TRENDS AND GAPS IN SUSTAINABLE FASHION RESEARCH: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

This research consists of a bibliometric analysis on sustainable and fast fashion that were published between 2007 and March 2025. With 764 articles taken from the Web of Science the analysis contains co-citation, co-occurrence, and clustering techniques to map thematic trends. There is an intense growth in research after 2015 and even further intensification post-2020 in alignment with the rising consumer awareness and policy initiatives. The results demonstrate that sustainability is an interdisciplinary field spanning environmental sciences, business, consumer studies, and textile engineering. Fiber recycling, bio-based fabrics, and low-impact dyeing are emerging themes, while gaps remain in communication, ethics, and cultural dimensions.

KEYWORDS

Bibliometric Analysis, Circular Economy, Fast Fashion, Sustainable Fashion, Textile Innovation.

INTRODUCTION

The fashion industry ranks as the second most polluting industry after oil extraction and production industries [1]. Previous research mainly emphasized the negative environmental impacts of the textile industry; including excess water consumption and pollution [2], greenhouse gas emissions from fossil fuel processing [3], and the use of hazardous chemicals [4]. Ten percent of the global annual carbon emission comes from the fashion industry which is equivalent to the emissions caused by international flights and maritime Furthermore, the emission of the textile industry is expected to increase more than 50 percent by 2030 [5]. Fast fashion which mainly relies on supplying affordable versions of high fashion products without the extremely high price tag [6] has proven to be an effective strategy within the textile industry [7], and it relies on a linear business model characterized by a cycle of production, use, and disposal [8,9,7]. Fast fashion is characterised with its short lead time, mass production and low stock turnover ratio with new product deliveries around every two weeks. This extreme speed in the management of the supply chain is the main driver of success in the fashion industry [6]. The rise of fast fashion has significantly accelerated speed-to-market beginning from the 1990s [10] and garment production has almost increased by 200 percent in the last 15 years [11]. The industry's evolution towards fast fashion brings

negative transition trends that are not sustainable [12,13].

In his book "Cannibals with Forks" Elkington introduced the triple bottom (TBL) philosophy of three pillars [14] economic prosperity, environmental quality and social justice mainly stated as. people, planet and profit. "People" refers to individuals and their interactions with society. "Planet" is related to the environment that companies operate in and "Profit" represents the economical value that is generated within society [15]. Increasing awareness about environmental and social sustainability challenges has brought many developments to the industry to make fashion sustainable as well as ethical [16,17]. Despite the fact that the economic contributions of the textile industry are major, it also has unique challenges to both environmental and social aspects of sustainability. The industry's numerous negative societal effects are mentioned by scholars such as inadequate working conditions [18], problems regarding health and safety [19], abuse of human rights such as child labour and modern slavery [20,21]. A dramatic example that reveals poor working conditions is the Rana Plaza Bangladesh incident in 2013 in which 1136 people that worked for the industry lost their lives. This incident raised awareness of poor working conditions consumer's attention to the sustainable social practices in the fast fashion industry [23]. The

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negative environmental impacts of this industry are listed by scholars as inordinate water use, wastewater and water pollution [2,19,23,5] and plastic pollution [24,25,26]. As an example of the industry's excess usage of water; one t-shirt production necessitates 2700 L of water to produce. Additionally, in 2015 the industry of fashion utilised 79 billion cubic water. A fifth of the global water pollution comes from textile dyeing and finishing while 0.5 million tonnes of microplastics are added to oceans each year due to washing of clothes made of synthetic fibres.

Ten percent of the global greenhouse gas emissions is caused by the industry, and it requires attention to be brought on air pollution [5,27]. Garments are perceived as short-lived in accordance with the nature of the fast fashion industry and increasing overconsumption [28]. Fast fashion causes excessive amounts of waste, waste-related emissions and toxicity [29,30]. The sustainability of fashion has been gaining further recognition in research and ecofashion, ethical fashion, slow fashion, and sustainable fashion are some of the main concepts that challenge the fast fashion paradigm. These concepts place sustainability as their strategy and aim to create a middle ground for economic and social development as well as the preservation of the environment [31].

Sustainable fashion has the goal to slow production, environmental destruction, ameliorate working conditions, move to a new business model that is circular and/or collaborative and foster the utilisation of organic resources with minimal environmental effects [32,33,34]. An increasing number of studies show that, despite the higher costs, consumers are getting more interested in sustainable fashion products [35.36.37]. The main reason that consumers' tend to lean towards sustainable fashion products is due to environmental concerns [35]. The increased awareness forced fast fashion brands to develop strategies focusing on sustainability all through the supply chain. H&M is a pioneer company in the industry and it claimed that all its products will be renewable or sustainable by 2030 in its conscious collection and in the company statement in 2022 the company declared that "...improving sustainability performance in our own value chain demonstrating the resilience sustainable business.." [38].

This research looks into the main research trends between 2007 and 2025 and maps their thematic evolution with analysis with the aim of providing a holistic picture of fast fashion and sustainability. A bibliometric analysis is employed based on a systematic literature review to create maps of existing knowledge. This paper pursues three main objectives. First, it seeks to integrate existing research on fast fashion and sustainability in the fashion industry from 2007 to 2025. Second, it aims to provide a detailed analysis of the broader research landscape surrounding these topics. Finally, it offers

a comprehensive knowledge map that captures the complex realities of fast fashion and its connection to The next section presents the sustainability. methodology, outlining the intricacies of data collection and processing. Section three highlights the research findings, delivering an in-depth analysis of active journals, collaborations between countries and institutions, document co-citation patterns, keyword co-occurrence, and the emerging clusters within the dataset. Section four introduces the knowledge map developed through this study, alongside a critical discussion grounded in bibliometric analysis. The final section concludes the paper and points toward potential directions for future research.

METHODOLOGY

Data Source and Search Strategy

Bibliometric analysis is a qualitative method in which the information visualization analysis tool is used to review research development trends with the utilization of physical units such as publications and bibliographic citations. By using this method the collection of literature is more efficient and the interrelationships between chosen publications within the options can be established. The key source of data used in this bibliometric research analysis is the Web of Science (WoS) database that was published by Thomson Reuters [39]. Compared to other databases like PubMed, Scopus, and Google Scholar, it is considered the most reliable database for studying literature in multidisciplinary fields [40]. This is the reason why WoS was chosen as the data source in the bibliometric analysis. Furthermore, subfield databases Science Citation Index Expanded (SCI-EXPANDED) and Social Sciences Citation Index (SSCI), Conference Proceedings Citation Index—Science (CPCI-S), and Conference Proceedings Citation Index— Social Science Humanities (CPCI-SSH) were utilised as data providers. For the first stage, the researcher identified the key terms of the research, searching the highly cited publications focusing on the relation between sustainability and fast fashion. The search terms included the title, abstract, and keywords: TS= (("sustainability*" AND "fast*fashion")). The analysis of the publication years span between 2007 and 2025. The first relevant article on the intersection of fast fashion and sustainability is from the year 2007. On the search conducted on the 16th of March 2025. 764 research articles were found from the WoS database. The one time search was made in order to eliminate possible bias that can arise from updates made in the database. In this period (2007-2025), researchers are starting to focus more on various aspects of research regarding textile waste and the impact of textile waste on the environment. The WoS database the task of searching for required publicati-

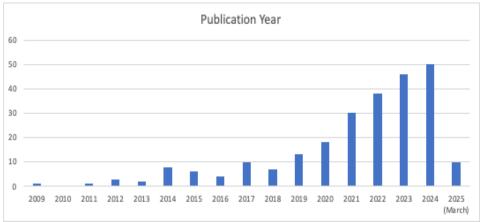


Figure 1. Distribution of academic publications between the years 2009 and 2025 (March).

-ons was done once on 16 March 2025 Furthermore the publications were solely in English. Only research articles were considered in this study therefore other document types like review papers, conference proceedings, meeting abstracts, early access articles editorial materials, data papers, and letters were not included in the analysis The trend analysis shows gradual expansion in academic interest over time with more significant progress from 2015 onwards. This increasing academic interest in the depicts environmental and social challenges that the fashion industry has. Especially recently there is a diversification in topics of research. Topics such as circular economy practices, ethical production and the utilisation of organic materials have gained. The vear-wise analysis reveals both the evolving landscape of academic inquiry in the field as well as the emerging themes and potential areas for future research.

In the Figure 1 the distribution of academic publications between the years 2009 and 2025 (March) on the theme of fast fashion and sustainability are given. The data provides important insights on how the research area has evolved over time and where academic interest has been concentrated. There is very limited research between the years 2009 and 2014 indicating that there was low interest in fast fashion's relation with sustainability. However there was an important shift in 2015. As it can be seen on the graph there was a notable increase in the quantity of publications starting from 2015, with this growth accelerating particularly after 2020. 2021, 2022 and 2023 are the years with the highest research intensity. This indicates a significant increase in scientific interest in the environmental impacts of the fashion industry, circular economy approaches, ethical production processes, and the use of organic materials. It can be argued that external factors such as increased awareness of sustainability in the post-pandemic period, changes in consumer behavior, and the increased popularity of sustainability reporting have corporate supported this trend. The data for 2025 appears relatively low as it only covers publications up to

March; however, an increase can be expected in the remaining months of the year.

Table 1 below lists the journals with the highest concentration of academic publications in the field of sustainability and fast fashion. Sustainability is the journal with the highest number of published articles (58 articles) and it is accepted as a knowledge source in this field due to its interdisciplinary structure. Journal of Cleaner Production with 17 articles is in second place with its technical studies focusing on sustainability environmental and production processes. The Journal of Fashion Marketing and Management (8 articles) and the Journal of Global Fashion Marketing (7 articles), both of which focus on fashion marketing and consumer behavior, highlight the influence of consumer trends on sustainability strategies. The list is followed by Fashion Practice and Business Strategy and the Environment journals that have focused on the intersection of design processes and environmental strategies, and have studies that incorporate both cultural and managerial perspectives. This distribution reveals that research sustainable fashion has taken multidimensional structure, spreading across various disciplines such as engineering, business strategy, design, and consumer behavior. Furthermore, various research showcases the role of textiles and materials, especially in areas like fiber recycling, lowimpact dyeing, and the development of bio-based fabrics. The fashion industry's sustainable innovation is driven by important drivers that are material science and textile engineering. The below Table 2 displays the top ten most cited academic publications on fast fashion and sustainability. The article 'Fast Fashion, Sustainability, and the Ethical Appeal of Luxury Brands', leads the list which has received 465 citations. This shows that there is a high level of interest in ethical consumerism and the sustainability strategies of luxury brands. The first five articles on the table focus on different subthemes such as consumer behaviour, circular economy and supply chain management, highlighting their central role in sustainable fashion literature Notably, studies like the 'Slow Fashion Movement' and 'Sustainable Fashion

Table 1. Journals with the highest concentration of academic publications.

Journal	No of Articles
Sustainability	58
Journal of Cleaner Production	17
Journal of Fashion Marketing and Management	8
Journal of Global Fashion Marketing	7
Fashion Practice-The Journal of Design Creative Process & The Fashion Industry	6
Business Strategy and the Environment	5

Supply Chain' examine consumer perceptions alongside corporate practices. The high citations indicate that the articles have become reference points not only in academia but also in industrial policymaking. This trend reveals sustainability is being addressed as multidimensional phenomenon and is not limited to solely environmentally, but also technically, ethically, economically, and from a consumeroriented perspective. The article "Fast Fashion, Sustainability, and the Ethical Appeal of Luxury Brands" written by Joy et al. [41] stresses on the exists contradiction that between the environmental values and fast fashion habits of young consumers. Despite the fact participants have aroused interest in sustainability activities, they still engage with fast fashion due to its affordability and trends. The study revealed that eco-fashion lacks appeal and luxury fashion could link sustainability with consumer demand. The second most cited article "Sustainable

Fashion Consumption and the Fast Fashion Conundrum [42]" focuses on the contradiction between consumers' awareness of sustainability and their continued preference for fast fashion. The study shows that despite the fact that environmental concerns are acknowledged. purchasing decisions are mainly affected by affordability and trendiness. Sustainable fashion is viewed as less accessible and stylish. The gap that exists between the values and behavior of consumers shows the need for cultural and behavioural change alongside technological solutions. The third article "Death by Waste: Fashion and Textile Circular Economy Case" [43] stresses on the extreme amount and urgency of the textile waste crisis. The research shows that in the past 20 years worldwide textile production and consumption has doubled. Over 66 percent of the discarded textiles go to landfill and less than 15 percent are being recycled. The research reveals that the environmental impact of both

Table 2. Top ten most cited academic publications.

Article Title	Source Title	Times Cited
Fast Fashion, Sustainability, and the Ethical Appeal of Luxury Brands	Fashion Theory-The Journal of Dress Body & Culture	465
Sustainable fashion consumption and the fast fashion conundrum: fashionable consumers and attitudes to sustainability in clothing choice	International Journal of Consumer Studies	356
Death by waste: Fashion and textile circular economy case	Science of the Total Environment	306
Sustainable supply chain management in the fast fashion industry: An analysis of corporate reports	European Management Journal	300
Slow fashion movement: Understanding consumer perceptions An exploratory study	Journal of Retailing & Consumer Services	217
Sustainable Markets: Motivating Factors, Barriers, and Remedies for Mobilization of Slow Fashion	Journal of Macromarketing	202
Sustainable Fashion Supply Chain: Lessons from H&M	Sustainability	197
Exploring young adult consumers' sustainable clothing consumption intention-behavior gap: A Behavioral Reasoning Theory perspective	Sustainable Production & Consumption	154
Closing the loop on take, make, waste: Investigating circular economy practices in the Swedish fashion industry	S Journal of Cleaner Production	139
Governance of sustainable supply chains in the fast fashion industry	European Management Journal	132



Figure 2. Top 10 research areas of publication.

natural and synthetic fibers that include intensive water usage, chemical contamination, greenhouse gas emissions, and microplastic release require the integration of circular economy frameworks within the fashion sector.

Figure 2 below shows that the highest publication density is under the category of "Science & Technology - Other Topics; Environmental Sciences & Ecology" which mainly examines the environmental. technical. and dimensions of the textile indiustry and fast fashion. The main focus is on textile innovation and material transitions in this category and fiberto-fiber recycling, biodegradable fibers, and lowimpact dyeing technologies are some examples of this category. These demonstrate the important effects of textile engineering and material science in the formation of sustainable solutions in the fashion industry. The second place is given to "Business & Economics" with its focus on

economic impacts of fast fashion and sustainability, consumer behavior, and business models. This shows that the subject is not constrained to solely an environmental perspective but it also has economic and managerial standpoints. "Communications" and "Arts & Humanities" have less representation indicating that sustainability's sociocultural and communication parts have received less attention. The Figure 3 illustrates the VOSviewer coshowing occurrence network map, relationships among keywords in sustainable Central terms such as fashion research. "sustainability," "fashion," "consumption," and "circular economy" dominate the graph which reflects their importance in shaping the field. The clustering of keywords highlights distinct thematic connections: "fast fashion," "consumer behavior," and "overconsumption" form a critical discourse cluster on unsustainable practices, whereas

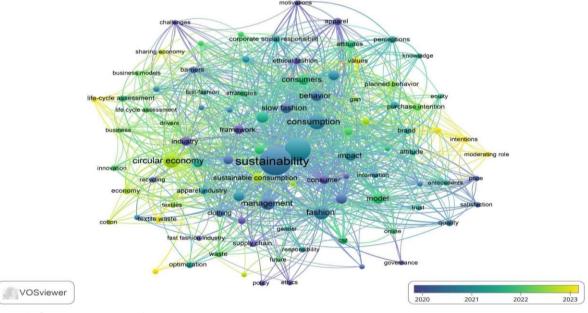


Figure 3. Co-occurrence network map.

"recycling," "innovation," and "circular design" point to technological and systemic solutions. Within these clusters, studies on technical textiles, material science, and eco-innovations are increasingly visible, emphasizing fiber-to-fiber recycling, bio-based fabrics, and low-impact dyeing methods as core areas of inquiry. The color gradient also demonstrates the temporal evolution of research. Darker nodes such as "environmental impact" and "sustainability" highlight long-standing concerns, while lighter ones like "circular economy" and "digitalization" represent recent research fronts (2022–2023).

The density of interconnections underscores the interdisciplinary character of the field, merging environmental science. consumer studies, business strategy, and textile engineering. Overall, the map shows that sustainable fashion is evolving toward a multidimensional research area where materials and textile technologies are becoming critical drivers of innovation, while also providing a tool to identify emerging trends and underexplored gaps. The second visualization is a heat map shown below in Figure 4. In the heatmap, the color gradient ranging from dark blue to bright yellow indicates the relative density of keyword occurrences, with yellow areas denoting high frequency and central importance. At the center of the map there is the term "sustainability" which is the densest and most interconnected keyword, highlighting its centrality in scholarly discussions. In close proximity to the term there are high-density terms such as "fashion," "consumption," "circular economy," "management," and "behavior," emphasizing their prominent association with sustainability research in the fashion area. Keywords like "slow fashion," "consumer behavior," "sustainable consumption," "supply chain," and "textile waste" reflect the evolving thematic focus of academic inquiry,

indicating that environmental concerns, ethical consumption patterns, and systems thinking (like circularity) are gaining traction. On the contrary, terms that are towards the periphery with cooler tones (green to blue), such as "innovation," "attitudes," "corporate social responsibility" and "perceptions," can represent less popular yet still relevant sub-themes or nascent areas that require further investigation. The map captures the breadth of existing academic engagement while it also underscores the necessity of the need to focus on underexplored, policy-driven, and interdisciplinary research domains.

DISCUSSION

It links into the materials perspective by showing how advances in production technology and shifts in consumer demand can reduce textile footprints-without sacrificing flexibility or the ability to respond quickly to market needs. Moreover, technical research provides a scientific foundation for policymakers, enhances the feasibility of industrial strategies, and supports processes of social acceptance. In this sense, the production of technical knowledge not only drives progress within environmental engineering but also strengthens the effectiveness of regulatory economic mechanisms. Furthermore, according to the literature a technological optimism exists around eco-innovations such as smart textiles and regenerative fibers. However systemic change cannot happen solely with technology due to adaptation barriers that can be cost, infrastructure, and lack of policy incentives. A more critical lens should question if these innovations bring the risk of becoming "green niches" instead of mainstream solutions. Lack of engagement with governance and policy frameworks illustrate that sustainability is usually

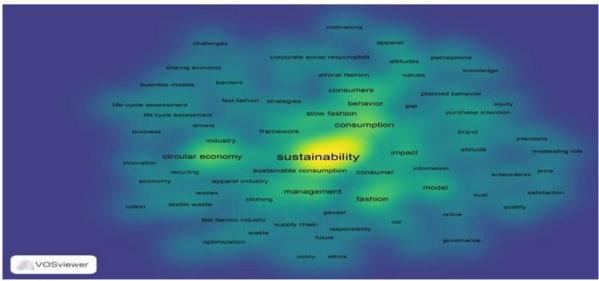


Figure 4. Heat map.

considered without taking into account regulatory mechanisms. The transformative potential of the innovations remain limited if they are not embedded into broader socio-political contexts such as the EU Green Deal or the carbon border adjustment measures. A balanced interdisciplinary approach is needed to strengthen the analytical depth of the field.

CONCLUSION

The research shows that there is a connection between sustainable fashion and advances in textile materials and engineering. The innovative environmentally friendly materials offer transformative opportunities for closing material loops such as regenerative fibers, recyclable composites, and smart textiles with embedded traceability functions. However, despite their transformative potential, the implementation of these innovations are mainly constrained by technical feasibility, cost, and limited industry adoption. Multi-disciplinary collaborations between material scientists, textile engineers, and sustainability scholars are targeted to close those gaps. Collaborations would result in improved environmental performance of fashion systems and the creation of scalable material innovations that are in alignment with circular economy principles. By bringing textile and material considerations more into sustainability research, it becomes possible to move beyond critique and develop practical solutions that can spark real, systemic change in both production and consumption.

Practicle Implications

From a practical perspective the findings of the research states that companies need to integrate sustainability practices into their daily business strategies in the fashion and textile industry. These strategies could involve adapting fiber recycling, lowimpact dyeing technologies, and bio-based fabrics at scale. Managers need to guide organisations in balancing short-term profitability with long-term sustainability goals which is compolicated as it calls for investment in cleaner production systems, transparent supply chains. and eco-material innovation. When brands embed sustainability into procurement, design, and logistics brands can decrease costs, mitigate reputational risks and build consumer trust.

Technological Imlications

This bibliometric analysis emphasizes the role of textile engineering and material science in determining the future of sustainable fashion. Reduced waste production, minimized environmental footprints, and increased product durability can be achieved through improvements in digital production, smart textiles, enzymatic processing and Industry 4.0 tools. The measurement and scaling of ecoinnovations in material flows are enabled by circular

economy indicators, data analytics, and automated traceability systems. To accelerate adaptation technological capabilities need to align with supportive infrastructure and regulations. In order to turn scientific progress into transformative sustainability outcomes R&D advancements could be connected with operational practices.

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