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SYSTEMATIC REVIEW

Investigating the limitations of fashion research methods in promoting a sustainable fashion practice and production: A systematic review

[version 1; peer review: 2 approved with reservations]

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Abstract

The need of research is often a complex issue, where the standardisation of methodologies, deeply rooted in the scientific method, has allowed humanity to progress. Since the fashion industry represents one of the most problematic industries for the environment, it is paramount to investigate the handicaps of sustainable fashion research practice. The goal of this systematic review is to outline the most used methodologies in the fashion research field that are being explored to achieve sustainability. The findings highlight the fragmentation of the literature in fashion research methodologies in relation to sustainability. Interviews and case studies are the most used methods while other less conventional, like Social Life Cycle Assessment, have been also tried. Finally, an exercise based on Generative AI using ChatGPT was performed to inform future routes to achieve a more sustainable fashion practice. Together, this work reveals the handicaps of the fashion research methodologies and show an example on how ChatGPT can be assessed to help the fashion practitioners define research plans to achieve a sustainable industry.

Keywords

Fashion research, Sustainable fashion design, Fashion research methods, Sustainable design, ChatGPT

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Introduction

"The saddest aspect of life right now is that science gathers knowledge faster than society gathers wisdom." Isaac Asimov

Researchers have been using a plethora of research approaches to explore, comprehend, develop, and test solutions for the progress of humankind (Williams, 2007). Even though the pace of producing data[1] and the specialisation degree of experts (Young & Muller, 2015) have been increasing, there is a need for a better understanding of the long-term impact of such human activities (Mensah, 2019). We are witnessing a post-pandemic period in business and fashion is no exception. The trend is the decreasing fashion market growth for the next years. The fashion industry faces other numerous challenges, from the environmental cost of manufacturing (Bick *et al.*, 2018; Pal & Gander, 2018), to the social issues (Adamkiewicz *et al.*, 2022; Bick *et al.*, 2018), and the economic unpredictable shifts (Castaneda-Navarrete *et al.*, 2021; Fierro Hernandez & Haddud, 2018). These factors represent a global environmental justice dilemma supplemented with strong economic risks with no clear foreseen solution (Brydges *et al.*, 2020; Galanakis *et al.*, 2022; Pedersen *et al.*, 2018).

Recently fashion brands like Zara and H&M have been under scrutiny due to their unsustainable practices (Dragomir & Dumitru, 2022). To meet a tentative solution, it is necessary to foster an enhanced research practice with standardised methodologies able to collect data, comprehend the patterns, and generate insightful conclusions that could be compared and widely disseminated. Therefore, scientific research might be seen as a useful tool to approach such issues. However, rigorous scientific standards must be present. To cite a wicked example, a broadly cited paper recently published in Nature Reviews Earth & Environment by Niinimäki and colleagues (2020) about the environmental impacts of the global clothing system used a reasonable amount of grey literature, presenting questionable methods and some contradictory estimations.

The objective of this systematic review is to critically analyse the most relevant fashion research methodologies published in scientific journals depicting the business, fashion, design, and sustainability arenas during the period ranging from 2015 and 2024. The decision to scope the search from 2015 onwards is justified by the Paris Agreement, since it was adopted by 196 Parties at the United Nations Climate Change (COP21) in Paris (France), on 12 December 2015. It represents "a landmark in the multilateral climate change process because, for the first time, a binding agreement brings all nations together to combat climate change and adapt to its effects"[2]. The Paris Agreement goal was to hold "the increase in the global average temperature to well below 2 ºC above pre-industrial levels (…) and to limit the temperature increase to 1.5 ºC above pre-industrial levels"[2]. Different from the Kyoto Protocol where the binding was signed to reduce greenhouse emissions, the Paris Agreement have no binding commitments, focusing on improving accountability (Doan *et al.*, 2024). Despite its ambitious goals, the Paris Agreement reinforced the national sovereignty by recognising that there will not be forced and drastic emission cuts (Falkner, 2016). This light commitment cast doubts on the signatory's ability to de-carbonise the global economy. Such superior aspirations and fade decisions may fail the expected and agreed goals depite recent optimistic results (Höhne *et al.*, 2021; Meinshausen *et al.*, 2022), mainly felt in developed countries (Salman *et al.*, 2022). Still, these positive impacts are being questioned. Doan and colleagues (2024) found little effect on the green transition resulting from the commitments agreed for the Paris Agreement, pointing out the need for a greater effort to meet the terms.

This work ends by suggesting considerations that may guide future fashion research in terms of sustainable practice and production.

Method

The systematic approach here implemented was adapted from the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) method (Page *et al.*, 2021). The method consists of a checklist composed of 27 items and a flow diagram that guides the reporting of systematic reviews based on transparency, accuracy, and comprehensiveness. So PRISMA 2020 is used for clear and complete identification of the relevant literature under the objective of answering the research question: how has fashion research methodologies being implemented to achieve sustainability?

This question aims to challenge the numbness that the sustainability term has gained in the recent years (Free *et al.*, 2024; He *et al.*, 2022) and to highlight clues for a more rigorous research approach to achieve sustainability in the fashion practice. Deeply rooted in creativity fashion designers might be overlooking the research phase, jumping too fast to prototyping, decreasing the knowledge production that must be obtained throughout research. Since this study searches for reports about fashion research methods with the purpose of implementing sustainability projects, it intends to foster a more intensive reporting to allow critical evaluations, reproducibility and replicability.

Primary search - Identified studies via Scopus

Firstly, the records were identified through Scopus databases (Table 1). For the identification phase, a different combination of appropriate keywords was searched using "AND" or "OR" whenever applicable in the database. The first search on Scopus used the combination "fashion research" AND "fashion design" AND "sustainability", resulting in 29,825 articles. The second search on Scopus used the combination "fashion research" AND "fashion design" AND "sustainability" AND ("methods" OR "methodology" OR "methodologies") and was aimed at Business, Management and Accounting, and Environmental Science, due to the lack of fashion research papers in

[1] https://explodingtopics.com/blog/data-generated-per-day, consulted on May 29, 2023

[2] https://unfccc.int/process-and-meetings/the-paris-agreement

Scopus, resulting in 7,351 articles. Finally, the third search used the combination "fashion research" AND "fashion design" AND "sustainability" AND ("methods" OR "methodology" OR "methodologies") AND ("limitations" OR "challenges") AND "fashion industry" AND "environmental impact" AND "fashion research methods", limited to the same fields, resulting in 3,144 articles. All searches found in Scopus were limited to Research Articles and Case Reports published between the years 2015 and 2023. Only Open access & Open archive were considered resulting in a total of 656 articles (Table 1).

Secondary search - Identified studies via other databases

To overcome the limitation of the few entries recovered from Scopus focusing on fashion, design, and technology-related practice, an additional search was performed in Association for Computing Machinery (ACM) Digital Library, Design Research Society (DRS) Digital Library, and Taylor & Francis Online from 2020 to 2024. For the secondary search, the same strategy was performed. The scope of the search spanned from 2020 until 2024 to highlight the research performed in the post-COVID-19 pandemic period. Only Open Access Research Articles were included resulting in a total of 1,205 (n = 1,154 from ACM, n = 10 from DRS, and n = 41 from Taylor & Francis Online – 23 in CoDesign and 18 in International Journal of Fashion Design, Technology and Education (IJFDTE)) (Table 2).

Studies screening and inclusion

To filter the retrieved records from the primary search, their titles and abstracts were assessed to check the relevance for the research objective. Using the PRISMA guidelines, from the initial 656 entries, a total of 49 were selected for relevance in answering the defined research question. From the initial 1,205 entries, 4 were selected from ACM, 6 from the DRS, and 8 from the Taylor & Francis Online (all from IJFDTE)

Table 1. Primary research methodology description.

Identification criterion	Description
Research objective	Investigate the impact of fashion research methodologies in sustainable design practice
Database	Scopus, assessed on April 15th 2023
Article types	Research articles, Case reports
Keywords	Fashion research, sustainability, methods, methodology, methodologies, limitations, challenges, fashion industry, environmental impact, fashion research methods
Language	English
Research criteria	Based on 3 research criteria: (1) 'fashion research' and 'fashion design' and 'sustainability', (2) 'fashion research and 'fashion design' and 'sustainability' and 'methods' or 'methodology' or 'methodologies' and limited to the subject areas 'Business, Management and Accounting' and 'Environmental Science', (3) 'fashion research and 'fashion design' and 'sustainability' and 'methods' or 'methodology' or 'methodologies' and 'limitations' or 'challenges' and 'fashion industry and 'environmental impact' and 'fashion research methods' and limited to the same subject areas.
Research years	2015–2023

Table 2. Secondary research methodology description.

Identification criterion	Description
Research objective	Same as Primary search
Database	ACM and DRS Digital Libraries, and Taylor & Francis Online, assessed on April 1st 2024
Article types	ACM: Research articles, in Proceedings, PDF available; DRS: Conference; Taylor & Francis Online: Article, Design subject
Keywords	ACM: "Fashion" and "Sustainability" in Title, "Sustainable fashion" in Abstract; DRS: "Sustainable fashion" and "sustainable fashion design" in Abstract Taylor & Francis Online: "Sustainable Fashion" in the Codesign and IJFDTE
Language	English
Research years	2020–2024

based on relevance. A total of 67 records were analysed and the remaining 1,794 records were excluded (Figure 1).

Since the entries were filtered manually there is a potential risk of bias or exclusion of relevant papers. So, the results presented must be interpreted as not final. One important thing to be considered is the fragmentation of the literature in the scope of fashion research for sustainability. Of note is the fact that no open access article was retrieved by the search in CoDesign related to the sustainability of fashion, while 57 articles were retrieved by not selecting the open access mode. From these 57 records, not a single article matched the purpose of the research objective. Such fragmentation increases the challenge of reporting, comprehending, and comparing between research projects and increase difficulties in transferring the conclusions to non-academic contexts.

Results

The starting scope of this research was intended to span a longer timeline to consider initiatives about fashion design methodologies tackling sustainable challenges happening earlier than 2015. However, the high number of entries retrieved by

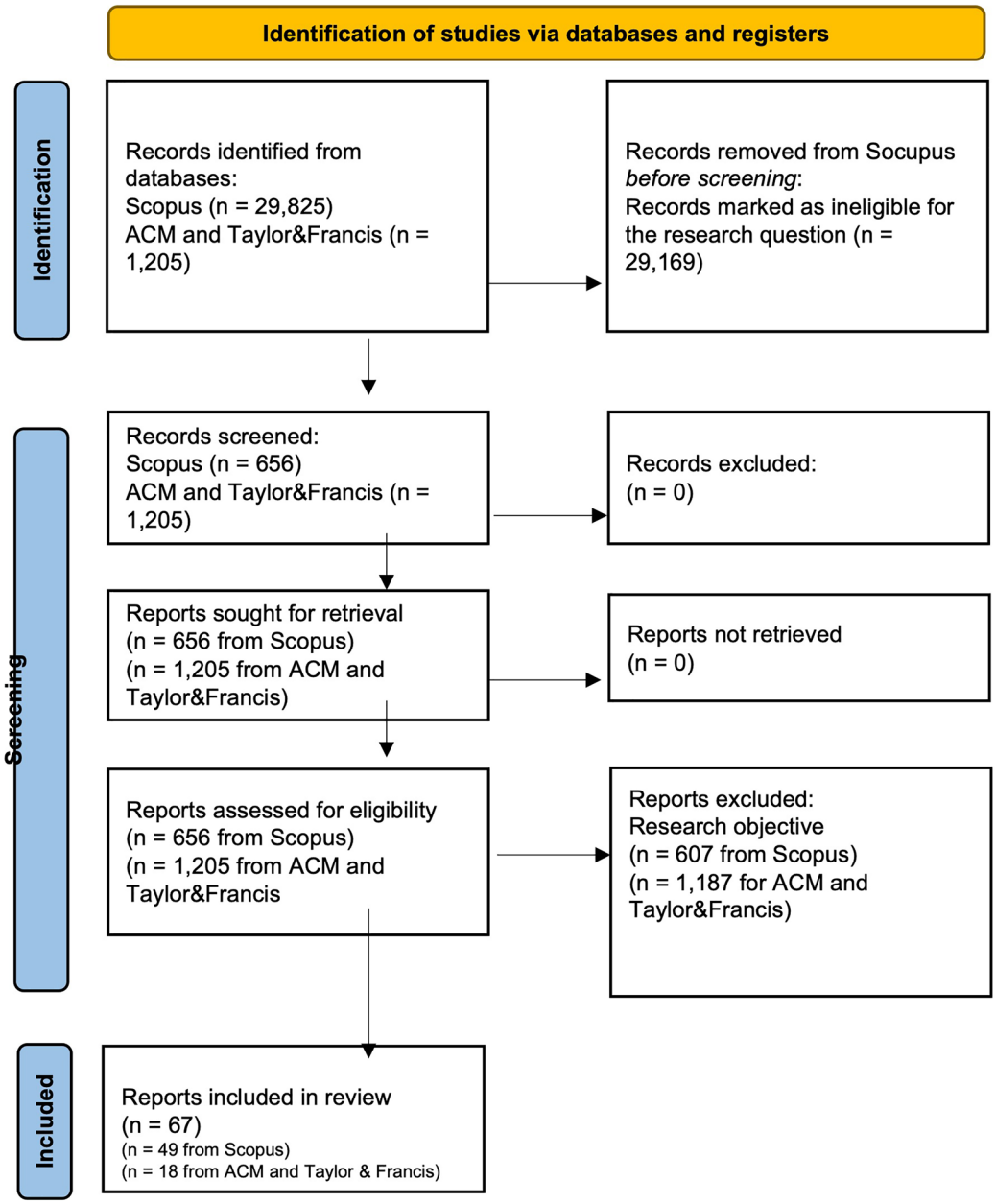

Figure 1. PRISMA flow diagram showing the identification, screening, and identification of studies to be included in the analysis.

the database in the recent years revealed that a strong interest in the sustainable aspect of fashion design and fashion industry is crescent. Despite the increased number of reports their content is fragmented and with reasonably documentation on the approaches.

Regarding the methods implemented and described by the analysed entries in the primary search, the most used research methods were interviews (n = 13), surveys (n = 11), and life cycle assessments (LCA) (n = 7). There were several research methods used by one study alone. They were the adaptive choice-based conjoint analysis, focus groups, and the two-round disaggregative Delphi approach (Table 3).

In terms of the limitations for sustainable fashion research during the primary search, they can be summarised by:

- **Low number of participants/ objects under study, limited geographies included (namely one country or in the same region), and limited range of time of the participation** (Aydin *et al.*, 2023; Bhandari *et al.*, 2022; Bocken & Konietzko, 2022; Brydges, 2021; Camacho-Otero *et al.*, 2019; Dangelico *et al.*, 2022;

Table 3. Total number of studies retrieved in the primary search outlined per type of method.

Type of method (n = total)	Reference
Adaptive choice-Based conjoint analysis (n = 1)	Fuchs & Hovemann, 2022
Case study (n = 10)	Brydges, 2021; Camacho-Otero *et al.*, 2019; Cooper & Claxton, 2022; Dragomir & Dumitru, 2022; Garcia-Ortega *et al.*, 2023; Gossen & Kropfeld, 2022; López *et al.*, 2023; Pal *et al.*, 2021; Salmi & Kaipia, 2022; Valor *et al.*, 2022
Compositional analysis (n = 1)	Wesley *et al.*, 2023
Focus group (n = 1)	Aydin *et al.*, 2023
Framework development/ Theoretical model (n = 5)	Aydin *et al.*, 2023; Kautish *et al.*, 2023; Shamsuzzaman *et al.*, 2023; Shou & Domenech, 2022; Turunen & Halme, 2021
Index Decomposition Analysis through the Logarithmic mean divisia index, and decoupling analysis (n = 1)	Román-Collado *et al.*, 2023
Interactive action research (n = 1)	Sandberg, 2023
Interview/ survey (n = 24)	Amasawa *et al.*, 2023; Bhandari *et al.*, 2022; Bocken & Konietzko, 2022; Dangelico *et al.*, 2022; de Oliveira *et al.*, 2022; Dhir *et al.*, 2021; Dukovska-Popovska *et al.*, 2023; Fontana *et al.*, 2021; Fuchs & Hovemann, 2022; Gossen & Heinrich, 2021; Johnstone & Lindh, 2022; Laukkanen & Tura, 2022; Nayak *et al.*, 2022; Padilha & Gomes, 2016; Pandey & Yadav, 2023; Persson & Hinton, 2023; Sandberg & Hultberg, 2021; Schmutz & Som, 2022; Scott *et al.*, 2023; Shamsuzzaman *et al.*, 2023; Siderius & Poldner, 2021; Singh *et al.*, 2019; Xue *et al.*, 2022
LCA (n = 7)	Amasawa *et al.*, 2023; Angelis-Dimakis *et al.*, 2022; Martin & Herlaar, 2021; Mölsä *et al.*, 2022; Shou & Domenech, 2022; Stone *et al.*, 2020; Wesley *et al.*, 2023
Material flow analysis (n = 1)	Schmutz & Som, 2022
Material flow analysis and carbon cost analysis (n = 1)	Millward-Hopkins *et al.*, 2023
Mathematical approach (n = 1)	Peters *et al.*, 2021
Scanning electron microscopy (n = 1)	Wesley *et al.*, 2023
Scenario development (n= 2)	Repp *et al.*, 2021; Shou & Domenech, 2022
Social LCA (n = 1)	Martin & Herlaar, 2021
Stakeholder analysis (n = 1)	Singh *et al.*, 2019
Systematic analysis (n = 2)	Cooper & Claxton, 2022; Jain *et al.*, 2021
Systems model technique (Causal loop diagram (n = 1)	Singh *et al.*, 2019
Thematic analysis (n = 1)	Bocken & Konietzko, 2022
Thermal transformation of waste cotton textile into carbon fibre (n = 1)	Wesley *et al.*, 2023
Thermo-gravimetric analysis (n = 1)	Wesley *et al.*, 2023
Two-round disaggregative Delphi approach (n = 1)	Luoma *et al.*, 2022
X-ray diffraction (n = 1)	Wesley *et al.*, 2023

de Oliveira *et al.*, 2022; Dhir *et al.*, 2021; Fontana *et al.*, 2021; Fuchs & Hovemann, 2022; Garcia-Ortega *et al.*, 2023; Gossen & Heinrich, 2021; Gossen & Kropfeld, 2022; Kautish *et al.*, 2023; Luoma *et al.*, 2022; Nayak *et al.*, 2022; Padilha & Gomes, 2016; Pandey & Yadav, 2023; Román-Collado *et al.*, 2023; Salmi & Kaipia, 2022; Sandberg & Hultberg, 2021; Scott *et al.*, 2023; Shamsuzzaman *et al.*, 2023; Siderius & Poldner, 2021; Turunen & Halme, 2021; Valor *et al.*, 2022; Xue *et al.*, 2022).

- **Limited knowledge and few technological tools from and for the stakeholders to enhance sustainability and/ or collaborative actions** (Bhandari *et al.*, 2022; Cooper & Claxton, 2022; Dragomir & Dumitru, 2022; Fuchs & Hovemann, 2022; Gossen & Kropfeld, 2022; Kautish *et al.*, 2023; Laukkanen & Tura, 2022; López *et al.*, 2023; Luoma *et al.*, 2022; Millward-Hopkins *et al.*, 2023; Nayak *et al.*, 2022; Pal *et al.*, 2021; Repp *et al.*, 2021; Román-Collado *et al.*, 2023; Shou & Domenech, 2022; Siderius & Poldner, 2021; Valor *et al.*, 2022).

- **Limited scope of the developed method** (Angelis-Dimakis *et al.*, 2022; Aydin *et al.*, 2023; Bhandari *et al.*, 2022; Bocken & Konietzko, 2022; Dhir *et al.*, 2021; Dragomir & Dumitru, 2022; Fuchs & Hovemann, 2022; Kautish *et al.*, 2023; Laukkanen & Tura, 2022; López *et al.*, 2023; Martin & Herlaar, 2021; Millward-Hopkins *et al.*, 2023; Mölsä *et al.*, 2022; Padilha & Gomes, 2016; Repp *et al.*, 2021; Sandberg, 2023; Schmutz & Som, 2022; Scott *et al.*, 2023; Shamsuzzaman *et al.*, 2023; Shou & Domenech, 2022; Turunen & Halme, 2021; Valor *et al.*, 2022).

There was also observed that no critical discussion was presented regarding the limitations of any particular method (Jain *et al.*, 2021; Johnstone & Lindh, 2022; Persson & Hinton, 2023; Schmutz & Som, 2022; Stone *et al.*, 2020; Wesley *et al.*, 2023). All the limitations summarised above were highlighted by the respective authors which means that there is a chance of an underrepresentation or bias. This is exemplified by Bocken and Konietzko (2022) and Dhir and colleagues (2021) where it is assumed the replicability limitation of their interviewing and surveying methodology which was not assumed by the other researchers who also perform similar approaches.

According to the secondary research it was observed that more practical methods were employed to research sustainability in fashion (Table 4).

The main limitations of the methodologies applied throughout the retrieved studies during the secondary search are related to the following challenges:

- **Resources (such as time, space, and equipment)** (Bolzan *et al.*, 2022; Forst, 2022; Maione, 2023; Pervez, 2023; Wetherell *et al.*, 2023)

- **Personal attributes and health (such as self-confidence, guilt, mental health)** (Maione, 2023; Pervez, 2023; Wood *et al.*, 2022)

- **Efficacy and evaluation** (Bolzan *et al.*, 2022; Maione, 2023; Wenjing, 2021)

- **Collaborative work** (Forst, 2022)

- **Future predictions** (Claussen *et al.*, 2023; Wenjing, 2021)

- **Limited data and few variables** (Aspinall & Holroyd, 2024; Baker & McNeill, 2024; Bennetta & Oeppen Hill, 2022; Claussen *et al.*, 2023; Fani & Bandinelli, 2023; Potdar *et al.*, 2024; Riesgo *et al.*, 2023; Sajja *et al.*, 2021).

The limitations identified by the secondary research are similar to the ones observed throughout the primary research. However, they may need further critical discussions in order to enhance the proper transfer of results and knowledge to business owners and non-academic fashion practitioners.

Discussion

Fashion is a complex system and it is becoming urgent and obvious the need for a radical shift (Jin & Shin, 2021). The current climate crisis is pushing all sectors to apply more

Table 4. Total number of studies retrieved in the secondary search outlined per type of method applied.

Type of method (n = total)	Reference
Mixed method (survey, semi-structured interviews; moodboard, sampling, prototyping; autoethnography, recrafting); participatory prototyping semi-structured interviews) (n = 4)	Aspinall & Holroyd, 2024; Bennetta & Oeppen Hill, 2022; Forst, 2022; Maione, 2023
Prototyping (n = 4)	Bolzan *et al.*, 2022; Pervez, 2023; Ravnløkke, 2021; Wood *et al.*, 2022
Interviews/ survey (n = 3)	Claussen *et al.*, 2023; Potdar *et al.*, 2024; Riesgo *et al.*, 2023
Case study (n = 2)	Baker & McNeill, 2024; Wenjing, 2021
Simulation Model (forecasting tool; discrete event simulation, agent-based modelling, geographic information system) (n = 2)	Fani & Bandinelli, 2023; Sajja *et al.*, 2021
Action research (n = 1)	Wetherell *et al.*, 2023

efficient, and socially just processes to achieve sustainable goals. McLaren and colleagues (2016) argued that extending the garment's lifecycle increases their maintenance and extended use thus reducing the need of buying more clothes. However, this strategy is lacking a broader implementation since the business models are hard to operate and it is not clear that the market is requesting them (Oxborrow & Claxton, 2016). This comes as a dilemma where the sustainable practices often conflict with the efficiency of business models (Dyllick & Muff, 2016; Lønne & Skjold, 2016). As an example, the fashion collections, designed season after season, in repetitive fast cycles, undermines the possibility of proper researching, developing, and disseminating of more sustainable materials and processes (Ræbild & Bang, 2018; Ræbild, 2020). To this end, Kapsali and Hall (2022) suggest that fashion designers shift from a "substance and energy" approach to a "structure and information" design practice, allowing a better assessment of requisites such as resource efficiency, material longevity and recovery.

The research practice is a tool to investigate complex challenges diminishing the effect of biases and established power structures (Popper, 1959). Intended as the application of a rigorous and scientific method, research aims to falsify hypotheses through replicable and strict experimentation. However, it is not trivial, and creative practices tend to overlook the scientific method. This is not an issue *per si* but it represents an handicap whenever designers seek for more robustness, efficacy, and comprehension in their research and development endeavors (Baskerville, 2008). Historically design practice stimulates a freer practice than the one expected from a transformative work. Therefore, there is no clear perspective on the implications of broad playfulness in the legitimacy and trustworthy of the designer as a professional equipped to solve complex challenges in flexible ways (Mukerjee *et al.*, 2023; Statler *et al.*, 2011).

The results here observed show that there must be an enhancement of the fashion research practice. This enhancement must entail:

- A wider participation (through the increase of participants' numbers and diversity),
- More connectedness with relevant stakeholders (through the use of inclusive technology and of co-design methodologies), and
- To increase the scope of the research employed (through resilient interdisciplinary capacity building of fashion practitioners).

By applying these recommendations, the limitations related to the efficacy and evaluation, personal attributes, and future predictions might be tackled as well. Still, there is a need to increase the resource allocation to fashion research, which might not be an exclusive problem for the sustainability ambition, as seen in scaling business models from auto-defined sustainable fashion brands and, and new co-funding initiatives (Dyllick & Muff, 2016; Fani & Bandinelli, 2023; Lønne & Skjold, 2016). Additionally, the complexity of these challenges deserves a more attentive effort, where collaboration with other disciplines may achieve more robust solutions. This interdisciplinary vision is being implemented by the New European Bauhaus (NEB) initiative[3] and could represent a new avenue for research, experimentation, and testing together with local communities.

Discussion using ChatGPT-generated critical assessment[4]

Large-Language Models have the potential to accelerate scientific research by increasing the speed of generation of insights (Birhane *et al.*, 2023; Taylor *et al.*, 2022). For this reason, ChatGPT 3.5 was used to generate a 3-year research plan to address the detailed limitations found through the primary search in the systematic analysis. The following prompt was used:

- Assume you are a decision-maker with full powers in your region, country, and continent. You also have influence globally. You were asked to develop a research plan to create and validate a framework for fashion practitioners (designers and professionals in companies) to fully transform the field. You have control on the budget to perform the project and to hire the necessary people to help you throughout the process. The brief is the following: 1) timeline of 3 years; 2) the outcomes of the project must be easily actionable across the fashion industry, despite further necessary adaptations and particular validations and optimisations; 3) take into consideration the following limitations of current methodologies: i) Low number of participants/objects under study, limited geographies included (namely one country or in the same region), and limited range of time of the participation, ii) Limited knowledge and technological tools from and for the stakeholders to enhance sustainability and/or collaborative actions, and iii) Limited scope of the developed methodology. Now please develop the research plan in less than 1000 words.

The answer was divided in the following items: i) Research Plan, ii) Objective, iii) Detailed phases per year, iv) Budget and Resource Allocation, and v) Conclusion. The research plan was named "Developing a Transformative Framework for Sustainable Fashion Design", and the objective was a repetition of the prompt. For the first year, a preparatory phase was delineated with the following tasks:

1. *Assemble a multidisciplinary research team consisting of experts in sustainable fashion, supply chain management, consumer behaviour, and technology;*
2. *Conduct an extensive literature review to gather existing knowledge on sustainable fashion practices, methodologies, and frameworks; and*
3. *Identify and engage with key stakeholders in the fashion industry, including designers, manufacturers, policymakers, and non-governmental organizations, to understand their challenges, needs, and perspectives.*

[3] https://new-european-bauhaus.europa.eu/

[4] ChatGPT, personal communication, May 26–30, 2023

For the second year, the generated response focused on a framework development phase with the following tasks:

1. *Design and implement a large-scale global research study that overcomes the limitations of current methodologies;*
2. *Ensure a diverse and representative participant pool from various countries and regions, involving designers, professionals, and other stakeholders from different fashion sectors;*
3. *Employ advanced technology tools, such as data analytics, machine learning, and blockchain, to enhance sustainability and collaborative actions within the study.*
4. *Develop an expansive and adaptable methodology that encompasses different geographies, cultures, and timeframes to capture a comprehensive understanding of sustainable fashion practices.*
5. *Collect data through mixed methods, including surveys, interviews, observations, and industry case studies, to generate rich insights into sustainable fashion practices, challenges, and opportunities.*
6. *Apply iterative and participatory design processes, involving stakeholders in co-creation sessions to refine and validate the framework's components.*
7. *Continuously assess the feasibility and practicality of the framework to ensure its actionability and adaptability across the fashion industry.*

Lastly, for the third year, a validation and dissemination phase were defined to:

1. *Validate the framework through pilot implementations in collaboration with selected fashion companies and organizations.*
2. *Assess the impact of implementing the framework on sustainability performance, consumer behavior, supply chain transparency, and collaboration within the participating organizations.*
3. *Gather feedback from practitioners and stakeholders involved in the pilot implementations to refine and optimize the framework.*
4. *Develop practical guidelines, toolkits, and training materials that distill the framework's key principles and actionable steps for easy adoption across the fashion industry.*
5. *Disseminate the research findings, framework, and associated resources through publications, industry conferences, workshops, and online platforms.*
6. *Collaborate with global fashion associations, NGOs, and policymakers to advocate for the adoption of the framework and support its implementation at a broader scale.*

In terms of the budget and resource allocation a general answer was provided without much informative insights.

Conclusions

This study evidences the non-trivial nature of researching within the fashion discipline. The plethora of methods applied and their limitations make it hard to standardise the research frameworks. As more quantitative approaches are implemented the need of adding different competencies to the fashion design practice is becoming apparent. As conclusion it is suggested that a broad network of universities, companies, not-for-profit organisations, alongside informed citizens combine their interests and expertise to co-design and validate a powerful set of methodologies for fashion research purposes such as seen in order initiatives like the NEB.

Finally, this study may be helpful for policy making since it uncovers the limitations of performing relevant research in the realm of fashion when focusing a more sustainable practice. Lastly, it is suggested a ChatGPT-based preliminary plan to guide a fast and reliable discourse under the scope of this systematic review. Ideally, it would provide aid for fashion practitioners and fashion decision-makers for the implementation of more sustainable processes.

Ethics statement

During the preparation of this work the author used ChatGPT in order to add a contribution to the discussion based on a broad AI-based answers to a main question related to the areas and research methodologies to be explored in fashion-related studies to achieve sustainability. After using this tool, the author reviewed and edited the content. Still, the author takes full responsibility for the content of this publication.

Ethics and consent

Ethical approval and consent were not required.

Data availability

No data are associated with this article.

Reporting guidelines

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Introduction:
The introduction presents an extensive overview of themes surrounding the intersection of fashion, sustainability, and research methodologies. It incorporates a wide range of references and situates the work within global debates about environmental, social, and economic challenges. While this breadth demonstrates commendable effort, the section tends to be descriptive rather than analytical. The claims about the post-pandemic context, environmental degradation, and economic instability are framed in general terms and not consistently supported with focused literature. In several cases, single statements are supported by long lists of references without a clear explanation of their specific contribution. This approach risks diluting the conceptual clarity of the argument. More importantly, the introduction does not adequately identify the specific knowledge gap the article intends to address. Since the article aims to review the methodologies applied in previous research, it would be essential to explain more explicitly why this methodological focus is novel, what is missing in the current literature, and how the study fills that gap. The research question is presented, but it emerges rather late and without the necessary conceptual scaffolding. Additionally, the scope could be broadened beyond a European perspective. The fashion industry has disproportionate effects in regions such as South and Southeast Asia, which are major production hubs and where ethical and responsible innovation debates are particularly relevant. Literature in outlets such as the *Asia Pacific Journal of Management* could provide a more global and critical view. Finally, it would be useful for the introduction to consider established conceptual frameworks, such as CSR or responsible innovation, which could anchor the discussion and provide more robust theoretical positioning.
Methodology:
The article adopts PRISMA 2020 as a guiding protocol, which is a rigorous and appropriate choice for systematic reviews. However, the way in which the methodology is presented leaves room for significant clarification. First, the use of Boolean operators in the search strategy is insufficiently detailed. It is unclear whether truncations, wildcards (e.g., *), or alternative spellings were systematically applied, and this omission limits replicability. Second, the eligibility and exclusion criteria are not explained with sufficient transparency. The process by which the very large initial pool of records was reduced to only 67 articles is not fully convincing, particularly when the text

states that “from these 57 records, not a single article matched the purpose of the research objective.” This formulation creates confusion and risks undermining the reader’s trust in the selection process. In a systematic review, clarity on how decisions are made at each stage of screening is crucial. Moreover, the justification for adopting a literature review of methodologies as opposed to alternative designs (qualitative fieldwork, meta-analysis, or mixed methods) is missing. Without this explanation, the choice appears arbitrary. A stronger methodological justification would reinforce the value of the review.
Results:
The results section succeeds in mapping out the most commonly used methodologies in sustainable fashion research, with interviews, surveys, and LCA emerging as predominant. This descriptive overview is useful, but it remains somewhat superficial. While the authors report the number of times each method was applied, there is little attempt to interpret why certain methods dominate or what this implies for the development of the field. The limitations summarized, such as small sample sizes, narrow geographies, and restricted timeframes, are certainly important. However, the discussion of these limitations is uneven. In particular, the article notes that many authors do not discuss methodological limitations, but it does not provide a critical reflection on what these reveal about the epistemological maturity of fashion research. Greater analytical depth would strengthen the section, especially if the results were connected more explicitly to the research question.
Discussion:
The discussion addresses the inherent complexity of the fashion system and the contradictions between sustainable practices and current business models. It raises valid concerns about the structural barriers to sustainability, such as the fast-paced cycle of fashion collections. Nonetheless, the linkages between the discussion and the earlier findings are not sufficiently developed. The argument often shifts to a broader debate about sustainability and design practices, which, while interesting, risks losing sight of the central purpose: to review and critically assess methodologies. For example, the section could be improved by proposing a conceptual framework for evaluating fashion research methods or by outlining criteria for methodological robustness. Instead, the discussion remains descriptive and does not generate new theoretical or practical insights. The integration of a ChatGPT-generated research plan is innovative and demonstrates openness to experimentation. However, it reads as an appendix rather than a central contribution, since it is not critically assessed or integrated into the main line of reasoning.
Conclusions:
The conclusion acknowledges the difficulties of standardising research frameworks in fashion studies and calls for broader collaboration among universities, firms, NGOs, and citizens. These are valuable observations, but they remain at a general level. The strength of a systematic review should lie in its capacity to synthesise existing knowledge and propose either new conceptual frameworks or precise research propositions. In this case, the conclusions do not fully achieve this objective. They highlight the fragmentation of the field but do not provide actionable pathways or original propositions that future research could test. Furthermore, the reliance on ChatGPT to produce a preliminary plan, while interesting, raises questions about academic rigour and whether such a tool can substitute for a theoretically grounded synthesis. The article would benefit from a more precise articulation of its contribution: is it descriptive mapping, critical assessment, or framework-building? Clarifying this would make the conclusion stronger and more impactful.

Hence, this article explores an important and under-researched question: how methodological practices shape the study of sustainability in fashion. It brings together a wide range of sources

and attempts to apply a systematic approach through PRISMA. However, the article does not yet meet the standards of clarity, rigour, and conceptual integration expected of a systematic review. The contribution would be significantly strengthened by adopting an explicit conceptual framework (e.g. CSR, responsible innovation), clarifying eligibility criteria, improving the coherence between sections, and moving beyond description to propose actionable research propositions. Despite the concerns outlined in my report, I believe the manuscript has the potential to be significantly improved, so I recommend it for revision.

Are the rationale for, and objectives of, the Systematic Review clearly stated?
Partly

Are sufficient details of the methods and analysis provided to allow replication by others?
No

Is the statistical analysis and its interpretation appropriate?
Not applicable

Are the conclusions drawn adequately supported by the results presented in the review?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Sustainability Accounting and Management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 02 June 2025

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MAZED ISLAM
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Reviewer comments: Major recommendations
Overall comments to the author:
Appreciate authors hard work researching the interesting topic “Investigating the limitations of fashion research methods in promoting a sustainable fashion practice and production: A systematic review”. The work is relevant from fashion industry contexts. Currently, there is a lack of enough/novel contributions to the subject in theory and practice. The methodology, literature section, interpretation of results, use of Gen AI, and quality of communication need

improvements. Paper needs to be restructured to achieve its potential. The work is worthy of publication if the manuscript is revised considering suggested comments. In general, I think there is possibility to make a novel contribution here, but it is not yet presented in the manuscript. I would recommend pushing significantly further in your analysis and implications and thinking very carefully about the novel contributions.

The topic “Investigating the limitations of fashion research methods in promoting a sustainable fashion practice and production: A systematic review” is relevant and important from fashion industry contexts and will be of interest to the readers of the journal through a stronger connection. Currently, there is a lack of novel contributions to the subject. The methodology, literature section, use of Gen AI, interpretation of results, and quality of communication need improvements. Paper needs to be restructured to achieve its potential. A critical review of literature is required. The author should clearly outline the Implication/contribution of the works from theoretical and practical contexts. In general, I think there is chances of a novel contribution here, but it is not yet presented in the manuscript. Overall, the manuscript work is worthy of publication if the suggested improvement is made in the revised version.

Originality: I think the work presented by the author may be considered for publication if it considers suggested comments. Firstly, a comprehensive literature review of the literature is needed. Author needs to provide significant and further original information in terms of contributions to theory and practices. Currently, there is a lack of novel contributions to the subject and wider contexts.

Relationship to literature: A more critical, relevant, and updated review of literature is required. The literature section should make a stronger connection to the journal, and target customer contexts. Authors could include further academic literature, theory, and market intelligence to enhance lit review credibility and expand wider connections to the subject. Often, some sentences are challenging to follow and there are weak sentence transition/links throughout the lit part.

Methodology: The methodology section needs to be developed more systematically and detailed information is required. More detailed information needed for using Gen AI and link them strongly with theoretical contexts. In addition, detailed procedures of data collection, and analysis techniques are required. How the authors-controlled researcher bias in interpretation? Moreover, Authors should provide more details about relevant reliability and validity of the works.

Results and analysis: Findings and discussion could have been more robust, systematic, and extensively analyzed, supported by more evidence. A more precise analysis with justification is required with a link to previous results. The author needs to make a stronger connection back to the purpose of this manuscript and the readership of the journal. Viable and evidence-based practical recommendations for stakeholders would be useful. Currently, the findings are weak, and do not explain/link well enough. I think that here is a great margin for more detailed analysis and interpretation that could lead the authors to reflect on linking Gen AI and sustainable fashion research methods. I would also suggest making an effort and explicitly linking the conclusions to the data shown in the paper in order to underline the validity of the conclusions.

Implications: The implications again remain at the surface in my view. What is the novelty of this research? However, the implications section may be re-written in a separate paragraph with the two-subheading (i) theoretical contribution and (ii) practical contribution, before the conclusion

para. Authors should be specific and more logical and compare with existing literature if any. The manuscript provides limited insights that bridge the gap between theory and practices. The implications are very brief and substantially lack depth. Gen AI use, how author link the with the overall research contexts?

Communication: The quality of communication needs improvement. Need proofread and stronger scientific flow. Some statement does not flow logically, and therefore challenging to understand for a general readership. References should be more selective and updated and requires double check. The conclusion and the abstract section should be developed more precisely and concisely. The paper is not sufficiently clear in its argument.

Are the rationale for, and objectives of, the Systematic Review clearly stated?
Partly

Are sufficient details of the methods and analysis provided to allow replication by others?
Partly

Is the statistical analysis and its interpretation appropriate?
Yes

Are the conclusions drawn adequately supported by the results presented in the review?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Fashion research methods, sustainable fashion, circular economy, fashion industrial sustainability, fashion digital transformation, and supply chain management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.