

Review Article

Environmental Impact Assessments of Fashion Industry Practices: A Comprehensive Review

Arham Khan

Student, Jamia Millia Islamia, New Delhi, India

I N F O

E-mail Id:

arhamkhan@gmail.com

Orcid Id:

<https://orcid.org/0009-0003-8791-7670>

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A B S T R A C T

The fashion industry is one of the largest global industries, contributing significantly to environmental degradation through resource consumption, waste generation, and pollution. As the industry faces increasing pressure to adopt sustainable practices, understanding the environmental impacts of fashion practices is critical. This review article provides a comprehensive overview of environmental impact assessments (EIAs) within the fashion industry. It explores the key environmental concerns associated with fashion production and consumption, including water usage, chemical pollution, waste generation, and carbon emissions. Additionally, the article examines the role of EIAs in promoting sustainability and improving practices across the supply chain. Finally, the review highlights the challenges and opportunities in using environmental impact assessments to drive positive change in the industry.

Keywords: Fashion industry, Environmental degradation, Sustainability, Environmental Impact Assessments (EIAs), Water consumption, Water pollution, Carbon emissions, Energy consumption

Introduction

The fashion industry, while a major economic driver, is also one of the largest contributors to environmental degradation. The industry's resource-intensive practices, including the use of raw materials, energy consumption, and the pollution of air and water, have raised serious concerns about its sustainability. According to the Ellen MacArthur Foundation, the fashion industry is responsible for approximately 10% of global carbon emissions and is a major contributor to water pollution, excessive waste, and microplastic contamination. Furthermore, textile production, consumption, and disposal create substantial amounts of waste, with millions of tons of clothing ending up in landfills each year.¹

In response to these growing environmental concerns, the adoption of Environmental Impact Assessments (EIAs) has become an essential tool in evaluating the environmental consequences of fashion industry practices. EIAs provide

a comprehensive analysis of the environmental effects of fashion production processes, from raw material extraction and manufacturing to garment disposal. These assessments help identify key areas of concern, such as water usage, carbon emissions, chemical pollution, and waste generation, while offering strategies to minimize negative impacts.

This article aims to review the current state of EIAs in the fashion sector, assessing their role in mitigating environmental harm and promoting more sustainable practices. The review explores how EIAs can drive positive change by offering actionable insights for fashion companies, policymakers, and consumers, ultimately fostering a more sustainable fashion industry. By examining key environmental issues within the sector, the article also discusses how EIAs contribute to promoting resource efficiency, eco-friendly technologies, and sustainable production methods, all of which are vital to the industry's future.²

Environmental Impacts of Fashion Industry Practices

Fashion production involves multiple stages, each of which contributes to significant environmental impacts. These stages range from raw material extraction to garment production, transportation, and eventual disposal. A comprehensive Environmental Impact Assessment (EIA) evaluates these impacts to identify areas for improvement and mitigate environmental harm. Below are key areas where fashion production processes result in environmental damage:

Water Consumption and Pollution

Water is a crucial resource in the fashion industry, particularly in the production of cotton and the dyeing process. The global demand for water in textile production is staggering, with some studies suggesting that the industry uses around 93 billion cubic meters of water annually. The dyeing process, in particular, is a significant contributor to water pollution due to the high volume of toxic chemicals released into rivers and waterways.

The textile industry consumes vast amounts of water, with cotton farming being particularly resource-intensive. Conventional cotton farming alone can use up to 10,000 liters of water per kilogram of cotton. Moreover, dyeing processes utilize toxic chemicals like azo dyes, heavy metals, and formaldehyde, which, when improperly managed, can leak into water systems, contaminating local ecosystems and endangering communities.

Environmental Impact Assessments (EIAs) focus on evaluating water use efficiency, the impact of textile production on water sources, and the risks associated with wastewater discharge. These assessments can identify opportunities to reduce water consumption and promote eco-friendly alternatives. For instance, sustainable alternatives like closed-loop water systems, waterless dyeing technologies, and the use of organic cotton can significantly reduce water consumption and pollution. Additionally, advancements such as dyeing with plant-based dyes or adopting digital printing techniques can further decrease water usage and chemical runoff.³

Carbon Emissions and Energy Consumption

The fashion industry is a major source of carbon emissions, contributing significantly to global climate change. From the production of synthetic fibers (like polyester) to the transportation of garments across the globe, the fashion supply chain is carbon-intensive. The manufacturing process of garments also requires significant amounts of energy, much of which comes from fossil fuels. Additionally, the transportation of goods via air and sea adds to the carbon footprint.

The fashion industry is responsible for around 10% of global carbon emissions, with most emissions resulting from energy-intensive processes such as fiber production (e.g., polyester), dyeing, finishing, and transportation. Synthetic fibers, which are derived from petroleum, require large amounts of energy and contribute to the industry's high carbon footprint.

EIAs in fashion focus on identifying carbon hotspots across the value chain, from raw material extraction to garment transport, and develop strategies to reduce emissions. Strategies to mitigate these emissions include adopting renewable energy sources in factories, optimizing transportation logistics to reduce carbon footprint, and shifting to low-carbon materials such as plant-based fibers (e.g., hemp, organic cotton, and Tencel). Moreover, the use of energy-efficient technologies and carbon offsetting practices can help reduce the fashion industry's overall carbon footprint. Brands can also focus on producing durable, long-lasting products, thereby reducing the need for frequent garment replacement and minimizing carbon emissions over the product lifecycle.⁴

Waste Generation and Textile Disposal

The rise of fast fashion has exacerbated the global textile waste crisis, with millions of tons of clothing discarded every year. Overproduction and overconsumption of garments contribute significantly to this issue. The rapid turnover of clothing, combined with unsustainable purchasing habits, has led to increased waste. In many cases, garments are made from non-recyclable blends of materials, rendering them impossible to recycle once discarded.

An estimated 92 million tons of textile waste are generated annually, with approximately 85% of discarded clothing ending up in landfills or being incinerated. This waste contributes to landfills overflowing and incineration processes that release harmful toxins into the air.⁵

EIAs in fashion assess opportunities for reducing waste generation and improving waste management strategies. By evaluating waste streams and implementing circular economy principles, EIAs can help reduce the reliance on landfills. This includes promoting garment reuse, recycling, and upcycling initiatives. For instance, brands can explore take-back schemes where consumers return used garments for recycling or repurposing. Additionally, increasing the use of biodegradable fibers and avoiding toxic dyes can help ensure garments break down more easily at the end of their lifecycle.

Chemical Pollution

Textile production relies heavily on chemicals, including dyes, solvents, finishing agents, and synthetic fibers. Many of these chemicals are harmful to both human health and

the environment. Hazardous chemicals, such as azo dyes, formaldehyde, and heavy metals, can leach into water systems during the production process, polluting rivers and ecosystems. Moreover, the release of these chemicals has been linked to health issues for factory workers and consumers alike.⁶

The use of chemicals in the fashion industry also extends to synthetic fibers, such as polyester, which are made using toxic petrochemicals. These fibers release microplastics when washed, contributing to oceanic plastic pollution.

EIAs assess the use and disposal of hazardous chemicals throughout the fashion supply chain. They focus on identifying harmful substances in production processes and offering alternatives that are safer for workers, consumers, and the environment. For example, replacing harmful dyes with natural dyes, using non-toxic finishing treatments, and moving towards organic and biodegradable materials can significantly reduce chemical pollution. Furthermore, adopting green chemistry principles and stricter chemical management policies can help improve sustainability in textile production.

Environmental Impact Assessments (EIAs) play a critical role in understanding and mitigating the environmental consequences of fashion industry practices. By addressing key environmental issues—such as water consumption and pollution, carbon emissions, textile waste, and chemical contamination—EIAs can provide valuable insights into the environmental performance of fashion brands and the fashion supply chain as a whole. The information gathered through these assessments can help fashion companies implement more sustainable practices, reduce their environmental footprint, and transition toward a more sustainable future. Moving forward, the widespread integration of EIAs in the fashion industry can drive systemic changes that promote environmental responsibility and ensure the longevity of the planet's resources for future generations.

The Role of Environmental Impact Assessments in Promoting Sustainability

Environmental Impact Assessments (EIAs) serve as essential tools for identifying the environmental risks associated with fashion production and consumption. Through thorough evaluation and data-driven analysis, EIAs allow fashion companies, policymakers, and consumers to gain a deeper understanding of the ecological consequences of industry practices. They also guide decision-making aimed at minimizing harm to the environment. EIAs are critical in advancing sustainability by offering insight into areas where improvements can be made and facilitating the development of strategies to reduce the fashion industry's environmental footprint.

Policy and Regulatory Frameworks

Environmental impact assessments provide a robust foundation for the creation and implementation of policies and regulations that support sustainability within the fashion industry. Governments and international organizations can leverage EIA findings to establish regulatory frameworks focused on sustainable resource usage, emissions standards, and waste management practices. For instance, EIA data can help policymakers create laws that regulate water usage in textile production, set limits on carbon emissions from garment manufacturing, and mandate sustainable waste disposal practices.

Governments can also use EIAs to establish eco-labels and certification systems, such as the Global Organic Textile Standard (GOTS) and OEKO-TEX Standard 100, which incentivize sustainable practices and promote transparency in the fashion industry. These labels allow consumers to make informed purchasing decisions based on a brand's environmental performance. As a result, companies are increasingly motivated to comply with these regulations and align their operations with sustainability goals to earn eco-certifications.

Corporate Social Responsibility (CSR)

Environmental impact assessments enable fashion brands to integrate sustainability metrics into their corporate social responsibility (CSR) strategies. By conducting EIAs, companies can evaluate their environmental footprint and assess the environmental risks associated with their production processes. With this knowledge, brands can set measurable sustainability targets, track progress, and identify opportunities for improvement.

For fashion companies, transparency in environmental impact is becoming a significant differentiator in the market. Consumers are increasingly seeking out eco-conscious brands, and those that engage in comprehensive sustainability practices often enjoy enhanced brand loyalty and recognition. By prioritizing sustainability through the use of EIAs, fashion brands not only fulfill their CSR obligations but also tap into a growing consumer base that values environmental stewardship. These practices can help companies gain a competitive edge, especially as sustainability becomes a key factor in purchasing decisions.

Challenges in Implementing Environmental Impact Assessments in Fashion

While EIAs provide a crucial framework for promoting sustainability in fashion, their effective implementation within the industry faces several challenges. Overcoming these barriers is necessary for the widespread adoption of sustainable practices and the integration of environmental assessments into the core of fashion industry operations.

Data Availability and Transparency

A major challenge in implementing EIAs within the fashion industry is the availability and transparency of data. Fashion companies, especially those with complex, global supply chains, often face difficulties in gathering reliable data regarding their suppliers' environmental practices. The lack of transparency in the supply chain, particularly regarding the environmental impact of raw material sourcing and labor practices, hinders the ability to conduct comprehensive EIAs.

For example, while large brands may collect data from direct suppliers, there may be limited insight into the operations of lower-tier suppliers, subcontractors, and manufacturers further down the supply chain. This lack of data makes it difficult to evaluate the full environmental impact of fashion production, as many crucial stages (e.g., raw material extraction, dyeing processes, and waste management) may not be properly documented or assessed. As a result, without transparent reporting and standardized data, EIAs may fail to provide an accurate picture of the industry's environmental consequences.

Cost and Resource Constraints

For many smaller fashion brands, conducting comprehensive EIAs can be cost-prohibitive. The process of gathering environmental data, performing detailed assessments, and implementing the required sustainable practices can require significant resources—financial, technical, and human capital. Smaller companies, which often lack the necessary budget or infrastructure, may find it challenging to adopt EIAs as part of their operations.

In addition, the cost of incorporating sustainability into business operations—whether through research and development of more sustainable materials, energy-efficient technologies, or waste reduction measures—can be a major hurdle for brands already operating on thin profit margins. These financial barriers can prevent smaller or independent fashion companies from conducting in-depth environmental assessments or pursuing long-term sustainability goals.

Complexity of the Supply Chain

The global and intricate supply chains inherent in the fashion industry present significant challenges for environmental impact assessments. Fashion production often involves multiple subcontractors, suppliers, and manufacturers across different regions, each with varying environmental standards and practices. This complexity makes it difficult to conduct comprehensive assessments, as the environmental impact of a garment can be affected by multiple factors and stages within the production process.

For instance, a single garment may pass through various

production stages in different countries: raw materials might be sourced from one country, textiles manufactured in another, and final garment production completed in a third. Each stage may involve different materials, energy usage, waste disposal practices, and transportation methods, complicating efforts to assess and mitigate environmental harm. Tracking environmental impacts across this vast and fragmented supply chain is a logistical challenge, and without standardized measurement tools or industry-wide cooperation, obtaining accurate and consistent data becomes increasingly difficult.

Lack of Standardization and Methodological Challenges

Another challenge in implementing EIAs in fashion is the lack of standardized methodologies for conducting environmental assessments. Unlike other industries, where impact assessments are more widely regulated, the fashion industry lacks uniform guidelines or frameworks for assessing environmental impacts across the supply chain. Without universally accepted standards for conducting EIAs, companies may implement different methods of measurement, leading to inconsistent results and making it difficult to compare the environmental performance of different brands.

Additionally, environmental impacts are multifaceted, and some may be challenging to quantify. For example, the contribution of microplastics from synthetic fibers or the long-term effects of chemicals in garment production may be difficult to measure in traditional EIAs. These gaps in methodology complicate efforts to fully understand and address the industry's environmental footprint.

Environmental impact assessments play an essential role in promoting sustainability within the fashion industry by identifying the environmental risks associated with production and consumption practices. Through data-driven analysis, EIAs help fashion brands, policymakers, and consumers make informed decisions that contribute to reducing the environmental footprint of the industry. However, challenges such as data availability, cost constraints, supply chain complexity, and a lack of standardization must be addressed to fully integrate EIAs into the industry's practices.

By overcoming these obstacles and promoting transparency and collaboration within the supply chain, the fashion industry can use environmental impact assessments to drive meaningful change. Governments, corporations, and consumers all have a role to play in fostering a more sustainable future for fashion, where environmental harm is minimized, and eco-friendly alternatives are prioritized. Through comprehensive EIAs and sustainable business strategies, the fashion industry can transition towards

a circular and low-impact economy, benefiting both the planet and the people who rely on it.

Opportunities for Improvement

Despite the challenges that hinder the widespread adoption and implementation of environmental impact assessments (EIAs) in the fashion industry, there are several promising opportunities for improvement. Addressing these opportunities will be critical for driving positive environmental change and enhancing the sustainability of fashion practices across the supply chain. By embracing technological innovations, fostering collaborations, and improving industry standards, the fashion sector can make significant strides in reducing its ecological footprint.

Digitalization and Technological Innovations

Advancements in digital technology, such as blockchain, artificial intelligence (AI), and Internet of Things (IoT), have the potential to greatly improve the accuracy and efficiency of environmental impact assessments in the fashion industry. These technologies can help overcome some of the data-related challenges by providing more transparency, traceability, and real-time monitoring across the supply chain.

- **Blockchain** can enhance transparency by providing a decentralized ledger where every step in the supply chain—from raw material sourcing to manufacturing and distribution—is recorded and made accessible. This technology can ensure the traceability of products, enabling consumers and companies to better understand the environmental impact of the items they purchase or produce.
- **Artificial intelligence (AI)** and machine learning can support fashion brands in analyzing vast amounts of data related to environmental impacts, such as energy consumption, water usage, and carbon emissions. By leveraging AI-driven predictive models, fashion companies can forecast the outcomes of different production processes, optimize resources, and develop more sustainable practices.
- **Internet of Things (IoT)** sensors can monitor real-time environmental data from factories, distribution centers, and transportation networks. These sensors can track energy use, waste production, and carbon emissions, providing brands with up-to-date information that can be used for more effective and informed EIAs.

Together, these technologies can streamline the EIA process, making it more accessible, efficient, and actionable for fashion companies of all sizes. They can also enable more accurate and consistent data collection, which is crucial for making informed decisions about sustainability and reducing the environmental impact of fashion production.

Collaboration Across Stakeholders

Collaboration between various stakeholders in the fashion industry, including brands, suppliers, governments, non-governmental organizations (NGOs), and academic institutions, can significantly improve the effectiveness of environmental impact assessments. Such collaboration can lead to the sharing of resources, data, best practices, and innovative solutions to mitigate environmental harm.

- **Brand-Supplier Partnerships:** Fashion brands can work closely with their suppliers to improve sustainability across the supply chain. By sharing information about resource usage, emissions, and waste management, both brands and suppliers can better understand each other's environmental impacts and identify opportunities for improvement. Joint efforts could lead to better sourcing of sustainable materials, more efficient manufacturing processes, and the implementation of greener technologies in production facilities.
- **NGOs and Academia:** Collaborating with NGOs and academic institutions can help bridge knowledge gaps and drive innovation in the fashion industry. Academic research can provide valuable insights into new sustainable materials, production techniques, and waste management solutions. NGOs, particularly those focused on environmental conservation, can offer expertise in sustainable practices and help guide brands in achieving their environmental goals.
- **Government and Policy:** Governments and regulatory bodies can play a significant role in fostering collaboration. By incentivizing sustainable practices through tax credits, subsidies, or eco-certifications, governments can encourage companies to integrate sustainability into their operations. Additionally, government involvement can help establish regulations and standards that promote transparency and accountability in the industry, further enhancing the EIA process.

Collaborative efforts can amplify the impact of environmental assessments and ensure that sustainability initiatives are more effectively implemented across the fashion industry. These partnerships can also foster innovation, improve data-sharing practices, and lead to the creation of new business models focused on sustainability.

Conclusion

Environmental impact assessments (EIAs) are vital tools for addressing the environmental challenges faced by the fashion industry. By evaluating the environmental consequences of fashion practices, EIAs provide actionable insights that can guide companies in making more sustainable decisions and help policymakers shape effective regulations.

However, to fully realize the potential of EIAs, the fashion industry must overcome several challenges, including the complexity of supply chains, lack of transparency, and resource constraints.

Fortunately, there are substantial opportunities for improvement. Technological innovations, such as blockchain, AI, and IoT, offer promising solutions to enhance data collection, traceability, and real-time monitoring. By integrating these technologies, fashion brands can improve the accuracy and efficiency of their EIAs and drive more sustainable practices. Furthermore, fostering collaboration between brands, suppliers, governments, NGOs, and academic institutions can create a more unified approach to sustainability, leading to more effective environmental impact assessments and actions across the industry.

Through continued commitment to sustainability, leveraging digital tools, and embracing cross-sector partnerships, the fashion industry can reduce its environmental footprint, promote circularity, and ultimately transition toward a more sustainable future. With concerted efforts, EIAs will play a crucial role in driving positive environmental change, ensuring that the fashion industry becomes a force for good in addressing global sustainability challenges.

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