

---

# Sustainable Outdoor Apparel: A Survey

---

[www.surveyyx.cn](http://www.surveyyx.cn)

## Abstract

This survey paper explores the intersection of sustainability and the fashion industry, focusing on outdoor apparel. It examines the environmental impact of traditional fashion practices and highlights the growing consumer demand for eco-friendly products. The paper delves into eco-friendly textile innovations, such as natural and biogenic dyes, zero-waste design, and smart textiles, which offer sustainable alternatives to conventional methods. It also discusses green supply chain management, emphasizing sustainable sourcing, logistics, and the integration of digital technologies to enhance efficiency and reduce environmental impact. Sustainable fashion practices, including ethical production methods, circular fashion models, and transparency in operations, are analyzed for their role in promoting sustainability. The paper further investigates eco-conscious consumer behavior, identifying the attitude-behavior gap and the influence of marketing strategies, generational, and cultural factors on sustainable fashion adoption. The survey concludes by acknowledging significant progress in sustainability within the fashion industry while highlighting persistent challenges, such as the need for standardized eco-labels and enhanced transparency. Future research directions include exploring sustainable design strategies, advancing recycling technologies, and promoting consumer awareness to foster a more sustainable and equitable future in outdoor apparel and beyond.

## 1 Introduction

### 1.1 Relevance of Sustainable Outdoor Apparel

The relevance of sustainable outdoor apparel is increasingly acknowledged within the context of environmental sustainability, particularly due to the fashion industry's significant ecological footprint. Traditional practices, notably fast fashion, contribute to environmental degradation through pollution, resource depletion, and waste generation [1]. These challenges are intensified by the industry's excessive water usage and high carbon emissions, necessitating a transition towards sustainable practices [2]. Sustainable outdoor apparel mitigates these issues by utilizing eco-friendly materials and production methods, thereby reducing environmental impact and promoting ecological responsibility [3].

Rising consumer demand for environmentally friendly products, driven by heightened awareness of the environmental consequences of fashion choices, underscores the need to understand the factors influencing eco-conscious purchasing decisions [4]. This understanding is critical for the adoption of sustainable apparel [1]. Consequently, outdoor apparel brands are integrating circular practices into their business models, demonstrating a commitment to sustainability and addressing gaps in existing literature [5]. The impact of sustainability attributes presented online on consumer purchasing decisions further emphasizes the role of consumer awareness in promoting sustainable practices [6].

Innovative eco-design strategies are crucial in this transition, aligning with consumer expectations and enhancing product development [7]. Brands like Patagonia exemplify effective incorporation of sustainable practices into their operations, setting industry precedents [7]. Patagonia's green marketing strategies reflect its commitment to sustainability and its influence on consumer behavior

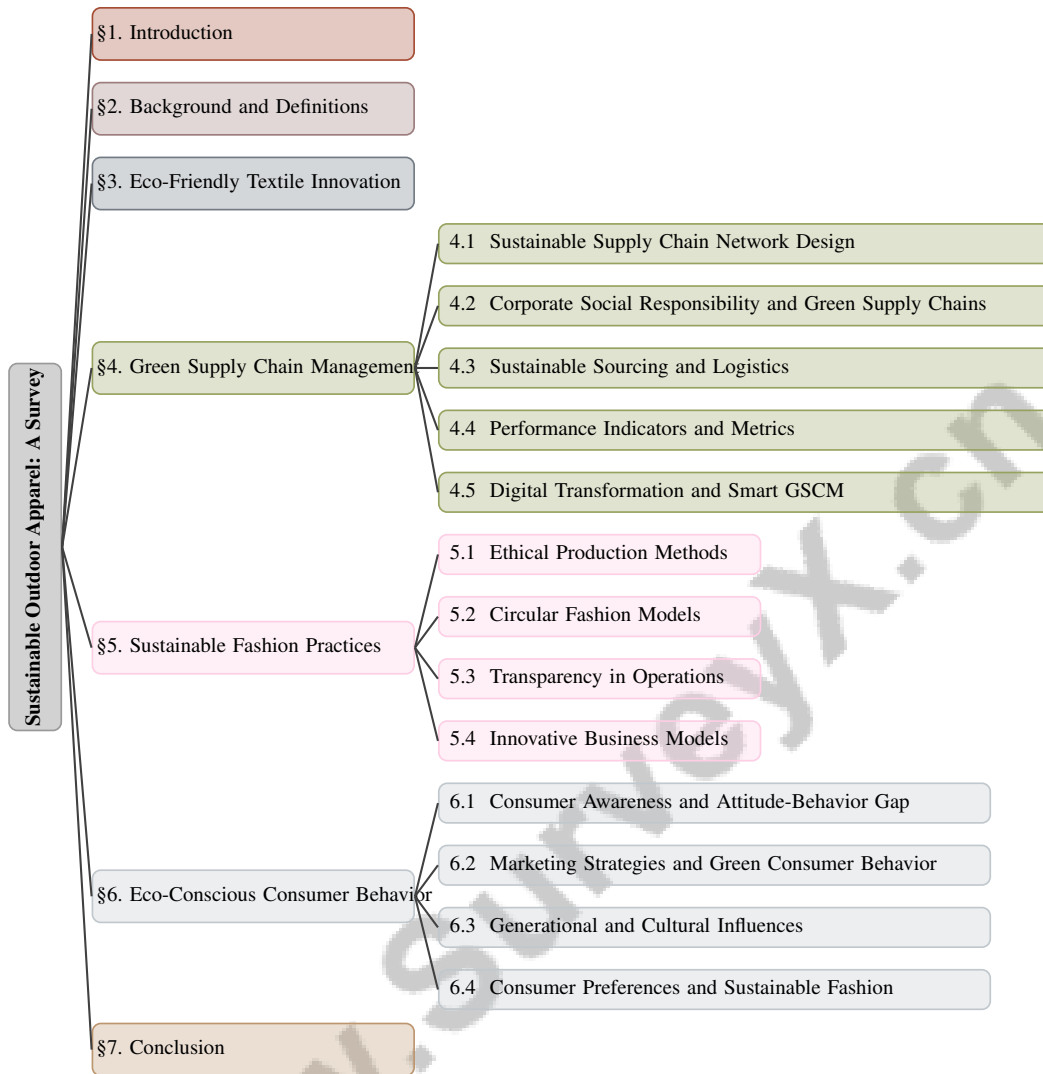


Figure 1: chapter structure

[8]. Furthermore, integrating sustainability into business models is essential for addressing the fashion industry's environmental impact and ensuring long-term ecological balance [9].

The collaboration between outdoor and luxury brands in sustainability efforts represents a genuine attempt to reduce environmental harm and foster a more sustainable fashion ecosystem [10]. This alignment is vital for mitigating the fashion industry's environmental impacts, which rank among the most polluting globally [11]. Additionally, consumer perceptions of sustainability, especially among ethical consumers, highlight the contrast between fast fashion and outdoor brands, emphasizing the latter's commitment to environmental stewardship [12]. Confidence in personal style also influences sustainable consumption behaviors, impacting purchasing, usage, and disposal practices [13].

Sustainable outdoor apparel is a critical component of the fashion industry's shift towards environmental sustainability. By prioritizing eco-conscious branding initiatives and aligning with sustainability goals, outdoor apparel brands play a pivotal role in fostering consumer purchasing decisions that support ecological responsibility [1]. This collective effort is essential for balancing consumer demands with the urgent need for environmental stewardship in the fashion industry.

## 1.2 Structure of the Survey

This survey on sustainable outdoor apparel is organized into distinct sections that address critical components of sustainability within the fashion industry. The introduction establishes the relevance

---

of sustainable outdoor apparel, emphasizing its role in mitigating the environmental impact of fashion practices and highlighting the industry's shift towards eco-friendly alternatives. Following this, the background and definitions section provides a comprehensive overview of key concepts, elucidating the environmental ramifications of traditional fashion and the necessity for sustainable practices.

The survey further explores eco-friendly textile innovations, including advancements in natural and biogenic dyes, zero-waste design principles, and the application of 3D printing in sustainable fashion. It also examines the development of smart and functional textiles, along with the use of eco-materials and sustainable fibers in textile production. The subsequent section on green supply chain management analyzes strategies to reduce the carbon footprint of the fashion industry, focusing on sustainable supply chain network design, corporate social responsibility, green supply chain practices, sustainable sourcing, logistics, performance indicators, and the impact of digital transformation.

Sustainable fashion practices are discussed in the following section, highlighting ethical production methods, circular fashion models, transparency in operations, and innovative business models that support sustainability. The survey also investigates eco-conscious consumer behavior, addressing the gap between consumer awareness and actual purchasing behavior, marketing strategies, generational and cultural influences, and consumer preferences affecting the adoption of sustainable fashion.

Finally, the conclusion synthesizes the survey's key findings, reflecting on progress towards sustainability in the fashion industry and identifying remaining challenges. The research highlights promising avenues for future investigation and outlines effective strategies for enhancing the adoption of sustainable practices within the outdoor apparel sector. It emphasizes the need for a deeper understanding of consumer perceptions, particularly among Generation Z, regarding sustainability in apparel brands, alongside challenges posed by eco-labels and certifications. Additionally, the inquiry calls for a critical examination of the decision-making processes surrounding sustainable clothing procurement, focusing on key factors such as durability, ecological production assurances, fair labor conditions, and socio-political influences. Addressing these areas aims to foster a more informed and responsible approach to outdoor apparel consumption [6, 11, 3, 14, 15]. The following sections are organized as shown in Figure 1.

## **2 Background and Definitions**

### **2.1 Environmental Impact of Fashion**

The fashion industry exerts a significant ecological impact, primarily driven by traditional practices that degrade the environment. The fast fashion model, with its rapid production cycles and inexpensive clothing, exacerbates these issues by creating a mismatch between consumer demand and oversupply, resulting in increased waste and pollution [16]. This problem is especially severe in low and middle-income countries, where pollution and waste pose serious health risks [17]. The prevalent use of synthetic dyes in textile production contributes to substantial water pollution and chemical waste, highlighting the urgent need for sustainable, non-toxic alternatives.

Integrating eco-friendly materials and processes into existing production systems is complex. Conventional methods, such as reactive dyeing of cotton, consume large volumes of water and chemicals, further harming the environment [18]. The industry's impact is compounded by waste from the agro-food sector, where valuable bioactive compounds in fruit peels are often discarded. This underscores opportunities for resource recovery and waste minimization through innovative recycling and upcycling strategies [19, 20]. However, supply chain complexities and inadequate recycling technologies remain significant obstacles [21].

Consumer behavior adds to these challenges, as a lack of knowledge about sustainable options and preconceived notions influence purchasing decisions [22]. Navigating eco-labels and certifications can be misleading, complicating sustainable purchasing choices [14]. Financial imbalances in textile collection and the need for innovation in markets and processes are critical for stabilizing the decline of traditional textile reuse [23]. The COVID-19 pandemic has further altered consumer behaviors, presenting challenges in financial sustainability and market segmentation for sustainable fashion brands [24].

A notable challenge is the unclear relationship between sustainability measures and outdoor apparel pricing, as brand sustainability does not statistically influence prices, complicating assessments of consumer willingness to pay for sustainable practices [3]. Rapid changes in fashion consumption

patterns, the dominance of fast fashion, and insufficient research on sustainable practices in developing markets pose significant challenges [11]. The attitude-behavior gap among ethical fashion consumers, where intentions to purchase sustainable fashion do not translate into actual buying behavior, remains a central issue [12]. Furthermore, the lack of clarity on how sustainability information impacts consumer choices online, coupled with the disconnect between consumers' environmental concerns and their purchasing behaviors, complicates the landscape [6].

These factors underscore the urgent need for the fashion industry to adopt sustainable practices, integrating eco-friendly materials and processes to reduce its environmental footprint and foster a more equitable and sustainable future [25]. The industry's significant contribution to pollution necessitates a shift towards sustainability, driven by growing environmental awareness among consumers [26].

In recent years, the fashion industry has increasingly focused on sustainable practices, which has led to the emergence of various eco-friendly textile innovations. Figure 2 illustrates the hierarchical structure of these innovations, categorizing key advancements and benefits across several domains. Specifically, it delineates the areas of natural and biogenic dyes, zero-waste design and 3D printing, smart and functional textiles, as well as eco-materials and sustainable fibers. Each category not only highlights significant features but also showcases technological innovations that contribute to sustainability in the fashion sector. This structured approach facilitates a comprehensive understanding of how these innovations interconnect and their collective impact on promoting environmentally conscious practices within the industry.

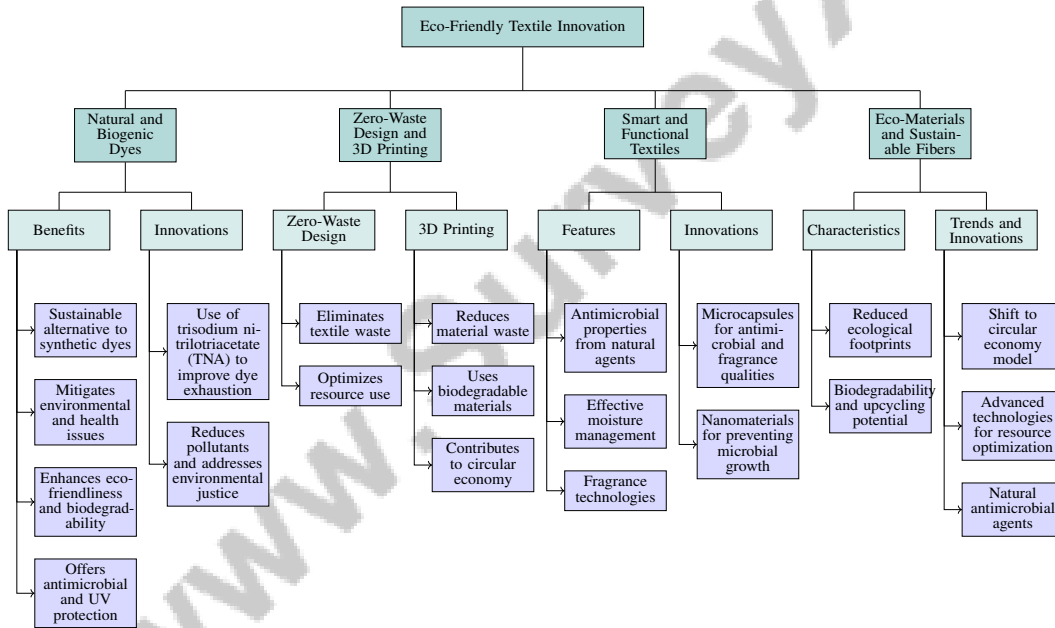


Figure 2: This figure illustrates the hierarchical structure of eco-friendly textile innovations, categorizing key advancements and benefits across natural and biogenic dyes, zero-waste design and 3D printing, smart and functional textiles, and eco-materials and sustainable fibers. Each category highlights significant features and technological innovations contributing to sustainability in the fashion industry.

### 3 Eco-Friendly Textile Innovation

#### 3.1 Natural and Biogenic Dyes

Natural and biogenic dyes present a sustainable alternative to synthetic dyes in textiles, addressing environmental and health issues associated with conventional dyeing [27]. Synthetic dyes contribute to pollution and health risks due to harmful chemical emissions [27]. In contrast, dyes from plant extracts and natural sources mitigate these effects, enhancing eco-friendliness and biodegradability [28]. These dyes not only boost sustainability but also offer functional benefits, such as antimicrobial

and UV protection, aligning with the industry’s shift towards sustainable practices [20]. Utilizing biodegradable resources significantly lowers the ecological footprint of dyeing processes [29]. Innovations like trisodium nitrilotriacetate (TNA) improve dye exhaustion and reduce pollutants, addressing environmental justice issues in fast fashion [18, 17]. The integration of natural and biogenic dyes is crucial for reducing the fashion industry’s ecological impact [27].

### 3.2 Zero-Waste Design and 3D Printing

Zero-waste design and 3D printing technologies offer significant advancements in sustainable fashion by addressing traditional manufacturing inefficiencies. Zero-waste design eliminates textile waste through patterns that fully utilize fabric, optimizing resource use [30]. As illustrated in Figure 3, the key components of zero-waste design and 3D printing in sustainable fashion include pattern optimization, the use of biodegradable materials, and the challenges associated with biogenic dye production. In 3D printing, methods that eliminate rafts or supports reduce material waste, enhancing production efficiency and aligning with sustainability goals [30]. Using biodegradable materials in 3D printing contributes to a circular economy by creating environmentally friendly fashion items that decompose without harmful residues [30]. Innovative business models incorporating 3D printing emphasize technological integration with sustainable design, especially in outdoor apparel [16, 31]. However, challenges in biogenic dye production, such as low yields and potential toxicity, need addressing to maximize sustainable innovation impacts [27].

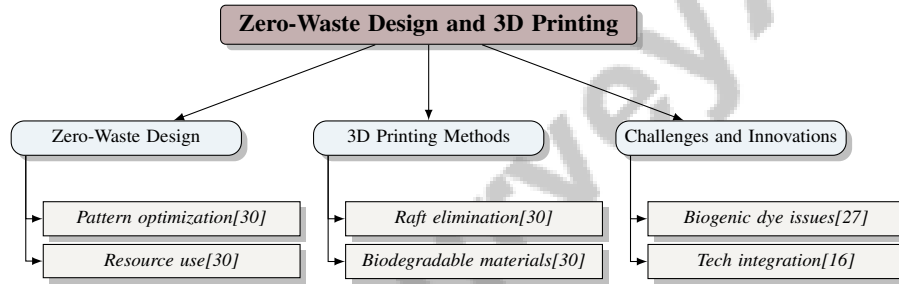


Figure 3: This figure illustrates the key components of zero-waste design and 3D printing in sustainable fashion, highlighting pattern optimization, biodegradable materials, and challenges in biogenic dye production.

### 3.3 Smart and Functional Textiles

Smart and functional textiles represent a significant advancement in sustainable fashion, offering enhanced features while maintaining eco-friendly attributes. These textiles incorporate antimicrobial properties from natural agents like chamomile and green tea, alongside effective moisture management and fragrance technologies, improving hygiene and reducing odors [32, 28, 33, 34]. Innovations include using chitosan and gum Arabic to create microcapsules for encapsulating limonene and vanillin, providing antimicrobial and fragrant qualities to cotton fabrics [35]. Nanomaterials also offer antimicrobial properties, preventing microbial growth, odor, and fabric degradation [36]. Advancements in moisture management enhance comfort and performance, particularly in outdoor apparel, by efficiently wicking moisture away and improving thermal regulation [37]. The integration of green culture within textiles influences innovation, offering a pathway to reduce environmental impact while meeting consumer demands for high-performance, eco-conscious apparel [26].

### 3.4 Eco-Materials and Sustainable Fibers

Integrating eco-materials and sustainable fibers is vital for advancing the fashion industry’s sustainability commitment. These materials, characterized by reduced ecological footprints, biodegradability, and upcycling potential, contribute to a sustainable fashion ecosystem. Sustainability factors, categorized into narrowing, slowing, and closing resource flows, contrast with traditional fast fashion, highlighting a shift to a circular economy model [38]. Innovative material extraction and processing approaches, such as advanced technologies for bioactive compound extraction from plant by-products, optimize resource use and minimize waste [20]. Natural antimicrobial agents from plants offer safer

alternatives in textile finishing, with herbal-treated cotton fabrics showing significant antimicrobial activity and durability [34, 33]. Although natural colorants offer a narrower range, their biodegradability and lower toxicity significantly reduce environmental impact [28, 27]. Consumer preferences for eco-materials, supported by trends towards secondhand clothing, indicate a shift towards sustainable materials among outdoor sports-oriented consumers [4]. This aligns with the industry's focus on eco-design, emphasizing the relationship between eco-materials and design elements like weight, fit, and aesthetics [7]. Enhancing clothing style confidence can promote sustainable consumption behaviors, reducing waste and extending product lifespans [13]. The influence of material types on apparel pricing underscores the economic viability of sustainable fibers, with research indicating significant impacts of sustainability factors on pricing [3]. Advancements in technology, such as AI-enabled demand forecasting and product design, highlight innovation's potential to contribute to sustainability in fashion [10].

## 4 Green Supply Chain Management

### 4.1 Sustainable Supply Chain Network Design

Sustainable supply chain network design is vital for aligning the fashion industry's operations with environmental and economic sustainability goals. This design minimizes costs and carbon emissions while addressing demand uncertainties and operational capacities, essential for resilience [39]. By integrating green and non-green evaluation criteria, it fosters a balanced model addressing environmental and economic factors [40].

Green Supply Chain Management (GSCM) practices encompass internal environmental management, green purchasing, customer cooperation, investment recovery, and eco-design, assessed across environmental, economic, and operational dimensions to identify improvement opportunities [41]. Incorporating digital technologies through a Smart GSCM approach enhances supply chain efficiency and sustainability, optimizing operations, reducing waste, and improving environmental impact [42].

As illustrated in Figure 4, the hierarchical structure of sustainable supply chain network design emphasizes the interconnectedness of GSCM practices, the integration of digital technologies for Smart GSCM, and advanced decision-making techniques. Key elements depicted in the figure include internal environmental management, the role of digital transformation in enhancing supply chain efficiency, and the application of Multi-Criteria Decision Making (MCDM) for balancing economic and environmental criteria.

Advanced decision-making techniques, categorized into decision problems, indicators, and multi-criteria decision-making (MCDM) approaches, are crucial for designing supply chains prioritizing sustainability and efficiency [43].

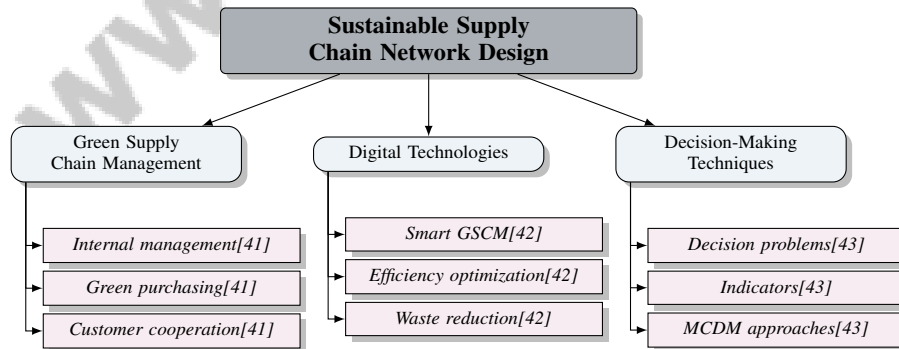


Figure 4: This figure illustrates the hierarchical structure of sustainable supply chain network design, focusing on Green Supply Chain Management (GSCM) practices, the integration of digital technologies for Smart GSCM, and advanced decision-making techniques. Key elements include internal environmental management, the role of digital transformation in enhancing supply chain efficiency, and the application of Multi-Criteria Decision Making (MCDM) for balancing economic and environmental criteria.

## 4.2 Corporate Social Responsibility and Green Supply Chains

Integrating Corporate Social Responsibility (CSR) within green supply chain practices is essential for advancing fashion industry sustainability, responding to consumer demand for transparency and ethical practices, and regulatory pressures [44]. CSR initiatives address environmental and social challenges, fostering innovation and enhancing environmental performance [40].

Successful CSR adoption requires combining lean, green, and process innovation practices to enhance green supply chain performance and achieve sustainable development goals [45]. Ecocentricity and supply chain traceability significantly influence green supply chain management outcomes [46].

Challenges persist in integrating CSR into green supply chains, including high costs, long ROI timelines, and perceptions of sustainability regulations as barriers [47]. Overcoming consumer skepticism regarding greenwashing and ensuring genuine engagement with environmental issues are crucial for maintaining trust and brand integrity [8]. The lack of robust government support further complicates the widespread adoption of green logistics practices [48].

Innovative business models and strategic partnerships are necessary to address these challenges. Strong relationships with strategic partners enhance adaptability and investment in circular initiatives [49]. Multi-objective robust optimization models, particularly those incorporating cap-and-trade mechanisms, effectively address green supplier selection, balancing environmental and economic objectives [50]. Various MCDM approaches have been successfully applied to reconcile economic and environmental performance in green supply chains [43].

## 4.3 Sustainable Sourcing and Logistics

Sustainable sourcing and logistics are crucial for the fashion industry's environmental and economic sustainability. Integrating sustainable practices enhances environmental performance and contributes to cost efficiency and operational resilience [46]. A key strategy involves adopting eco-friendly materials and processes that minimize resource consumption and environmental impact. For instance, trisodium nitrilotriacetate (TNA) in dyeing significantly reduces water and chemical usage, showcasing sustainable innovations' potential [18].

Designing sustainable supply chains requires a dual focus on operational and organizational practices, essential for achieving sustainability goals and ensuring resilience to environmental and market fluctuations [51]. Implementing GSCM practices, including sustainable sourcing, is critical for improving metrics such as material recycling and emissions reduction [42].

Challenges in adopting sustainable sourcing and logistics practices are pronounced in emerging economies like Bangladesh, where infrastructural deficiencies and regulatory constraints complicate implementation [52]. Additionally, the deterministic data assumption in most studies fails to account for variability and uncertainty in supply chain operations [43].

Models incorporating waste minimization strategies and standardized eco-efficiency indicators are imperative for overcoming these challenges. Such models accurately represent supply chain dynamics and facilitate effective sustainability initiatives [43]. Prioritizing sustainable sourcing and logistics can significantly reduce the fashion industry's environmental footprint and enhance its competitive advantage.

## 4.4 Performance Indicators and Metrics

Benchmark	Size	Domain	Task Format	Metric
TNA[18]	1,000	Textile Dyeing	Dyeing Performance Evaluation	COD, BOD

Table 1: This table presents a representative benchmark for evaluating dyeing performance within the textile industry. It details the benchmark name, size, domain, task format, and the metrics used, namely COD and BOD, which are critical for assessing environmental sustainability in textile dyeing processes.

Identifying key performance indicators (KPIs) and metrics is essential for assessing sustainability within supply chains under GSCM frameworks. These indicators enable a comprehensive evaluation

---

of environmental, economic, and social dimensions, aligning with the triple bottom line approach to sustainable development [53]. This holistic assessment balances these pillars and achieves sustainable growth. Table 1 provides an illustrative example of a benchmark used to assess sustainability performance in the textile dyeing sector, highlighting key metrics and task formats relevant to the industry.

The Analytic Hierarchy Process (AHP) ranks GSCM performance indicators, utilizing expert opinions to prioritize sustainability aspects [54]. This structured approach allows systematic evaluation of supply chain practices and identification of key improvement areas. Empirical evidence shows that integrating lean, green, and process innovation practices significantly enhances green supply chain performance, highlighting synergies among these approaches [55].

A comprehensive roadmap for designing sustainable supply chains involves critical steps such as Law Compliance, AS-IS Evaluation, Internal Sustainability Improvement, Supply Chain Assessment, and Supply Chain and System Development [51]. This ensures sustainability is embedded in every supply chain aspect, from legal compliance to continuous process improvement.

Research indicates that GSCM practices positively impact green innovation and environmental performance, with green innovation mediating these effects [56]. Key factors such as regulatory compliance, green procurement, manufacturing, logistics, and internal environmental protection significantly contribute to successful GSCM implementation [57].

Comparative analyses reveal that moderators like firm size and ISO certification significantly influence GSCM effectiveness across performance metrics [58]. This variability underscores the need for tailored sustainability strategies specific to each organization's context. Furthermore, the relationship between GSCM practices and environmental performance is negatively moderated by high levels of supply chain traceability, necessitating careful consideration of traceability in sustainable strategies [46].

The survey emphasizes the need for more MCDM models incorporating uncertainty and addressing real-life complexities in GSCs [43]. Structural Equation Modeling (SEM) has demonstrated strong correlations between variables, reinforcing the importance of these advanced analytical techniques in optimizing GSCM practices [40]. By focusing on robust KPIs and metrics, the fashion industry can better measure and enhance its sustainability performance.

#### **4.5 Digital Transformation and Smart GSCM**

Digital transformation is pivotal in enhancing sustainability in supply chain management through advanced technologies that improve both external and internal activities within GSCM. The rise of Smart GSCM, integrating digital technologies, is essential for achieving superior green performance in supply chains [42]. This approach boosts operational efficiency and significantly reduces environmental impact by streamlining processes and minimizing waste.

Integrating digital technologies such as real-time data analytics and dynamic inventory management provides a comprehensive supply chain management strategy [59]. By embedding inventory decisions into location and routing processes, supply chains can adjust inventory levels based on real-time demand data, thus reducing costs and emissions [59]. This capability is crucial for balancing efficiency and sustainability.

The potential of 3D printing technology to create unique, sustainable fashion items while adhering to zero-waste principles marks a significant advancement in sustainable design practices [30]. This innovation minimizes material waste and aligns with broader digital transformation goals in promoting sustainability within the fashion industry.

Advanced statistical analyses and comparisons with methods like Differential Evolution (DE) and Particle Swarm Optimization (PSO) demonstrate how digital technologies can optimize supply chain operations [60]. The effectiveness of digital transformation in GSCM is further enhanced by integrating lean, green, and process innovation practices, collectively improving performance in green supply chains [55].

The tripartite model introduced by Industry 4.0 categorizes impacts into 'smart factories,' 'smart networks,' and 'smart products,' linking these advancements to digital technologies' role in transforming



---

supply chain management towards sustainability [61]. The COVID-19 pandemic has accelerated the need for digital transformation in the fashion industry, emphasizing agility and responsiveness [16].

Using Colored Petri Nets (CPN) models to simulate interactions within a green supply chain innovatively captures forward and reverse logistics [62]. This method effectively represents discrete-event systems, allowing for scenario simulation and analysis of resource flow and recycling processes [62]. Additionally, focusing on minimizing operational costs and environmental impacts through advanced optimization techniques like the Epsilon Constraint Method and Genetic Algorithm is crucial for sustainable supply chain management [39].

Future research should explore the impact of GSCM practices across various industrial contexts, particularly in developing regions, and investigate additional moderators influencing the interplay between GSCM and social performance indicators. The application of dynamic game models in different supply chain configurations and examining varying regulatory frameworks' effects on CSR decision-making offer further research avenues [63].

## **5 Sustainable Fashion Practices**

Exploring responsible and ethical practices is crucial for addressing the sustainability challenges in the fashion industry. This section highlights the importance of ethical production methods as foundational elements in promoting sustainability, aligning with consumer expectations and industry standards.

### **5.1 Ethical Production Methods**

Ethical production methods are essential for advancing sustainability in the fashion industry by addressing environmental and social dimensions, ensuring fair labor conditions, minimizing environmental impact, and enhancing supply chain transparency. Integrating sustainability into design processes meets consumer demand for eco-friendly products and responds to legislative actions promoting sustainable practices. Companies like Patagonia exemplify eco-material selection and sustainability in product design, setting benchmarks for eco-friendly practices [3]. The incorporation of green culture and innovation into organizational practices bolsters the development of ethical production methods, enhancing sustainability in the textile industry [40]. However, challenges persist, particularly regarding the adoption of natural dyes as alternatives to synthetic dyes, which face issues like inconsistent color reproduction and higher costs [28, 20]. Natural antimicrobial agents offer a safer alternative to synthetic ones, promoting health and environmental safety [34]. The inclination towards outdoor sports positively influences purchasing intentions toward sustainable and secondhand fashion, emphasizing the importance of ethical production methods [4]. Despite consumer interest in sustainable apparel, reluctance to pay a premium necessitates strategies that balance cost and sustainability [3]. Addressing infrastructure challenges is vital for enhancing supply chain sustainability and reducing the environmental impact of fashion production [40]. Consumer skepticism regarding eco-labels, price sensitivity, and perceptions of quality in eco-labeled products complicate the adoption of ethical production methods [13]. Marketers and policymakers must devise effective strategies to promote green products and foster sustainable consumer behaviors [13].

### **5.2 Circular Fashion Models**

Circular fashion models emphasize waste reduction and product lifecycle extension through innovative business strategies, diverging from traditional linear production-consumption-disposal patterns by promoting recycling, upcycling, and closed-loop systems [30]. These models enable customized designs without waste, mitigating the fashion industry's environmental impact [11]. Integrating circular practices into business models is essential for sustainability, particularly through rental and repair services that extend product lifespans and align with consumer demand for sustainable options. Addressing literature gaps, especially in developing countries where sustainable retailing is underexplored, is crucial [11]. Innovative sustainable business models vary in approach, emphasizing collaborative efforts among strategic partners to create mutually beneficial situations that consider economic, environmental, and social dimensions [49, 64]. Future research should focus on empirical case studies that highlight the benefits of such partnerships, facilitating the adoption of circular fashion models across diverse market contexts. Transitioning from traditional inventory

management to models that minimize inventory through direct-to-consumer sales and AI-driven demand forecasting showcases the potential of circular fashion models to revolutionize the industry [10]. By leveraging advanced technologies, fashion brands can optimize operations, reduce waste, and enhance sustainability credentials.

### 5.3 Transparency in Operations

Transparency in fashion operations is crucial for sustainability, fostering consumer trust and driving behavioral change. Brands that genuinely commit to sustainable practices and communicate these efforts transparently are more likely to gain consumer loyalty and influence purchasing decisions [8]. The perception of outdoor apparel brands as sustainable and high-quality reinforces brand loyalty and purchase intentions, emphasizing the significance of transparent operations [15].

As illustrated in Figure 5, the hierarchical structure of transparency in fashion operations highlights the interconnected roles of consumer trust, supply chain communication, and ethical consumption in fostering sustainable practices. This visual representation underscores how transparency extends beyond marketing to encompass the entire supply chain, where clear communication of sustainable practices enhances green supply chain performance [65]. Educating consumers about eco-labels empowers informed purchasing decisions and reinforces the importance of sustainable consumption [66]. Increased consumer awareness and willingness to consider eco-labeled products indicate a positive trend towards environmentally conscious purchasing [67].

Moreover, transparency is vital for addressing the complexities of ethical consumption, where community and peer influence play significant roles [12]. By fostering an environment of openness and accountability, fashion brands can promote ethical consumption patterns and sustainable practices throughout the industry. However, reliance on specific assumptions regarding player behavior and market conditions highlights the need for adaptable strategies applicable to diverse real-world scenarios [68].

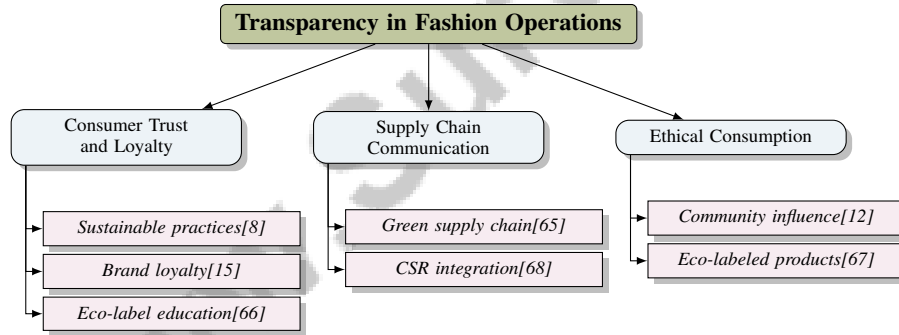


Figure 5: This figure illustrates the hierarchical structure of transparency in fashion operations, emphasizing the roles of consumer trust, supply chain communication, and ethical consumption in fostering sustainable practices.

### 5.4 Innovative Business Models

Innovative business models are essential for addressing the environmental challenges faced by the fashion industry. These models incorporate principles such as the circular economy, fair trade, and the sharing economy, each offering unique strategies to minimize the ecological footprint of fashion. Transitioning from linear to circular models allows businesses to extend product lifecycles through recycling and upcycling, integrating closed-loop systems to reduce waste and resource consumption [21]. Collaboration among stakeholders is vital for these innovative strategies, facilitating resource, knowledge, and technology sharing necessary for sustainable development [53]. The integration of Industry 4.0 technologies supports the development of sustainable business models, enabling companies to optimize operations and reduce environmental impact through advanced data analytics and digital transformation [16]. This technological integration enhances productivity and sustainability, underscoring the importance of innovating business models to meet evolving consumer needs [10]. The fashion rental market exemplifies the transformative potential of innovative business models in shaping consumer behavior and promoting sustainability. As consumer attitudes towards renting

---

and second-hand consumption evolve, particularly post-COVID-19, the long-term sustainability of fashion rentals emerges as a promising avenue for reducing waste and fostering circularity [38]. The role of influencers in shaping sustainable fashion practices is significant, with varying degrees of flexibility and commitment among different influencers affecting consumer perceptions and behaviors towards sustainable choices. Effective eco-branding, supported by community engagement and strategic communication, can enhance brand loyalty and encourage sustainable consumer behaviors. Future research should focus on optimizing eco-friendly material use and assessing the long-term impacts of these innovations on health and the environment [28]. Developing networks for sourcing materials, enhancing consumer education on sustainability, and exploring modular manufacturing techniques are crucial for improving efficiency in upcycling.

## **6 Eco-Conscious Consumer Behavior**

### **6.1 Consumer Awareness and Attitude-Behavior Gap**

The discrepancy between consumer awareness and sustainable purchasing behavior remains a significant issue in the fashion industry. Despite increased awareness of sustainability, consumers often do not translate this into action [8]. This attitude-behavior gap is influenced by complex perceptions, the appeal of personalized products, and knowledge gaps, particularly in niche groups such as mountaineers [16, 22]. Understanding identity expression and social image can align consumer identities with sustainable practices [12]. However, research often overlooks the long-term impacts of eco-branding and variations in strategies across demographics, such as generational and gender differences [69, 70].

Determinants of eco-conscious behavior include intrinsic religious orientation, green trust, and environmental concern, especially among specific groups like Muslim consumers in Indonesia [71]. Further exploration of how style confidence interacts with demographics and sustainability is needed [13]. Additionally, consumer overconsumption presents a barrier to sustainable practices, highlighting the need for effective interventions [45]. Advertising, price, and quality perceptions significantly influence eco-labeled product choices, complicating the attitude-behavior gap [67]. While environmentally conscious consumers focus on sustainability attributes, this does not always lead to increased purchases compared to less concerned consumers [6]. Addressing these challenges requires enhanced consumer education, effective marketing strategies, and supportive policies to foster sustainable consumption [2].

### **6.2 Marketing Strategies and Green Consumer Behavior**

Exploring marketing strategies that encourage eco-conscious consumer behavior is crucial for bridging the awareness-action divide. Younger generations show increased environmental awareness, evidenced by heightened recycling and waste separation [70]. This necessitates targeted marketing and educational initiatives to convert awareness into action, particularly among youth [72]. Marketing strategies significantly influence consumer behavior, with eco-label knowledge and general environmental knowledge affecting attitudes towards sustainability, which in turn impact ecologically conscious behaviors and green purchase intentions [66]. Integrating intrinsic religious orientation with the Theory of Planned Behavior provides insights into eco-conscious behavior, emphasizing the alignment of marketing strategies with consumers' intrinsic values [71].

Comparative analyses indicate that green marketing enhances brand awareness and environmental concern, positively influencing eco-conscious behavior [73]. Understanding antecedents of green purchase intentions is vital for developing effective marketing strategies that align with consumers' environmental values [1]. Despite the effectiveness of these strategies, barriers such as perceived product quality and price remain significant. Consumers are more inclined to choose eco-labeled products when quality is perceived as high, while advertising has a moderate impact on behavior. Price sensitivity continues to hinder the adoption of eco-friendly products, necessitating strategies that enhance perceived value [67]. The influence of eco-conscious consumer behavior extends beyond individual choices, positively impacting environmental knowledge, concern, social responsibility, and eco-friendly actions [74]. This underscores the potential of marketing strategies to drive sustainable consumption and foster a cultural shift towards environmental stewardship.

---

### 6.3 Generational and Cultural Influences

Generational and cultural factors significantly shape consumer preferences for sustainable fashion, affecting awareness and adoption of eco-friendly practices. Younger generations, particularly Generation Z, are more engaged with environmental issues, such as frequent waste separation, compared to older generations [70]. This generational shift necessitates tailored marketing strategies that align with the values and behaviors of different age groups. The interplay between environmental knowledge, attitudes, and ecologically conscious behaviors is crucial for understanding green purchase intentions across generations [66]. Younger consumers typically demonstrate higher environmental knowledge, leading to stronger eco-conscious behaviors and increased likelihood of purchasing sustainable fashion. Educational initiatives aimed at enhancing environmental knowledge could effectively promote sustainable consumption among younger demographics.

Cultural contexts further complicate sustainable fashion consumption by influencing the psychological mechanisms behind consumer choices. Research is limited regarding the effectiveness of eco-branding across diverse cultural settings, underscoring the need for studies that examine how cultural differences affect preferences for sustainable fashion [69]. Recognizing these cultural nuances is essential for crafting targeted marketing strategies that effectively communicate the value of sustainable fashion across consumer segments. Integrating consumer behavior concepts with environmental sustainability offers a comprehensive framework for analyzing the drivers of eco-friendly actions [74]. This theoretical approach highlights the importance of considering generational and cultural influences in examining ethical consumption behaviors. Future research should empirically test this framework to explore how various factors, including generational differences and cultural contexts, shape preferences for sustainable fashion [12].

### 6.4 Consumer Preferences and Sustainable Fashion

Consumer preferences are crucial in determining the adoption and market success of sustainable fashion, directly influencing purchasing decisions and demand for eco-friendly products. Despite increased awareness of environmental issues, a significant gap persists between consumer knowledge and sustainable purchasing behavior, necessitating policy interventions to enhance sustainability awareness [2]. This gap is compounded by the complexity of decision-making processes, where improved cognitive awareness does not necessarily lead to greater sustainable purchasing [6]. The interaction between green marketing and green consumer values significantly impacts brand awareness and environmental concern, which partially mediate their relationship with eco-conscious behavior [8]. This emphasizes the necessity of strategic marketing efforts to shape consumer preferences and promote sustainable fashion. However, price often dominates consumer motivation, overshadowing sustainability considerations and posing challenges for broader adoption of sustainable practices [2].

Positive correlations exist between eco-consciousness, satisfaction, and disposal challenges with green consumer behavior, indicating that consumers who are more aware of environmental issues and satisfied with sustainable products are more likely to engage in eco-friendly purchasing practices [74]. However, the comparative effectiveness of natural versus synthetic agents remains a critical obstacle, influencing consumer preferences for sustainable fashion [34]. Factors like risk and eco-appraisal do not significantly predict green consumer behavior, suggesting intrinsic religious orientation and environmental concern are more influential [74]. Segmenting consumers into categories such as committed green consumers, persuasive consumers, and indifferent consumers aids in understanding varying levels of environmental engagement, allowing for tailored marketing strategies [2]. Furthermore, questions remain regarding consumer acceptance of circular practices and the scalability of these models across product categories [5]. Future research should focus on developing user-friendly ex-ante assessment tools that incorporate comprehensive checklist elements and foster collaboration among industry practitioners for knowledge sharing [75].

## 7 Conclusion

The survey highlights notable strides in sustainability within the fashion industry, particularly in outdoor apparel, where there is a growing adoption of eco-friendly materials and production techniques. Innovations such as the use of trisodium nitrilotriacetate (TNA) in dyeing processes illustrate efforts to reduce harmful effluents while maintaining efficiency. Nevertheless, challenges remain, including the absence of standardized eco-labels and a lack of transparency in supply chains, which hinder the

---

development of a cohesive sustainability framework. Furthermore, the oversight of the use phase in sustainability assessments often results in a preference for short-lived products over more durable options, thereby underestimating the environmental impact of synthetic fibers.

The potential for the fashion industry to further embrace sustainability is underscored by the principles of Industry 4.0, which offer opportunities for enhanced efficiency and innovation. However, the integration of Fourth Industrial Revolution (4IR) technologies into traditional business models faces obstacles, highlighting the need for additional research into the interplay between hyper-personalization and sustainability. Moreover, incorporating health outcomes associated with fast fashion into public health policies is crucial, pointing to a gap in current research.

Future research should focus on sustainable design strategies across various demographics and extend these approaches to other fashion categories. Advancements in functionalization methods and the exploration of educational impacts on sustainable consumer practices are vital for promoting sustainability in textile practices. Additionally, investigating affordable cooling solutions tailored to developing countries offers promising prospects for merging advanced technologies with sustainability.

To further advance sustainable practices in outdoor apparel, emphasis should be placed on improving recycling technologies, enhancing consumer awareness, and formulating comprehensive policies that incentivize sustainability. The role of adaptability culture in driving innovation and green performance, especially with employee commitment as a mediator, deserves attention. Moreover, fostering cross-sector collaborations and conducting in-depth analyses of consumer behavior towards sustainable fashion are essential. Future studies should also explore comparative eco-design practices among different fashion brands and evaluate the impact of supply chain factors on sustainable product development. Finally, identifying effective extraction technologies that promote sustainability and exploring the potential use of agricultural by-products as valuable resources in the textile industry should be prioritized.

---

## References

- [1] Amar Shafiq, Muhammad Mohsin Ali Khan, and Syed Ali Tahir. Identifying key antecedents of eco-conscious consumer behavior: Mediating role of intentions to purchase green dc inverter air conditioners. *Review of Applied Management and Social Sciences*, 7(2):69–88, 2024.
- [2] Farhat Naseem Shaikh. The impact of sustainability on fashion industry. *Journal of Business Strategies*, 15(1):45–58, 2021.
- [3] Elyse Lindahl. The outdoor apparel industry: Measuring the premium for sustainability with a hedonic pricing model. 2019.
- [4] David Benedikt Goetz. Surfing the green wave: The impact of sustainable and secondhand fashion clothing on purchasing behaviors and the moderating role of outdoor sports orientation. Master's thesis, Universidade Catolica Portuguesa (Portugal), 2023.
- [5] Paal Saatvedt and Haakon Haldorsen. Circular business models in the outdoor sporting goods industry: Perspectives from norwegian outdoor brands. Master's thesis, NTNU, 2023.
- [6] Md Mayedul Islam. *Consumers' online decision-making process toward sustainable apparel: an exploratory study using eye-tracking technology*. PhD thesis, 2019.
- [7] Luo Wang and Bin Shen. A product line analysis for eco-designed fashion products: Evidence from an outdoor sportswear brand. *Sustainability*, 9(7):1136, 2017.
- [8] Manuela Guerreiro, Christina Muhs, Mélanie Carvalho Neves, Laura Engel, and Leandro Fernandes Cardoso. Green marketing: a case study of the outdoor apparel brand patagonia. *Responsibility and Sustainability*, 8(2):49–57, 2023.
- [9] Saeed Nosratabadi, Amir Mosavi, Shahaboddin Shamshirband, Edmundas Kazimieras Zavadskas, Andry Rakotonirainy, and Kwok Wing Chau. Sustainable business models: A review. *Sustainability*, 11(6):1663, 2019.
- [10] Byoungho Ellie Jin and Daeun Chloe Shin. Changing the game to compete: Innovations in the fashion retail industry from the disruptive business model. *Business Horizons*, 63(3):301–311, 2020.
- [11] Shuai Yang, Yiping Song, and Siliang Tong. Sustainable retailing in the fashion industry: A systematic literature review. *Sustainability*, 9(7):1266, 2017.
- [12] Lamberto Zollo. Ethical identity, social image and sustainable fashion: still an impossible deal? a sociopsychological framework of ethical consumers' attitude-behavior gaps. *Journal of Consumer Marketing*, 41(5):564–582, 2024.
- [13] Kirsi Niinimäki. *Sustainable fashion in a circular economy*. Aalto University, 2018.
- [14] Simon Beames, Jannicke Høyem, Imre van Kraalingen, Jørgen Eriksen, Thomas Vold, Kristian Abelsen, Axel Rosenberg, and Trond Augestad. The jacket: Making sustainable clothing choices in outdoor education. *Canadian Journal of Environmental Education (CJEE)*, 26, 2024.
- [15] Haylie Hicks, Deborah C Fowler, Hyo Jung Julie Julie Chang, and Tun-Min Catherine Jai. The effects of sustainability perceptions on perceived values and brand love for outdoor versus fast fashion apparel brands. In *International Textile and Apparel Association Annual Conference Proceedings*, volume 77. Iowa State University Digital Press, 2020.
- [16] Byoungho Ellie Jin and Daeun Chloe Shin. The power of 4th industrial revolution in the fashion industry: what, why, and how has the industry changed? *Fashion and Textiles*, 8(1):31, 2021.
- [17] Rachel Bick, Erika Halsey, and Christine C Ekenga. The global environmental injustice of fast fashion. *Environmental Health*, 17:1–4, 2018.
- [18] Tarek S Aysha, Nahed S Ahmed, Mervat S El-Sedik, Yehya A Youssef, and Reda M El-Shishtawy. Eco-friendly salt/alkali-free exhaustion dyeing of cotton fabric with reactive dyes. *Scientific Reports*, 12(1):22339, 2022.

- 
- [19] Pierpaolo Scarano, Maria Tartaglia, Daniela Zuzolo, Antonello Prigioniero, Carmine Guarino, and Rosaria Sciarrillo. Recovery and valorization of bioactive and functional compounds from the discarded of opuntia ficus-indica (l.) mill. fruit peel. *Agronomy*, 12(2):388, 2022.
- [20] Thu Lam Nguyen, Ari Ora, Suvi T Häkkinen, Anneli Ritala, Riikka Räisänen, Mari Kallioinen-Mänttari, and Kristian Melin. Innovative extraction technologies of bioactive compounds from plant by-products for textile colorants and antimicrobial agents. *Biomass conversion and biorefinery*, 14(20):24973–25002, 2024.
- [21] Valentina Jacometti. Circular economy and waste in the fashion industry. *Laws*, 8(4):27, 2019.
- [22] Annette Karoline Arngart Behrendt. Understanding the contradictions of garment consumption: exploring the attitude-behavior gap in purchase decisions of mountaineers in austria.
- [23] Sara LC Han, Priscilla YL Chan, Praburaj Venkatraman, Phoebe Apeagyei, Tracy Cassidy, and David J Tyler. Standard vs. upcycled fashion design and production. *Fashion Practice*, 9(1):69–94, 2017.
- [24] My wardrobe in the cloud an in.
- [25] Kalina Pashkevych, K Khurana, OV Kolosnichenko, TF Krotova, and AM Veklich. Modern directions of eco-design in the fashion industry. *Art and design*, 2019.
- [26] Sahiba Sharma, Gyan Prakash, Anil Kumar, Eswara Krishna Mussada, Jiju Antony, and Sunil Luthra. Analysing the relationship of adaption of green culture, innovation, green performance for achieving sustainability: Mediating role of employee commitment. *Journal of cleaner production*, 303:127039, 2021.
- [27] Richard Fried, Ilinca Oprea, Karin Fleck, and Florian Rudroff. Biogenic colourants in the textile industry—a promising and sustainable alternative to synthetic dyes. *Green Chemistry*, 24(1):13–35, 2022.
- [28] Menna M Ragab and Ahmed G Hassabo. Various uses of natural plants extracts for functionalization textile based materials. *Journal of Textiles, Coloration and Polymer Science*, 18(2):143–158, 2021.
- [29] Barbara Pizzicato, Severina Pacifico, Diana Cayuela, Gabriela Mijas, and Marta Riba-Moliner. Advancements in sustainable natural dyes for textile applications: a review. *Molecules*, 28(16):5954, 2023.
- [30] Anupama Pasricha and Rachel Greeninger. Exploration of 3d printing to create zero-waste sustainable fashion notions and jewelry. *Fashion and Textiles*, 5:1–18, 2018.
- [31] Hyeon Jeong Ji. Design strategy and outer jacket prototype study for sustainable growth of outdoor brands. *Journal of the Korean Society of Clothing and Textiles*, 48(1):120–139, 2024.
- [32] Kirsi Laitala, Ingun Grimstad Klepp, and Beverley Henry. Does use matter? comparison of environmental impacts of clothing based on fiber type. *Sustainability*, 10(7):2524, 2018.
- [33] A El-Shafei, Sahar Shaarawy, FH Motawe, and R Refaei. Herbal extract as an ecofriendly antibacterial finishing of cotton fabric. *Egyptian Journal of Chemistry*, 61(2):317–327, 2018.
- [34] A Reshma, V Brindha Priyadarisini, and K Amutha. Sustainable antimicrobial finishing of fabrics using natural bioactive agents-a review. *Int. J. Life Sci. Pharma Res*, 8(4):10–20, 2018.
- [35] <div style="text-align: center;"
- [36] U Abdul-Reda Hussein, ZH Mahmoud, KM Abd Alaziz, ML Alid, Y Yasin, FK Ali, AN Faisal, AN Abd, and E Kianfar. Antimicrobial finishing of textiles using nanomaterials. *Brazilian Journal of Biology*, 84:e264947, 2023.
- [37] Pooyan Makvandi, Sidra Iftexhar, Fabio Pizzetti, Atefeh Zarepour, Ehsan Nazarzadeh Zare, Milad Ashrafizadeh, Tarun Agarwal, Vinod VT Padil, Reza Mohammadinejad, Mika Sillanpaa, et al. Functionalization of polymers and nanomaterials for water treatment, food packaging, textile and biomedical applications: a review. *Environmental Chemistry Letters*, 19:583–611, 2021.

- 
- [38] Rudrajeet Pal and Jonathan Gander. Modelling environmental value: An examination of sustainable business models within the fashion industry. *Journal of cleaner production*, 184:251–263, 2018.
- [39] Md. Mohsin Ahmed, S. M. Salauddin Iqbal, Tazrin Jahan Priyanka, Mohammad Arani, Mohsen Momenitabar, and Md Mashum Billal. An environmentally sustainable closed-loop supply chain network design under uncertainty: Application of optimization, 2020.
- [40] Nanang Adie Setyawan, Hadiahti Utami, Bayu Setyo Nugroho, Mellasanti Ayuwardani, and Suharmanto. Analysis of the driving factors of implementing green supply chain management in sme in the city of semarang, 2022.
- [41] Chencheng Fang and Jiantong Zhang. Performance of green supply chain management: A systematic review and meta analysis. *Journal of Cleaner Production*, 183:1064–1081, 2018.
- [42] Laura V Lerman, Guilherme Brittes Benitez, Julian M Müller, Paulo Renato de Sousa, and Alejandro Germán Frank. Smart green supply chain management: A configurational approach to enhance green performance through digital transformation. *Supply Chain Management: An International Journal*, 27(7):147–176, 2022.
- [43] Aleksander Banasik, Jacqueline M Bloemhof-Ruwaard, Argyris Kanellopoulos, GDH Claassen, and Jack GAJ van der Vorst. Multi-criteria decision making approaches for green supply chains: A review. *Flexible Services and Manufacturing Journal*, 30:366–396, 2018.
- [44] Thorey S Thorisdottir and Lara Johannsdottir. Sustainability within fashion business models: A systematic literature review. *Sustainability*, 11(8):2233, 2019.
- [45] Carson Dobrowski. All hype or helping? an exploration of the joint sustainability efforts between outdoor and luxury brands. 2022.
- [46] Paul D Cousins, Benn Lawson, Kenneth J Petersen, and Brian Fugate. Investigating green supply chain management practices and performance: The moderating roles of supply chain ecocentricity and traceability. *International Journal of Operations & Production Management*, 39(5):767–786, 2019.
- [47] Laura Macchion, Alessandro Da Giau, Federico Caniato, Maria Caridi, Pamela Danese, Rinaldo Rinaldi, and Andrea Vinelli. Strategic approaches to sustainability in fashion supply chain management. *Production Planning & Control*, 29(1):9–28, 2018.
- [48] Syed Abdul Rehman Khan, Yu Zhang, Muhammad Anees, Hêriş Golpîra, Arij Lahmar, and Dong Qianli. Green supply chain management, economic growth and environment: A gmm based evidence. *Journal of Cleaner Production*, 185:588–599, 2018.
- [49] Didrik Dege Dimmen, Eva Røglér, and Linnea Tveraen. Changes in strategic partnerships of fashion companies when innovating from a linear to a circular business model. Master’s thesis, NTNU, 2020.
- [50] Hossein Mirzaee, Hamed Samarghandi, and Keith Willoughby. A robust optimization model for green supplier selection and order allocation in a closed-loop supply chain considering cap-and-trade mechanism, 2022.
- [51] Antonella Moretto, Laura Macchion, Andrea Lion, Federico Caniato, Pamela Danese, and Andrea Vinelli. Designing a roadmap towards a sustainable supply chain: A focus on the fashion industry. *Journal of cleaner production*, 193:169–184, 2018.
- [52] Tasmia Jannat Tumpa, Syed Mithun Ali, Md Hafizur Rahman, Sanjoy Kumar Paul, Priyabrata Chowdhury, and Syed Abdul Rehman Khan. Barriers to green supply chain management: An emerging economy context. *Journal of cleaner production*, 236:117617, 2019.
- [53] Bin Shen, Qingying Li, Ciwei Dong, and Patsy Perry. Sustainability issues in textile and apparel supply chains, 2017.
- [54] Vijay Kumar Sharma, Pankaj Chandna, and Arvind Bhardwaj. Green supply chain management related performance indicators in agro industry: A review. *Journal of cleaner production*, 141:1194–1208, 2017.



- 
- [55] Anass Cherrafi, Jose Arturo Garza-Reyes, Vikas Kumar, Nishikant Mishra, Abby Ghobadian, and Said Elfezazi. Lean, green practices and process innovation: A model for green supply chain performance. *International Journal of Production Economics*, 206:79–92, 2018.
- [56] Noor Aslinda Abu Seman, Kannan Govindan, Abbas Mardani, Norhayati Zakuan, Muhamad Zameri Mat Saman, Robert E Hooker, and Seckin Ozkul. The mediating effect of green innovation on the relationship between green supply chain management and environmental performance. *Journal of cleaner production*, 229:115–127, 2019.
- [57] Lei Jihu. Green supply chain management optimization based on chemical industrial clusters, 2024.
- [58] Guido JL Micheli, Enrico Cagno, Gianluca Mustillo, and Andrea Trianni. Green supply chain management drivers, practices and performance: A comprehensive study on the moderators. *Journal of cleaner production*, 259:121024, 2020.
- [59] Meysam Mahjoob, Seyed Sajjad Fazeli, Soodabeh Milanlouei, Ali Kamali Mohammadzadeh, and Leyla Sadat Tavassoli. Green supply chain network design with emphasis on inventory decisions, 2021.
- [60] Nidhi Sharma, Madhu Jain, and Dinesh Sharma. Anfis and metaheuristics for green supply chain with inspection and rework, 2024.
- [61] Fashion 4.0.
- [62] Daffa R. Kaiyandra, Farizal F, and Naly Rakoto. Colored petri nets for modeling and simulation of a green supply chain system, 2024.
- [63] Mehrnoosh Khademi, Massimiliano Ferrara, Bruno Pantera, and Mehdi Salimi. A dynamic game on green supply chain management, 2015.
- [64] Bruna Villa Todeschini, Marcelo Nogueira Cortimiglia, Daniela Callegaro-de Menezes, and Antonio Ghezzi. Innovative and sustainable business models in the fashion industry: Entrepreneurial drivers, opportunities, and challenges. *Business horizons*, 60(6):759–770, 2017.
- [65] Deepa Mishra, Angappa Gunasekaran, Thanos Papadopoulos, and Benjamin Hazen. Green supply chain performance measures: A review and bibliometric analysis. *Sustainable production and consumption*, 10:85–99, 2017.
- [66] Sinem Sargin and Şükrü Akdoğan. Analysis of the antecedents of ecologically conscious consumer behavior and its effect on green purchase intention. *Pazarlama ve Pazarlama Araştırmaları Dergisi*, 15(2):379–402, 2022.
- [67] FATHIMA MUHSINA KK, NICOLE ELIZABETH SAJEEV, et al. The eco-conscious consumer: Unveiling how advertising, price, and quality shape eco-label decisions in ernakulam. 2024.
- [68] Mehrnoosh Khademi, Massimiliano Ferrara, Mehdi Salimi, and Somayeh Sharifi. A dynamic stackelberg game for green supply chain management, 2015.
- [69] Elena Kulikova and Ilya Kondratenko. Eco-branding and consumer behavior: innovative marketing strategies in ecology and environmental sciences. In *E3S Web of Conferences*, volume 541, page 04005. EDP Sciences, 2024.
- [70] Tibor Zsigmond-Annamária Zsigmondová-Renáta Machová. Ecological conscious consumer behaviour from the viewpoint of different generations and genders.
- [71] Sumayyah Amalina Nasr and Anya Safira. Determinants of eco-conscious consumer behavior of muslims in indonesia using the theory of planned behavior. *ASEAN Marketing Journal*, 12(1):3, 2021.
- [72] Bo Zhang, Yaozhong Zhang, and Peng Zhou. Consumer attitude towards sustainability of fast fashion products in the uk. *Sustainability*, 13(4):1646, 2021.

- 
- [73] Lei Chen, Sheema Matloob, Yang Sunlei, Sikandar Ali Qalati, Ali Raza, and Mónica Lorena Sánchez Limón. A moderated–mediated model for eco-conscious consumer behavior. *Sustainability*, 15(2):897, 2023.
- [74] Adam A Musa, SK Brika, and MA Almezher. The impact of conscious consumer behavior on environmental friendliness: Saudi arabia’s sustainable vision 2030. *International Journal of Advanced and Applied Sciences*, 8(7):31–40, 2021.
- [75] Sebastian Wehrkamp. On the hunt for outdoors’ next (circular) top model-investigating ex-ante assessment tools for circular business models in the outdoor fashion industry. *IIIEE Theses* 2022, 2022.

www.SurveyX.cn

---

**Disclaimer:**

SurveyX is an AI-powered system designed to automate the generation of surveys. While it aims to produce high-quality, coherent, and comprehensive surveys with accurate citations, the final output is derived from the AI's synthesis of pre-processed materials, which may contain limitations or inaccuracies. As such, the generated content should not be used for academic publication or formal submissions and must be independently reviewed and verified. The developers of SurveyX do not assume responsibility for any errors or consequences arising from the use of the generated surveys.

www.SurveyX.cn