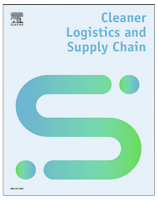
Cleaner Logistics and Supply Chain 4 (2022) 100032

Contents lists available at ScienceDirect

Cleaner Logistics and Supply Chain

journal homepage: www.elsevier.com/locate/clscn



Sustainable supply chain management in the fast fashion Industry: A comparative study of current efforts and best practices to address the climate crisis

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ARTICLE INFO

Handling Editor: Kannan Govindan

Keywords:
Sustainability
Sustainable supply chain management
Fashion

ABSTRACT

In 2018, the fashion sector was responsible for approximately 2.1 billion metric tons of GHG emissions, half of which were created by fast fashion. Fast fashion brands produce high volumes of synthetic, petroleum-based garments in developing countries, creating high levels of emissions and textile waste. In recent years, fast fashion leaders have adopted sustainability initiatives, including sustainable supply chain management (SSCM). However, even with current strategies in place, fast fashion is on a trajectory that will contribute to irreparable damage to the environment by 2030. The following study analyzes how fast fashion brands currently implement SSCM, identifies weaknesses in current initiatives, and outlines key actions brands can take to significantly reduce the environmental impact of their supply chains in the long term.

To analyze SSCM in the fast fashion industry, this study compares the sustainability reports of H&M and Everlane, industry leaders with strong sustainability messaging. This comparison reveals that fast fashion has failed to sufficiently engage upstream and downstream stakeholders in their SSCM strategies. Moving forward, fast fashion companies should incentivize collaboration towards more comprehensive SSCM policies throughout the supply chain. To significantly reduce their impact, brands must invest in long-term decarbonization and energy infrastructure, engage with suppliers and consumers, and re-evaluate the design standard for products. If adopted at the industry level, these reforms will significantly mitigate fast fashion's impact on the planet.

1. Introduction

Fast fashion companies like H&M, Zara, and Forever 21 have transformed the way Americans consume clothing. Instead of releasing garments in four scheduled seasons, fast fashion brands introduce new styles weekly, or even daily, at very low prices. In 2019, the industry was valued globally at 36 billion USD and is estimated to reach 43 billion USD by 2029 (Statista, 2021). In order to meet the growing demand for low-cost clothing, brands have developed supply chains that manufacture high volumes of synthetic, petroleum-based garments in developing countries. This creates significant levels of greenhouse gasses (GHGs) and landfill waste. After a series of exposés and controversies surrounding fast fashion's impact in the early 2010 s, fast fashion leaders adopted various sustainability initiatives and claimed to be more "eco-friendly". Upon closer analysis, these initiatives are limited in scope and insufficient to address the impact fast fashion has on the climate. Even with current sustainability practices, it is estimated the fast fashion industry will contribute to irreversible damage to the environment by 2030.

In order to create a more environmentally-conscious industry, fast fashion companies must reduce the environmental impact of their entire supply chains. This will require effective sustainable supply chain management (SSCM), which integrates sustainable policies throughout supply chain operations. Brands can take a comprehensive approach to SSCM by focusing on two key areas: reducing indirect impact created by upstream and downstream activities, and reevaluating garment design to make current sustainability measures more effective. If adopted at the industry level, these reforms will significantly mitigate fast fashion's environmental impact and create a more sustainable industry for all. This study aims to outline how fast fashion brands currently implement SSCM, identify weaknesses in current initiatives, and outline key actions that fast fashion companies can take to reduce the environmental impact of their supply chains in the long term.

https://doi.org/10.1016/j.clscn.2022.100032
Received 19 August 2021; Revised 31 January 2022; Accepted 24 February 2022

2. Materials and methods

2.1. Literature Review

With the urgent climate crisis and changing consumer demands, several studies analyzing SSCM in the fashion industry have been published in recent years (Seuring & Müller, 2008; Li et al., 2014; Turker and Altuntas, 2014; Moretto et. al, 2017). The most relevant framework for mapping out how companies manage SSCM was developed by Stefan Seuring and Martin Müller in "From a Literature Review to a Conceptual Framework for Sustainable Supply Chain Management", published in the *Journal of Cleaner Production*. After analyzing 191 SSCM papers published from 1994 to 2007, this study stated that there are three key elements to corporate SSCM strategies: 1) Triggers That Incentivize Companies To Adopt SSCM Practices, 2) Supplier Evaluation For Risk And Performance and 3) Supply Chain Management For Sustainable Products. This framework is highly beneficial when analyzing fashion supply chains as the legal requirements around sustainability are vague, so each brand is able to selectively report their progress according to their own metrics. This paper paved the way for future studies to analyze SSCM in the fashion industry, including "Designing A Roadmap Towards A Sustainable Supply Chain: A Focus On The Fashion Industry" in 2018 (Moretto et. al). However, these studies focus on the luxury industry in particular, which differs from the fast fashion industry in the consumers targeted and production processes used.

There are many studies exploring innovative sustainability initiatives by fashion brands, such as using organic input materials and offering repair services (Berg et al., 2020; Ellen MacArthur Foundation, 2020; Masunaga, 2019; Moretto et al, 2018; Segran, 2019). However, these initiatives are usually applied to luxury goods or brands with a sustainability-focused business model. These companies have historically invested in high-quality raw materials and production processes, unlike fast fashion brands, who have generally leveraged the most affordable resources available.

2.2. Gaps in existing Literature

Previous studies on SSCM in the fashion industry concentrate on luxury brands, rather than fast fashion. As the fast fashion industry makes up approximately half of the industry's emissions output, this sector must be addressed in order to make significant improvements to fashion supply chains. The fast fashion industry relies on different raw materials, manufacturing processes, and consumer segments than luxury brands. To address the unique challenges of this industry, their SSCM efforts should be analyzed independently from other fashion sectors. The following paper utilizes the existing Suering and Müller framework to analyze fast fashion brands specifically (Seuring and Müller, 2008).

In order to reduce the impact of the fast fashion industry, it is also essential to understand if innovative practices in sustainable infrastructure and raw materials are feasible for clothing that the average American can access. This paper aims to provide clear action points for fast fashion companies by adapting SSCM practices from previous studies to a fast fashion context.

2.3. Methodology

Fashion sustainability reports are not strictly regulated, so there is no standard format or data that a brand is required to share with the public. Therefore, an understanding of where SSCM strategies are failing requires a close analysis of individual corporate reports. To analyze how fast fashion companies currently tackle SSCM, this study applies the Suering and Müller framework to the sustainability reports of two industry leaders: H&M and Everlane. These brands were selected because they undertook sustainability initiatives under different circumstances, are considered leaders among their peers, and target similar price points. H&M is a fast fashion behemoth, with over 5,000 stores worldwide and a net revenue of 24.3 billion USD in 2019. Everlane is an e-commerce brand founded on "radical transparency", touting their commitment to eco-friendly materials and processes (McCormack, 2017). Weaknesses in their strategies were identified by comparing the two companies and incorporating the best practices identified in previous research, such as engaging more closely with supplier networks (Moretto et al., 2018). For clarity of analysis, this study focuses on reducing environmental impact, although the human rights component of supply chains is of great importance and should be explored in future studies.

The final portion of this study applies innovative sustainability practices to a fast fashion context, outlining how these companies can integrate sustainability principles into upstream and downstream interactions. To do so, this study references improvements that are currently under study or have been implemented in luxury businesses, as described in "Designing a Roadmap Towards a Sustainable Supply Chain: A Focus on The Fashion Industry" (2017) and a variety of business publications (Berg et al., 2020; Ellen MacArthur Foundation, 2020; Masunaga, 2019; Segran, 2019).

3. Theory: The need for sustainable supply chain management in fast fashion

3.1. Fashion's contribution to a growing crisis

Fast fashion is a major contributor to a growing environmental crisis. Average global temperatures are rising at an alarming rate, fueled by human creation of greenhouse gasses (GHG) and non-biodegradable waste. Recent research from The Intergovernmental Panel on Climate Change (IPCC) shows that the impact of even a 1.5C (2.7F) increase in average global temperatures could be disastrous, leading to an increase in the severity of natural disasters and the destruction of ecosystems beyond repair (Masson-Delmotte et al., 2018). Fashion contributes to this issue with high levels of GHG emissions and textile waste. In 2018 alone, the fashion sector was responsible for approximately 2.1 billion metric tons of GHG emissions, about 4% of the global total (Berg et al., 2020). If current production levels are maintained, fashion's GHG emissions are expected to rise by 2.7 billion metric tons by 2030, a trajectory that will push global average temperatures above the IPCC's 1.5C limit.

3.2. The environmental impact of the fast fashion industry

Fast fashion is responsible for approximately half of the fashion industry's emissions. This sub-sector is especially harmful due to its fragmented supply chains, use of synthetic materials, and consistent overproduction. Fast fashion supply chains are scattered across developing countries with low environmental regulations; for example, H&M works with 800 suppliers in nations such as Bangladesh and Vietnam (H&M). Even when companies set environmental standards above legal limits, geographic distance makes it difficult to track compliance. Final products will be shipped by air to ensure short lead times, further contributing to carbon dioxide emissions.

Unlike luxury or high-end brands, fast fashion relies on petroleum-based synthetic materials, such as polyester and nylon. Manufacturing these materials creates high levels of emissions; for example, creating one medium polyester t-shirt emits an estimated 5.5 kg of CO_2, compared to an estimated 2.34 kg for an organic cotton t-shirt (Nature Climate Change, 2018). Furthermore, synthetic fabrics are non-biodegradable and difficult to break down to raw materials. Even if a consumer or brand tries to recycle garments, these efforts are often ineffective.

Finally, fast fashion brands consistently produce more inventory than they can realistically sell. H&M and its competitors only sell

approximately 60% of their garments without a markdown, and unsold inventory is usually sent to a landfill. According to a 2020 report by the Global Fashion Agenda, an industry sustainability group, a garbage truck's worth of clothes is added to landfills every second.

In recent years, consumers have become increasingly aware of the impact of their clothing and demanded change. By the late 2010 s, most fashion brands had introduced some form of sustainability initiatives and began publishing annual sustainability reports. However, their efforts are not sufficient to address the urgent climate crisis.

3.3. Why analyze SSCM in the fast fashion industry

Even with current sustainability measures in place, the fashion industry will contribute to pushing global temperatures above the IPCC's 1.5C limit by 2030. According to a 2020 McKinsey report, the fashion industry will need to reduce its total CO_2 output to below 1.1 billion metric tons by 2030, a 48% decrease from current levels, to prevent irreversible damage to the climate.

In reality, no industry producing garments at such high volumes can be considered truly "sustainable" unless every single output can be reintegrated into the value chain. Unfortunately, the growing demand for low-cost clothing indicates that fast fashion will not be replaced anytime soon. As the industry is cemented in the global economy, it is important to approach the problems with realistic sustainability solutions. In order to significantly reduce GHG emissions and environmental impact, fast fashion brands must reevaluate their current efforts and actively engage with the entire value chain.

4. Results: Current efforts and areas for improvement

4.1. Sustainable supply chain Management: Current efforts

To analyze how fast fashion companies currently tackle SSCM and where improvements are needed, this study directly compares the SSCM reporting of one fast fashion industry leader, H&M, and a self-proclaimed ethical brand, Everlane. When this study began, we expected to find a significant difference between the two brands. Everlane describes itself as "radically transparent" and has received media attention for ethical manufacturing practices since its foundation in 2010. Therefore, it was predicted that this brand's sustainability reporting would serve as a model for H&M and its competitors to follow in the future. While some differences were observed, especially in the criteria for raw materials, we came to the realization that Everlane's approach to SSCM is not significantly different from that of fast fashion brands. In fact, Everlane and H&M share a number of weaknesses that make their SSCM strategies insufficient to address their environmental impact.

To compare the SSCM strategies of H&M and Everlane, this study outlines their sustainability reports according to the framework created by Stefan Seuring and Martin Müller in their 2008 report, "From a Literature Review to a Conceptual Framework for Sustainable Supply Chain Management", which breaks down SSCM into three main components (Fig. 1):

- Triggers That Incentivize Companies To Adopt SSCM Practices: Brands may begin implementing SSCM for a variety of reasons, one of the most common being criticism from consumers.
- Supplier Evaluation For Risk And Performance: This serves two purposes: protecting a brand's image and tracking overall sustainability performance. Therefore, this category is broken down into 1) avoiding risks and 2) improving supply chain performance.
- Supply Chain Management For Sustainable Products: This includes activities concerning supplier selection and compliance, and is broken down into 3) improvement of suppliers, 4) communication with suppliers, and 5) criteria for suppliers.

4.2. Overview

Sustainable Supply Chain Management	H&M	Everlane
Triggers	- Accusations of "greenwashing"	- Founded as response to fast fashion - Concerns about plastic usage
Avoiding Risk	- Adheres to external set of sustainability standards that span value chain - Participates in sustainability organizations, including, Sustainable Apparel Coalition (SAC) - Discloses names of suppliers - Numerous external CSR projects, such as water and education initiatives	- Applies different external standards at specific stages of supply chain - Participates in sustainability organizations, including, Sustainable Apparel Coalition (SAC) - Discloses names of suppliers - Limited external CSR projects
Improving Supply Chain Performance	- Reports internal operations and emissions - Reports overall performance in certain areas, but not for individual suppliers	- Reports internal operations - Does not report internal emissions - Reports performance of select suppliers
Improvement of Suppliers	- Use of Sustainable Impact Partnership Program (SIPP) to incentivize compliance	- Code of Conduct integrating Four Fundamental Freedoms required to begin relationship
Communication with Suppliers	- Reliance on partner's self-assessments and internal audits - Currently integrating third-party verification - Suppliers reports progress through Sustainable Apparel Coalition's (SAC) Higg Index Facility Environmental Module	- Combination of Everlane audits and certified third-party audits - Frequent in-person visits to suppliers
Criteria for Suppliers	- Applies internal Code of Ethics and Sustainability Commitment - References recommendations from International Labor Organization	- Applies internal Vendor Code of Conduct and Social Responsibility Code of Conduct - References recommendations from International Labor Organization and Think Green Initiative
Areas for Improvement	- Focus on internal operations - Failure to integrate upstream activities into SSCM initiatives - Use of self-reported metrics from suppliers - Lack of integration of raw materials and garment design into SSCM strategy - Failure to accurately report annual emissions or estimate impact of the entire supply chain	

4.3. Triggers

The main trigger for H&M to engage in SSCM was backlash against environmentally harmful practices and accusations of "greenwashing". "Greenwashing" occurs when an organization makes a public commitment to environmental initiatives without the transparency or impact to support its claims (Kenton, 2021). In 2013, H&M adopted a series of initiatives and declared their new products were more "eco-friendly", including their new "H&M Conscious" line. These claims were not backed by concrete action, and the Norwegian Consumer Authority reported that the company's eco-friendly claims were so misleading they should be considered "illegal" (Hendriksz, 2017) (Fig. 2).

Calls for boycotts motivated H&M to strengthen their commitment to SSCM and engage in corporate social responsibility (CSR) programs (Section 4.4).

Everlane, on the other hand, has been engaged in SSCM activities since its foundation. The brand began as a response to the unethical manufacturing conditions that characterize fast fashion. Committing themselves to "radical transparency", Everlane emphasizes working with ethical suppliers and using organic materials. Despite these efforts, Everlane has been accused of exaggerating their sustainability claims. One major source of contention is company's use of plastics in their clothing. Similar to H&M, Everlane strengthened its commitment to SSCM in response to consumer backlash, promising to remove all newly-made plastics from their products by 2021.

4.4. Avoiding Risk

Fashion brands take on various risks when implementing SSCM, especially when working with suppliers in developing countries. The main risks are a lack of external verification of sustainability claims, weaker environmental regulations in supplier countries, and lapses in supplier compliance that damage consumer trust. According to Seuring and Müller's framework, fast fashion companies use three main tools to protect their brand from these risks:

- Networking activities such as collaborating with industry leaders, joining sustainability campaigns, or adhering to external sustainability standards
- Reaching out to their community through corporate social responsibility (CSR) projects
- Increasing transparency about suppliers

H&M utilizes all three of these tools, especially after the backlash of 2013. H&M has engaged in numerous networking activities, such as joining the Sustainable Apparel Coalition (SAC), an organization that brings together fashion leaders to discuss sustainability solutions. While Everlane has very different origins than H&M, the brand utilizes similar methods to mitigate SSCM risks. Everlane has joined several international organizations that focus on sustainability, including the Global Fashion Agenda, the leading international coalition promoting sustainability within the fashion industry, and the Sustainable Apparel Coalition (Global Fashion Agenda, 2021).

Including external standards in SSCM reporting adds a sense of legitimacy to sustainability efforts and provides an objective measurement for performance. In H&M's criteria for suppliers (Section 4.8), the company frequently references recommendations put forth by the International Labor Organization. These recommendations apply to the supply chain overall, rather than to specific production processes. In contrast, Everlane applies external verifications to distinct processes in its supply chain. One of the company's verified processes is their internal use of efficient energy, which complies with Leadership in Energy and Environmental Design (LEED) standards (Everlane, n.d.). These networking activities and external standards promote the image of a sustainable, ethical brand.

Corporate social responsibility (CSR) initiatives impact stakeholders outside of supply chain processes, such as underserved communities in the brand's home or supplier countries. These do not deal with the creation or sale of products, and are therefore distinct from SSCM. H&M currently embraces three CSR pillars in their supplier countries: raising awareness on water conservation and sanitation, promoting quality education for women and children, and funding projects that empower women. Unlike H&M, Everlane has not actively

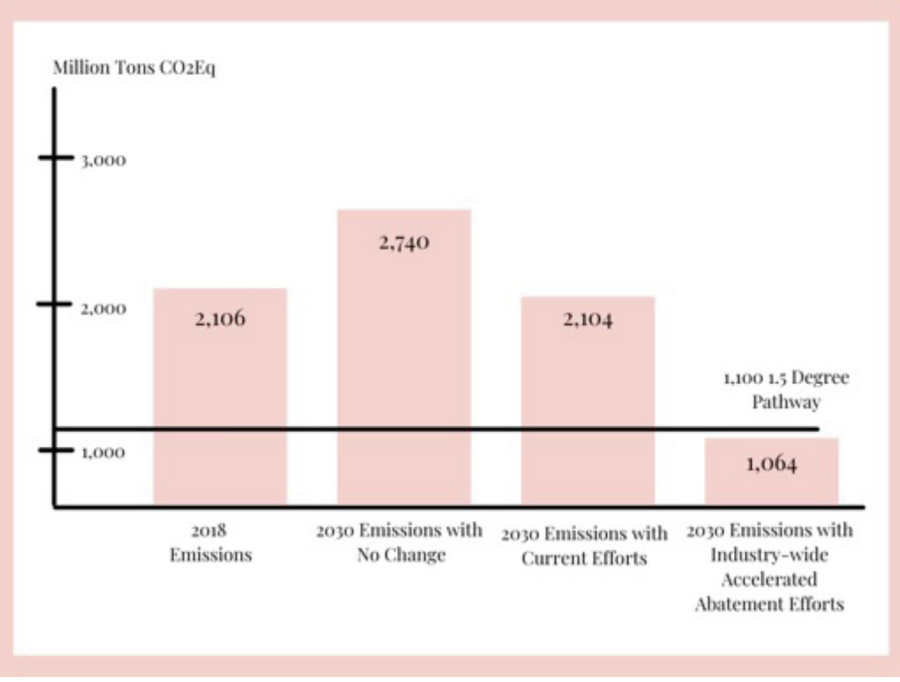

Fig. 1. Current and Estimated CO2 Output of the Fashion Industry (Berg et al., 2020).

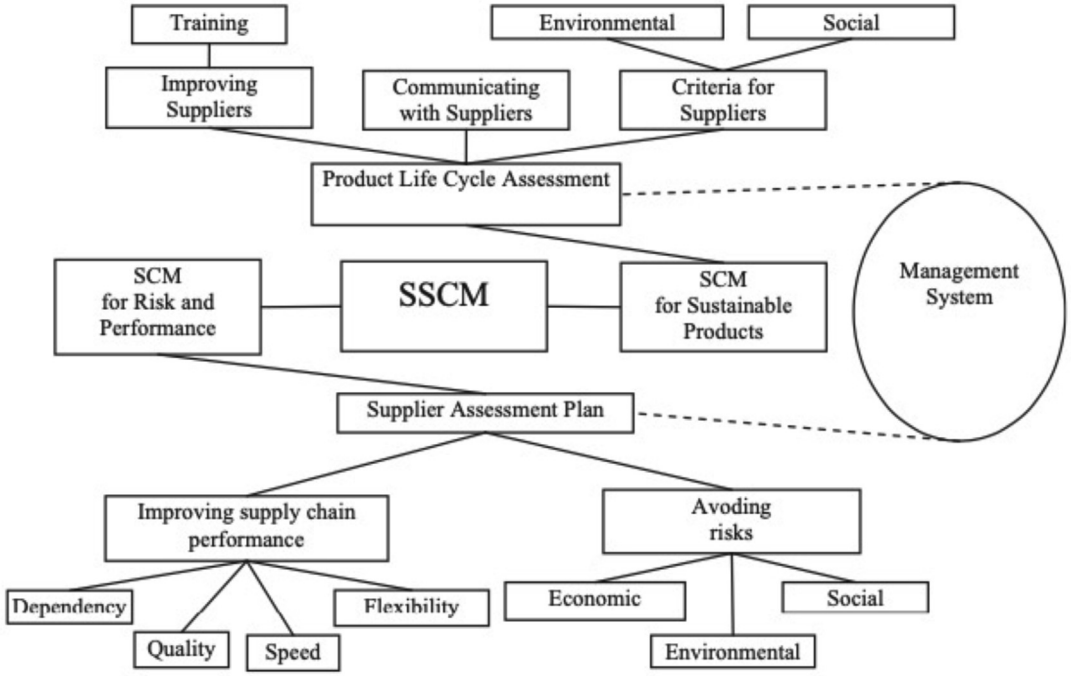

Fig. 2. Suering and Müller's Framework for SSCM (Seuring and Müller, 2008).

engaged in numerous CSR projects to improve brand image. Instead, Everlane focuses on internal sustainability measures, such as their plastic-free initiative and supply chain improvement.

In order to increase transparency about suppliers, H&M lists all of their suppliers and the total number of compliance violations recorded each year in their annual sustainability report. Everlane provides more detailed information than H&M, providing a list and map of all suppliers with specific information about how raw materials are manufactured (Image 2). Everlane promotes transparency by giving independent garment workers a voice, displaying their testimonies alongside the tag #KnowYourFactories. By providing more details about who their suppliers are, Everlane has reinforced their image as a "transparent" brand.

4.5. Improving supply chain performance

When evaluating sustainability performance, most brands focus on how much they can reduce their direct emissions, rather than setting ambitious goals to incorporate all suppliers in their strategy. Direct emissions refers to those created by sources owned or controlled by a company, while indirect emissions includes emissions caused by a brand's activity that do not come from brand facilities. H&M is a prime example; their reporting focuses on reducing direct emissions from previous levels. They are not transparent about the emissions created by the entire supply chain, or how they plan to reduce overall emissions. In H&M's annual sustainability report, emissions are provided in terms of Scope 1, 2 and 1 + 2 (Fig. 3). As laid out by the GHG Protocol from the World Resources Institute, Scope 1 includes direct emissions from company operations, Scope 2 includes indirect emissions from consumption of purchased energy, and Scope 3 includes all direct and indirect emissions created throughout the supply chain. No attempt is made to provide Scope 3 emissions or estimate year-on-year improvements in this area.

Similarly, Everlane reports its ability to reduce its direct emissions and use nonrenewable energy. 100% of Everlane's internal power usage has earned renewable energy certificates (RECs), for using wind, solar, and geothermal power; however, little information is provided about the type of energy that their suppliers uses. Similar to H&M, Everlane fails to provide concrete data or estimates of the impact of their entire supply chain. No specific figures are provided about supplier's carbon emissions or waste levels, weakening the brand's claims of "radical transparency" (Images 1–5).

A major distinction between the two brands is that Everlane evaluates supply chain performance based on their ability to utilize organic or recycled inputs. One of their most well-known SSCM initiatives is committing to eliminate newly-made plastics from their products by 2021. As of October 2020, the company had transitioned 90% of apparel materials that formerly contained virgin plastic to recycled materials from water bottles, fishing nets, and other plastic items.

4.6. Improvement of suppliers

This element of SSCM involves monitoring supplier compliance with a brand's sustainability requirements. For H&M, the improvement of suppliers consists of training initiatives and tracking compliance through their Sustainable Impact Partnership Program (SIPP). In the SIPP, H&M rewards suppliers who display excellent compliance with sustainability initiatives by offering increased orders, training opportunities, and longer-term contracts. Suppliers self-report their progress with standardized modules, the Sustainable Apparel Coalition's (SAC) Higg Facility Environmental Module (FEM) and Higg Facility Social and Labor Module (FSLM). If an audit shows insufficient progress, H&M will send a warning and eventually end the partnership. In 2019, 100% of their suppliers claimed to implement SIPP practices to some degree, and five suppliers were dropped for failing to comply. While SIPP has begun to incorporate suppliers into H&M's SSCM strategy, the geographic distance from suppliers and the reliance on self-assessments could encourage factories to exaggerate their progress towards sustainability goals.

Everlane has strict standards for its partners, and holds the bar for improvement much higher than H&M. For example, Everlane requires all direct suppliers to go through annual compliance audits and quarterly observation audits performed by an accredited third-party firm. Auditors ensure that suppliers comply with Everlane's Code of Con-

Scope	2016	2017	2018	2019
Total Scope 1 CO_2e emissions, including renewables (tonnes)*	10,376	12,484	11,818	13,380
Total Scope 2 CO_2e emissions, including renewables (tonnes)*	70,165	51,206	45,160	48,082
Total Scope 1 & 2 CO_2e emissions, including renewables (tonnes)*	80,541	63,690	56,978	61,462

Fig. 3. Emissions Information Provided in H&M's 2019 Sustainability Report.

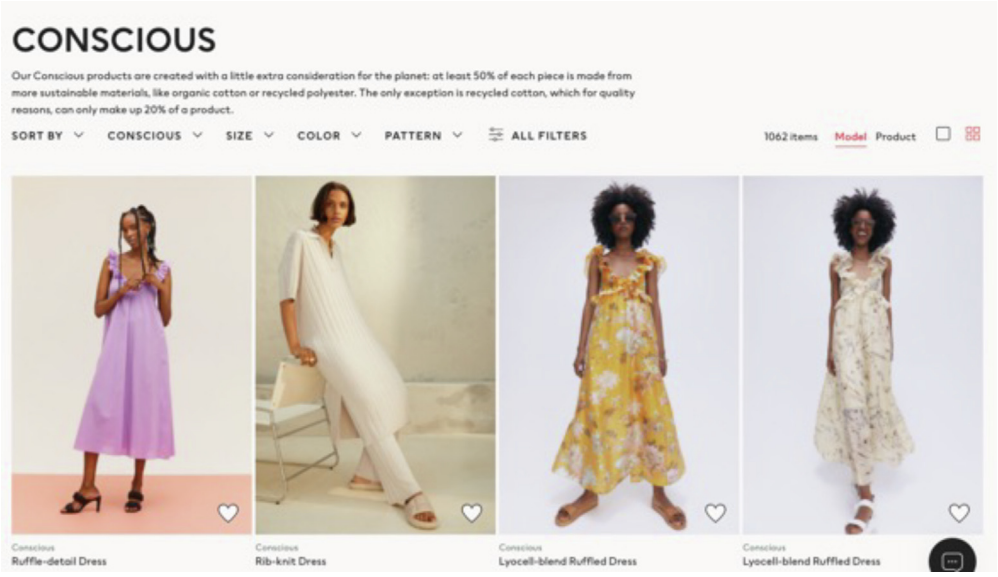

Image 1. H&M Conscious Collection, H&M Website, 2021

duct, which is implemented alongside stringent requirements for materials and manufacturing processes. Auditors will also conduct individual and group interviews with employees in their local language to ensure they are properly treated and compensated (Everlane, n.d.). In the case of non-compliance issues, Everlane issues a Corrective Action Plan to improve the necessary areas. The use of third-party auditors makes Everlane's supplier evaluations more reliable than H&M, as it exposes factories to the assessments of an objective party.

4.7. Communication with suppliers

Ensuring that SSCM standards are followed requires close communication with suppliers. H&M refers to their suppliers as "partners", indicating the long-term relationship they intend to build. With 800 partners spread across developing countries, it is difficult for H&M to monitor compliance. Therefore, communication often consists of the supplier self-assessments described above. Other methods used to communicate with suppliers may include factory visits and collaboration with supply chain partners on research initiatives, although these were not prioritized in H&M's sustainability report.

Everlane also focuses on fostering long-lasting relationships with its partners. Their communication consists of frequent auditing by an accredited third-party firm and in-person visits, including those conducted by executive leadership. A direct line of communication is especially important as Everlane seeks to introduce more innovative processes into its supply chain, such as its plastic-free initiative. Nikki Player, Everlane's Raw Materials Research and Development Manager, described the close communication that the brand aims to build with suppliers: "We are really trying to make sure that we understand who we're buying from and what they place importance on to set a baseline, and then work together to set growth plans, both for us as a brand and then with the mills that we work with." (Velasquez, 2020) This gives Everlane the ability to communicate with partners in a much more personal way than H&M.

4.8. Criteria for suppliers

In order to compensate for less strict environmental regulations and ensure that partners' behavior is in line with a company's sustainability goals, brands set forth their own sustainability criteria for suppliers. These often incorporate standards set forth by industry groups. The minimum requirement for H&M's suppliers consists of its Code of Ethics and Sustainability Commitment. The Code of Ethics includes following relevant regulations and avoiding corruption. The Sustainability Commitment outlines basic requirements for building healthy workplaces, maintaining healthy ecosystems, protecting animal welfare, and guidelines for emissions and energy usage. Each category includes a "Fundamental" level and an "Aspirational" level of compli-

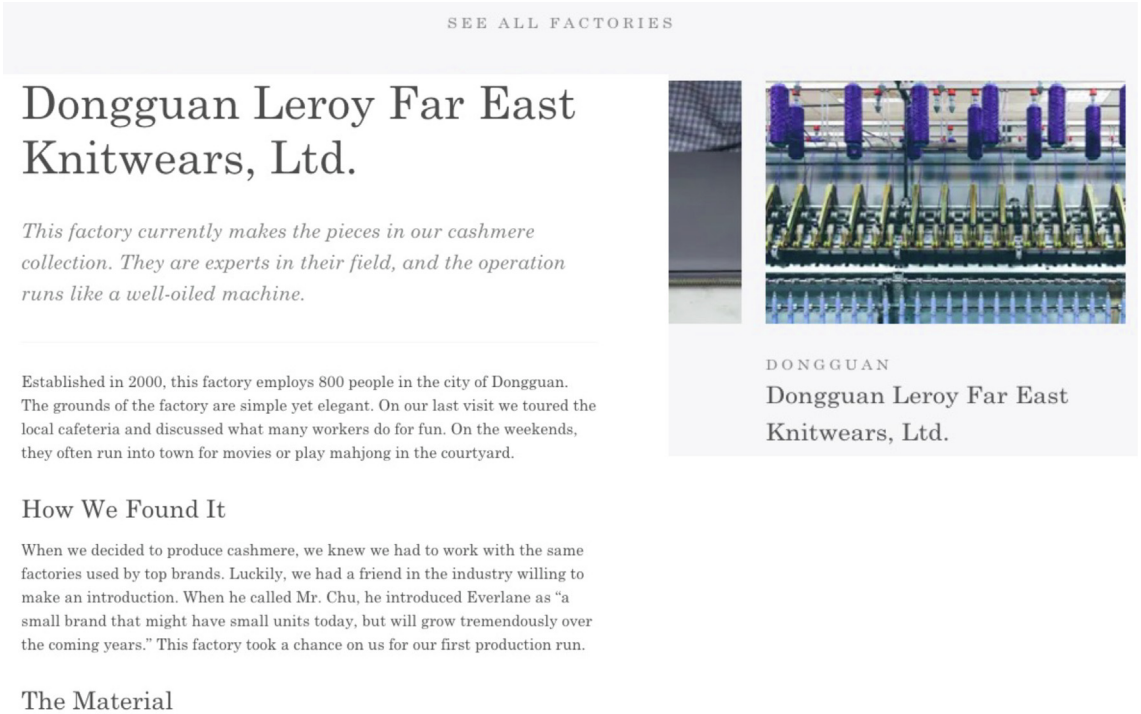

Image 2. Supplier Information Provided by Everlane, Everlane's Website, 2021

Image 3. Everlane Shares The Sustainability Information of Its Denim Factory Partner, Everlane's Website, 2021

Image 4. Climate-smart farming in Guadeloupe (left, photo by Jean-Marc Blazy) and specialized cereal farming system in Normandy (right, photo by Daniel Chopin), "Avenues for improving farming sustainability assessment with upgraded tools, sustainability framing and indicators", Chopin et al., 2021.

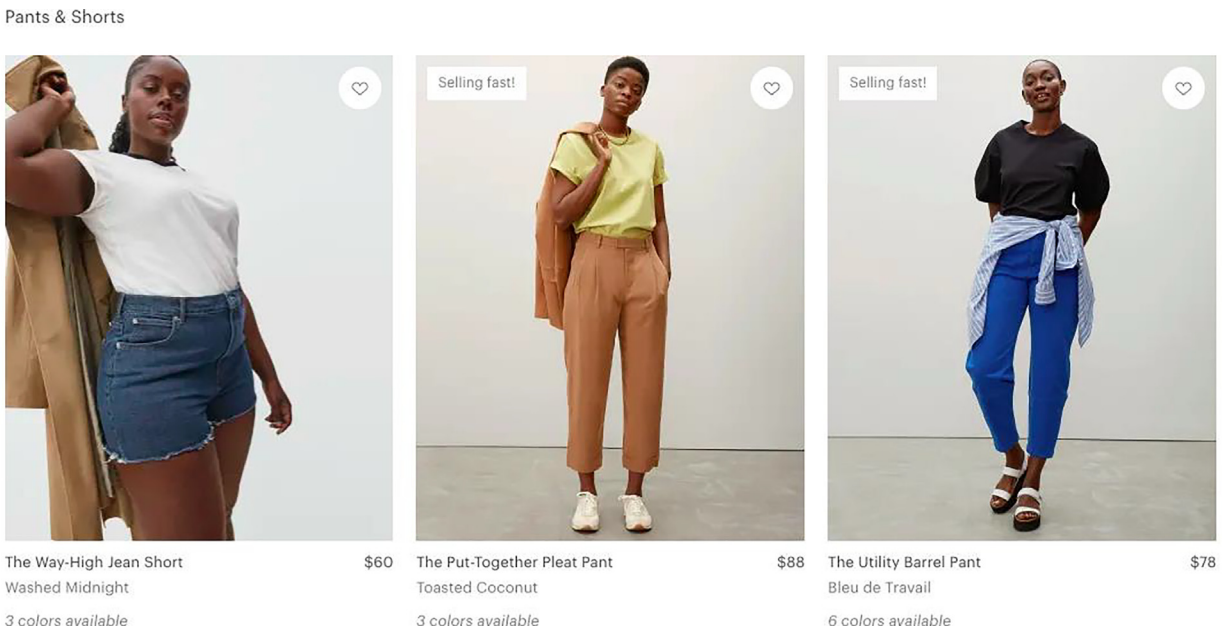

Image 5. Examples of Everlane's Minimalist Pieces, Everlane.com, 2021.

ance. All suppliers are required to meet the "Fundamental" level, and those that go further are rewarded with increased orders or trainings. H&M advertises sustainability criteria for raw materials only in certain collections, such as their "Conscious" collection, in which each piece is made from at least 50% sustainable materials.

Everlane partners must comply with strict sustainability standards consisting of both internal and external criteria. To be selected as a partner, each supplier must undergo an extensive intake audit process, as well as frequent follow-up audits. Each supplier must maintain compliance with the company's Vendor Code of Conduct and Social Responsibility Code of Conduct, which cover the Four Fundamental Freedoms laid out by the International Labor Organization- freedom of association, freedom from forced labor, abolition of child labor, and freedom from discrimination (International Labor Organization ILO, 1998). Everlane stands apart from H&M due to the high criteria it sets for raw materials, including organic and recycled inputs. For example, to meet its goal of eliminating newly-made plastics from its supply chain, the brand must seek out suppliers who are willing to create garments with all-recycled plastic materials. These high criteria severely limit the factories they can partner with (Segran, 2019). Strict criteria for production processes and materials are also essential for evaluating future partners that will help the brand reduce its environmental impact even further.

4.9. Areas for improvement

Both fast fashion leaders like H&M and sustainability-focused brands such as Everlane have implemented SSCM to some capacity. As the above comparison highlights, these two brands share a number of weaknesses that make their SSCM efforts largely ineffective. These include the failure to engage upstream partners in sustainability initiatives, the focus on short-term supplier incentives and self-assessment rather than long-term sustainability investments, the failure to commit to a more sustainable design standard with less harmful raw materials, and a lack of transparency about the impact of their supply chains.

Overall, both H&M and Everlane place a heavy emphasis on "greening" internal operations and reducing direct emissions. For example, both companies have touted energy efficiency improvements within their office and retail spaces. Focusing only on internal operations neglects the fact that a major portion of emissions are created in the raw material and processing stages. To make meaningful and long-term reductions in GHG emissions, fast fashion companies must incorporate upstream and downstream activities into their SSCM initiatives.

When rewarding compliance with SSCM initiatives, fast fashion companies focus more on short-term rewards than long-term sustainability improvements. For example, H&M currently rewards partners increased orders and training opportunities. H&M and its contemporaries can incentivize long-term improvements by adjusting the rewards offered by current loyalty programs to invest in long-term solutions, such as energy efficiency or less harmful manufacturing processes, alongside increasing orders from these facilities (outlined in Section 5.1.2). This will continue to reward suppliers who comply with SSCM criteria, while significantly reducing emissions in the long term.

Another major weakness that must be addressed is the failure to fully incorporate the design standard of garments into a company's SSCM strategy. The majority of fast fashion products are made from petroleum-based synthetic materials, such as polyester or nylon, which are difficult to recycle. By investing in less harmful and recyclable materials, brands can ensure that manufacturing each garment has a significantly lower environmental impact throughout the course of its life.

Finally, industry leaders cannot fully commit to effective SSCM strategies without also committing to transparency. H&M and Everlane publicly share the names of their suppliers and engage with international networks; however, they both fail to report an estimate of the overall impact of their value chains, including year-on-year emissions. As described in Section 4.5, H&M lists out its emissions as Scope 1, 2, and 1 + 2, but not Scope 3, which would estimate emissions created by all direct and indirect supply chain activities. The company's internal emissions have decreased since 2016, but consumers cannot determine if this is true for the entire value chain. Similarly, Everlane provides clear information about the output of individual factories, but fails to paint a clear picture of emissions created by their supply chain. Without transparency about their impact, it is difficult for consumers and policymakers to develop a clear understanding of the industry's improvement. This is a major challenge the brand must address in its future SSCM efforts.

5. Applying innovative SSCM methods to fast fashion supply chains

As discussed in the previous section, fast fashion brands can address current weaknesses in SSCM by incentivizing sustainable practices in upstream and downstream activities, and committing to a more sustainable design standard for garments. To address upstream operations, brands can leverage their partner programs to decarbonize material production and processing, improve energy efficiency, and increase usage of renewable energy sources. Integrating downstream activity takes several forms, including giving garments another purpose with recycling, repair, rental, and resale activities, investing in innovative materials that will make existing recycling efforts more effective, and designing clothes that provide more long-term value for consumers.

5.1. Upstream activities

5.1.1. Decarbonizing material production and processing

Decarbonization of manufacturing processes will be a key component in reducing the environmental impact of fashion supply chains. Decarbonization can be achieved through the use of various new processing technologies and targeted farming techniques. For example, raw material suppliers can decarbonize the production of cotton by reducing fertilizer and pesticide usage, and utilizing improved farming practices such as targeted spreading (Chopin et al., 2021). This fertilization method involves the targeted application of fertilizers rather than blanket application, which creates spillover and releases excess carbon that is stored in soil. In order to incentivize these practices, brands like H&M should integrate specific decarbonization methods into their criteria for raw material manufacturers, and incentivize these practices through their supplier relations program (Section 5.1.3).

5.1.1.1. Improving energy efficiency and utilizing renewable energy. Improving energy efficiency in upstream operations will be essential in reducing GHG emissions created by fast fashion supply chains. This can be achieved primarily through technology improvements in processing and manufacturing, such as transitioning from wet processing to dry processing. Wet processing refers to the processes that use large amounts of water and energy to convert fabrics into finished goods, including bleaching, dyeing, printing and finishing. An example of switching to dry processing is laser dyeing jeans instead of heating large quantities of water for dyeing. Improving energy efficiency will be especially important when manufacturing synthetic materials, like polyester, which take large amounts of energy to create.

5.1.2. Incentivizing decarbonization and energy developments

Companies like H&M can incentivize these sustainable practices by leveraging existing partner programs to invest in new technologies and renewable energy in upstream operations. SIPP, H&M's existing partner program, can be used for long-term change by altering the reward system. Instead of offering increased orders, H&M can reward partners with investments in more sustainable infrastructure, which will in turn help them better comply with sustainability criteria in the future. This integration also directly benefits H&M, by helping the brand maintain close communication with suppliers, further protecting them from supply chain risks.

5.2. Downstream activities

5.2.1. Four R's: Recycling, Rental, Repair, and resale

Brands can reduce the number of garments sent to landfills by encouraging consumers to give garments another purpose when they are finished using it. Many brands, including H&M, have started doing this by using their retail locations as a collection point for used garments, then sorting through those that may be recycled for future use. H&M encourages consumers to participate in their SSCM efforts by giving shoppers 15% off their next in-store purchase (Masunaga, 2019). This empowers consumers to reduce their contributions to landfills and enables brands to take an active role in recycling garments that are no longer useful. However, this program can be leveraged more effectively to encourage a higher rate of participation. For example, H&M can incentivize participation by raising the discount that consumers receive for returning garments, adding an additional reward after a specific number of items have been donated, or adding incentives for customers who encourage friends to donate. As previously described, brands like H&M will likely only sell 60% of their clothing without a markdown. Because the majority of H&M's inventory is already sold to consumers at a significant markdown, H&M can utilize markdowns to their advantage by incentivizing sustainable consumer behavior.

Rental allows customers to use a garment for a limited amount of time while keeping it in circulation. This model is currently utilized by several brands, such as Banana Republic's "Style Passport" program that allows customers to rent a variety of garments for a monthly fee of eighty-five dollars. In recent years, several platforms have been created to facilitate the rental of luxury and high-end goods, like Rent the Runway and Style Lend (The Good Trade, 2016). These rental options offer benefits for both brands and shoppers- brands can earn an ongoing revenue stream from a single garment and reduce waste, while customers have the opportunity to try new styles at an affordable price.

Brands can also offer repair services to extend the lifetime of a product. The industry leader in this practice is Patagonia. Patagonia has implemented a send-in repair service, which has garnered popularity and helped the company develop an image of an ethical brand with sustainable values. Repair services require that a brand recruits tailoring services, which provides an excellent opportunity for the company to create jobs for underserved communities and boost CSR efforts.

Resale, or the retail of secondhand garments, is quickly gaining popularity among young consumers. Applications like Depop have burgeoned the growing resale market, and the resale sub-segment is growing approximately 5 times faster than thrift as a whole (thredUp, 2021). Resale provides an opportunity for additional revenue as companies earn revenue from gently used garments, in addition to strengthening their public commitment to sustainable practices. Several brands have taken note of the resale's financial opportunities; for example, Levi is planning to launch their own resale site, "Levi's Secondhand". McKinsey (2020) estimated that if fashion brands invest in garment rental and resale at an industry level, they could abate up to 347 million metric tons of GHG emissions by 2030.

5.2.1.1. Transparency with consumers. A major weakness in the current SSCM reporting is a lack of transparency in sharing the total carbon emissions or impact created by a company's supply chain activities (Section 4.5, "Improving Supply Chain Performance"). This was neglected in both the sustainability reports of H&M and Everlane. To accurately report progress in decarbonization, recycling, and other SSCM initiatives, brands must be transparent about the carbon emissions created by the entire supply chain. Companies should provide a complete overview of the emissions created by internal operations as well as the activities of their suppliers, displaying year-on-year changes in terms of Scope 3 emissions. Doing so will be important for measuring the success of collaborative decarbonization efforts in the future. This will also allow NGOs and government bodies to make informed policy recommendations based on accurate information.

5.3. Creating greener products

The majority of fast fashion garments are made with low-quality, petroleum-based materials, which wear out quickly and are difficult to recycle. Therefore, even if a brand introduces recycling, rental, and resale programs, they cannot be leveraged to their full potential. To effectively reduce the environmental impact of their value chain, fast fashion brands must turn their attention to the beginning of the value chain. They can effectively engage the early stages of the supply chain by incorporating product design and raw materials into their SSCM efforts. This begins by completing a life cycle assessment for each type of garment, after which brands reevaluate the design standard of products and invest in innovative sustainable materials.

5.3.1. Life cycle assessment (LCA)

In order to create more environmentally-friendly products, brands must first understand the current impact of each garment. This can be accomplished through a Life Cycle Assessment (LCA), which tracks the environmental impact of a specific product during each stage of the supply chain from the raw material collection to disposal. An LCA will identify which products and processes have the greatest impact and need the greatest changes (Seuring & Müller, 2008). Because fast fashion brands offer a wide variety of products, companies can conduct LCAs on a sampling of products that represents their most popular offerings, such as common shirt silhouettes and jeans. By assessing a representative sample of products, brands can address the products and materials that cause the highest level of environmental impact.

5.3.2. Investing in sustainable and recyclable materials

After a completed LCA, creating environmentally-conscious products begins with one of the most pivotal stages of the supply chain: the Design Phase. The design standard for clothes includes the amount and type of material used. By altering the design standard for an item, fashion companies influence a garment's impact at every stage of the supply chain, from manufacturing raw materials to the recycling a garment after consumer use.

Innovation in raw materials is a key component of creating greener products. The materials used to make a garment determine how it is manufactured, how it will be cared for, and how it may be repurposed at the end of its life. By researching and utilizing more environmentally-friendly and long-lasting materials, brands can make recycling efforts more effective. Synthetic materials like polyester are difficult to break down and re-use, meaning that collecting fast fashion garments has a very limited impact.

While a completely sustainable fabric does not exist, brands can utilize alternatives that have significantly less environmental impact. One of the major innovations in raw materials in recent years is the use of recycled plastic materials as inputs. Everlane is a prime example, as 90% of plastic in its clothing is from recycled plastics such as water bottles. While it is not currently affordable to eliminate all plastics and still target a mass-market price point, this initiative allows Everlane to offer a more sustainable alternative at a reasonable price for consumers.

In the future, fast fashion companies can make recycling more effective in the long term by focusing CSR funds on researching raw materials that are suitable for recycling or reuse. This investment offers long-term benefits by demonstrating a brand's genuine commitment to sustainability and making recycling efforts more effective in the long term.

6. Discussion

6.1. Major contributions

This study addresses a major gap in previous literature surrounding SSCM in fashion supply chains by applying a standardized framework to fast fashion brands. As the fast fashion industry makes up approximately half of the industry's emissions output, it is important to identify the weaknesses in current SSCM efforts specifically in this subsector in order to make significant improvements to fashion supply chains. Fast fashion brands are cemented in the modern economy, and in order to address the impact of the overall fashion industry, it is essential to approach this sub-sector with practical strategies that respond to its unique challenges.

This paper has also laid out several key actions that fast fashion brands can take to improve their SSCM strategies. These include engaging with both upstream and downstream stakeholders, adapting existing partner programs to invest in long-term sustainable infrastructure, and re-evaluating the raw materials used in garments.

6.2. Implications for practice

To address the climate crisis with the urgency it demands, industry leaders like H&M and Everlane must take a more comprehensive approach to SSCM and actively engage with upstream and downstream stakeholders. Brands must also shift their focus from short-term fixes, such as "conscious collections", to investing in long-term energy and processing infrastructure. These investments will have long-term implications for a company's environmental impact, as they will reduce the impact of all future garments made in their improved facilities.

These investments also offer marketing and financial benefits. H&M and its competitors already invest in CSR projects, such as promoting access to clean water in developing countries, to avoid accusations of greenwashing. Investing in SSCM will serve the same marketing purpose while making sustainability initiatives more effective, reducing the impact of manufacturing and processing in the long run. Furthermore, a study by McKinsey demonstrated that investing in sustainability in the raw material production, preparation, and processing stages of the supply chain offers considerable financial benefits. For example, an 80% efficiency improvement in wet processing technology could save companies $500 for every ton of CO2 abated. As these potential benefits demonstrate, investing in green supply chains is not only an ethical choice and an excellent marketing opportunity- it offers tangible benefits for financial performance.

A major challenge in analyzing SSCM for this paper and future studies is the lack of standardization and regulation in sustainability reporting or marketing. Brands can engage in greenwashing, misleading consumers with claims of "green" products, with no legal consequences. In the future, policymakers should take steps to ensure companies are fully transparent about the impact of their entire supply chain, and are not able to make unfounded claims about their sustainability efforts. This will hold companies accountable for their progress towards a more sustainable supply chain and empower consumers to make more informed shopping choices.

6.3. Implications for theory

In future studies concerning sustainability in fashion supply chains, it will be essential to distinguish between different sub-sectors of the industry. Fast fashion uses different materials, processes, and marketing strategies than the luxury segment. Therefore, the strategies to make each of their respective supply chains more sustainable should be tailored specifically to the sub-sector.

Companies, researchers, and policymakers cannot focus solely on a company's internal operations when developing sustainability goals. Fashion companies have a direct role in the emissions created by factories and the textile waste created by non-biodegradable materials. Therefore, they should be held accountable for mitigating the effects of these activities. Brands should be considered an influential stakeholder in an interconnected web, with each decision impacting the emissions created at each stage in the supply chain.

6.4. Limitations of research

The analysis of current SSCM efforts was limited by the information provided in annual sustainability reports. For example, H&M only provided information about its direct emissions, and Everlane provided very little information about its emissions. Therefore, it is difficult to determine how their overall emissions have changed in recent years. In order to gather this information, researchers will need to engage with external stakeholders, such as NGOs or suppliers, in order to gather information about the overall emissions created by specific fast fashion brands.

While this study aims to provide a roadmap for fast fashion brands to improve their SSCM initiatives, an analysis of the value chain was limited by the information that sustainability reports provide. Based solely on the brand's sustainability reports, it was not feasible to evaluate the emissions or waste created by the supply chain for a brand like H&M, which works with over 800 suppliers in various countries. This challenge highlights the importance of transparency from brands about their manufacturing activities.

6.5. Future research

While this study lays out key actions that brands can take, there is much work to be done to ensure that SSCM is implemented effectively and reduces environmental impact in the long term. First, further research must be done on how to recycle synthetic materials more effectively. Materials like polyester and nylon make up the majority of fast fashion garments, and there are currently no alternatives at a comparable price point. Because these materials are very difficult to break down into raw materials, current recycling efforts are often rendered ineffective. Methods like chemical processing, which separates polyester from natural materials, dyes, and other components, are currently under study, but are not yet accessible at a mass scale (Freethink Team, 2021). Researching cost-effective ways to break down or reuse synthetic materials will be of the utmost importance moving forward.

Furthermore, it is essential to continue researching alternative inputs that can be mass-produced at a reasonable cost. Some of the most promising areas of research are recycled inputs or those derived from organic materials. For example, H&M shared in its report that it has begun research on textiles derived from orange peel and pineapple leaves, although these have not been implemented in manufacturing. Researching textiles derived from recycled or organic inputs will be vital for reducing the impact of fast fashion garments.

Finally, it is important to analyze the human rights impact of fast fashion supply chains. This paper did not analyze the human rights aspect of SSCM for clarity of analysis. Fast fashion companies demand high product volumes with very short lead times, which places immense pressure on factories and can lead to the abuse of workers. The geographic distance from suppliers makes it difficult for brands to effectively enforce ethics codes. With the unique challenges of the fast fashion industry, human rights are of great importance for future studies.

7. Conclusion

As the state of the climate becomes more urgent, it is essential for the fast fashion industry to recognize the magnitude of their contribution to global emissions and landfill waste. This sector currently constitutes approximately half of the fashion industry's emissions, and is especially harmful due to their use of fragmented supply chains, synthetic materials, and consistent overproduction. To address the climate crisis with the urgency it demands, industry leaders like H&M and Everlane must take a more comprehensive approach to SSCM and actively engage with upstream and downstream stakeholders. Companies can reduce the impact of upstream activities by leveraging existing supplier programs to invest in decarbonization, energy efficiency improvements, and renewable energy. Fast fashion companies can incentivize more sustainable consumer behavior through recycling, rental, repair, resale, and through increased transparency in their sustainability reporting. Investing in recycled or organic inputs will reduce the emissions created by manufacturing, and make current recycling efforts more effective by allowing used garments to re-enter the value chain. Moving forward, fast fashion companies should incentivize collaboration towards more holistic SSCM policies throughout the fashion supply chain. If the industry takes decisive action to prioritize sustainability in supply chains, fast fashion companies can significantly mitigate their environmental impact and create a more sustainable industry that offers long-term benefits to their bottom line, to customers, and to the planet (Revolution, 2020; HM, n. d., 2021).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Berg, A., Granskog, A., Lee, L., & Magnus, K., 2020. Fashion on climate: how the fashion industry can urgently act to reduce its greenhouse gas emissions (Rep.). https://www.mckinsey.com/industries/retail/our-insights/fashion-on-climate (accessed 2 January 2021).

Chopin, P., Mubaya, C.P., Descheemaeker, K., Öborn, I., Bergkvist, G., 2021. Avenues for improving farming sustainability assessment with upgraded tools, sustainability framing and indicators: a review. Agron. Sustain. Dev. 41 (2). https://doi.org/10.1007/s13593-021-00674-3.

Masson-Delmotte et al, 2018. Global warming of 1.5 °C (Rep.). The Intergovernmental Panel on. Climate Change. (accessed 8 February 2021).

Ellen MacArthur Foundation, 2020. Outlook for a new textile economy in China (Rep.) https://www.ellenmacarthurfoundation.org/assets/downloads/Make-Fashion-Circular%EF%BC%9AOutlook-for-A-New-Textile-Economy-20201021.pdf (accessed 7 February 2021).

Everlane. (n.d.). CA SB657: Supply Chain Transparency Act. https://www.everlane.com/supply-chain/ (accessed 20 January 2021).

Nature Climate Change, 2018. The Price of Fast Fashion. Nature Climate Change 8 (1). https://doi.org/10.1038/s41558-017-0058-9.

Revolution, F., 2020. Definitions accessed 25 November 2020 https://www.fashionrevolution.org/definitions/ .

Freethink Team, 2021. https://www.freethink.com/series/just-might-work/polyester (accessed 7 February 2021).

Global Fashion Agenda., n.d. What we do. https://www.globalfashionagenda.com/about-us/our-mission/ (accessed 21 January 2021).

H&M. (n.d.). FAQ Production, H&M Career. https://career.hm.com/content/hmcareer/en_et/workingathm/get-to-know-us/faq-production.html (accessed 15 November 2021).

International Labor Organization (ILO), 1998. Declaration on fundamental principles and rights at work (DECLARATION) https://www.ilo.org/declaration/lang–en/index.html (accessed 22 February 2021).

Kenton, W., 2021. What you should know about greenwashing. https://www.investopedia.com/terms/g/greenwashing.asp (accessed 22 February 2021).

Li, Y., Zhao, X., Shi, D., Li, X., 2014. Governance of sustainable supply chains in the fast fashion industry. European Management Journal 32 (5), 823–836. https://doi.org/10.1016/j.emj.2014.03.001.

Masunaga, S., 2019. Does fast fashion have to die for the environment to live? (accessed 5 January 2021).

McCormack, N., 2017. What goes into making an earth-friendly $68 pair of jeans https://www.bloomberg.com/news/articles/2017-10-06/what-goes-into-making-everlane-s-eco-friendly-jeans/ (accessed 7 December 2020).

Moretto, A., Macchion, L., Lion, A., Caniato, F., Danese, P., Vinelli, A., 2018. Designing a roadmap towards a sustainable supply chain: a focus on the fashion industry. Journal of Cleaner Production 193, 169–184. https://doi.org/10.1016/j.jclepro.2018.04.273.

Seuring, S., Müller, M., 2008. From a literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production 16 (15), 1699–1710. https://doi.org/10.1016/j.jclepro.2008.04.020.

Statista, 2021. Fast fashion market value forecast worldwide in 2009 and 2019, with a forecast for 2029 (in billion U.S. dollars). https://www.statista.com/statistics/1008241/fast-fashion-market-value-forecast-worldwide/. (accessed 7 January 2021).

The Good Trade, 2016. Renting is the new black: 6 places to rent designer dresses & clothing online. The Good Trade. https://www.thegoodtrade.com/features/7-places-to-rent-designer-dresses-and-clothing-online. (accessed 7 December 2020).

Turker, Duygu, Altuntas, Ceren, 2014. Sustainable Supply Chain Management in the Fast Fashion Industry: An Analysis of Corporate Reports. European Management Journal. 32 (5), 837–849. https://doi.org/10.1016/j.emj.2014.02.001.

Segran, E., 2019. Fashion's plastic problem is bigger than you can imagine- but this brand is finding new ways to solve it. https://www.fastcompany.com/90325711/everlanes-founder-vowed-to-remove-all-new-plastic-from-the-brands-supply-chain-by-2021-now-he-has-to-figure-out-how/ (accessed 30 December 2020).

Velasquez, A., 2020. Long-term suppliers play a key role in Everlane's transparent model. https://sourcingjournal.com/denim/denim-brands/everlane-orta-anadolu-transparency-denim-supply-chain-kingpins24-217724/ (accessed 8 January 2021).

thredUp, 2021. thredUP Releases Its Ninth Annual Resale Report with First-Ever Impact Section. https://ir.thredup.com/node/7166/pdf#:~:text=Resale%20is%20expected%20to%20grow,in%20the%20next%205%20years. (accessed 30 December 2020).

Hendriksz, Vivian, 2017. H&M accused of burning 12 tonnes of new, unsold clothing per year. https://fashionunited.uk/news/fashion/h-m-accused-of-burning-12-tonnes-of-new-unsold-clothing-per-year/2017101726341. (accessed 15 November 2020).