175221124971

de Oliveira Neto, G. C., Correia, J. M. F., da Silva, P. C., de Oliveira Sanches, A. G., & Lucato, W. C. (2019). Cleaner Production in the textile industry and its relationship to sustainable development goals. *Journal of Cleaner Production*, *228*(NA), 1514-1525. https://doi.org/10.1016/j.jclepro.2019.04.334

Dissanayake, G., & Sinha, P. (2015). An examination of the product development process for fashion remanufacturing. *Resources, Conservation and Recycling*, *104*(NA), 94-102. https://doi.org/10.1016/j.resconrec.2015.09.008

ElShishtawy, N., Sinha, P., & Bennell, J. A. (2021). A comparative review of zero-waste fashion design thinking and operational research on cutting and packing optimisation. *International Journal of Fashion Design, Technology and Education*, *15*(2), 187-199. https://doi.org/10.1080/17543266.2021.1990416

Faisal, N. A. (2023). Do Banks Price Discriminate Based on Depositors' Location? *Available at SSRN 5038968*.

Farabi, S. F., Prabha, M., Alam, M., Hossan, M. Z., Arif, M., Islam, M. R., Uddin, A., Bhuiyan, M., & Biswas, M. Z. A. (2024). Enhancing Credit Card Fraud Detection: A Comprehensive Study of Machine Learning Algorithms and Performance Evaluation. *Journal of Business and Management Studies*, *6*(3), 252-259.

Fischer, C. (2011). The development and achievements of EU waste policy. *Journal of Material Cycles and Waste Management*, *13*(1), 2-9. https://doi.org/10.1007/s10163-010-0311-z

Fletcher, K. (2008). *Sustainable Fashion and Textiles: Design Journeys* (Vol. NA). NA. https://doi.org/NA

Fletcher, K. (2010). Slow Fashion: An Invitation for Systems Change. *Fashion Practice*, *2*(2), 259-265. https://doi.org/10.2752/175693810x12774625387594

Fletcher, K. (2013). *Sustainable Fashion and Textiles* (Vol. NA). Routledge. https://doi.org/10.4324/9781315857930

Fung, Y. N., Chan, H.-L., Choi, T.-M., & Liu, R. (2021). Sustainable product development processes in fashion: Supply chains structures and classifications. *International Journal of Production Economics*, *231*(NA), 107911-NA. https://doi.org/10.1016/j.ijpe.2020.107911

Gangidi, P. (2019). A systematic approach to root cause analysis using 3 × 5 why's technique. *International Journal of Lean Six Sigma*, *10*(1), 295-310. https://doi.org/10.1108/ijlss-10-2017-0114

DoI:10.71292/sdmi.v2i01.15

Gharfalkar, M., Court, R., Campbell, C., Ali, Z., & Hillier, G. (2015). Analysis of waste hierarchy in the European waste directive 2008/98/EC. *Waste management (New York, N.Y.)*, *39*(5), 305-313. https://doi.org/10.1016/j.wasman.2015.02.007

Girmanová, L., Šolc, M., Kliment, J., Divoková, A., & Mikloš, V. (2017). Application of Six Sigma Using DMAIC Methodology in the Process of Product Quality Control in Metallurgical Operation. *Acta Technologica Agriculturae*, *20*(4), 104-109. https://doi.org/10.1515/ata-2017-0020

Gordon, J. F., & Hill, C. (2014). *Sustainable Fashion: Past, Present and Future* (Vol. NA). NA. https://doi.org/NA

Goyal, S., Chauhan, S., & Mishra, P. (2021). Circular economy research: A bibliometric analysis (2000–2019) and future research insights. *Journal of Cleaner Production*, *287*(NA), 125011-NA. https://doi.org/10.1016/j.jclepro.2020.125011

Greyson, J. (2007). An economic instrument for zero waste, economic growth and sustainability. *Journal of Cleaner Production*, *15*(13-14), 1382-1390. https://doi.org/10.1016/j.jclepro.2006.07.019

Gupta, V., Arora, M., & Minhas, J. (2020). *Recycling from Waste in Fashion and Textiles - Innovating Opportunities for Fashion Brands by Using Textile Waste for Better Fashion* (Vol. NA). Wiley. https://doi.org/10.1002/9781119620532.ch5

Gwilt, A. (2014). *A Practical Guide to Sustainable Fashion* (Vol. NA). NA. https://doi.org/NA

Hamid, S., Skinder, B. M., & Bhat, M. A. (2020). Zero Waste: A Sustainable Approach for Waste Management. In (Vol. NA, pp. 134-155). IGI Global. https://doi.org/10.4018/978-1-7998-0031-6.ch008

Harane, R. S., & Adivarekar, R. V. (2017). A frugal way of reusing wastewater in textile pre-treatment process. *Journal of Water Process Engineering*, *16*(NA), 163-169. https://doi.org/10.1016/j.jwpe.2017.01.002

Harmsen, P. F. H., Scheffer, M., & Bos, H. t. (2021). Textiles for Circular Fashion: The Logic behind Recycling Options. *Sustainability*, *13*(17), 9714-NA. https://doi.org/10.3390/su13179714

Huang, H.-C., Lee, C.-L., Lai, C.-H., Fang, M.-D., & Lai, I. C. (2012). Transboundary movement of polycyclic aromatic hydrocarbons (PAHs) in the Kuroshio Sphere of the western Pacific Ocean. *Atmospheric Environment*, *54*(NA), 470-479. https://doi.org/10.1016/j.atmosenv.2012.02.066

Hur, E., & Cassidy, T. (2019). Perceptions and attitudes towards sustainable fashion design: challenges and opportunities for implementing sustainability in fashion. *International Journal of Fashion Design, Technology and Education*, *12*(2), 208-217. https://doi.org/10.1080/17543266.2019.1572789

Islam, M., Perry, P., & Gill, S. (2020). Mapping environmentally sustainable practices in textiles, apparel and fashion industries: a systematic literature review. *Journal of Fashion Marketing and Management: An International Journal*, *25*(2), 331-353. https://doi.org/10.1108/jfmm-07-2020-0130

Islam, S. M., Sarkar, A., Khan, A. O. R., Islam, T., Paul, R., & Bari, M. S. (2024). AI-Driven Predictive Analytics for Enhancing Cybersecurity in a Post-Pandemic World: A Business Strategy Approach. *International Journal for Multidisciplinary Research*.

Islam, T., Islam, S. M., Sarkar, A., Obaidur, A., Khan, R., Paul, R., & Bari, M. S. (2024). Artificial Intelligence in Fraud Detection and Financial Risk Mitigation: Future Directions and Business Applications. *International Journal for Multidisciplinary Research*.

Italiano, I. C., Kauvauti, L. S., & Marcicano, J. P. P. (2022). Zero Waste na indústria do vestuário: limitações e alternativas. *Sustainability in Debate*, *13*(2), 190-219. https://doi.org/10.18472/sustdeb.v13n2.2022.40716

Jacometti, V. (2019). Circular economy and waste in the fashion industry. *Laws*, *8*(4), 27. https://doi.org/10.3390/laws8040027

Ji, H. Q. (2013). Application of Low Carbon Materials in Packaging. *Advanced Materials Research*, *651*(NA), 462-465. https://doi.org/10.4028/www.scientific.net/amr.651.462

Kant, R. (2011). Textile dyeing industry an environmental hazard. *Natural Science*, *2012*(1), 22-26. https://doi.org/NA

Khairul Akter, M. M., Haq, U. N., Islam, M. M., & Uddin, M. A. (2022). Textile-apparel manufacturing and material waste management in the circular economy: A conceptual model to achieve sustainable development goal (SDG) 12 for Bangladesh. *Cleaner Environmental Systems*, *4*(NA), 100070-100070. https://doi.org/10.1016/j.cesys.2022.100070

Khan, A. O. R., Islam, S. M., Sarkar, A., Islam, T., Paul, R., & Bari, M. S. (2024). Real-Time Predictive Health Monitoring Using AI-Driven Wearable Sensors: Enhancing Early Detection and Personalized Interventions in Chronic Disease Management. *International Journal for Multidisciplinary Research*.

Koszewska, M. (2018). Circular Economy — Challenges for the Textile and Clothing Industry. *Autex Research Journal*, *18*(4), 337-347. https://doi.org/10.1515/aut-2018-0023

Lahoda, O., Tokar, M., Hurdina, V., Bondarenko, B., & Ieremenko, I. (2023). Ecodesign and initiatives of sustainable development in the dimension of passion of artistic and design creativity. *Revista Amazonia Investiga*, *12*(65), 212-218. https://doi.org/10.34069/ai/2023.65.05.20

Lawless, E., & Medvedev, K. (2015). Assessment of sustainable design practices in the fashion industry: experiences of eight small sustainable design companies in the Northeastern and Southeastern United States. *International Journal of Fashion Design, Technology and Education*, *9*(1), 41-50. https://doi.org/10.1080/17543266.2015.1116616

Lehmann, S. (2011). Optimizing Urban Material Flows and Waste Streams in Urban Development through Principles of Zero Waste and Sustainable Consumption. *Sustainability*, *3*(1), 155-183. https://doi.org/10.3390/su3010155

Maghsoudlou, H., Kahag, R., Niaki, S. T. A., & Pourvaziri, H. (2016). Bi-objective optimization of a three-echelon multi-server supply-chain problem in congested systems. *Computers & Industrial Engineering*, *99*(NA), 41-62. https://doi.org/10.1016/j.cie.2016.07.008

Mashud, A. H. M., Roy, D., Daryanto, Y., Chakrabortty, R. K., & Tseng, M.-L. (2021). A sustainable inventory model with controllable carbon emissions, deterioration and advance payments. *Journal of Cleaner Production*, *296*(NA), 126608-NA. https://doi.org/10.1016/j.jclepro.2021.126608

Matete, N., & Trois, C. (2007). Towards Zero Waste in emerging countries – A South African experience. *Waste management (New York, N.Y.)*, *28*(8), 1480-1492. https://doi.org/10.1016/j.wasman.2007.06.006

Mathew, M. L., Gopalakrishnan, A., Aravindakumar, C. T., & Aravind, U. K. (2018). Low - cost multilayered green fiber for the treatment of textile industry waste water. *Journal of hazardous materials*, *365*(NA), 297-305. https://doi.org/10.1016/j.jhazmat.2018.11.014

McKinney, E., Cho, S., Zhang, L., Eike, R. J., & Sanders, E. A. (2020). Analysis of Zero Waste Patternmaking Approaches for Application to Apparel. In (pp. 31-51). Springer International Publishing. https://doi.org/10.1007/978-3-030-37929-2_2

McQuillan, H. (2020). Digital 3D design as a tool for augmenting zero-waste fashion design practice. *International Journal of Fashion Design, Technology and Education*, *13*(1), 89-100. https://doi.org/10.1080/17543266.2020.1737248

McQuillan, H., Archer-Martin, J., Menzies, G., Bailey, J., Kane, K., & Derwin, E. F. (2018). Make/Use: : A System for Open Source, User-Modifiable, Zero Waste Fashion Practice. *Fashion Practice*, *10*(1), 7-33. https://doi.org/10.1080/17569370.2017.1400320

McQuillan, H., Rissanen, T., & Roberts, J. V. (2013). The Cutting Circle: How Making Challenges Design. *Research Journal of Textile and Apparel*, *17*(1), 39-49. https://doi.org/10.1108/rjta-17-01-2013-b004

Md Al, I., Abdullah Al, F., Abdullah Al, B., Khorshed, A., Md Ali, M., Upal, M., & Hossen, M. S. (2023). Integrating IoT and AI For Predictive Maintenance in Smart Power Grid Systems to Minimize Energy Loss and Carbon Footprint. *Journal of Applied Optics*, *44*(1), 27-47. https://appliedopticsjournal.net/index.php/JAO/article/view/149

Mozumder, M. A. S., Nguyen, T. N., Devi, S., Arif, M., Ahmed, M. P., Ahmed, E., Bhuiyan, M., Rahman, M. H., Al Mamun, A., & Uddin, A. (2024). Enhancing Customer Satisfaction Analysis Using Advanced Machine Learning Techniques in Fintech Industry. *Journal of Computer Science and Technology Studies*, *6*(3), 35-41.

Murphy, S., & Pincetl, S. (2013). Zero waste in Los Angeles: Is the emperor wearing any clothes? *Resources, Conservation and Recycling*, *81*(NA), 40-51. https://doi.org/10.1016/j.resconrec.2013.09.012

Muthu, S. S. (2014). Assessing the environmental impact of textiles: summary and conclusions. In (Vol. NA, pp. 180-186). Elsevier. https://doi.org/10.1533/9781782421122.180

Muthu, S. S. (2024). Introduction to the Book: Zero Waste Sustainable Apparel Industry. In (pp. 1-5). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-76542-1_1

Niinimäki, K., Peters, G. M., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, *1*(4), 189-200. https://doi.org/10.1038/s43017-020-0039-9

Oral, E. (2019). Sustainability Challenges of Fast Fashion: Environmental and Social Impacts of Cotton Growing and the Ready-Made Garment Industry in Turkey. *Yuridika*, *34*(3), 443-466. https://doi.org/10.20473/ydk.v34i3.14937

Partal, R., Basturk, I., Murat Hocaoglu, S., Baban, A., & Yilmaz, E. (2022). Recovery of water and reusable salt solution from reverse osmosis brine in textile industry: A case study. *Water Resources and*

DoI:10.71292/sdmi.v2i01.15

Industry, *27*(NA), 100174-100174. https://doi.org/10.1016/j.wri.2022.100174

Peter John, E., & Mishra, U. (2023). A sustainable three-layer circular economic model with controllable waste, emission, and wastewater from the textile and fashion industry. *Journal of Cleaner Production*, *388*, 135642-135642. https://doi.org/10.1016/j.jclepro.2022.135642

Pietzsch, N., Ribeiro, J. L. D., & de Medeiros, J. F. (2017). Benefits, challenges and critical factors of success for Zero Waste: A systematic literature review. *Waste management (New York, N.Y.)*, *67*(NA), 324-353. https://doi.org/10.1016/j.wasman.2017.05.004

Provin, A. P., de Aguiar Dutra, A. R., Gouveia, I. C., & Cubas, e. A. L. V. (2021). Circular economy for fashion industry: Use of waste from the food industry for the production of biotextiles. *Technological Forecasting and Social Change*, *169*(NA), 120858-NA. https://doi.org/10.1016/j.techfore.2021.120858

Rissanen, T., & McQuillan, H. (2016). *Zero Waste Fashion Design* (Vol. NA). NA. https://doi.org/NA

Rissanen, T., & McQuillan, H. (2023). *Zero Waste Fashion Design* (Vol. NA). Bloomsbury Publishing Plc. https://doi.org/10.5040/9781350241862

Roy, M., Sen, P., & Pal, P. (2020). An integrated green management model to improve environmental performance of textile industry towards sustainability. *Journal of Cleaner Production*, *271*(NA), 122656-NA. https://doi.org/10.1016/j.jclepro.2020.122656

Shamim, M. (2022). The Digital Leadership on Project Management in the Emerging Digital Era. *Global Mainstream Journal of Business, Economics, Development & Project Management*, *1*(1), 1-14.

Saeidi, E., & Wimberley, V. (2017). Precious cut: exploring creative pattern cutting and draping for zero-waste design. *International Journal of Fashion Design, Technology and Education*, *11*(2), 243-253. https://doi.org/10.1080/17543266.2017.1389997

Saha, K., Dey, P. K., & Papagiannaki, E. (2021). Implementing circular economy in the textile and clothing industry. *Business Strategy and the Environment*, *30*(4), 1497-1530. https://doi.org/10.1002/bse.2670

Sepehri, A. (2021). Controllable carbon emissions in an inventory model for perishable items under trade credit policy for credit-risk customers. *Carbon Capture Science & Technology*, *1*(NA), 100004-NA. https://doi.org/10.1016/j.ccst.2021.100004

Shafie, S., Kamis, A., Ramli, M. F., Abu Bedor, S., & Ahmad Puad, F. N. (2021). Fashion Sustainability: Benefits of Using Sustainable Practices in Producing Sustainable Fashion Designs. *International Business Education Journal*, *14*(1), 103-111. https://doi.org/10.37134/ibej.vol14.1.9.2021

Shamim, M. (2022). The Digital Leadership on Project Management in the Emerging Digital Era. *Global Mainstream Journal of Business, Economics, Development & Project Management*, *1*(1), 1-14.

Shen, B., Zhu, C., Li, Q., & Wang, X. (2020). Green technology adoption in textiles and apparel supply chains with environmental taxes. *International Journal of Production Research*, *59*(14), 4157-4174. https://doi.org/10.1080/00207543.2020.1758354

Smestad, L. (2009). The Sweatshop, Child Labor, and Exploitation Issues in the Garment Industry. *Fashion Practice*, *1*(2), 147-162. https://doi.org/10.2752/175693809x469139

Song, Q., Li, J., & Zeng, X. (2015). Minimizing the increasing solid waste through zero waste strategy. *Journal of Cleaner Production*, *104*(104), 199-210. https://doi.org/10.1016/j.jclepro.2014.08.027

Song, Q., Wang, Z., & Li, J. (2013). Sustainability evaluation of e-waste treatment based on emergy analysis and the LCA method: A case study of a trial project in Macau. *Ecological Indicators*, *30*(NA), 138-147. https://doi.org/10.1016/j.ecolind.2013.02.016

Stanescu, M. D. (2021). State of the art of post-consumer textile waste upcycling to reach the zero waste milestone. *Environmental science and pollution research international*, *28*(12), 14253-14270. https://doi.org/10.1007/s11356-021-12416-9

Steenmans, K., Malcolm, R., & Marriott, J. (2017). Commodification of Waste: Legal and Theoretical Approaches to Industrial Symbiosis as Part of a Circular Economy. *SSRN Electronic Journal*, *NA*(NA), NA-NA. https://doi.org/10.2139/ssrn.2983631

Surjit, R., Indu, G. M., Anusri Mahalakshmi, B., & Shubha Shree, M. (2024). Six Sigma Approach: A Pathway to Zero Waste Sustainable Apparel Industry. In (pp. 25-41). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-76542-1_3

Thorisdottir, T. S., & Johannsdottir, L. (2020). Corporate Social Responsibility Influencing Sustainability within the Fashion Industry. A Systematic Review. *Sustainability*, *12*(21), 9167-NA. https://doi.org/10.3390/su12219167

Toprak, T., & Anis, P. (2017). Textile Industry's Environmental Effects and Approaching Cleaner

Production and Sustainability: an overview. *Journal of Textile Engineering & Fashion Technology*, *2*(4), NA-NA. https://doi.org/10.15406/jteft.2017.02.00066

Townsend, K., & Mills, F. (2013). Mastering zero: how the pursuit of less waste leads to more creative pattern cutting. *International Journal of Fashion Design, Technology and Education*, *6*(2), 104-111. https://doi.org/10.1080/17543266.2013.793746

Tran, T.-A., Luu-Nhan, K., Ghabour, R., & Daróczi, M. (2020). The use of Lean Six-Sigma tools in the improvement of a manufacturing company – case study. *Production Engineering Archives*, *26*(1), 30-35. https://doi.org/10.30657/pea.2020.26.07

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, *14*(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Turker, D., & Altuntaş, C. (2014). Sustainable Supply Chain Management in the Fast Fashion Industry: An Analysis of Corporate Reports. *European Management Journal*, *32*(5), 837-849. https://doi.org/10.1016/j.emj.2014.02.001

Turunen, T. (2017). Deconstructing the Bottlenecks Caused by Waste Legislation: End-of-Waste Regulation. *Journal for European Environmental & Planning Law*, *14*(2), 186-207. https://doi.org/10.1163/18760104-01402004

Vennström, K. (2012). Sustainable Fashion Consumption : An Interactive System between Consumers and Institutions. *NA*, *NA*(NA), NA-NA. https://doi.org/NA

Whitty, J. (2021). Fashion Design for Holistic Systems. In (Vol. NA, pp. 1-22). Springer Singapore. https://doi.org/10.1007/978-981-16-2466-7_1

Wilson, L. (2015). The sustainable future of the Scottish textiles sector: challenges and opportunities of introducing a circular economy model. *Textiles and Clothing Sustainability*, *1*(1), 5-NA. https://doi.org/10.1186/s40689-015-0005-y

Young, C.-Y., Ni, S.-P., & Fan, K.-S. (2009). Working towards a zero waste environment in Taiwan. *Waste management & research : the journal of the International Solid Wastes and Public Cleansing Association, ISWA*, *28*(3), 236-244. https://doi.org/10.1177/0734242x09337659

Zaman, A. (2014). Identification of key assessment indicators of the zero waste management systems. *Ecological Indicators*, *36*(NA), 682-693. https://doi.org/10.1016/j.ecolind.2013.09.024

Zaman, A. (2015). A comprehensive review of the development of zero waste management: lessons learned and guidelines. *Journal of Cleaner Production*, *91*(NA), 12-25. https://doi.org/10.1016/j.jclepro.2014.12.013

Zaman, A. (2016). A comprehensive study of the environmental and economic benefits of resource recovery from global waste management systems. *Journal of Cleaner Production*, *124*(NA), 41-50. https://doi.org/10.1016/j.jclepro.2016.02.086

Zaman, A., & Lehmann, S. (2011). Challenges and Opportunities in Transforming a City into a "Zero Waste City". *Challenges*, *2*(4), 73-93. https://doi.org/10.3390/challe2040073

Zaman, A., & Lehmann, S. (2013). The zero waste index:a performance measurement tool for waste management systems in a zero waste city. *Journal of Cleaner Production*, *50*(NA), 123-132. https://doi.org/10.1016/j.jclepro.2012.11.041

Zaman, A. U. (2012). Developing a Social Business Model for Zero Waste Management Systems: A Case Study Analysis. *Journal of Environmental Protection*, *3*(11), 1458-1469. https://doi.org/10.4236/jep.2012.311163

Zhang, Y., Kang, H., Hou, H., Shao, S., Sun, X., Qin, C., & Zhang, S. (2018). Improved design for textile production process based on life cycle assessment. *Clean Technologies and Environmental Policy*, *20*(6), 1355-1365. https://doi.org/10.1007/s10098-018-1572-9