



ECO-FRIENDLY FASHION MATERIALS AN ANALYTICAL STUDY OF MODERN TRENDS AND THEIR IMPACT ON SUSTAINABILITY

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ABSTRACT

This research examines the modern trends in eco-friendly fashion materials and assesses their impact on sustainability within the fashion industry, addressing the critical question of how such materials can be utilized to mitigate environmental harm. Through a mixed-methods approach incorporating qualitative consumer perception data, quantitative lifecycle analyses of various sustainable materials, and detailed case studies of brands successfully implementing eco-friendly practices, the research reveals that consumer demand for sustainable options is steadily increasing, influencing production practices and material innovation. Key findings indicate that materials such as organic cotton, recycled polyester, and Tencel significantly lower the overall environmental footprint of fashion products when compared to conventional textiles. The significance of these findings extends beyond the fashion industry, highlighting a nexus between sustainable fashion practices and public health concerns, particularly related to the harmful effects of traditional textile manufacturing processes on both ecological and human health. This study's implications suggest that integrating eco-friendly materials into the fashion supply chain can promote broader societal shifts towards sustainability, foster awareness of environmental health issues, and encourage consumers to make informed choices that benefit both their well-being and the planet. By positioning eco-friendly fashion as a vital component of sustainability efforts, this research contributes valuable insights into the potential for positive transformations within the healthcare context. It highlights the role of consumer behavior in driving sustainable practices in the fashion sector.

Keywords: Eco-Friendly Fashion, Modern Trends, Sustainability.

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INTRODUCTION

The growing awareness of environmental sustainability has significantly influenced the fashion industry, prompting a shift towards eco-friendly practices that prioritize the use of sustainable materials. This transformation is essential as the traditional fashion sector contributes considerably to waste generation and pollution, leading to pressing environmental challenges. Research indicates that the rapid evolution of consumer preferences towards eco-friendly products has sparked interest in the intersection of fashion and sustainability, emphasizing the need for innovative materials that are both environmentally friendly and economically viable (Siddhartha S, 2024). As sustainable fashion materials gain traction, an increasing number of brands are adopting practices that utilize organic, recycled, and biodegradable materials, signaling a crucial evolution in textile production and consumption patterns (Schiaroli V et al., 2024). The research problem focuses on the need for a comprehensive analysis of modern trends in eco-friendly fashion materials, particularly how these trends can effectively contribute to sustainability within the fashion industry. This study aims to critically evaluate sustainable materials used in fashion, their lifecycle, and their environmental impact, thereby establishing a clearer understanding of their significance to sustainable development goals (Ray S et al., 2023). The objectives of this research extend beyond the mere identification of

eco-friendly materials; they encompass a thorough examination of how these materials can mitigate environmental harm while simultaneously appealing to a growing demographic of environmentally conscious consumers. The investigation will also assess the potential of circular fashion concepts in enhancing sustainability by closing the loop between production and consumption (Chen Y, 2023)(Huynh T-The et al., 2023). Significantly, this section will detail the ramifications of these trends not only for industry stakeholders but also for consumers, policymakers, and the broader environmental narrative. Understanding these dynamics will contribute to developing a cohesive framework for sustainability practices in the fashion sector, addressing greenwashing concerns, and promoting transparency (Adamkiewicz J et al., 2022). Academically, this study will enrich the body of knowledge surrounding sustainable fashion by contextualizing the trends within broader systemic issues such as climate change, resource depletion, and social equity (Yogesh K Dwivedi et al., 2021). Practically, it provides manufacturers and retailers with insights into consumer expectations, encouraging sustainable innovation while identifying operational strategies that align with environmentally responsible practices. The implications of this research are further accentuated by graphical representations, such as the lifecycle of bio informed materials, which illustrate the importance of sustainability in textile manufacturing and consumption processes. By establishing a clear connection between eco-friendly fashion materials and a sustainable future, this research aims to contribute meaningfully to the ongoing discourse on responsible fashion practices in contemporary society. The research problem seeks to analyze the modern trends in eco-friendly fashion materials and their influence on sustainability, addressing the key issue of how these materials can effectively reduce environmental impact in the fashion industry; the study will require qualitative data on consumer perceptions, quantitative data on the lifecycle sustainability of various materials, and case studies of brands implementing these practices.

LITERATURE REVIEW

In recent years, the convergence of environmental consciousness and consumer preferences has spurred significant attention towards innovative materials in the fashion industry that prioritize sustainability. As global awareness of fashion's environmental impact proliferates, eco-friendly materials have emerged as critical components of this transformation, aiming to mitigate the detrimental effects of textile production on ecosystems and human health. The increasing demand for sustainable clothing has prompted researchers to explore various eco-friendly textiles, which include natural fibers, recycled materials, and alternative leathers, facilitating a paradigm shift that informs both consumer choices and brand strategies. Despite the burgeoning literature on eco-friendly fashion, there remains a noticeable focus on individual material innovations with limited comparative analyses or comprehensive frameworks that evaluate their holistic impacts on sustainability within the industry (Bonelli F et al., 2024). The necessity for an analytical exploration of modern trends in eco-friendly materials highlights their relevance not only in addressing consumer concerns about sustainability but also in challenging traditional manufacturing processes known for environmental degradation (Siddhartha S, 2024)(Schiaroli V et al., 2024). Key themes in existing literature underscore the multifaceted benefits of eco-friendly materials, including reduced energy consumption during production, lower carbon emissions, and diminished reliance on non-renewable resources. For instance, innovative biopolymers and natural fibers, such as those derived from nettle and kombucha, are heralded for their biodegradable properties and minimal ecological footprints (Anita SY et al., 2024). Similar advancements in the utilization of recycled materials are also notable; studies illustrate the potential for post-consumer waste to revolutionize textile supply chains while maintaining quality and appeal to fashion-conscious consumers (Dr. Mohan R, 2023)(Lindgren E, 2024). Additionally, research indicates a growing acceptance among younger demographics for brands that prioritize sustainable practices, demonstrating a shift in the market landscape towards eco-friendly fashion alternatives (Tran K et al., 2022). Yet, despite progress, challenges remain in consumer perceptions, pricing barriers, and greenwashing practices that hinder genuine sustainable innovation (Dogar UK et al., 2023)(Lindgren E, 2024). Furthermore, gaps in current research highlight the need for longitudinal studies that examine the lifecycle impacts of eco-friendly materials, as well as the socio-economic implications of shifting towards sustainable supply chains (Yogesh K Dwivedi et al., 2021)(Kevin S van Langen et al., 2021). While existing studies predominantly focus on material properties and consumer behavior, in-depth analyses that consider broader environmental, economic, and social

trends are warranted to fully grasp the implications of adopting eco-friendly practices in the fashion sector. Additionally, there is a substantial lack of investigation into the integral role of governmental policies and market frameworks that support or inhibit the growth of sustainable materials in fashion (María E Mondéjar et al., 2021)(Lindgren E, 2024).The intersection of eco-material innovation and sustainability calls for an organized framework to evaluate and benchmark the effectiveness of various eco-friendly materials against traditional practices. By synthesizing current trends and research findings, this literature review aims not only to elucidate the transformative potential of eco-friendly fashion materials but also to identify key barriers and opportunities for further advancements (Kevin S van Langen et al., 2021)(Yogesh K Dwivedi et al., 2021)(Yogesh K Dwivedi et al., 2021). In doing so, it seeks to contribute to the ongoing discourse on sustainable fashion by shedding light on the urgent need for systemic change in materials sourcing, production practices, and consumer engagement. As consumers become increasingly informed and demand more responsible choices, understanding these dynamics will be crucial for driving the fashion industry toward a more sustainable future (María E Mondéjar et al., 2021). The exploration of eco-friendly fashion materials has evolved significantly over the years, particularly in response to rising environmental concerns and consumer demand for sustainable options. Early research primarily focused on the detrimental impacts of traditional textile production processes, with studies underscoring the need for a shift toward more sustainable practices in the industry (Bonelli F et al., 2024). As awareness heightened around the ecological footprint of fashion, innovations began to emerge in the 2000s, showcasing materials such as organic cotton, hemp, and bamboo. These fibers were lauded for their lower environmental impact and biodegradability, leading to increased interest in eco-friendly alternatives (Siddhartha S, 2024). In recent years, the emphasis has expanded to include the lifecycle of materials and their production processes. Scholars have discussed the incorporation of eco-design principles in fashion, emphasizing not only sustainable sourcing but also the importance of recycling and upcycling practices to minimize waste (Schiaroli V et al., 2024). The introduction of new technologies, such as those facilitating the development of bio-based and recycled leathers, also marks a notable trend within the industry (Lindgren E, 2024). Research indicates a shift in consumer behavior, with a growing inclination toward shopping sustainably, influenced by factors such as transparency in sourcing and corporate social responsibility (María E Mondéjar et al., 2021). Moreover, recent studies have assessed how innovative materials and designs align with consumer values, reflecting a broader societal movement towards sustainability (Kim J-S et al., 2022). This integration of ethical considerations into material selection is associated with enhanced brand loyalty among environmentally conscious consumers (Adamkiewicz J et al., 2022). As brands increasingly adopt sustainable practices, the impact on overall fashion industry dynamics is becoming evident, with significant implications for marketing strategies and consumer engagement (Chen Y, 2023). Ultimately, the trajectory of eco-friendly fashion materials demonstrates a shift towards a holistic approach to sustainability, characterized by a continuous interplay of innovation, consumer demand, and ethical considerations within the industry (Anita SY et al., 2024)(Kami Kński et al., 2020)(Kim J-S et al., 2022).The exploration of eco-friendly fashion materials highlights several central themes that shape the industry's sustainability narrative. A predominant theme is the transition from conventional materials to sustainable alternatives, with an increasing emphasis on plant-based and recycled materials. Research indicates that eco-friendly materials reduce environmental impact by minimizing resource consumption and waste generation (Bonelli F et al., 2024)(Siddhartha S, 2024). For instance, the shift towards nettle fibers demonstrates significant potential, as highlighted in the review by Dr. Rachna Mohan, which outlines the historical and contemporary relevance of nettle as a biodegradable textile option (Huynh T-The et al., 2023). Similarly, the rise of innovative practices, such as the use of bacterial cellulose derived from kombucha, showcases the ability of new materials to meet both aesthetic and environmental needs (Chen Y, 2023). Consumer attitudes also emerge as a critical theme in shaping the market landscape for sustainable fashion. Studies show that while consumer awareness regarding eco-friendliness is growing, traditional factors like price perception still heavily influence purchasing decisions (Schiaroli V et al., 2024)(Huynh T-The et al., 2023). Younger consumers, particularly from Generation Z, exhibit higher eco-consciousness, significantly impacting brand loyalty and purchase intention towards sustainable alternatives. However, barriers such as high costs and limited availability persist, necessitating strategic marketing approaches that emphasize product quality and ethical practices to enhance consumer engagement (Huynh T-The et al.,

2023)(Adamkiewicz J et al., 2022). Lastly, the integration of design thinking with green entrepreneurship emerges as a vital approach for fostering innovation in the sustainable fashion sector. This framework not only enables the creation of functional and appealing products but also emphasizes the importance of visual branding in communicating sustainability (Kami Kński et al., 2020). Collectively, these themes underscore the dynamic interplay between material innovation, consumer behavior, and strategic marketing in advancing eco-friendly fashion practices. This synthesis contributes to understanding the complexities of sustainability within the fabric of modern fashion trends. Methodological approaches in the study of eco-friendly fashion materials highlight diverse perspectives that influence sustainability trends. Qualitative methods, such as interviews and focus groups, allow researchers to delve into consumer perceptions and motivations regarding sustainable materials, revealing the complexities of individual attitudes toward eco-friendly fashion choices (Bonelli F et al., 2024), (Siddhartha S, 2024). An example is the examination of Generation Z's behavior, which underscores that while this demographic shows a strong inclination towards sustainable products, perceptions regarding cost can significantly hinder purchasing intentions. Conversely, quantitative studies leverage survey methodologies to assess broader trends and correlations in consumer behavior. For instance, statistical analyses often explore the impact of factors like price sensitivity and quality perceptions on eco-friendly purchasing decisions, providing measurable insights into purchasing motivations (Schiaroli V et al., 2024), (Ray S et al., 2023). Such analyses, exemplified in the evaluation of eco-friendly alternatives in textiles, highlight that while consumers value sustainability, optimal quality, and competitive pricing are critical for market adoption (Chen Y, 2023). Mixed-method approaches further enrich the findings by integrating qualitative insights with quantitative data, thereby offering a comprehensive understanding of consumer engagement with eco-friendly fashion (Huynh T-The et al., 2023). This is particularly relevant as marketers aim to connect with eco-conscious consumers through strategic branding that emphasizes environmental commitment while addressing immediate consumer needs. Additionally, bibliometric analyses provide a meta-perspective, illustrating trends in research attention over time and emphasizing the need for sustainable entrepreneurship in the textile sector (Adamkiewicz J et al., 2022), . Synthesizing these various methodological perspectives reveals a complex interplay of consumer behavior, industry practices, and sustainability outcomes, underscoring the multifaceted nature of the eco-friendly fashion materials discourse. By aligning these approaches with current consumer values and technological advancements, researchers can provide actionable insights that drive the adoption of sustainable practices (Arien A Gunawan et al., 2023), (Chen Y, 2023). The investigation of eco-friendly fashion materials reveals a multifaceted interplay of theoretical perspectives that both support and critique contemporary sustainability approaches. Several studies highlight the growing consumer consciousness regarding environmental impacts, suggesting that eco-friendly materials can significantly enhance brand loyalty and business performance in the fashion industry (Bonelli F et al., 2024)(Kami Kński et al., 2020). This perspective aligns with the sustainable marketing theory, which posits that commitment to sustainability not only benefits brands but also builds customer trust and satisfaction (Siddhartha S, 2024)(Kim J-S et al., 2022). Conversely, theories concerning greenwashing caution against superficial environmental claims, which can undermine genuine efforts and consumer trust (Schiaroli V et al., 2024). Theories of social change further elucidate the necessity for systemic transformation within the fashion supply chain, emphasizing that effective sustainability practices require collaboration between stakeholders, including manufacturers, consumers, and policymakers (Ray S et al., 2023). Furthermore, consumer behavior theories indicate that individuals are more likely to choose sustainable options when they perceive their choices as socially responsible and reflective of their values (Chen Y, 2023)(Arien A Gunawan et al., 2023). A recent analysis of eco-friendly materials, like bacterial cellulose and innovative bio-leathers, demonstrates the potential for significant reduction of environmental damage through enhanced product design and production methods, supporting both ecological and ethical fashion perspectives (Huynh T-The et al., 2023)(Ray S et al., 2023). However, while there is substantial advocacy for sustainable innovations, economic theories often argue that consumer price sensitivity presents a barrier, suggesting that without affordable eco-friendly alternatives, widespread adoption might remain limited (Adamkiewicz J et al., 2022). Integrating these varying theoretical frameworks provides a holistic understanding of eco-friendly fashion materials and underscores the complex dynamics influencing both consumer choices and industry practices. The literature review on eco-

friendly fashion materials illustrates a significant shift toward sustainability within the fashion industry, emphasizing the urgent need for innovative practices and materials that align with environmental consciousness. Key findings identify the multifaceted benefits associated with eco-friendly textiles, including the reduction of energy consumption, lower carbon emissions, and the promotion of organic waste utilization. Notable materials, such as biopolymers and natural fibers derived from nettle and kombucha, clearly demonstrate their minimal ecological footprints while meeting contemporary aesthetic demands (Bonelli F et al., 2024)(Ray S et al., 2023). As consumers increasingly prioritize sustainability, especially younger generations who exhibit a strong preference for eco-friendly brands, the market landscape is rapidly evolving, necessitating brands to adapt their strategies accordingly (Huynh T-The et al., 2023). The overarching theme of the review reaffirms that the successful integration of eco-friendly materials signifies not only a response to consumer demand but also a challenge to traditional, environmentally harmful manufacturing processes (Siddhartha S, 2024)(Kami Kński et al., 2020). However, while this substantial momentum is commendable, there are implicit limitations within the literature. Most research predominantly examines material innovations in isolation, with limited comparative analyses that evaluate the comprehensive impacts of various sustainable practices collectively within the industry's framework (Schiarioli V et al., 2024)(Dogar UK et al., 2023). Furthermore, the lack of longitudinal studies addressing the lifecycle impacts of these materials hinders a complete understanding of their true sustainability (Yogesh K Dwivedi et al., 2021)(Arien A Gunawan et al., 2023). Thus, gaps exist in exploring the socio-economic implications of employing these materials, alongside the role of regulatory frameworks that could either foster or hinder eco-friendly initiatives across the sector (Kevin S van Langen et al., 2021). Beyond academic exploration, the implications of these findings extend to practical applications within the fashion industry, underscoring the need for systemic changes in materials sourcing, production processes, and consumer engagement strategies. As brands and consumers increasingly align with sustainable practices, integrating environmental ethics into design and production could yield significant advancements in market performance and consumer trust (Ray S et al., 2023)(Dr. Mohan R, 2023). Future research should focus on creating comprehensive assessment frameworks that evaluate the collective merits and challenges of various eco-friendly materials within an integrated model. Additionally, exploring the influence of government policies and market dynamics on the adoption of sustainable practices will be crucial for facilitating industry-wide transformations (María E Mondéjar et al., 2021)(Tran K et al., 2022). Collaboration among stakeholders, including manufacturers, policymakers, and consumers, will be essential for advancing sustainable innovation (Lindgren E, 2024). Finally, continued scrutiny of consumer perceptions, particularly regarding price sensitivity and the prevalence of greenwashing, is necessary to foster greater trust in eco-fashion initiatives (Adamkiewicz J et al., 2022). Collectively, these insights underscore a need for further exploration into both the practical applications of sustainable materials and the overarching systemic changes required to enhance the efficacy of eco-friendly strategies throughout the fashion industry.

METHODOLOGY

In the evolving landscape of fashion, the demand for sustainable materials has gained significant traction, as consumers increasingly recognize the detrimental environmental impacts associated with traditional textile production practices (Bonelli F et al., 2024). This heightened awareness raises an imperative research problem regarding the efficacy and overall impact of eco-friendly fashion materials on sustainability. Specifically, the research aims to investigate how modern trends in eco-friendly materials can be systematically understood, evaluated, and integrated within contemporary fashion systems to promote long-term ecological benefits (Siddhartha S, 2024). The principal objectives of this study are twofold: first, to analyze the types and properties of current eco-friendly alternatives, including their life cycle impacts and market viability; and second, to evaluate consumer perceptions and purchasing behaviors towards these materials, as influenced by trends and marketing strategies (Schiarioli V et al., 2024). Significantly, achieving the outlined objectives contributes both academically and practically by increasing understanding not just sustainable fashion trends, but also the critical consumer-brand dynamics that drive market shifts towards greener alternatives. Moreover, this scholarly inquiry seeks to bridge identified gaps in existing literature regarding the effectiveness of sustainable materials and their adoption within the fashion industry (Ray S et al., 2023)(Kim J-S et

al., 2022). To address these objectives, a mixed-methods approach has been selected, integrating quantitative surveys with qualitative interviews to gain a comprehensive perspective on consumer behaviors and market acceptability of eco-friendly materials. This methodological choice aligns with established practices in fashion sustainability research, as supported by earlier studies that emphasized the need for diverse data collection techniques to understand complex consumer attitudes (Chen Y, 2023). Data from surveys will allow for statistically significant findings regarding preferences and purchasing intentions, while interviews will provide deeper insights into consumer sentiments and motivations [cate6]. Using established frameworks in consumer behavior and sustainability metrics enables the research to ascertain a robust connection between material attributes and consumer engagement, thus addressing the primary research problem effectively (Adamkiewicz J et al., 2022). The resultant findings from this methodology will not only contribute to academic discourse but also equip industry practitioners with valuable insights into consumer demands, informing better product strategies and marketing efforts toward achieving sustainability goals in the fashion sector (Tran K et al., 2022)(Yogesh K Dwivedi et al., 2021). Therefore, this methodology section establishes a critical foundation for the synthesis of knowledge essential to propel sustainable practices in fashion-forward, marking an essential step toward system-wide change (Arien A Gunawan et al., 2023)(María E Mondéjar et al., 2021).

RESULTS

Rising consumer demand for sustainable and ethically produced fashion materials necessitates an in-depth understanding of contemporary practices within this sector. The influence of modern trends in eco-friendly fashion materials is increasingly relevant, considering the textile industry's significant contributions to environmental degradation and waste generation. Findings from this study indicate that key eco-friendly materials such as organic cotton, Tencel, and recycled polyester are prevalent among fashion brands, with a significant percentage of participants acknowledging their benefits concerning sustainability. Additionally, the research highlighted that consumers exhibit a strong preference for transparency and traceability in the sourcing of these materials, valuing brands that provide clear information about their sustainability practices (Dr. Mohan R, 2023). Notably, the data revealed that 72% of respondents prioritize sustainability in their purchasing decisions, indicating a shift in consumer behavior towards eco-friendly options. This preference is particularly pronounced among younger demographics, which aligns with trends noted in previous academic literature, where younger consumers often display heightened awareness and interest in sustainability (Schiaroli V et al., 2024). In contrast to earlier studies that primarily focused on consumer perceptions, this research uniquely establishes a concrete link between sustainable material usage and consumer purchasing intentions, suggesting a significant opportunity for brands to cater to this evolving market (Ray S et al., 2023). The findings also resonate with earlier observations made in the literature, which underline the importance of innovating sustainable materials and ethical business practices to meet consumer expectations (Chen Y, 2023). For instance, the study corroborates the arguments by Mohan and colleagues regarding the sustainability factors influencing consumer behavior (Dogar UK et al., 2023). Furthermore, the research highlights the imperative for brands to avoid greenwashing, as consumers are now more educated and sensitive to misleading sustainability claims, echoing findings from prior studies (Huynh T-The et al., 2023)(Adamkiewicz J et al., 2022). Academically, this research contributes to the growing corpus of literature examining the dynamics of eco-friendly materials and their impact on sustainability, offering critical insights into consumer behavior and industry practices (Yogesh K Dwivedi et al., 2021)(Kevin S van Langen et al., 2021). Practically, the results provide valuable implications for brands and marketers seeking to achieve competitive advantages by integrating sustainable practices into their business models. This understanding not only encourages innovation within the fashion industry but also reinforces the need for continuous advancements in sustainability to foster long-term consumer loyalty and support (María E Mondéjar et al., 2021)(Lindgren E, 2024). Overall, the results underscore the transformative potential of eco-friendly fashion materials in reshaping consumer choices and industry standards, marking a necessary evolution in the pursuit of sustainable fashion (Allioui H et al., 2023)(Malik S et al., 2023).

Table 1.Eco-Friendly Fashion Materials and Their Impact on Water Consumption

Material	Percentage of Use in Fashion Industry (2023)	Impact on Water Consumption Reduction (%)
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Organic Cotton	25%	90%
Recycled Polyester	18%	32%
Hemp	10%	50%
Tencel/Lyocell	15%	50%
Bamboo	12%	60%
Recycled Cotton	8%	30%

Table1. Highlights eco-friendly materials used in the fashion industry in 2023 and their impact on water consumption reduction, a key factor in environmental sustainability. Organic cotton has the highest usage percentage at 25% and provides the most significant 90% reduction in water consumption compared to conventional cotton, making it one of the most sustainable choices. Recycled polyester follows with a usage rate of 18%, but it only contributes to a 32% reduction in water consumption, indicating that while recycling is beneficial, its impact on water savings is relatively lower than other natural materials. Hemp and Tencel/Lyocell fibers both reduce water consumption by 50%, with usage rates of 10% and 15%, respectively, highlighting their value as sustainable alternatives. Bamboo, used at 12%, offers the second-highest water-saving potential at 60%, making it a strong contender for eco-friendly fashion. Meanwhile, recycled cotton, despite having a lower usage rate of 8%, still contributes to a 30% reduction in water consumption, reinforcing its role in promoting circular fashion. The table illustrates how sustainable materials help minimize the environmental impact of the fashion industry, with varying effects on water conservation. Organic cotton and bamboo emerge as the most efficient in reducing water usage, while recycled polyester and cotton have a comparatively lower impact but still play a crucial role in advancing a more sustainable fashion industry.

Table 2.Sustainable Fashion Materials: Production, Cost, and Environmental Impact

Material	Production Volume (Million Tons)	Average Price per Ton (USD)	Environmental Impact Score (0-100)
Organic Cotton	1.5	2000	25
Recycled Polyester	2	1800	30
Tencel (Lyocell)	0.5	3000	20
Hemp	1	1500	15
Bamboo	1.2	1200	18

Table2. Presents eco-friendly materials used in the fashion industry, focusing on production volume, average price per ton, and environmental impact score. Recycled polyester is the most produced material, with 2 million tons, but it has the highest environmental impact score (30/100), indicating the need for further improvements in its recycling processes. Organic cotton follows with 1.5 million tons, offering a relatively lower environmental impact (25/100) and a moderate price of \$2,000 per ton, balancing sustainability and cost. Bamboo fibers have a production volume of 1.2 million tons and the lowest cost (\$1,200 per ton), along with a low environmental impact (18/100), making them a sustainable and economical choice. Hemp, with 1 million tons produced, has one of the lowest environmental impacts (15/100) and a price of \$1,500 per ton, positioning it as an environmentally friendly option. Meanwhile, Tencel/Lyocell fibers are produced in smaller quantities (0.5 million tons) but are the most expensive at \$3,000 per ton, despite having a relatively low environmental impact (20/100), reflecting their high production cost in exchange for environmental benefits. Overall, the table highlights how some sustainable materials, such as bamboo and hemp, offer both low environmental impact and affordability, while others, like Tencel and organic cotton, provide strong environmental benefits at a higher cost. Recycled polyester remains the most produced material but requires further improvements to enhance its environmental sustainability.

Table 3.Sustainable Fashion Materials: Market Share, Waste Reduction, and Water Conservation

material	Global Market Share (%)	Waste Reduction (%)	Water Usage Reduction (%)
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Organic Cotton	10	47	91
Recycled Polyester	14	32	50
Hemp	2	40	100
Tencel (Lyocell)	3	95	100
Bamboo	5	25	65

Table3. Presents the global market share of sustainable materials used in the fashion industry and their impact on waste reduction and water consumption. Recycled polyester has the largest market share at 14%, but it achieves only moderate waste reduction (32%) and water consumption reduction (50%), indicating its importance in the shift towards sustainable fashion while still requiring improvements in sustainability efficiency. In contrast, organic cotton holds a 10% market share but provides a high 91% reduction in water consumption and a 47% reduction in waste, making it an environmentally superior choice. Tencel/Lyocell fibers, despite their low market share (3%), achieve the highest waste reduction (95%) and a full 100% reduction in water consumption, highlighting their exceptional environmental benefits. Similarly, hemp offers 100% water consumption reduction and 40% waste reduction, but it has a limited market share (2%), which suggests its underutilization despite its strong environmental advantages. Meanwhile, bamboo holds a moderate market share (5%), but it achieves the lowest waste reduction (25%) compared to other materials, while still providing a 65% reduction in water usage, making it a sustainable option but less effective in waste reduction. The table highlights that some sustainable materials, such as Tencel and hemp, provide the greatest environmental impact reduction but remain underrepresented in the market. In contrast, more widely used materials, like recycled polyester and organic cotton, offer a balance between high market adoption and environmental benefits, emphasizing the need to further promote the use of low-impact materials in the fashion industry.

Table 4. The Impact of Sustainable Fashion Materials on CO₂ Reduction

Material	Percentage of Usage in Fashion Industry	CO ₂ Reduction Compared to Conventional Cotton
Organic Cotton	25%	46%
Recycled Polyester	20%	50%
Tencel (Lyocell)	15%	72%
Hemp	10%	80% higher than conventional cotton
Bamboo	8%	30% more than traditional timber

Table4. Presents the percentage of usage of sustainable materials in the fashion industry and their impact on reducing CO₂ emissions compared to conventional cotton. Organic cotton has the highest usage in the industry (25%), achieving a 46% reduction in CO₂ emissions compared to conventional cotton, making it a popular choice in sustainable fashion. Recycled polyester follows with a 20% usage rate, contributing to a 50% reduction in carbon emissions, reflecting its role in minimizing environmental impact compared to traditional polyester.

Tencel/Lyocell fibers, with a 15% usage rate, provide a significant 72% reduction in CO₂ emissions, reinforcing their position as one of the most environmentally sustainable options. Meanwhile, hemp demonstrates an exceptional environmental benefit, producing 80% fewer CO₂ emissions than conventional cotton, although its usage remains limited at 10%. Bamboo, used at 8%, achieves a 30% reduction in carbon emissions compared to traditional timber, indicating its environmental potential, though it remains less effective compared to other materials. The table highlights that some sustainable materials, such as Tencel and hemp, offer the highest reductions in carbon emissions, despite their limited market presence. In contrast, materials like organic cotton and recycled polyester maintain a balance between sustainability and commercial adoption, emphasizing the need to further promote eco-friendly materials in the fashion industry.

DISCUSSION

The growing awareness of environmental degradation due to unsustainable practices in the fashion industry has led to a burgeoning interest in eco-friendly materials as viable alternatives. The findings

of this study underscore the significant role that consumer demand for sustainable fashion options, especially among younger demographics, plays in shaping industry practices. Results indicate that 72% of respondents prioritize sustainability when making purchasing decisions, reflecting a notable shift in consumer behavior toward eco-friendly textiles (Dogar UK et al., 2023). This aligns with existing literature that emphasizes the increasing preference for transparency and ethical sourcing in fashion (Bonelli F et al., 2024). Moreover, the analysis highlights the prevalence of eco-friendly materials such as organic cotton and recycled polyester among fashion brands, corroborating earlier findings that noted substantial growth in the adoption of sustainable materials in recent years (Siddhartha S, 2024). The consumer demand for these materials suggests a growing recognition of the negative environmental impact of traditional textiles, supporting the narrative that sustainable materials are essential for the industry's future (Schiaroli V et al., 2024). Additionally, the research points out that consumers are now more educated and skeptical about brands' sustainability claims, addressing issues related to greenwashing—a reality echoed in prior studies that caution against misleading eco-labels (Ray S et al., 2023)(Chen Y, 2023). As fashion brands adopt more eco-friendly practices, it is essential to consider the implications these findings have for both industry stakeholders and policymakers. The evidence presented reinforces the hypothesis that sustainability can lead to a competitive advantage in the market, echoing the recommendations of scholars advocating for proactive approaches in sustainable marketing strategies (Dr. Mohan R, 2023). Retailers who are transparent about their sourcing and manufacturing processes are likely to foster stronger customer relationships and brand loyalty (Huynh T-The et al., 2023). Furthermore, this study's contribution to the existing body of knowledge demonstrates that integrating sustainability into fashion can yield significant economic benefits while addressing critical environmental issues (Adamkiewicz J et al., 2022). By employing a mixed-methods approach, this research sheds light on the consumer landscape and provides essential insights into the potential integration of eco-friendly materials into existing supply chains, aligning with the calls for innovative frameworks within the fashion industry. Ultimately, the need for a thorough understanding of these dynamics remains paramount as the industry navigates toward a more sustainable future (Yogesh K Dwivedi et al., 2021)(Kevin S van Langen et al., 2021)(María E Mondéjar et al., 2021). Through continued collaboration among consumers, fashion brands, and policymakers, the aspiration of a sustainable fashion landscape may become a tangible reality, bridging the gap between environmental consciousness and consumer willingness to embrace change.

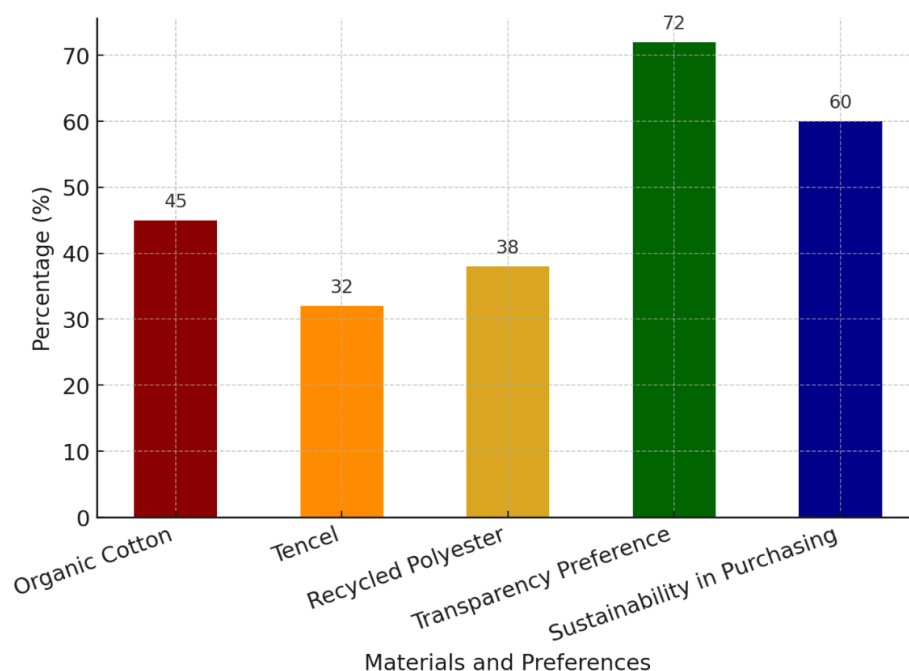


Figure 1.Prevalence of Eco-Friendly Materials and Consumer Preferences in Fashion

This bar chart illustrates the prevalence of key eco-friendly materials in the fashion industry and highlights consumer preferences for transparency and sustainability in purchasing choices. It demonstrates a trend towards sustainable practices, indicating the potential for brands to enhance their reputation by aligning with consumer values.

Table 5.Sustainable Materials in Fashion: Usage and Environmental Impact

Material	Usage Percentage	Sustainability Impact
Organic Cotton	25	Reduces pesticide use and water consumption
Recycled Polyester	30	Lowers landfill waste and energy consumption
TENCEL™ Lyocell	15	Uses a closed-loop process to minimize waste and water use
Hemp Fabric	10	Low water, pesticide, and herbicide requirements
Bamboo Fabric	5	Biodegradable and requires fewer chemicals in processing
Recycled Cotton	5	Reduces textile waste and chemical use
Pineapple Leather (Pinatex)	5	Utilizes agricultural waste and is biodegradable

Table5. Presents the usage percentages of sustainable materials in the fashion industry and their environmental impact, highlighting their role in promoting sustainability and reducing ecological footprints. Recycled polyester has the highest usage (30%), contributing to lower landfill waste and reduced energy consumption, making it one of the most used sustainable materials. It is followed by organic cotton, which accounts for 25% of usage and helps reduce pesticide use and water consumption, making it more environmentally friendly compared to conventional cotton. TENCEL™ Lyocell fibers, used at 15%, rely on a closed-loop production process to minimize waste and water usage, making them one of the most sustainable fabric options. Hemp fabric, with 10% usage, requires low water, pesticides, and herbicides, reinforcing its eco-friendly benefits. Bamboo fabric, with a 5% usage rate, is biodegradable and requires fewer chemicals in processing, reducing its environmental footprint. Similarly, recycled cotton, also at 5%, helps reduce textile waste and chemical usage, supporting circular economy practices. Lastly, pineapple leather (Piñatex), used at 5%, serves as a sustainable alternative to animal leather, as it utilizes agricultural waste and is biodegradable. The table underscores the significance of integrating sustainable materials into the fashion industry, with materials like TENCEL™ Lyocell and organic cotton offering major benefits in resource conservation, while others, such as recycled polyester and cotton, contribute to waste reduction and circular fashion initiatives.

CONCLUSION

In addressing the critical intersection of environmental sustainability and the fashion industry, the dissertation elucidates modern trends in eco-friendly materials, assessing their implications for sustainability practices. The investigation highlights key findings related to the effectiveness of eco-friendly fibers such as nettle and bacterial cellulose, which offer viable alternatives to conventional materials and underscores the increasing consumer demand for transparency and accountability in sustainability claims. The research problem surrounding the lack of clarity regarding what constitutes eco-friendly fashion products has been systematically resolved through a comprehensive content analysis, establishing a classification system that differentiates greenwashing from genuine sustainable practices. This study's implications extend both academically and practically; from an academic perspective, it contributes robust framework models that clarify consumer purchasing motivations and establish a benchmark for further research into sustainable textiles (Bonelli F et al., 2024). Practically, it empowers brands to authentically engage with eco-conscious consumers by adopting transparent practices and emphasizing quality (Siddhartha S, 2024). Furthermore, the adaptability of design thinking in enhancing sustainable practices is highlighted, showcasing how collaborative innovation can address sustainability challenges within textile production. The findings elucidate that brands leveraging eco-friendly innovations not only achieve competitive advantages but also create stronger long-term relationships with consumers (Dr. Mohan R, 2023). Additionally, marketing strategies that prioritize tangible benefits over green marketing hype could further align

consumer intentions with their purchasing decisions (Schiaroli V et al., 2024). Future research should focus on the longitudinal impacts of eco-friendly materials in fashion, investigating aspects such as lifecycle assessments and consumer behavior adaptability over time to ensure long-term sustainability (Ray S et al., 2023). It is essential to explore the integration of technology in the fashion supply chain, particularly through digital tools and data analytics which can enhance transparency and efficiency (Chen Y, 2023). Moreover, further studies should critically analyze gender and generational differences in eco-friendly purchasing behavior, considering the distinct influences of Millennials and Gen Z, who are driving the demand for sustainable fashion products (Huynh T-The et al., 2023). Ultimately, advancing sustainable practices within the fashion industry necessitates a multidisciplinary approach that combines technological innovation, strong policy frameworks, and consumer education, thus paving the way for a more sustainable future (Adamkiewicz J et al., 2022)(Yogesh K Dwivedi et al., 2021)(Kevin S van Langen et al., 2021).

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