

A bibliometric study on sustainable development in the clothing industry

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Abstract. *In the context of growing global concerns about the environmental impact of the clothing industry, sustainability has become a topic of major interest in the literature. The aim of this study was to explore and analyze the research development in the field of sustainable fashion. The methodology was based on a literature review and a bibliometric analysis of publications from the period 2015 - 2024 by extracting and analyzing data from the Dimensions database, identifying the most influential authors and journals, thematic trends, co-authorship analysis and citation analysis. By analyzing the distribution of publications over time, the evolution over the years of academic interest in sustainable fashion was observed, including topics such as circular economy and responsible consumption. The results of the study emphasize the need for an interdisciplinary approach to support the transition towards sustainable practices in the clothing industry. This study improves the understanding of sustainability mainstreaming in the sustainable fashion and provides new avenues for researchers in the field.*

Keywords: sustainable development, fashion, bibliometrics, clothing industry, recycling

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Introduction

Clothing products have many positive aspects, but they also have a negative influence on the environment. This has given rise to the concept of sustainability, which is a complex approach at a time when human activities have become a factor in destroying and polluting the environment, a problem that needs to be solved as soon as possible. The shortest definition for the concept of sustainable development in the clothing industry could be the responsibility that each person has towards nature when it comes to clothes [1].

The clothing industry is a global economic sector specializing in the design, manufacture and marketing of clothing. It combines the creativity of clothing design with complex industrial processes, influencing culture, identity and economy worldwide. Apparel can be classified into several categories, depending on purpose, materials and style. The most common classifications include casual (for everyday wear), formal (for events and professional environments), sportswear (for physical activities), protective (for work or extreme conditions) and luxury (associated with premium brands). Another classification of clothing can be made according to the season it is intended for, gender or age [2].

This study was motivated by the need to understand the challenges in the sustainable fashion industry, assess trends in the field and identify future frontiers. To this end, the paper utilizes a scientometric analysis to understand the dynamics and underlying characteristics of sustainable fashion literature. This study aims to map the research in the field, emphasize the growth of the field in recent years from 2015-2024, and answer the following research questions (RQs):

RQ 1: What has been the progress of the field of sustainable fashion in recent years?

RQ 2: Who are the most relevant authors in the field of sustainable fashion?

RQ 3: What are the most relevant literature streams in the field of sustainable fashion literature based on citation?

Scientometrics is based on the quantitative analysis of literature, involving analyzing the effect of research by exploring the relationship between terms and citation. Citation is a manifestation of influence and, through citation, authors develop previously existing knowledge [3] as a rich representation of a domain can be obtained by analyzing citations [4]. The rest of the paper is divided into four sections: the literature review, the methodology, which contains the steps necessary to collect and analyze bibliometric data, the results, which describe the mapping and evolution over time of the field of sustainable fashion, and the conclusions, which reveal the findings and future directions of the research.

Literature review

In recent decades, sustainable fashion has become a central topic in academic discourse as global concerns about the environmental impact of the textile industry have intensified. The concept of sustainable fashion is defined in literature, but broadly, it refers to the design, production, distribution and consumption of clothing in a way that reduces environmental impacts and promotes social equity [1]. Sustainable fashion implies a systemic transformation of the industry, with a focus on circular economy, eco-friendly materials, transparency in the supply-chain, and engaging consumers in responsible choices [5].

Recent literature highlights several technological advances that support the transition towards sustainability. For example, the integration of blockchain technology in textile product traceability [6], the development of biodegradable fibers and smart textile materials [7], and the application of artificial intelligence in supply-chain and demand management. These innovations are accompanied by emerging theoretical models such as the triple bottom line model (economic, social and environmental) [8].

Current research in sustainable fashion explores the integration of technology with sustainability in design, production and consumption. Kirsi Niinimäki defines sustainable fashion as a systemic approach based on circular economy and ethical design [5]. Claudia Henninger emphasizes the importance of slow fashion, traceability and consumer education [9]. Tsan-Ming Choi proposes analytical models for sustainable supply chains using big data, blockchain and reverse logistics [8]. Key terms such as eco-design, responsible production and circular economy are frequently used. Theoretical models such as life cycle thinking and closed-loop supply chains are central in the literature. Current trends include sustainable digitalization [10] and the development of regenerative materials [7].

The textile industry is one of the most polluting industries on the planet. Very large quantities of manufactured clothes that are then bought and later thrown away contribute to global warming, because a complex chain must be followed to produce clothes, starting from buying the raw material from which the textile yarns are made, manufacturing the textile materials, producing the garments, transporting, marketing, using and finally throwing them away [11].

Circular fashion is an approach that looks to clothes not just as fast-moving consumer items, but as garments with a prolonged life, part of a complete cycle - from design and production to the moment they are no longer worn. The essence of this model is to reduce waste and pollution by giving clothes a second life, either through reuse, recycling or biodegradation. Unlike the classic, linear system in which clothes are produced, sold and thrown away, circular fashion proposes recycled materials, biodegradable textiles and design thinking for sustainability and repair [12]. It is a way to create and consume fashion with respect for the planet, resources and people, contributing to a cleaner and more conscious future [9]. Clothing recycling is more than a sustainable trend; it's a form of responsibility towards the planet's resources. Clothes do not have to become waste, they can be put back into circulation, turned into useful materials or creatively reinterpreted to make new clothes. By recycling, textiles extend their life, and the environmental impact is greatly reduced. In a world affected by overconsumption and pollution, the valorization of textile waste becomes an important step towards a circular economy, in which nothing is lost, but everything is transformed with meaning [13]. Thus, recycling becomes a conscious and meaningful act that combines environmental protection with design innovation [14].

In a landscape dominated by fast fashion, where clothes are produced cheaply and in excess, fashion has unfortunately become synonymous with waste. The fast pace of trends and impulsive consumption turn clothing into disposable items, generating tons of textile waste and a negative impact on the environment [9]. Faced with this imbalance, more voices in the industry are proposing sustainable solutions, such as recycling, i.e. the process by which old clothes are transformed into reusable raw materials [14]. Others choose the upcycling route, a creative approach that involves reimagining old clothes into new products with aesthetic and functional value, without going through an industrial decomposition process [15]. These alternatives not only reduce pollution, but also prolong the life of clothing products, supporting a culture of conscious consumption. In addition, the choice of eco-friendly materials, such as biodegradable or recycled textiles, completes this circle of sustainability, demonstrating that fashion can evolve in harmony with nature and the values of a responsible society [16].

Methodology

The aim of this study is to analyze the evolution and structure of scientific research in the field of sustainable fashion, using bibliometric methods, identifying main authors, collaboration networks, and the academic impact of these publications and research themes. Figure 1 shows the methodological steps of research.

To answer the questions of this research, a Dimensions-based analysis [17] was conducted in March 2025, which resulted in the extraction of a list of academic publications relevant to the apparel industry. The selection of the Dimensions database is justified by the fact that it is a large database that can provide the broadest coverage of current literature as it can be freely used by all researchers, unlike Web of Science or Scopus, which are subscription-based [4]. To cover the majority of publications in the clothing industry, after an initial selection of several keywords and combinations, the logical sequence of terms was limited to: ("sustainable fashion"). The search led to comprehensive data limited to English-language publications, applying filter as all types of publications and the period from 2015 to 2024.

The Dimensions database provided 21,708 initial entries, from which 16,016 publications were selected referring only to articles, chapters, edited books, proceedings and preprints. VOSviewer tools [18] integrated in the Dimensions database were used to analyze citations and collaborations between authors. Network maps were created to help identify research clusters and collaborations between authors. Citations were analyzed to assess the impact of scientific papers and to identify the most influential publications in the field of sustainable fashion. Dimensions database identifies emerging themes and research trends and has an intuitive interface that allows users to easily navigate bibliometric data.



Figure 1. Flow diagram of the methodological steps of the research

Source: Realized by the authors

Results discussions

From the Dimensions database, 16.016 academic publications that refer only to articles, chapters, edited books, monographs, preprints and proceedings were extracted for the query ("sustainable fashion"). The typological analysis of these publications reveals a notable diversity in the forms of scholarly dissemination, reflecting the high level of interest and multidimensional complexity of sustainable fashion as in Figure 2. Scientific articles (9.355), which are the main form of communicating research results in this field, account for the largest share, indicating a growing interest in sustainable fashion in academic literature. Chapters (3.614) and edited books (1.450) underline the interdisciplinary nature of the topic, frequently addressed in collective volumes bringing together perspectives from fields such as sustainability or cleaner production, this type of publication is often used to integrate theoretical and applied knowledge. The presence of 657 monographs reveals a growing interest in full-length treatments of the topic, while a total of 579 proceedings indicates an active and expanding academic community concerned with the exchange of ideas and innovations in international scientific events. Also, the existence of 361 preprints reflects a recent trend in academic research, but also the acceleration of the publication process and the desire of researchers to get their results out quickly.

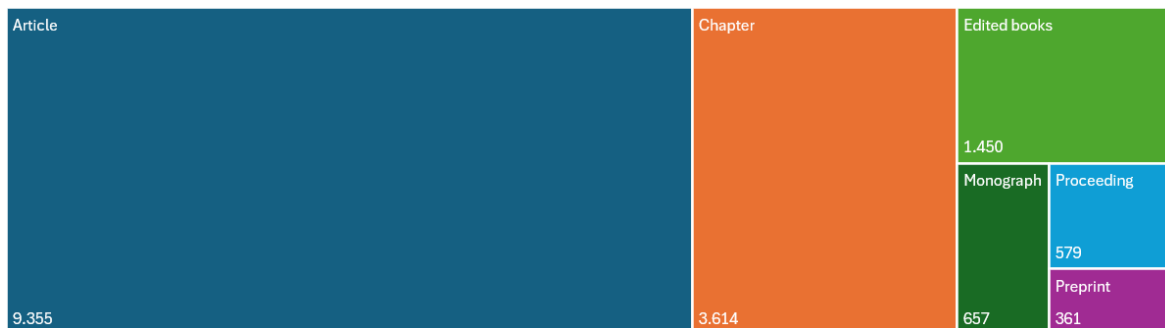


Figure 2. Selected types of publications for sustainable fashion

Source: Processed from the query performed on Dimensions database

In Figure 3 the regression model applied shows an exponential increase of publications, from 601 in 2015 to 3415 in 2024. The coefficient of determination R^2 is very close to 1 ($R^2=0.9914$), indicating an excellent fit of the model to the real data. The trend suggests that sustainable fashion has become a central research topic due to the increased interest in the apparel industry.

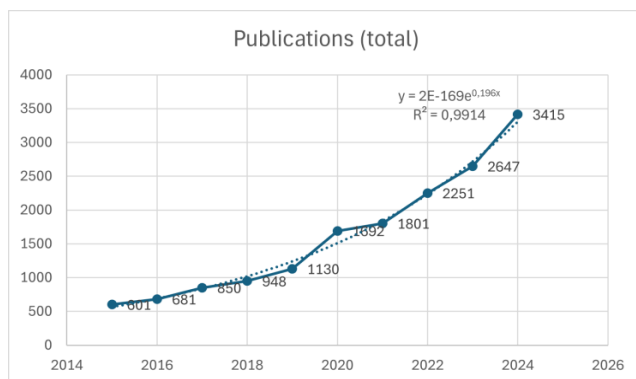


Figure 3. Distribution over time of publications in sustainable fashion domain

Source: Processed from the query performed on Dimensions database

Figure 4 illustrates the number of publications by research areas according to the Sustainable Development Goals classification, observing an unequal distribution of publications between the different fields, with certain areas significantly dominating the research activity.

A significant area is Sustainable Development Goal 12 (SDG 12 - Responsible Consumption and Production, which leads the way with 4,154 publications, followed by SDG 9 - Industry, Innovation and Infrastructure with 623 publications and SDG 7 - Affordable and Clean Energy with 518 publications.

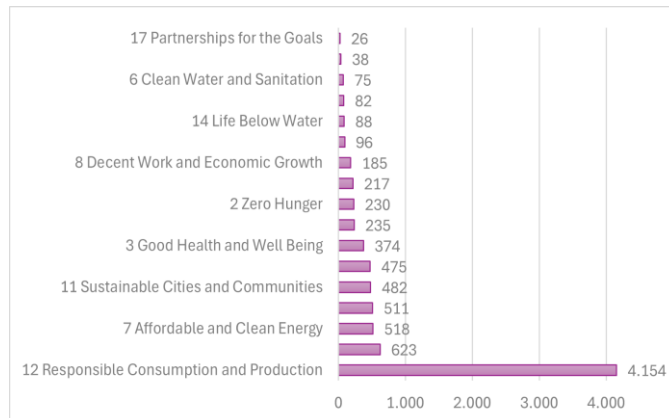


Figure 4. The number of publications by field of research in Sustainable Development Goals

Source: Processed from the query performed on Dimensions database

Table 2 reveals the most influential authors in the field of sustainable fashion, revealing contributions from both Global North and Global South, with United Kingdom, China and Northern Europe leading the way.

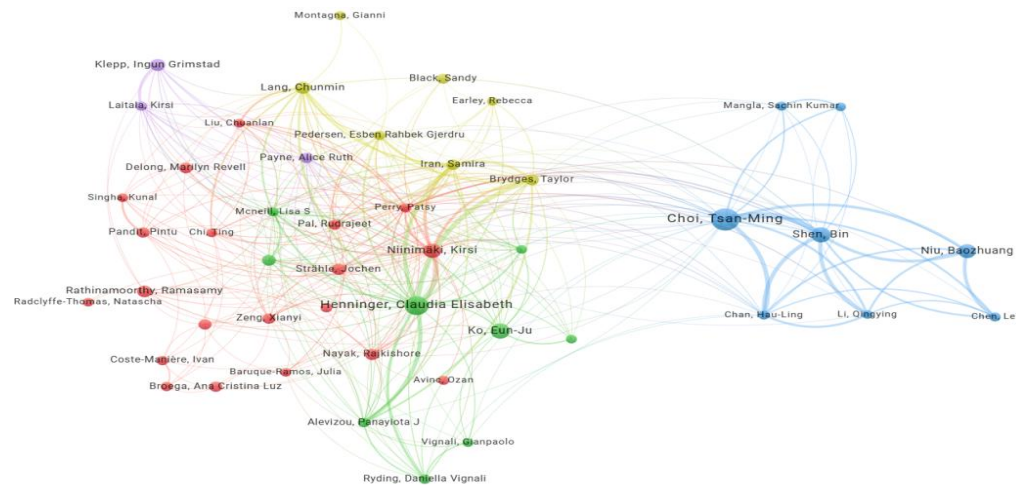
Table 2. Top 10 authors in sustainable fashion domain

Name	Organization	Country	Publications	Citations
Tsan-Ming Choi	University of Liverpool	United Kingdom	79	5.894
Claudia Elisabeth Henninger	University of Manchester	United Kingdom	57	1.492
Bin Shen	Donghua University	China	37	1.913
Eun-Ju Ko	Yonsei University	South Korea	37	1.118
Kirsi Niinimäki	Aalto University	Finland	33	1.803
Baozhuang Niu	South China University of Technology	China	31	1.184
Chunmin Lang	Louisiana State University	United States	24	864
Ingun Grimstad Klepp	Oslo Metropolitan University	Norway	23	375
Ramasamy Rathinamoorthy	Anna University	India	22	313
Rajkishore Nayak	RMIT Vietnam	Vietnam	20	482

Source: Processed from the query performed on Dimensions database

Figure 5 illustrates the map of the co-authors in the field of sustainable fashion, which highlights a fragmented network in several collaboration clusters, chromatically delimited, each representing a distinct group of researchers who frequently collaborate with each other. The result was 180 researchers, 390 co-authorship links, 930 total co-authorships and 19 clusters. It provides insight into the structure of sustainable fashion research, highlighting influential authors and the connections between subfields. Claudia Elisabeth Henninger is a central author with many connections, being a key figure in the network. Tsan-Ming Choi is represented by another major node, connected to

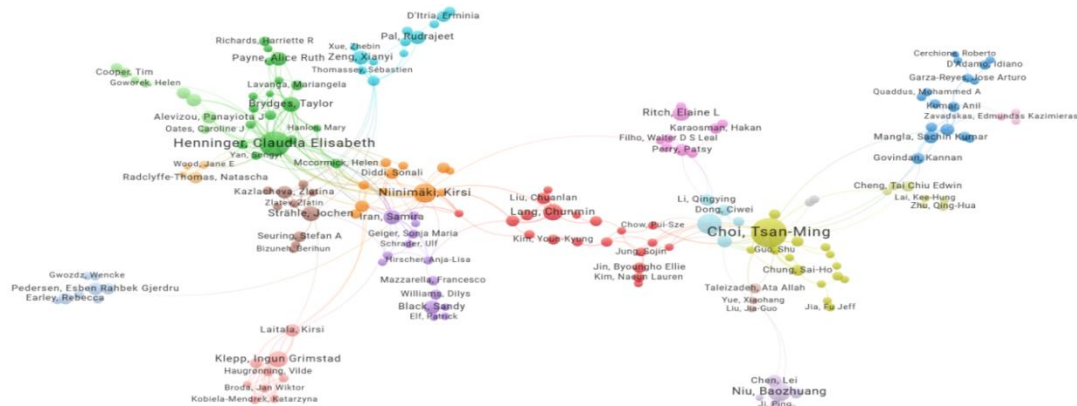
other authors with research in supply chains and sustainability. Kirsi Niinimäki, a key name in sustainability studies in the fashion industry, is represented by the orange cluster.



This group seems to be focused on the social and sustainable design dimension. Elaine Ritch and Sandy Black have a role of liaison between clusters, indicating interdisciplinary activity and international collaborations.

Figure 5. Co-authorship map in the field of sustainable fashion
Source: VOSviewer

Figure 6 provides insight into how researchers around the world cite each other and help shape a complex and interdisciplinary field, sustainable fashion. The Dimensions database returned 47 researchers, 335 citation links, 2034 citations and 5 clusters. The nodes represent the authors, and the size of each node reflects its influence on the network, the number of citations or links to other researchers. For example, Tsan-Ming Choi, highlighted by the



colour blue, is one of the central authors in the East Asian cluster, where concerns are often geared towards the sustainable supply chain.

Figure 6. Citation map in the field of sustainable fashion
Source: VOSviewer

In the green zone, one can observe a dense network of European researchers, including Claudia Elisabeth Henninger, whose work focuses more on consumer behaviour and sustainable brand strategies. Kirsi Niinimäki, visible in the centre of the map, acts as a binder between multiple clusters, being one of the most influential voices in the field, known for his work on sustainable design and circular economy in the textile industry. Also, the groupings highlighted by different colours suggest the existence of distinct thematic directions, some focused on recycling and responsible design, others on circular economy or technological innovation.

Table 3 illustrates the most influential journals in sustainable fashion domain. Sustainability (MDPI) is the journal with the highest number of articles published on sustainable fashion (604), confirming that MDPI is a prolific platform for the field. Although it has a lower impact factor compared to other journals, its high volume of publications and citations make it a very active journal. The Journal of Cleaner Production ranks among the journals with the highest impact factor, with an impact factor of 9.8, the first top-ranked being Business Strategy and the Environment with an impact factor of 12.5. The Journal of Cleaner Production with 246 publications and 17,470 citations, stands out as the most influential in sustainability studies, including fashion, attracting the highest number of citations, indicating an interdisciplinary scope of the topic. Table 4 shows thematic trends in sustainable fashion, the theme being closely connected with circular economy and zero-waste fashion.

Table 3. Journals publishing in sustainable fashion domain, listed on the importance of their impact factor

Name	Impact factor	Publications	Citations
Business Strategy and the Environment	12.5	95	3,882
Journal of Cleaner Production	9.8	246	17,470
Transportation Research Part E Logistics and Transportation Review	9.59	104	7,786
Sustainability	3.3	604	15,650
Journal of Fashion Marketing and Management	3.2	132	4,458
International Journal of Fashion Design Technology and Education	1.9	88	1,187
Fashion Practice	0.96	124	1,036
Textile Science and Clothing Technology	0.438	115	1,188
Encyclopedia of the UN Sustainable Development Goals	n.a	237	570
Sustainable Textiles: Production, Processing, Manufacturing & Chemistry	n.a	140	454

Source: Processed from the query performed on Dimensions database

Table 4. Thematic trends in sustainable fashion domain

Thematic	Main sources
Circular fashion	[5], [15], [10]
Zero-waste fashion	[2], [13], [19]
Slow fashion	[1],[9],[16]
Responsible production	[6], [14], [20]
Supply Chain Management	[8], [12], [21]

Source: Authors' own research

The main limitations of this research may be linked to the selection of Dimensions database, predefined search string and the exclusion of unindexed literature, which can lead to an incomplete representation of the research landscape. Nevertheless, the selection of the Dimensions database is justified by the fact that it is a large database that can provide the broadest coverage of current literature and has an integrated tool helping researchers to visualize the VOSviewer clusters. At the same time, the search string can be perfectible, but it served best the purpose of this research and covered many aspects of sustainability in the clothing industry.

Conclusions

The bibliometric study carried out on sustainable fashion research highlights an accelerated development of academic interest in recent years, which is reflected by a significant increase in the number of publications and citations. The analysis of the citations made it possible to identify fundamental works and influential authors, who

contributed decisively to the formation of the main research directions, such as circular fashion, responsible production and consumption. Also, the co-authorship analysis reveals a clear trend of interdisciplinary collaboration between researchers from fields as diverse as engineering, economics, and design, suggesting that sustainability challenges are addressed through collective and integrative efforts. Strengthening international and interdisciplinary cooperation has helped to increase the visibility and scientific impact of publications. Overall, the results of the study highlight the importance of collaboration and the influence of reference work in advancing sustainability research in the apparel industry, providing a solid foundation for researchers in the field.

Future research directions include a systematic review of the papers in sustainable fashion, with an emphasis set on circular fashion.

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