

The academic insight for approaching the sustainability of the textile industry

La visión académica para abordar la sostenibilidad en la industria textil

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Abstract

Objective: Sustainability is gaining importance in the textile sector, but there is a lack of literature reviews using bibliometric techniques to provide a quantitative and comprehensive assessment of scientific output. This article aims to provide a current and systematic overview of previous literature on sustainability in the textile sector. To achieve this, a literature review on this topic is done and a model of analysis of the issues studied is presented.

Methodology: A mixed-method approach combining bibliometric analysis and qualitative reflection was employed on a sample of 580 papers. Co-word analysis identified thematic clusters in the literature.

Results: A general analytical model has been presented to provide a comprehensive and up-to-date review creating five key thematic research domains: Sustainable Development, Value Chain - Cellulose and Textile, Design Process, Circular Economy, and Sustainability. The model has also made it possible to evaluate the relationship of these areas with each other and identify other emerging themes.

Limitations: The main limitations come from the methodology used. Future studies can complement the results obtained using additional techniques such as event analysis or case studies.

Practical implications: This approach allows companies to focus their strategic decisions on sustainability practices. The findings provide insights for industry stakeholders to prioritise sustainability-related investments and initiatives and enhance operational efficiency.

Keywords: textile industry; sustainability; bibliometric analysis; supply chain; circular economy

JEL Codes: M00; M2; Q56

Resumen

Objetivo: La sostenibilidad está ganando importancia en el sector textil, pero faltan revisiones de la literatura que utilicen técnicas bibliométricas para ofrecer una evaluación cuantitativa y exhaustiva de la producción científica. El propósito de este artículo es ofrecer una visión actual y sistemática de la literatura previa sobre la sostenibilidad en el sector textil. Para ello, en primer lugar, se realiza una revisión de la bibliografía sobre este tema y, en segundo lugar, se presenta un modelo de análisis de las cuestiones estudiadas.

Metodología: Se ha utilizado un método mixto combinando el análisis bibliométrico y la reflexión cualitativa sobre una muestra de 580 artículos. El de co-palabras permitió identificar grupos temáticos.

Resultados: Se ha presentado un modelo analítico general para proporcionar una revisión exhaustiva y actualizada que crea cinco ámbitos temáticos clave de investigación: desarrollo sostenible, cadena de valor - celulosa y textil, proceso de diseño, economía circular y sostenibilidad. El modelo también ha permitido evaluar la relación de estas áreas entre sí e identificar otros temas emergentes.

Limitaciones: Las principales limitaciones proceden de la metodología, pero estudios futuros pueden complementar los resultados obtenidos utilizando técnicas como el análisis de eventos o método del caso.

Implicaciones prácticas: Los resultados obtenidos ayudan a las empresas a enfocar sus decisiones estratégicas hacia la sostenibilidad. Se aportan ideas a los grupos de interés del

sector sobre el valor de las inversiones e iniciativas relacionadas con la sostenibilidad, y su efecto en la mejora de la eficiencia operativa.

Palabras clave: industria textil; sostenibilidad; análisis bibliométrico; cadena de suministro; economía circular

Códigos JEL: M00; M2; Q56

1. Introduction

The textile industry faces a double challenge that involves incorporating sustainability principles throughout its value chain and meeting the growing demands of customers who call for quality garments at a good price and produced responsibly. For textile companies, it means manufacturing quality products that respond to the new values of consumers, especially the new generations, and strengthening their brand identity and competitive difference. They must not only find ways to reduce the environmental impact of garment production but also plan operations efficiently, improve productivity and reduce costs.

Some previous studies have conducted analyses to identify sustainable practices in the textile industry and trends in sustainability in textile and fashion products. Li and Leonas (2022) identified sustainable operations developed by the textile and apparel industry. They established 36 themes at three levels (environmental, social, and consumer) and collected abstracts of 1,168 journal articles related to the industry's themes and practices published between 2013 and 2020. Rajkishore et al. (2019) reviewed articles related to sustainable fashion and textile production and discussed some of the pre-2019 trends in sustainable fashion production. Gbolarumi et al. (2021) conducted a literature review on sustainability in the textile and garment industry from 2009 to 2019 and selected 76 articles. The results present information on the level of assessment, boundaries, source and weight of indicators, and usefulness of the results. However, since 2019, the world has undergone significant changes and sustainability has become a decisive and strategic factor in the sector, with increased business activity and research. Furthermore, there appears to be a lack of literature reviews using bibliometric techniques on this subject, which can offer a quantitative, objective and comprehensive assessment of scientific output.

This article aims to provide a current and systematic overview of previous literature on sustainability in the textile sector. To achieve this, a literature review on this topic is done and a model of analysis of the issues studied is presented.

By providing an analytical model, future studies will be able to focus on key areas of research such as the development of a study model that allows us to propose the processes of a 100% sustainable value chain, consumer attitudes and their sustainability habits, the implications of new sustainability regulations for small and medium enterprises, and the social impact that may result from the integration of sustainable production processes throughout the textile value chain.

The main contributions of this work are: 1) conducting a review of the literature up to 2023; 2) utilising mixed methods combining qualitative (reflexive analysis) and quantitative techniques (co-word analysis); and 3) creating an analytical model to describe the sustainability phenomenon in the textile industry.

The paper is structured as follows. After the introduction, the second section provides the background. Then, the third section details the methodology employed. The fourth section presents the results. The fifth section shows the discussion and explains the model of analysis. Lastly, the paper concludes by presenting contributions, conclusions, and future research lines.

2. Background

Sustainability management is the resource management process that aims to improve a company's environmental performance to achieve sustainable development (Mohan et al., 2020). This involves reducing negative environmental impacts, increasing energy efficiency, and adopting responsible business practices, which are the key elements for developing a sustainability strategy. There are various strategies for achieving and measuring a company's sustainability, including circular economy and product life cycle. The circular economy is based on a sustainable economy that seeks to reduce waste generation, reuse materials, and promote the use of renewable natural resources. Furthermore, it focuses on optimising production systems and reducing environmental impacts (Hole & Hole, 2019). On the other hand, the product life cycle encompasses the processes of production, distribution, use, recycling, and disposal of a product. This approach, based on minimising environmental impact, includes the analysis of the stages of a product's existence and enables companies to responsibly plan their production from the moment of its design and improve environmental performance (Seuring, 2004).

The textile sector is one of the most polluting sectors globally, as it is responsible for processing both natural and synthetic fibres to produce fabrics, garments, and other related items (De Oliveira Neto et al., 2019). Sustainability in the textile sector refers to the adoption of production and processing practices that are not only cost-effective but also environmentally friendly. This implies reducing the use of natural resources, decreasing greenhouse gas emissions, minimising environmental impact, improving occupational health and safety, using environmentally friendly materials and technologies, and promoting social responsibility and human rights (Beyers & Heinrichs, 2020).

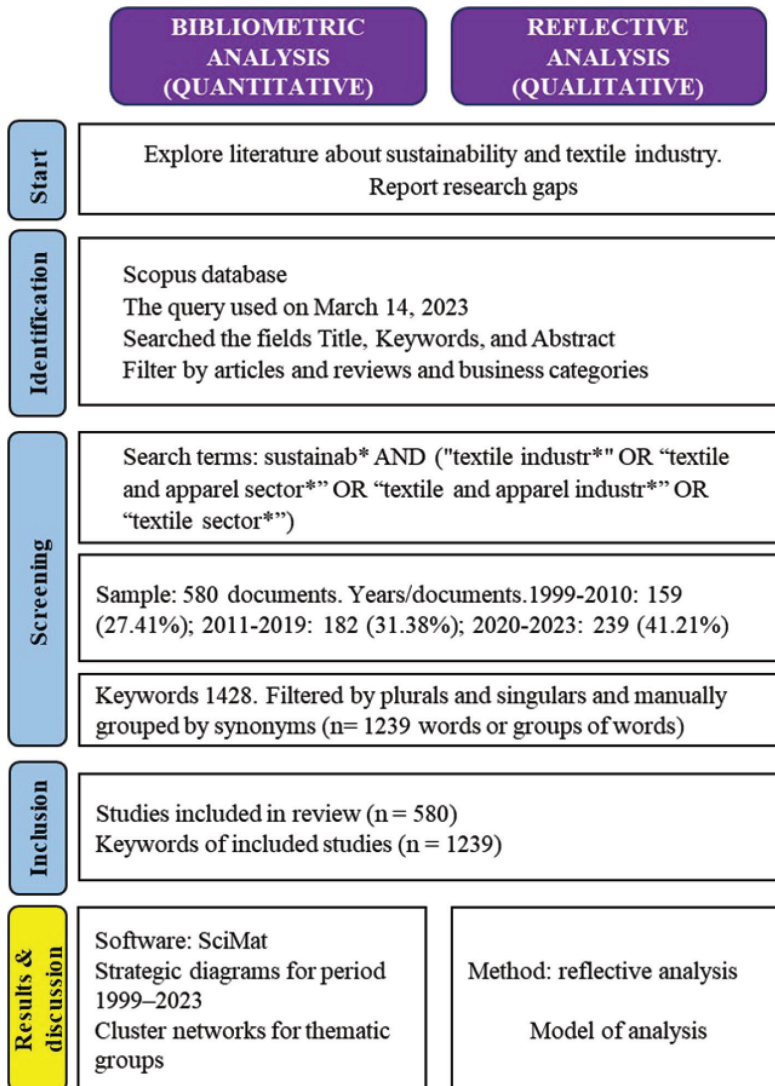
3. Methodology

A mixed-method approach has been adopted to provide an overview of the most extensively researched subjects related to sustainability in the textile sector. This approach encompasses a bibliometric analysis, which constitutes a comprehensive

literature review, and the application of a qualitative reflection technique to interpret the findings and offer recommendations for future research endeavours. Figure 1 illustrates the stepwise methodology utilised for sample selection and delineates the various phases of our study.

To determine the diverse themes addressed in the literature about sustainability in the textile industry, we conducted a co-word analysis that allows the identification of themes.

Figure 1. Mixed methodology process



Source: Own elaboration.

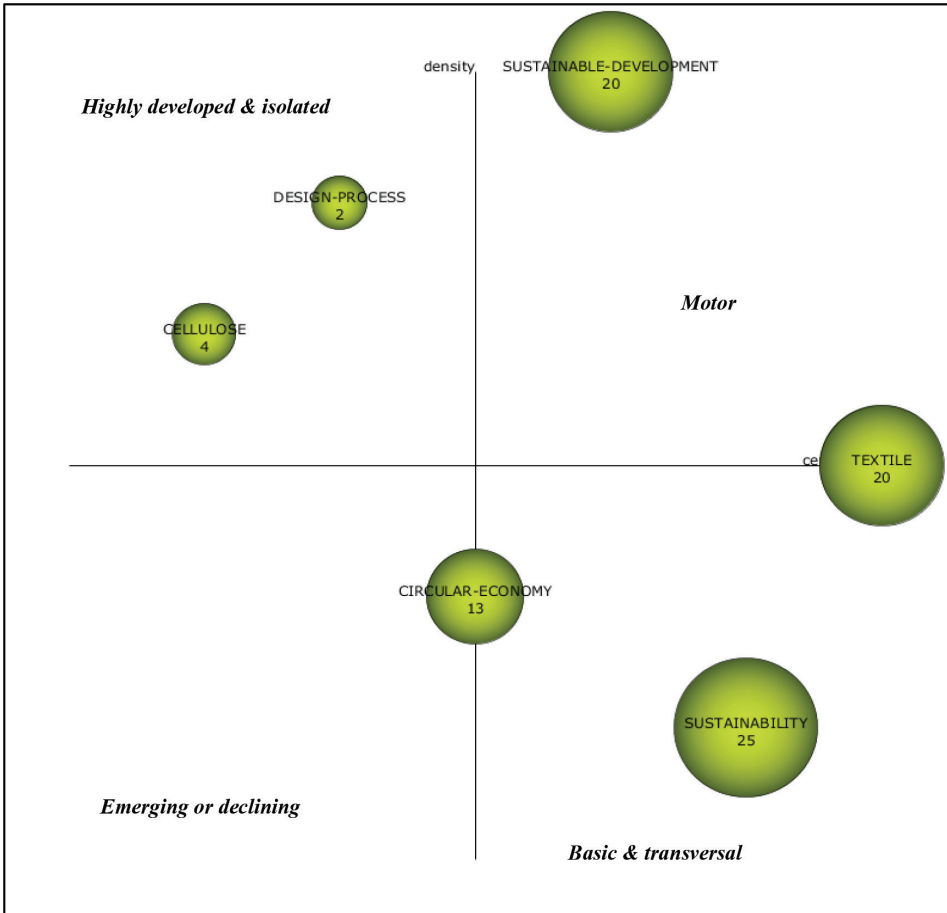
4. Results

Thematic clusters resulting from the co-word analysis are analysed. Each cluster displays the main relationships between topics identified by the SciMat programme, which prioritises citation and relationship metrics when constructing the network.

The results of the co-word analysis are presented in the strategic diagram depicted in Figure 2. Also, the networks of each thematic group are shown. Additionally, the most cited references by thematic networks are provided in the Appendix.

Figure 2 displays a strategic diagram showing the number of documents for the entire period from 1999 to 2023.

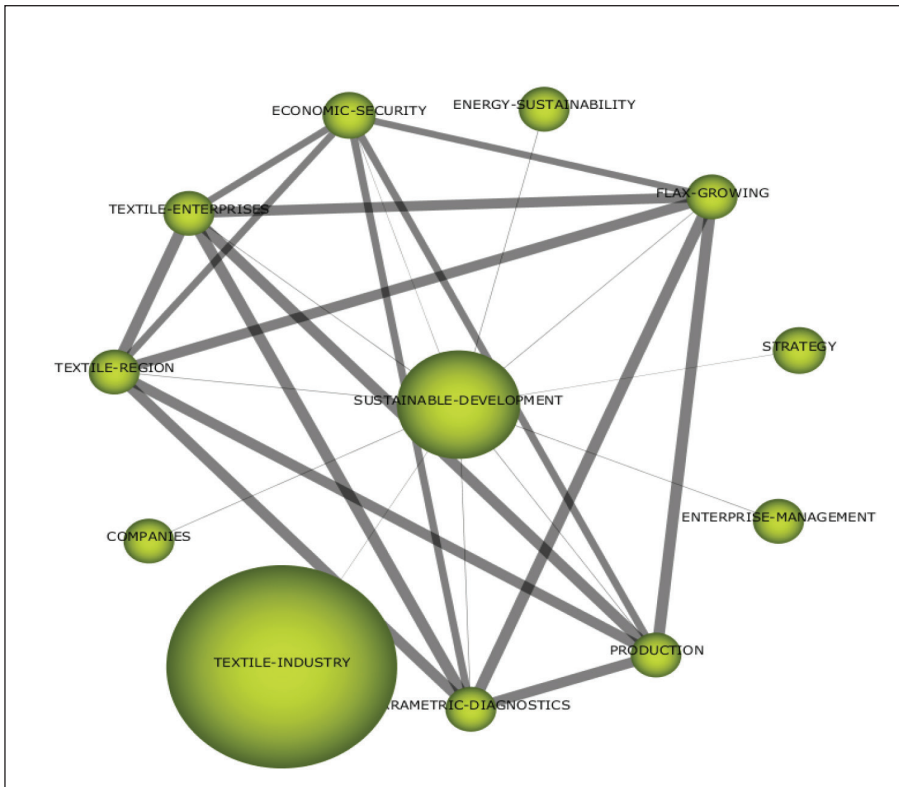
Figure 2. Strategic diagram by document number (1999-2023)



Source: SciMat.

As Figure 2 reveals, sustainable development stands out as a motor theme in the textile sector, including many facets interconnected with production, consumption, environmental concerns, and social well-being. This forward-looking approach requires the textile industry's consideration of critical issues such as energy efficiency, the use of sustainable materials, the implementation of environmentally responsible waste management practices, the promotion of diversity and gender equality, and the conscientious use of water and other finite resources, among other factors (Figure 3).

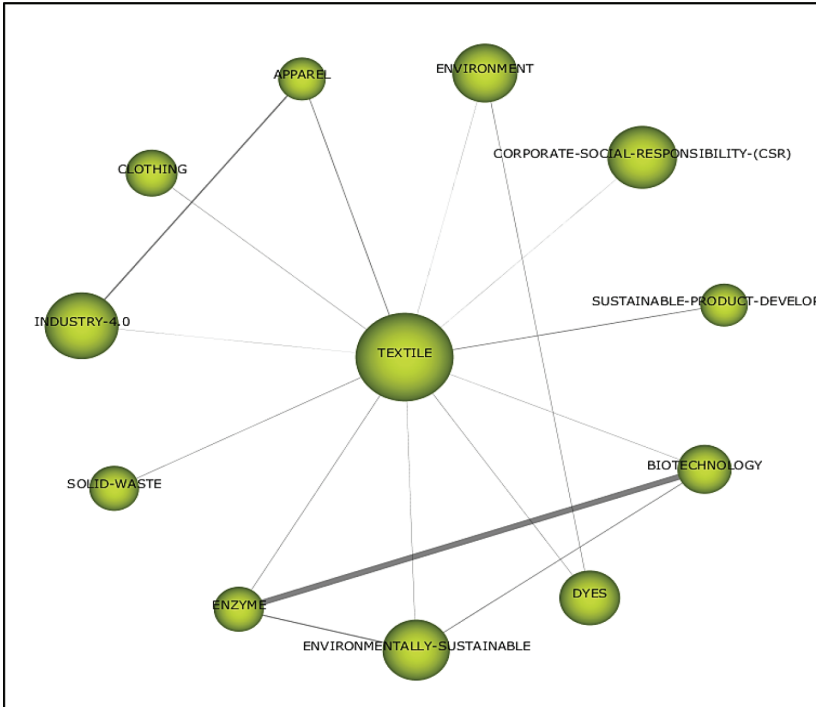
Figure 3. Thematic network for sustainable development



Source: SciMat.

The textile theme has transitioned from a motor theme to a basic and transversal theme (Figures 2 and 4). This transformation has occurred as the textile sector shifted from its traditional roots to embrace a modern, sustainability-focused paradigm (Dal Forno et al., 2023).

Figure 4. Thematic network for textile

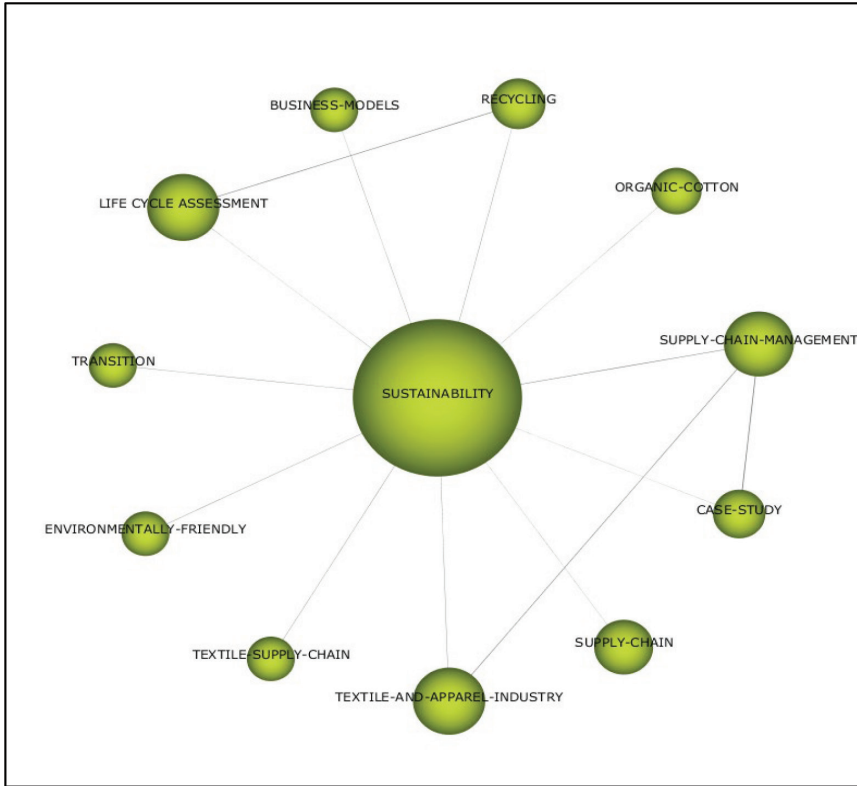


Source: SciMat.

Simultaneously, sustainability has become a transversal issue that permeates every aspect of the industry, from production to transport, waste management and resource utilisation (Figures 2 and 5). Consequently, manufacturers and consumers alike must factor in the environmental consequences of their actions at every stage of the production process. This dynamic scene presents opportunities for enhancing the sector’s sustainability, all-embracing initiatives like reducing energy consumption, minimising the depletion of natural resources, enhancing air quality, incorporating recycled materials, and optimising production efficiency.

The circular economy is among the emerging and transversal themes, representing a sustainable approach that emphasises the efficient use of resources (Figures 2 and 6). Its primary objective is to minimise waste generation and disposal while ensuring that resources remain within the production and consumption cycle (Parthiban et al., 2009). In practice, this entails the reuse, recycling or natural decomposition of materials to reduce carbon emissions and environmental impact. Notably, the textile sector has already reaped the benefits of embracing circular economy initiatives, thanks to the development of innovative technologies that curtail resource usage, optimise production processes and enhance product longevity (Jia et al., 2020).

Figure 5. Thematic network for sustainability



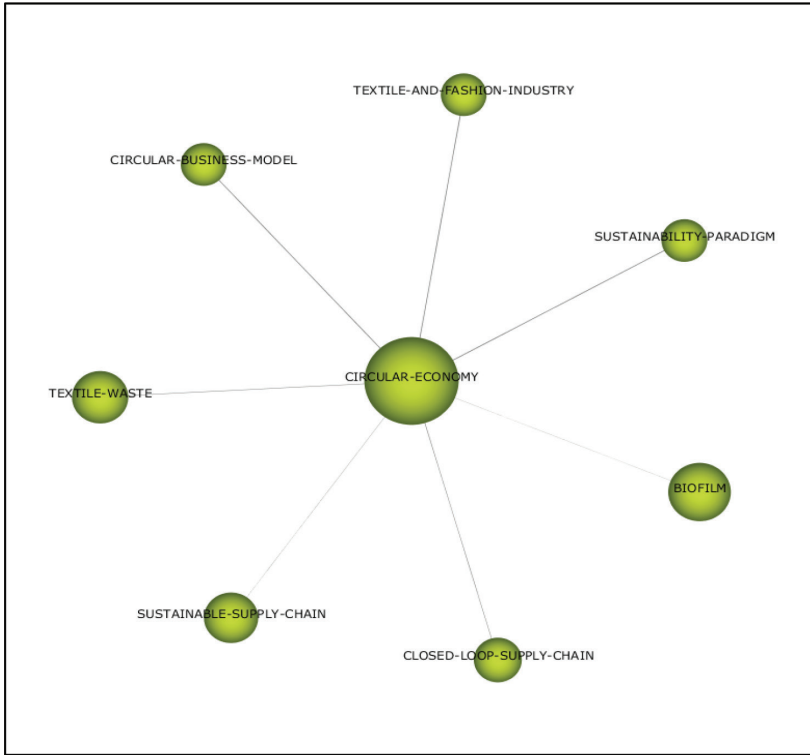
Source: SciMat.

Moreover, the design process and the utilisation of cellulose are two extensively explored themes within the sector, addressing a range of contexts (Figures 2 and 7). The design process for sustainable clothing is the decision-making procedures that underpin the creation of sustainable garments (Battesini Teixeira et al., 2023). Accordingly, it includes thinking about eco-friendly materials, using resources wisely, streamlining production, and choosing eco-friendly transportation. Cellulose, a sustainable material known for its strength, durability, and eco-friendliness, has gained popularity in the textile industry.

5. Discussion. A model of analysis

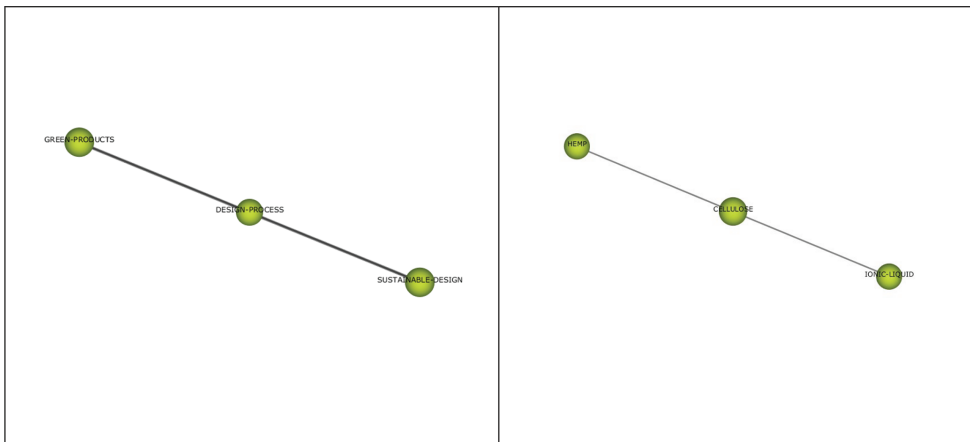
From the results obtained, the thematic clusters were considered and an analytical framework was devised. This framework systematically and logically illustrates the steps required to attain sustainability in the textile industry, emphasising the

Figure 6. Thematic network for circular economy



Source: SciMat.

Figure 7. Thematic networks for design process and cellulose

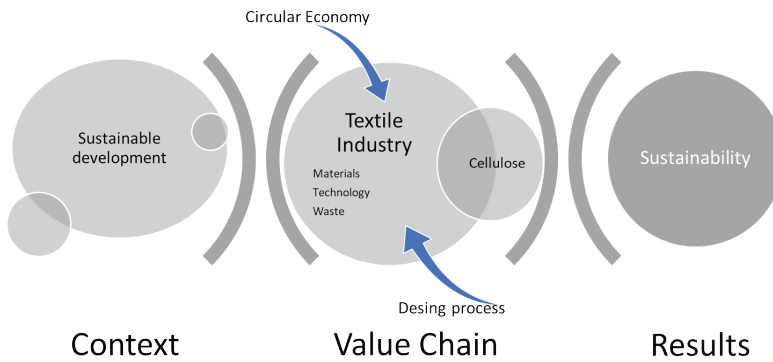


Source: SciMat.

key topics explored in the scholarly literature within each phase. First, it establishes the analytical context; second, it outlines the development process grounded in the industry value chain; and finally, it culminates by presenting the intended outcomes, specifically, the achievement or improvement of sustainability (Figure 8).

The model is grounded on a reflective and narrative analysis of each cluster, investigating the key aspects explored in each phase of the proposed model (Figure 8).

Figure 8. Research trends model for sustainability in the textile industry



Source: Own elaboration.

5.1. Sustainable development

Sustainable development (Figure 3) is an increasingly relevant paradigm for companies in their interactions with the environment. This concept of sustainable development implies a holistic approach that attempts to balance economic growth with both environmental protection and social welfare. As a framework of reasoning and behaviour, sustainable development guides the strategic decisions and actions of the company and links them to the sustainability concept. In the business sector, sustainable development involves the implementation of sustainable practices aimed at guaranteeing long-term economic development and economic security for the company. Moreover, for business management and the creation of competitive advantages, approaches such as the theory of dynamic capabilities consider that sustainable development can be a determining factor for the differentiation and growth of a company (De-Pablos-Heredero & Garaña-Corces, 2015).

By ensuring economic security through sustainability, textile companies can protect their competitive position in a changing and volatile business context, while contributing to the sustainable development of society and the achievement of broader economic and social welfare goals.

As far as the textile industry is concerned, a company should engage in sustainable development taking measures to ensure efficient production, both in terms of resources and time (Shen et al., 2022). This means that the company should look for ways to reduce its carbon footprint, improve energy efficiency and minimise the use of non-renewable resources. Thus, a sustainable textile company will give careful consideration to the use of natural resources, energy efficiency, responsible waste management and the adoption of eco-friendly technologies and processes. These practices contribute to reducing the environmental impact and generating economic benefits through resource optimisation, improved operational efficiency, and access to markets that value sustainability (Wu et al., 2022). In addition, they encourage companies to adopt sustainable development practices related to their value system. According to Stavropoulos et al. (2023), flax farming offers a real opportunity to the textile industry in the search for sustainable development. This multipurpose crop has many applications and is more efficient in energy consumption and its impact on the environment is lower.

Sustainable development thus becomes an indispensable strategy for ensuring the well-being of humankind and the environment. Sustainable development is described as the process of creating an economy that satisfies the needs of the present without jeopardising the ability of future generations to satisfy their own needs. This means that all sectors of the economy must work to ensure sustainable economic security, allowing access to quality resources and services at a reasonable cost (De-Oliveira-Neto et al., 2022). Considering a broader frame of influence beyond that of individual companies, integrating sustainability can help to create more efficient cities and communities. This involves optimising the use of resources and reducing waste not only within companies but also within the sphere of individual consumers (Tejero Palomo, 2021).

5.2. Value chain: cellulose and textile

The textile industry (Figure 4) can benefit from the proposal of a sustainable development strategy that involves the adoption of sustainable business management (Wang, 2023). This includes designing energy and environmentally-efficient products and processes, using environmentally friendly raw materials and technologies, and adopting responsible labour practices. The adoption of responsible production strategies, the use of parametric diagnostics, the promotion of flax farming and the implementation of business management strategies can be encouraged to ensure sustainable development in the region.

In the value chain of the textile industry, inputs, processes and outputs must be considered. The focus on a raw material such as cellulose (Figure 7) and the textile products that can be developed sustainably is noteworthy. Cellulose is a natural material obtained from wood and is commonly used to make clothing. Unlike synthetic materials, cellulose is biodegradable and does not contribute to environmental

pollution. In addition, cellulose is a durable material, meaning that garments made from cellulose last a long time. These characteristics make cellulose a popular material for the manufacture of sustainable clothing. Therefore, some authors have investigated the use of cellulose in the textile sector (Kim et al., 2022).

5.3. Design process

To develop products and services within the textile industry that comply with the principles of sustainable development, it is necessary to analyse the design process (Figure 7). Researchers have addressed the design process from various approaches such as minimising waste, using recycled materials, reducing carbon footprint, designing durable products, and creating products with high perceived value for consumers.

The concepts of green products, design process and sustainable design are now intrinsically linked to the sustainability approach in the textile sector. Their relationship is based on the search for solutions that minimise environmental impact, encourage the use of sustainable materials and resources, promote product durability and separability, and consider the full life cycle of products. Green products refer to those manufactured taking into account their environmental impact, using natural or recycled materials, avoiding the use of harmful substances, and reducing the emission of pollutants (Pui-Yan Ho & Choi, 2012).

The design process, in turn, is directly related to how textile products are created, involving criteria such as durability, ease of repair, waste reduction or the use of renewable resources in manufacturing. Sustainable design is a holistic approach that encompasses the above concepts and seeks to minimise environmental impact throughout the product life cycle, from design and manufacture to use and final disposal. This involves considering aspects such as the choice of sustainable materials, energy and water savings during production, waste minimisation and consideration of local biodiversity. Therefore, to achieve ecological and sustainable products, it is essential to bear in mind the principles of sustainability from the outset and at every stage of the process as well as the social, economic (cost reduction and long-term viability) and environmental aspects. Consumers, as both demanders and users of these products, play a key role in their life cycle and can contribute to the circular economy with their decisions, for example, by facilitating the reuse and recycling of these products, thus cutting the volume of waste (Niinimäki & Hassi, 2011).

5.4. Circular economy

The circular economy (Figure 6) provides an overarching framework for addressing sustainability challenges in the textile industry, which has attracted increased interest and attention from governments, companies, and society at large (Reike

et al., 2022). Through the implementation of circular practices, companies can optimise resource use, reduce production costs, drive innovation and access new markets. The circular economy fosters the creation of more resilient and secure supply chains, and technological innovations have made the circular economy more viable and cost-effective, contributing to its widespread adoption (Saha et al., 2021).

Drawing on the thematic network of this theme, we can further explore its relationship with other aspects of the textile sector. The sustainability paradigm implies a shift towards an economic system that attempts to balance economic growth with both environmental protection and social welfare. The circular economy is based on this paradigm, as it aims to move away from the linear model of production and consumption and establish a continuous cycle in which resources are used efficiently, waste generation is minimised and reuse, recycling and regeneration of materials are encouraged. The concept of biofilm refers to the use of biodegradable and compostable materials in textile production, which helps to decrease dependence on non-renewable resources and reduce the environmental impact of textile waste.

The closed-loop supply chain requires the implementation of practices that enable the reuse and recycling of products and materials in the textile sector, including designing products that can be easily disassembled and recovered, as well as establishing efficient textile waste collection and recycling systems. The sustainable supply chain, for its part, aims to integrate sustainability criteria at all stages of the value chain, from the production of raw materials to the distribution and consumption of textile products (Rovanto & Bask, 2021). This means promoting fair labour practices, reducing environmental impacts, and establishing fair and equitable relationships with suppliers.

5.5. Sustainability

The goal is the achievement of sustainability. According to Cai and Choi (2020), sustainability has become a basic and cross-cutting issue in the textile sector for several reasons. First, the traditional textile industry has had a significant impact on the environment, from the intensive use of natural resources, such as water and energy, to the generation of large amounts of waste and water and soil pollution. Second, the textile sector also faces challenges related to social responsibility, such as poor working conditions, labour exploitation, lack of transparency in the supply chain and violation of human rights. Sustainability in the textile sector promotes ethical and fair practices, ensuring respect for labour rights, gender equality, safety, and well-being of workers throughout the supply chain. It also focuses on eliminating child labour and promoting decent jobs. By addressing these challenges and promoting sustainability, the textile sector seeks to improve its image and reputation and respond to the growing demands of consumers who value transparency, social responsibility, and care for the environment. In addition, sustainability can generate competitive advantages for textile companies by driving innovation, improving

operational efficiency, increasing customer loyalty, and accessing new markets that value sustainable products.

Sustainability (Figure 5) is related to important aspects of the value chain and the business model. In this industry, it is important to ensure that production is efficient enough to sustain the environment and the economy, so energy sustainability is an important part of this equation (Warasthe et al., 2022). Economic security is a priority for the textile sectors and results from good resource and production management. This means that products must be made from sustainable materials, such as linen, a versatile and durable material. In addition, linen production requires less energy and resources than many other materials and is easier to recycle (Provin et al., 2021).

The adoption of sustainable practices also contributes to improving the competitiveness of textile regions (Prashar, 2019). A sustainable development strategy is an important issue for the textile industry, as this industry is a major contributor to environmental pollution. It has become a leading industry worldwide, causing a great impact on the environment through using harmful chemicals and a large amount of waste, among others. Therefore, the textile industry must implement a sustainable business management strategy to reach its sustainable development goals, as stated by Li et al. (2021).

6. Conclusions

Although the topic of sustainability is not new, the purpose of this article has been to provide an updated and comprehensive overview of the literature on sustainability in the textile sector. A mixed method of analysis has been used in this article. A general analytical model has been presented to provide a comprehensive and up-to-date review creating five key thematic research domains: Sustainable Development, Value Chain - Cellulose and Textile, Design Process, Circular Economy, and Sustainability. The model has also made it possible to evaluate the relationship of these areas with each other and identify other emerging themes.

This analytical framework will allow future studies to focus on key areas of research, including the development of a study model to propose the processes of a 100% sustainable value chain, consumer attitudes and their sustainability habits, the implications of new sustainability regulations on medium and small businesses, and the social impact that may result from the incorporation of sustainable production processes throughout the textile value chain.

The article has practical implications. This study is useful for the industry as it can prioritise sustainability-related fields, such as investing in new technologies focused on processes, betting on the development of performance indicators, or integrally working on waste treatment in the textile value supply chain (Luoma et al., 2022). Theoretical and policy approaches aim to fundamentally change how production and consumption are conceived in the textile sector, promoting a transition

towards a more sustainable and circular industry. As for companies, it offers a model for better allocation of resources when pursuing more efficient and responsible performance. Achievements in sustainability can help to strengthen their identity and competitive difference in the eyes of consumers.

It has also revealed a lack of references to consumers and their attitude towards sustainability, making this an interesting field for future research. The academy should not only study consumers to understand their behaviour and discover how it affects company processes but also investigate how the company can influence them in terms of sustainability, e.g. by modifying their decisions and purchasing habits. Likewise, the academic study of the application of AI in the design process and throughout the supply chain can help to provide a better response to consumers, also contributing to the sustainable development of the textile industry, fostering collaboration of different stakeholders, as has been studied in other sectors (Gallego Gómez & Vaquero Frías, 2022).

This article includes the context of analysis and key value chain processes, emphasising aspects which are covered in the academic literature and which can be the basis for new research. For example, consumer behaviour, transparency in processes, comprehensive waste treatment in a circular economy system and the ability of companies to adapt to increasing sustainability regulations, a field in constant change. This set of tensions could be a line of research to solve current academic shortcomings and, at the same time, be useful in the industrial sector. Priority research should be the exploration of a data model for understanding the processes of a 100% sustainable value chain. In that context, an interesting future research line is the development of this new supply chain model, so it can serve as a specific standardisable tool that creates value for the product and the company, contributing to the economic performance of the company. Companies are making a great effort in their sustainable transformation, but there is still a long way to go.

However, bibliometric techniques may have limitations since they are based on analysis of bibliographic and scholarly sources. Future studies can complement the results obtained using additional techniques such as event analysis or case studies.

Declaration of conflicts of interest

The authors declare that they have no conflicts of interest in relation to the research, authorship or publication of this work.

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Appendix. The top 5 most cited references for themes and examples of references by thematic networks

Thematic Networks	Authors (year) and times cited*	Source / DOI	Thematic Networks	Authors (year) and times cited*	Source / DOI
Circular economy (Figure 6)	Jia, Yin, Chen, and Chen (2020). Times cited: 183	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2020.120728	Textile (Figure 4)	Shahid-Ul-Islam, Shahid, and Mohammad (2013). Times cited: 235	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2013.06.004
	Saha, Dey, and Papagiannaki (2021). Times cited: 36	<i>Business Strategy and the Environment</i> / https://doi.org/10.1002/bse.2670		Ozturk, Koseoglu, Karaboyaci, Yigit, Yetis, and Kitis (2016). Times cited: 70	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2016.02.071
	Provin, Dutra, De Sousa e Silva Gouveia, and Cubas (2021). Times cited: 32	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.techfore.2021.120858		Resta, Gaiardelli, Pinto, and Dotri (2016). Times cited: 60	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2016.06.135
Design process (Figure 7)	Rovanto and Bask (2020). Times cited: 30	<i>Business Strategy and the Environment</i> / https://doi.org/10.1002/bse.2677	Sustainable development (Figure 3)	Eid and Ibrahim (2021). Times cited: 42	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2020.124701
	Ribul, Lanot, Tommencioni Pisapia, Purnell, McQueen-Mason, and Baurley (2021). Times cited: 18	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2021.129325		Moreira, De Santa-Eulalia, Ait-Kadi, Wood-Harper, and Wang (2015). Times cited: 27	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2014.09.056
	Curwen, Park, and Sarkar (2013). Times cited: 60	<i>Clothing and textiles research journal</i> / https://doi.org/10.1177/0887302X124727		Seuring (2004). Times cited: 162	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2004.02.006
Design process (Figure 7)	Ross, Posner, Jönsson, and Peters (2015). Times cited: 37	<i>Clothing and textiles Research Journal</i> / https://doi.org/10.1177/0887302X15576404	Sustainable development (Figure 3)	Abreu, Castro, Soares, and Silva Filho (2012). Times cited: 92	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2011.08.010
	Niinimäki and Hassi (2011). Times cited: 267	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2011.04.020		Prashar (2019). Times cited: 31	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2019.07.045

(continued)

Appendix. The top 5 most cited references for themes and examples of references by thematic networks (continued)

Thematic Networks	Authors (year) and times cited*	Source / DOI	Thematic Networks	Authors (year) and times cited*	Source / DOI
	Kozlowski, Searcy, and Bardecki (2018). Times cited: 55	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2018.02.014		Govindan (2022). Times cited: 5	<i>IEEE Transactions on Engineering Management</i> / https://doi.org/10.1109/TEM.2022.3155247
	Ecer and Torkayesh (2022). Times cited: 8	<i>IEEE Transactions on Engineering Management</i> / https://doi.org/10.1109/TEM.2022.3151491		Dudin, Lyasnikov, Dzhurabaeva, and Kuznecov (2015). Times cited: 2	<i>Fibres and Textiles in Eastern Europe</i> / https://doi.org/10.5604/12303666.1152704
	Kocic, Bizjak, Popovic, Poparic, and Stankovic (2019). Times cited: 40	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2019.04.355		Cai and Choi (2020). Times cited: 64	<i>Transportation Research Part E: Logistics and Transportation Review</i> / https://doi.org/10.1016/j.tre.2020.102010
	Adu, Zhu, Jolly, Richardson, and Eichhorn (2021). Times cited: 13	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2020.124503		Pui-Yan and Choi (2012). Times cited: 61	<i>Journal of Fashion Marketing and Management</i> / https://doi.org/10.1108/13612021211222815
Cellulose (Figure 7)	Novaakovic, Popovic, Mladenovic, Poparic, and Stankovic (2020). Times cited: 8	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2020.122154	Sustainability (Figure 5)	Curwen, Park, and Sarkar (2013). Times cited: 60	<i>Clothing and Textiles Research Journal</i> / https://doi.org/10.1177/0887302X12472724
	Meksi and Moussa (2017). Times cited: 51	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2017.05.066		Seuring, Goldbach, and Koplin (2004). Times cited: 34	<i>International Journal of Integrated Supply Management</i> / https://doi.org/10.1504/IJISM.2004.004864
	Erdogan, Duran, and Selli (2019). Times cited: 5	<i>Industria Textila Journal</i> / https://doi.org/10.35530/IT.070.01.1553		Hole and Hole (2019). Times cited: 37	<i>Journal of Cleaner Production</i> / https://doi.org/10.1016/j.jclepro.2018.12.080

* Number of times cited in WoS on the search day (14.03.2023)

Source: Own elaboration based on the results of the co-word analysis performed by SciMat.