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Review

Towards A Conceptual Framework of Sustainable Practices of Post-consumer Textile Waste at Garment End of Lifecycle: A Systematic Literature Review Approach

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Abstract: Fashion is characterised by rapidly changing trends and consumption patterns which have led to complexities and dynamism of the fashion supply chain (SC). Excessive generation of wastes highlights the need for innovative ways to address unsustainable practices by feeding the waste back into the supply chain system. This paper reviews the extant literature on sustainability within the fashion industry's supply chain to establish available sustainability practices to manage post-consumer textile waste (PCTW) at garment end of lifecycle. Four sustainable practices emerged from the review—education and engagement, recovery and redistribution, reuse, and recycling—and are central to a framework that shows the interaction of garment end of lifecycle practices and could the achievement of strategic competitive advantage. Our findings emphasise the importance for interaction and collaboration between consumers and retailers and further involvement of the entire supply chain. In addition, sustainability paradoxes were evident across the sustainable practices. To avoid this, for retailers are urged to shift towards cradle to cradle (closed loop) lifecycle supply chains. Furthermore, retailers should evaluate the practices they adopt by questioning their aim in the achievement of sustainability. We suggest that firms should consider the entire supply chain when adopting a sustainable practice and each agent's role in achieving the overall outcome of sustained competitive advantage.

Keywords: supply chain; sustainability; fashion industry; literature review; end of lifecycle

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1. Introduction

At its core, the fashion industry's supply chain (SC) is "based on the notion of continual consumption of the 'new' and the discard of the 'old'" [1]. The disposal mindset of consumers and shortened lifecycle of garments simply does not equate to the pursuit of sustainability, making the afterlife of a product more significant, particularly with reducing and recycling waste within the supply chain [2]. Kang, Liu [3] discussed consumer knowledge as a key factor in attaining environmental sustainability.

Traditional garment production before the late 1980s concentrated on basic items with occasional changes to design elements [4]. However, the end of the twentieth century brought about many changes including the decline of traditional apparel production and the growth of fast fashion where, for consumers to fit in socially, they must stay current with the ever-changing trends [5]. In more recent times, the COVID-19 pandemic has caused the pivot of fashion manufacturers to making face masks and other creative designs to keep their businesses open [6].

Prior to COVID-19, the industry had an expected growth of approximately five percent by 2030, and the demand for clothing was set to increase by 63 percent at the current trajectory, it is estimated that the fashion industry will use two Earth's worth of resources

exerting an unprecedented strain on the planet's resources [7,8]. It is no wonder the fashion industry is considered to have one of the largest environmental footprints [9,10], second only to the oil and coal industries [11]. Globally, the industry generates 10 percent of all greenhouse gas emissions and 20 percent of all wastewater [8,12]. Recently, the COVID-19 pandemic has highlighted the social detriments of the industry, looking at fashion workers' health care, welfare, and payment rights in developing countries [6,13]. These articles highlight modern day slavery that are unsustainable.

To gain success in this generation, supply chain agents need to view sustainability as a central business strategy by committing to sustainability targets [14]. As the supply chain shifts away from the cradle to grave approach, firms within the fashion industry must be proactive and strive toward a closed-loop strategy [2]. Closed-loops, or circular economy principles, highlight the significance of a lifecycle approach towards products and how their by-products are managed [15,16]. The cost implications of the depletion of resources and the associated by-products created, that are not captured or used (pollutants and waste), are a key consideration within the supply chain [15]. Moreover, sustainability should be considered in relation to the resilience of supply chains and their productivity [17,18]. Experiences during the COVID-19 pandemic demonstrate how situations can change rapidly and sustainable policies may need to be adjusted to accommodate those changes [17,18]. D'Adamo and Rosa [17] put this into perspective in their editorial paper. They talk about having an infrastructure in place to address sustainability issues within the economy [17]. In the same light, Obrenovic, Du [18] suggested that organisations that are able to experience sustained operations during and post COVID-19 should have distributed leadership, workforce and an adaptive culture.

Within the context of the current paper, the role of supply chain agents is crucial in moving towards sustainability. James and Montgomery [19], Belz [20], and Yang, Song [21] argued that retailers have a significant role to play through their power and control, and capacity to connect consumers and suppliers, acting as "ecological gatekeepers" [21]. However, Taghikhah, Voinov [22], Shen [23], Thorisdottir and Johannsdottir [24], and Cervellon and Wernerfelt [25] all suggested that sustainability activities should not stop with retailers but should also extend to cover the post-consumption period. This puts the spotlight on consumers as a key part of the supply chain with their behaviour vital in the transition towards sustainability [22]. Moreover, collaboration between all supply chain agents is important to the implementation of sustainability practices [26].

Yang, Han [27] argued that, within the fashion industry, more and more firms are adopting various sustainable strategies and practices, such as considering the use of eco-friendly materials that can be reused and recycled, green products and green certifications to achieve more sustainable supply chains. However, on the consumer side, the shortened lifecycle of clothing, and disposal mindset of consumers, contribute to post-consumer textile-waste (PCTW) and challenges have been noted with retrieving and sorting these waste products [2]. Similarly, Shedroff [28] discussed issues relating to recycling as these PCTW are composed of various blends during manufacture which may be unknown at the post-manufacture stage.

Consequently, the garment end of lifecycle has never been more important, particularly with managing waste within the supply chain [2]. Several researchers have explored the need for transparency between consumers and retailers [19,29]; however, little is known in the context of the garment end of lifecycle. Within the literature, papers analyse sustainability within the fashion supply chain [30–32] and alternative power structures (suppliers and retailers) [33], whilst others discuss the circular economy and the role of consumers in fashion reuse [34]. Upcycling [35] and recycling [36] have also been examined but focus tends to be on the design phase [35–37] and not on garment end of lifecycle. Thus, this paper reviews extant literature on sustainability within the fashion industry's supply chain to establish available sustainability practices to manage PCTW at garment end of lifecycle with the aim for firms to attain sustained competitive advantage.

To address how firms can attain sustained competitive advantage, this paper builds on the work of Jia, Yin [38], that the natural resource-based view (NRBV) is an appropriate theory for understanding closed-loop supply chain (CLSC) practices. NRBV stems from resource-based view (RBV) where competitive advantage for a firm is achieved through utilisation of resources that are scarce (rare) and unique (valuable) and therefore not easily replicated by competitors [39,40]. Thus, resources (such as physical, financial assets, social processes and employees' skills) are basic units of analysis which in bundles results in a firm's capabilities and has an effect particularly on value-added tasks [39]. Therefore, Hart [39] stated that competitive advantage is achieved by firms who are not just focused on the conventional approaches to strategic planning but also where they understand, nurture and leverage on their core competencies. Further, Hart [39] and Shi, Koh [41] argued that challenges and limitations caused by natural (biophysical) and social environments are in fact the key drivers of new resources and capability development. In more recent discussions, Jia, Yin [38] affirmed that a firm's competitive advantage is not only attained through the utilisation of rare, valuable, inimitable resources or resources that are internal to the firm but also those that consider the external environment.

The NRBV posits that the natural environment could constrain a firm's sustainable advantage [42]. Hence, sustained competitive advantage is "rooted in capabilities that facilitate environmentally sustainable economic activity— a natural-resource-based view of the firm" [39]. Hart [39] suggested three interconnected strategic capabilities: pollution prevention, product stewardship, and sustainable development which Yunus and Michalisin [43] believe could aid a firm in achieving its business and environmental sustainability.

According to Yunus and Michalisin [43], the pollution prevention capability involves the prevention of emissions, effluents and wastes at the production and operation processes rather than 'at the end-of-pipe'. One of the limitations with this explanation, however, is that it does not explain the notion of 'end-of-pipe' in relation to CLSC, where there is no clear start or end point in the supply and value chain. This concept of pollution prevention as it pertains to the end-of-pipe stage has been challenged by Miemczyk, Howard [44], whose study demonstrated that pollution prevention and innovation orientation are needed in a CLSC. They elaborated on the NRBV theory and argue that there are issues beyond the control of a firm which may lead to end-of-pipe controls such as sorting and testing [44].

Product stewardship extends on pollution prevention to include the entire value chain and lifecycle of a firm's product system [42]. It attempts to integrate the 'voice of the environment' with perspectives of various stakeholders into the product design and development processes [42,43]. Miemczyk, Howard [44] suggested that when considering product stewardship and pollution prevention as strategies, managers need to look beyond the entirety of their organisation, thereby highlighting the role of leadership within the supply chain.

The third capability is sustainable development which goes beyond environmental integrity to consider economic prosperity and social equity [42,43]. Therefore, sustainable development presents a higher level capability strategy to pollution prevention and product stewardship as it looks at how competitive advantage could be maintained and sustained indefinitely [42].

In understanding these capabilities, there is increasing concern with the limited study of the PCTW at garment end of lifecycle and how it could point firms towards sustained competitive advantage within the fashion CLSC. Thus, this paper builds on findings from the reviews of Jia, Yin [38] and Ki, Chong [45] to explore sustainable practices beyond the 6Rs (redesign, reduce, reuse, recycle, remanufacturer, repair) and the post-consumption stage. With consideration, this paper uniquely focuses on sustainable practices at garment end of lifecycle and how these could result in sustained competitive advantage through the application of the NRBV theory. Hence, this paper reviews extant literature on sustainability within the fashion industry's supply chain to establish available sustainability practices to manage PCTW at garment end of lifecycle. Therefore, this paper develops a conceptual

framework that explains the combination of these practices from a NRBV lens towards sustained competitive advantage.

To achieve the aim of the paper, we conduct a systematic literature review (SLR) to map, assess and synthesise literature to reach a clear conclusion as to what is known and unknown [46–48]. Abstracts for 274 papers are evaluated with 81 selected for in-depth full-text review. The method adopted for material collection and selection within the SLR is presented in Section 2. Section 3 provides descriptive analysis of the reviewed papers. Section 4 presents the results of the content analysis with the four major practices for garment end of lifecycle that emerged from the SLR, explained. The paper concludes in Section 5 with a proposed framework along with discussion of findings from the review and future research directions.

2. Methodology

This paper employs the systematic literature review (SLR) method to establish a set of possible practices for managing PCTW generated from garment's end of lifecycle within the fashion supply chain. This method was selected as it provides the researcher with an objective, and less biased method, for selecting existing literature sources, and evaluating and analysing published works [46]. It documents the researchers' decisions and procedures, enabling clear conclusions to be drawn [46,47]. By minimising selection bias, the study benefits from the recursive and iterative process of defining, clarifying, and refining keywords from searched academic resources (Saunders, Lewis, and Thornhill 2009).

A four-step process was adopted in line with Seuring and Gold (2012). The research material was collected, descriptively analysed, cogent categories were identified from the research material, and then evaluated. These four steps are described in more detail in subsequent sections.

2.1. Material Collection and Selection

SCOPUS and ISI Web of Science (WoS) were selected as the most appropriate databases for this study, as they are major databases that provide access to high-quality peer-reviewed journals. To frame the search, 'title, abstract and keywords' were used for the Scopus search, while the 'all fields category' was used for WoS. The searches were conducted in February 2020 and involved the keyword equations listed in step 4 in Table 1. The search returned 746 document results from SCOPUS and 910 using WoS. To refine the search results and obtain relevant documents, the scope of the study was delimited by the following:

Table 1. Research process.

1.	Research Question	What are the available practices that exist for garment end of lifecycle?			
2.	Databases	Scopus and Web of Science			
3.	Delimiters	**Inclusion** Articles Journal (Scopus only) English Language All years of publication	**Exclusion** Conference papers, working papers, technical reports, reviews, books, editorial, conference review, and book chapters		
4.	Search Terms	Keyword Equations	Scopus	WoS	Total
		Sustain * AND "Supply chain *" AND (Fashion OR Garment)	146	225	371
		Eco * AND "Supply chain *" AND (Fashion OR Garment)	190	341	531
		Green * AND "Supply chain *" AND (Fashion OR Garment)	26	59	85
		"Supply chain *" AND Reuse AND Recyc * AND Upcyc *	1	1	2
		"Circular Economy" AND (Fashion OR Garment)	34	49	83
		Total	**397**	**675**	**1072**

Table 1. *Cont.*

5.	Remove Duplicates	Remove duplicates across the different keyword equations	320
6.	Selection Criteria	**Inclusion** The articles focus on the fashion/garment/apparel industry The articles focus on downstream supply chain agents Address any of the sustainability criteria (economic, social, environmental) Some coverage on the garment end of lifecycle.	**Exclusion** Articles that only focus on value chain
7.	Search Results	From keyword search (with removal of duplicates) From title and abstract review From full-text article review (with removal of unobtainable articles)	320 81 32
8	Reverse Snowballing	Steps 4 and 6 implemented	3
9		**Final articles for content analysis**	$n = 35$

* Asterisk used as a wildcard symbol to broaden search for keywords.

2.1.1. Delimiters

- Only articles published in English language.
- Journals are limited to article document type and journal source type.
- With few publications in these research areas, all years of publication are considered and included.
- 'Articles in press' (publications that have been accepted but not assigned to a journal issue yet) are included.
- Conference papers, working papers, technical reports, reviews, books, editorials, conference review, and book chapters are not considered in this review to maintain the quality of content.

One thousand and seventy-two articles resulted from the keyword search using the delimiters stated in Section 2.1.1.

After removing the duplicates within and between the keyword equations, 320 articles remained for the evaluation.

Articles were selected in two stages. The first selection was based on the review of abstracts. In line with Seuring and Müller [49], abstracts of these 320 articles were read by two researchers independently, to increase the rigour and reliability of the process. The abstracts were manually assessed based on their fit with the research question and alignment with the research aim. Researchers one and two (independent of one another) prepared individual excel spreadsheets assessing each paper based on its relevance to the research question and aim. Using a 'traffic light' coding system, articles deemed as definitely relevant to the review were assigned a green code, an orange code was used for articles that might be relevant, and a red code applied to articles deemed non-relevant for the review. The two researchers then discussed their assessment with any discrepancies discussed until ultimately agreed upon. After this process, a total of 81 articles were selected for the second stage which involved a review of the full text.

The selected 81 articles were filtered further by reviewing the full article. Accordingly, inclusion and exclusion criteria were established to set the boundaries of the study (refer to Sections 2.1.2 and 2.1.3). These criteria are reflected in step 6 of Table 1. Four articles were not available for analysis; thus, the total sample was reduced from 81 to 77. To ensure accurate and consistent implementation of the inclusion and exclusion criteria, a sample of 20 randomly selected articles (approximately 25 percent of the total collected material) was reviewed by two authors. Divergences were again discussed until eventually agreed upon and shaped the selection process for the remaining articles. At the end of this stage, a total of 32 articles were identified and deemed relevant for the analysis contained in this review.

2.1.2. Inclusion Criteria

- Only articles with a focus on the fashion/garment/apparel industry were considered for the review
- Articles with inclusion of supply chain management activities, especially looking at the downstream supply chain agents such as retailers and consumers were deemed appropriate for the research
- The articles needed to address at least one of the sustainability dimensions (economic, social, or environmental)
- Articles needed some coverage on the garment end of lifecycle.

2.1.3. Exclusion Criteria

- Articles were excluded if they focussed on value chain.

To strengthen the comprehensiveness of the review, a backward snowballing process was used to identify additional relevant articles from the reference list of the selected articles. This process, as adopted by Koberg and Longoni [48] and Martins and Pato [50], secured the identification of 11 new articles for consideration. To illustrate how the backward snowballing process was used, we take the article by Freudenreich and Schaltegger [51] as an example. As one of the 32 articles deemed relevant for analysis, after reading the full article, we identified Morana and Seuring [52] and Morana and Seuring [53] as potentially relevant articles that were not captured by our keyword search. We acquired both articles to assess their fit with our research question and aim. In this manner, we identified 11 articles that were obtained through steps 3 to 6 of Table 1. Based on the delimiters identified in steps 3, two of the eleven articles were eliminated. Furthermore, after applying the selection criteria in step 6 to the abstract and full-text review, only three of the remaining eight articles were deemed relevant from the backward snowballing process. The total number of articles suitable for review was 35. The analysis of these articles is explained in more depth in the following sections.

3. Descriptive Analysis

This section provides a descriptive analysis of the selected 35 articles along with various elements.

3.1. Analysis of Articles by Year of Publication

The most important criterion of descriptive analysis is to examine the sample of literature based on its distribution over time and across various journals (Seuring and Gold 2012). A descriptive analysis was conducted which shows that the publication frequency was distributed between 2007 and 2020; 2007 (n = 1), 2011 (n = 1), 2012 (n = 2), 2013 (n = 1), 2014 (n = 3), 2015 (n = 3), 2016 (n = 2), 2017 (n = 5), 2018 (n = 8), 2019 (n = 8) and 2020 (n = 1). As is shown in Figure 1, an increasing trend over the past decade is evident, particularly since 2013, of a steady rise in interest of the research areas. As the 2020 data are from an incomplete year, these results are excluded from Figure 1.

3.2. Analysis of Articles Distributed across Various Journals

The selected 35 articles are distributed across 22 different journal titles. Seventeen of these journals only account for one article each. Furthermore, more than 50 percent of the analysed articles (n = 18) are concentrated in the remaining five journals, which infers research priority and expertise of this research area (Table 2). The *Journal of Fashion Marketing and Management* and *Sustainability* journals contained the highest number of publications, with six publications each. The spread of selected articles across various journals validates different journals' willingness to publish in the areas of sustainability, supply chain, and the fashion industry.

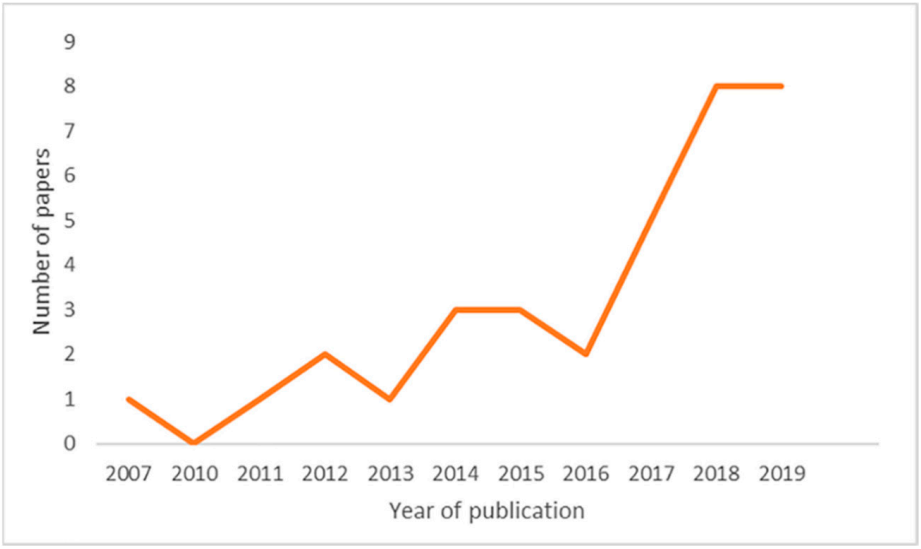


Figure 1. Spread of reviewed articles according to the year of publication.

Table 2. Spread of reviewed articles by journals.

Journal Title	Number of Papers (n = 35)
Journal of Fashion Marketing and Management	6
Sustainability	6
International Journal of Fashion Design, Technology and Education	2
Journal of Cleaner Production	2
Sustainable Development	2
Supply Chain Management	1
Clothing Cultures	1
Resources, Conservation and Recycling	1
International Review of Retail, Distribution and Consumer Research	1
International Journal of Productivity and Performance Management	1
Design Journal	1
Journal of Interdisciplinary and Multidisciplinary Research	1
International Journal of Logistics Management	1
Fashion and Textiles	1
Waste Management and Research	1
AUTEX Research Journal	1
Fashion Practice	1
Journal of Strategy and Management	1
International Journal of Electronic Marketing and Retailing	1
Production Planning and Control	1
Journal of Macromarketing	1
International Journal of Production Research	1

3.3. Analysis of Journal by Scimago Rating

The quality and rigour of the articles forming the review can be traced to the journals in which they were published. Twenty of the articles analysed were published in Scimago-rated Q1 journals [2,5,51,52,54–69]; 12 articles were included in Q2-rated journals [23,53,70–79]; with two articles rated Q3 [80] and Q4 [81], and the last journal was not available on Scimago [82].

3.4. Analysis of Articles Distributed by Region

Information about the region of study of the selected articles is shown in Figure 2. Analysis of the data reveals that Europe dominates the garment end of lifecycle literature with just under half of the research (49 percent) originating from the region. The geo-

graphical region of the analysed articles is spread over 15 countries. It is important to note that the European countries cover sub-regions of Scandinavia with several research studies stemming from Sweden. This is followed by the UK, France, Finland, Spain, Poland, Germany, and Italy. Whilst 32 percent of the articles did not disclose the region of study, Europe is followed by North America, occupying 10 percent, Asia contributing to 7 percent, and South America with 2 percent. Neither the African nor Australasian region were represented in the study.

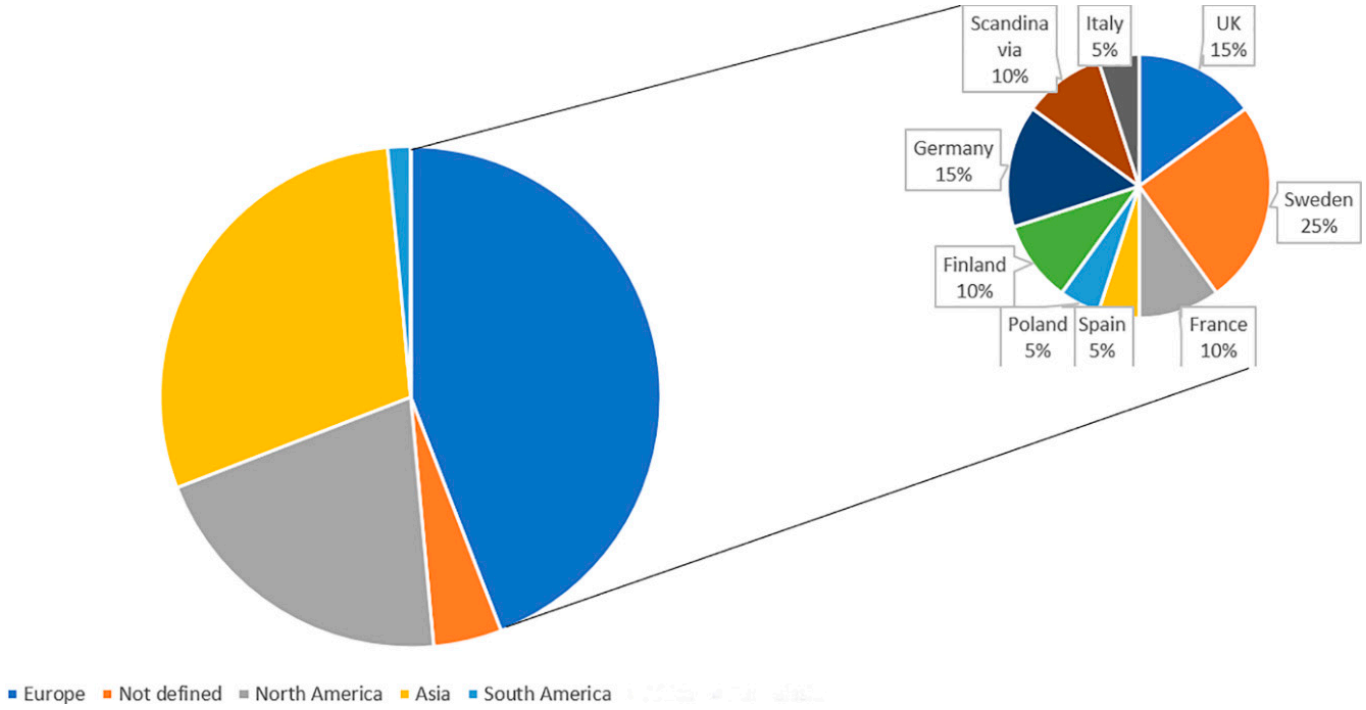


Figure 2. Reviewed articles distributed by region.

3.5. Analysis of Articles Distributed by Sustainability Dimensions

Figure 3 presents the distribution of the reviewed papers concerning the three dimensions of sustainability. It is observed that the environmental dimension is the most studied within the analysed texts, as it was covered in all the papers. The environmental criterion included the diversion of waste materials from landfills, reduction in carbon dioxide emissions, and energy and water preservation. Social dimensions were addressed by 17 of the 35 articles studied. Issues such as job provision and health and safety measures were discussed within this dimension. The economic dimension was the least discussed, covered in only 10 of the 35 articles. Whilst most papers did not specifically mention this criterion, it seemed to be implied, as most objectives for the organisation addressed profitability and sustained economic development.

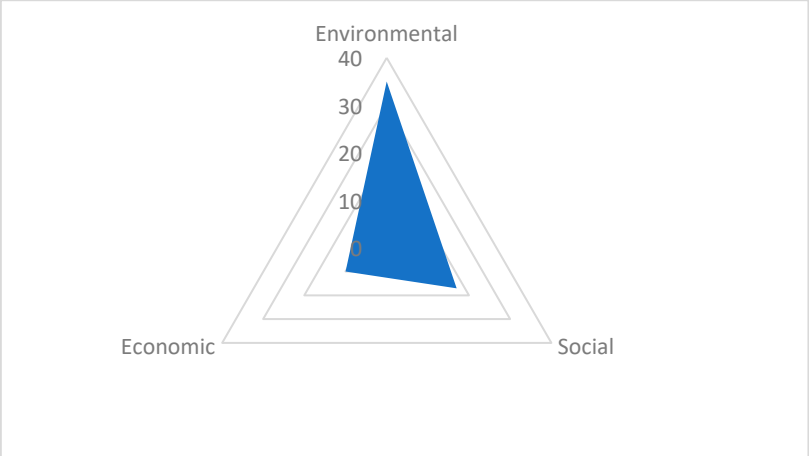


Figure 3. Reviewed articles based on the dimensions of sustainability.

4. Result: Category Development

This paper conducts a review of literature using structured content analysis, a common approach for enhancing the rigour of review processes [83]. Structured content analysis objectively and systematically evaluates themes of recorded information, to provide clarity to the purpose of the written text in a rule-governed and theory-driven way, enhancing its replicability [48,83]. We conclude from the review/analysis of literature that there are four significant themes that emerge, viz., education and engagement, reuse, recovery and redistribution, and recycling. These practices are discussed in the next section within the context of the current study's aim to develop a conceptual framework that could explain the combination of these sustainable practices from a NRBV lens.

4.1. Content Analysis

This section provides an analysis of the four sustainability practices that arose from the review of literature. This includes education and engagement, reuse, recovery and redistribution, and recycling.

4.1.1. Education and Engagement

The first of the themes that emerge strongly from literature is 'Education and Engagement'. It relates to the education of consumers, creating community engagement programmes, and forming recycling campaigns that will engage consumers and inform them of activities they could partake towards sustainable management of PCTW at garment end of lifecycle. Community engagement projects help to facilitate public understanding [58] and raise consumer awareness, through multiple communication channels [68], of sustainability issues in the industry.

One such channel of communication is retailers, with responsibilities to educate and engage consumers in sustainable practices to achieve waste reduction. For instance, Macchion, Da Giau [63], suggested 'structured awareness programmes' as a means by which retail staff could increase customers' awareness of companies sustainability efforts. Retailers could educate consumers on laundry care requirements to reduce waste. Education on laundry care requirements was considered an important role for retailers, in the sustainability education process (through extending garment lifecycle), although studies have shown that this was an underexplored area [57,80]. Stål and Jansson [69] are of the view that providing washing advice is nothing new, but more recent advice is being framed in environmental terms. Stål and Jansson [69] explained further that firms can provide environmentally conscious suggestions to their consumers, thereby addressing the post-consumer phase, when retailers do not have direct control over how consumers wash their garments.

Retailers' responsibilities could be in the form of the implementation of waste reduction policies- extended producer responsibility (EPR). In this situation, retailers are responsible (both physically and economically) for the collection, treatment, and disposal of their products at the post-consumption lifecycle stage [70,82]. This responsibility can also be extended to the broader supply chain agents (government agencies/policy makers, manufacturers, suppliers, transport agents, charities), to provide environmentally conscious suggestions of laundry care on each garment made. Through it all, emphasis is placed on the need to re-educate consumers on resale, donation, reuse, and recycling opportunities for all garments [82].

In summary, education and engagement is significant to managing PCTW at garment end of lifecycle. Several authors agree that information sharing and dissemination is crucial to attaining sustainability within the fashion industry [72,77]. The provision of sustainability information to consumers could decrease the volume of textile waste sent to landfills and increase the volume of waste that is collected for reuse and recycling [77].

4.1.2. Reuse

Our review found that the extension of garment life was explored through the notion of reuse. Reuse is defined as acquiring and wearing clothing, that is of good condition, beyond the use of one consumer [12,53,74]. The reuse practice extends the lifecycle of products and provides an alternative to discarding items [2]. As the reuse practice deals with already existing goods [72], there is reduction in the number of new clothing that consumers buy [51].

Reuse acknowledges that consumers do not necessarily need to abstain totally from consumption but can achieve satisfaction by obtaining and wearing clothing that has been previously used [51]. This process of redistributing ownership from one owner to another could be achieved through giving or handing down clothing between family, friends and domestic staff, donation to charity, repair, swapping, or selling of clothing in garage sales [61,66,73,76]. Diddi and Yan [71] argued that by extending the garment lifecycle, consumers could develop some emotional attachment to their clothes, which in turn may help to change their consumption behaviours [71]. We contend that reuse practices, could compel retailers, producers, and upstream supply chain agents to adjust their product lines, by creating higher quality clothes that last longer, to provide opportunities for amendments when necessary, and/or organise reuse events.

Across the various practices discussed under the reuse umbrella is the need for consumers to relinquish the benefits of ownership and assume the position of a user [69]. In contrast to Diddi and Yan [71], becoming users rather than owners, reduces emotional attachment, so consumers can willingly pass their clothing on to others. Hu, Li [78] and Holtström, Bjellerup [73] indicated that when consumers participate in gifting, swapping, rental, or repair instead of buying, they safeguard the return of garments for use again or for recycling.

4.1.3. Recovery and Redistribution

Recovery and redistribution are another theme that resonates in the literature. The theme encompasses the efforts made by retailers to recover clothing from consumers, such as providing return boxes/areas within retail stores, street and container collection, delivery to superstores, and the take-back scheme [64,77]. Literature highlighted several challenges within this practice with implications for consumers, retailers, and the broader supply chain. Some of these challenges are described in the next paragraphs.

The first challenge is that the volume of clothing recovered is extremely low compared to the volume of clothing sold each year. This is in spite of the interest shown by consumers to recycle [52,60]. An increasingly popular recovery option are take-back schemes, which involve retailers providing return areas and boxes in their stores for consumers. The consumers are then incentivised to recover and recycle their end of lifecycle garments in exchange for vouchers for future purchases [63]. Stål and Jansson [69] argued that this

practice contributes to the issues around the increased disposal mindset of consumers as the incentives provided, encourage consumption. Thus, one question that needs to be asked, is the validity of the take-back scheme as a sustainable practice for managing end of lifecycle PCTW.

The second challenge is associated with sorting the recovered clothing for redistribution [54]. Mostly, recovered items are manually sorted in terms of quality. Those considered of high quality are sold in second-hand stores [77] or sold as second-hand products by the brand's themselves. Most of what is leftover is sold in secondary markets, in nations across Africa, Asia, and Eastern Europe [77,81]. Other low-quality clothing acquired, or textile waste collected can be utilised in other industries, such as insulation for automotive or construction industries, industrial cleaning cloths [72,82], or converted to energy for heating or electricity in municipalities [77]. We conclude that this manual sorting process for recovered wastes, are time consuming and require logistics for coordination and planning. Therefore, retailers would need to establish guidelines for when and how (and in what conditions) products are to be returned. Beh, Ghobadian [54] suggested that such guidelines may improve retailer's knowledge of items returned and provide better evaluation of returned goods for redistribution purposes.

4.1.4. Recycling

Recycling is the collection of materials to be processed into reusable forms and later used as raw materials for new products [2]. Recycling involves efforts by retailers and the upstream supply chain agents in sorting and transforming unusable old products into raw materials or new goods [70,72]. After sorting recovered garments, the garments are redirected to garment regeneration [82]. This includes practices of upcycling; altering recovered garment to improve its value and quality either through redesign and/or remanufacturing [67], or downcycling; turning the recovered garment into less valuable end uses [62].

Recycling is a practice that underlines the other practices identified within this study. Whether it is education and engagement, reuse, or recovery and redistribution, their end point is mostly recycling. As a result, recycling can be achieved at scale. However, there are degrees of complexity and challenges related to the recycling practice. There are often issues with raw material shortages, as the volume of textile waste cannot be guaranteed and retailers cannot ensure they will receive the same and/or similar items [59]. Similar to the issues highlighted in the recovery and redistribution practice, there are problems in the separation process of collected PCTW [65]. As textiles are often composed of various natural and artificial fibre blends, such as cotton and rayon, this brings about a challenge as some fibres cannot be recycled [2]. Additionally, there is a current lack of technology to assist in the separation of the blended fibres [65]. Consequently, the recycling process tends to be expensive as it requires considerable resources such as finances and human labour [2,69]. This calls for a joint effort amongst consumers, retailers and the entire supply chain in achieving this practice.

5. Discussion

This SLR has discovered and synthesised the current findings in the literature on sustainable practices available to manage PCTW at garment end of lifecycle. Emerging from the content analysis, are four key sustainable practices: education and engagement, reuse, recovery and redistribution, and recycling. These sustainable practices and their subset are defined in their respective boxes in Figure 4. As discussed in the content analysis section, the education and engagement, reuse, recovery and redistribution, and recycling practices are driven to a large extent by efforts made by consumers and retailers but to some extent by the wider SC. This study suggests that if implemented together, the practices will lead to sustainable outcomes. Thus, a conceptual framework is developed (Figure 4) that explains the combination of these practices from a NRBV lens towards sustained competitive advantage.

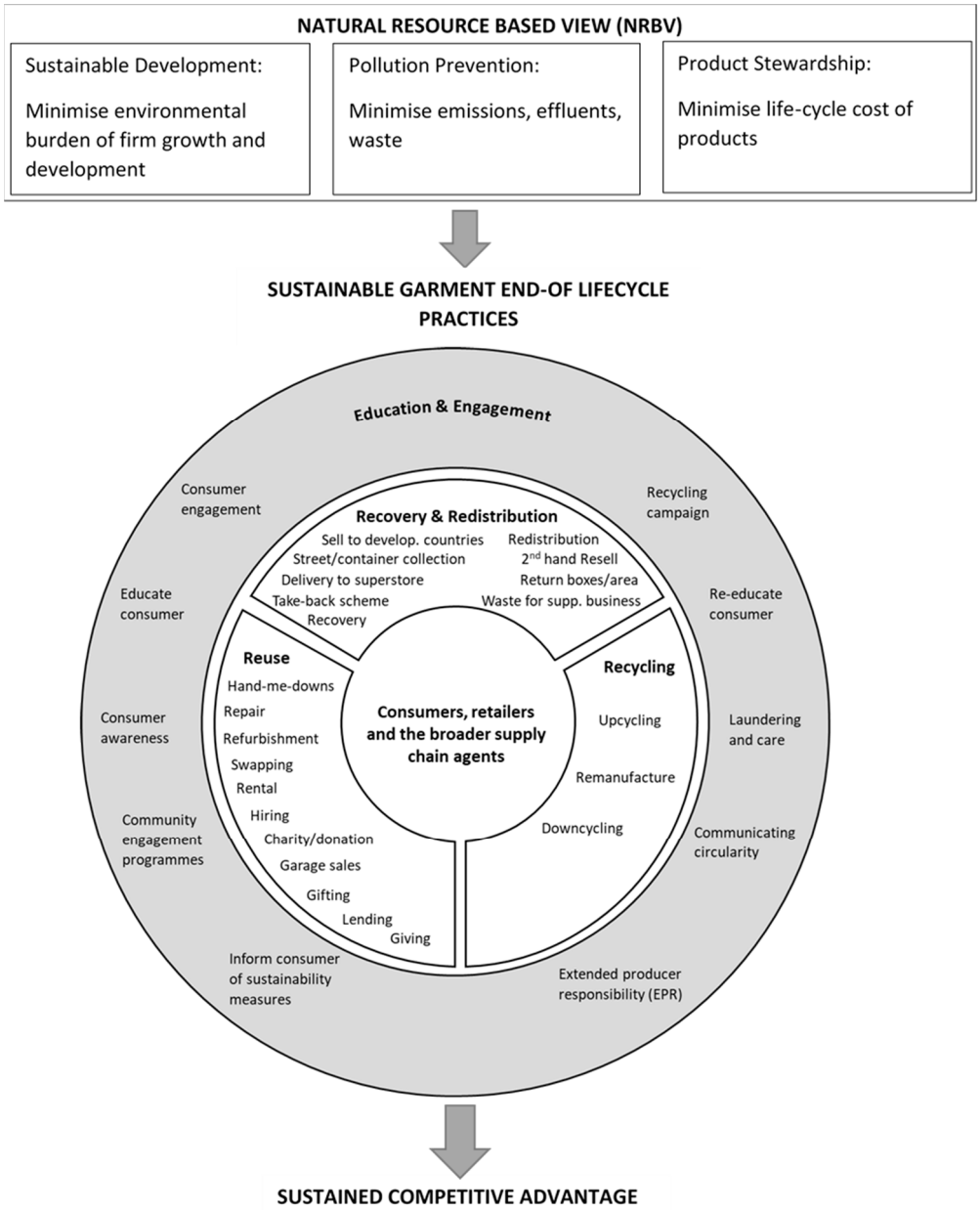


Figure 4. Conceptual framework showing sustainable garment end of lifecycle practices in the achievement of strategic competitive advantage.

As indicated in the conceptual framework, the NRBV ascribes sustainable garment end of lifecycle practices with aims for achieving sustained competitive advantage. The NRBV suggests that for a firm to sustain competitive advantage it must consider the external environment, that is, limitations caused by natural (biophysical) and social environments [38,39,42]. In applying NRBV to the practices of reuse, recovery and redistribution, and recycling, these practices re-purpose the collected waste when fed back into the supply chain system. Product stewardship expands the scope of pollution prevention by considering the entire lifecycle, in the case of this research, the garment end of lifecycle. The practices associated with both pollution prevention and product stewardship creates potential for competitive advantage through reducing the raw material inputs required and the impact on the environment and finding innovative ways to re-use the PCTW. As stated earlier, sustainable development looks beyond the environmental impact to also include social and economic issues, which is true for all the practices especially education and engagement. Education and engagement play an essential role in the adoption of the

other three practices, reuse, recovery and redistribution, and recycling. Further, education and engagement, reuse, recovery and redistribution, and recycling, highlights roles for consumers, retailers and the broader supply chain agents. Implementation of these practices contributes to safeguarding the environment and subsequently, impacts on the social and economic dimensions of sustainability.

The roles of consumers, retailers, and the supply chain are highlighted in the findings from the SLR with varying responsibilities and implications for each practice. For consumers to capitalise on the systems that are in place for diverting garment waste from landfills, garments needs to be placed back within the system [82]. Educating consumers that end of lifecycle garments still have a useful life and can be recycled despite their state is a key success factor for recycling [74]. Almost all textiles can be recycled or in some way repurposed to avoid landfills [5]. Even soiled, worn, ragged, or ripped cloth are recycled into fibres that can be used as fillings in automotive, audio, and mattress industries [77,81]. It is, therefore, necessary to engage with consumers to recover textiles and clothes for the recycling process [66] and increase their knowledge on the value of reuse and recycling [77]. Thus, there is a role for retailers in the textile and apparel supply chain, to retrieve and help alongside other supply chain agents to recycle used clothing and look for alternatives for used fibres [74].

Overall, this conceptual model shows that to attain sustained competitive advantage within the fashion industry there needs to be a consideration of strategic capabilities for garment end of lifecycle. This includes viewing the practices; education and engagement, reuse, recovery and redistribution, and recycling, as sources for achieving sustainable outcomes. The practices enable the fashion industry to overcome hurdles associated with retrieving waste, turning these into resources, reducing waste sent to landfill, and achieving sustained competitive advantage.

This SLR offers some implications to research and practice within the fashion industry.

A striking result to emerge from the review is the power that the downstream agents (consumers and retailers) have in improving sustainability within the fashion industry. Retailers are called to extend their definition of sustainability to address the use and disposal of products. In doing so, the importance of consumers is apparent. This finding corroborates the ideas of Stål and Jansson [69], who suggested elements of reciprocal responsibility between retailers and consumers are crucial to achieving sustainability. This is also in line with the assertions by James and Montgomery [19], Belz [20], and Yang, Song [21] that retailers have the power to connect consumers and suppliers to incorporate sustainability across the supply chain [21]. However, whilst the roles of consumers and retailers are crucial in managing end of lifecycle garments for sustained competitive advantage, our findings reveal the need for collaboration across all supply chain agents, from upstream to downstream. This is in line with Friedman [14] and Ho and Choi [2] findings that suggested the inclusion of supply chain agents such as second-hand shops, charities, government, etc.

As for implications for the industry, our research provides various end of lifecycle practices in which retailers could partake that have a key impact on their competitive advantage and overall sustainability.

Retailers should look beyond mere garment end of lifecycle to consider shifts towards cradle to cradle (closed loop) lifecycle supply chains. This ensures that retailers evaluate the practice they adopt by questioning its true aim in achieving sustainability. Our findings show paradoxes in the pursuit of a sustainability agenda within this context. We suggest that these paradoxes are avoidable if the practices adopted within a firm are selected with consideration of the entire supply chain and the role that each agent can play in achieving overall outcome of sustained competitive advantage.

Future Research Directions

According to the SLR and proposed conceptual framework, several gaps were identified for future examination. Some areas for future research are proposed to further improve

understanding of practices at garment end of lifecycle and move towards more sustainable outcomes for the planet, people and profit.

Emerging from the review of literature are the paradoxes of sustainability within the fashion industry. Studies reveal that not all practices utilised and encouraged by retailers lead to more sustainable outcomes and beg questions of how sustainable these practices are at managing PCTW [53,57,71]. Extending the use of PCTW by reuse or recycling does not necessarily lead to sustainable outcomes, as it cannot guarantee that the recycled or reused items will not be thrown into landfill by the next user. Comparably, re-distributing retrieved second-hand clothing to other countries for resale requires transportation, which contributes to the overall environmental footprint, emphasising the point for retailers to look at shorter, more localised supply chains [51]. Donated clothing of low quality collected during swapping events, are kept aside for donation to charities and vulnerable communities, implying that these groups are not deserving of quality clothes and therefore, contradicts the aim of swapping which is to promote sustainability, solidarity and community values [55]. While Shen [23] argued that a win-win-win outcome between consumers, H&M, and the environment is realised by using the take-back scheme, Stål and Jansson [69] counter-argued that take-back schemes are deceptive, with vouchers offered to consumers on disposal of their PCTW in collection boxes. This encourages increased consumption and subsequent increase in textile waste [69].

Our findings show that considerations of garment end of lifecycle practices should involve all supply chain agents from upstream to downstream agents. Thus, collaboration should extend beyond retailers and consumers to other supply chain agents. Further, while it is beyond the scope of this paper, Ferrari [84] discussed the role that policy makers could have in building resilient and sustainable infrastructures especially post-COVID. The findings from this study could be extended to developing a resilient sustainable supply chain. Future empirical research could look at applying stakeholder theory and conducting studies into the roles of various stakeholders from a system of systems perspective.

Resonating across the different practices is the need for retailers to encourage consumers to hand-in used clothing to be put back into the system. This is key to closing the supply chain loop and diverting PCTW from landfill by acquiring enough clothes for the reuse, recovery and redistribution, and recycle practices. Engaging and educating consumers on their role in textile recovery and its significance for the aforementioned practices is paramount in striving to attain sustainability within the fashion industry [66,77]. To amply and sustainably engage in the practices available for their end of lifecycle garment, it is fundamental that consumers forgo ownership over products by instead becoming users [73]. Thus, the role of consumers is highlighted—therefore, research into the awareness of consumers about these practices is needed, including an understanding of how retailers can better engage consumers in these practices.

Thirdly, the review of literature revealed challenges associated with sorting returned clothes, which is in line with findings by Shedroff [28]. This issue is still prevalent as PCTW are composed of various material blends, that are difficult to distinguish at the end of garment's lifecycle stage [2,65], and a current lack of technology to assist in the separation of blended fibres other than the two-dimensional barcode mentioned by (Bertram and Chi 2018). Although a separate focus to the essence of this research, the efficiency of the sorting process for reuse, recycling, or redistribution and innovative technologies to aid in the process of identifying the various blends would be useful for informing consumers with the sorting of garments or textiles for return.

Lastly, the results from the descriptive analysis indicate that most of the existing research focusses on Europe and America, underlining an opportunity for further research into managing waste generation within the fashion supply chains of other regions. Conducting a comparative study between these regions and analysing how their practices differ to findings within this review is noteworthy. Moreover, the impact of the recent worldwide pandemic on the global fashion industry presents new opportunities for research regarding fashion consumption, sustainable extension of garment end of lifecycle and waste genera-

tion across the global regions. More broadly, what is the feasibility of sustainability within the fashion industry and its associated challenges in the current and post global COVID-19 context? It will be interesting to see the effect of consumption patterns within the COVID context and the impact it will have on fashion waste generated. Nonetheless, whatever happens, it is important that sustainability remains part of the conversation post COVID.

This study is not without its limitations. Firstly, the review included only academic journals, whereas future research may benefit from also considering other published works, such as commercial journals, industry reports, books, book chapters, and reviews. Secondly, future studies benefit from using only highly ranked journals in its reviews. However, despite these limitations, we believe that this review is rigorous, insightful, and contributes towards enhancing knowledge on available sustainability practices to manage PCTW at garment end of lifecycle in achieving sustained competitive advantage and consequently, a more sustainable, fashion supply chain for all.

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