April Sunid

The Apparel Industry: Moving Towards Sustainability

Introduction: Sustainability Problems

The global textile and apparel industry is a multi-billion dollar market, with significant contributions to the economies of many countries. In the last 15 years, clothing production has approximately doubled mainly due to the 'fast fashion' phenomenon, with quicker turnaround of new styles, increased number of collections offered per year, and – often – lower prices. Today's clothing system is largely reliant on nonrenewable resources that pollute the environment at every step of the way, from fiber production, clothing production and after use. These garments are largely lost to landfill or incineration, further adding to the negative environmental impact. Approximately half a million tons of plastic microfibers are shed during the washing of plastic-based textiles like polyester, nylon, or acrylic and end up in the ocean each year.[1]

Fast fashion is everywhere – from your H&Ms to Forever 21s, they rely on the rapid production of clothing using large quantities of natural resources such as water, energy, and raw materials. This leads to overconsumption and depletion of finite resources, contributing to environmental degradation and strain on ecosystems. The production and manufacturing processes of fast fashion generate pollution at various stages, including chemical waste from dyeing and finishing textiles, air pollution from factory emissions, and water pollution from untreated wastewater discharge. These pollutants can contaminate soil, waterways, and air, posing health risks to both ecosystems and human populations.

Clothing is being underutilized, with more than half of fast fashion products disposed of in under a year. Only 10% of clothing donated to Salvation Army actually makes it to the storefront while the remaining 90% or more of what you give away is sold by the charitable institution to textile recycling firms or foreign buyers.[2]

The fibers market is predominantly made up of (PET; 70%). PET is most notably used in the manufacturing of polyester fabrics, which offer several advantages, including durability, wrinkle resistance, ease of care, and versatility in terms of texture and appearance. PET is a synthetic thermoplastic derived from the crude oil petroleum, a well-sought after natural resource that requires an environmentally taxing process to acquire. The extraction and processing of petroleum oil for plastic production releases greenhouse gasses such as carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). These emissions contribute to climate change by trapping heat in the Earth's

[1] International Union for Conservation of Nature, Primary microplastics in the oceans: A global evaluation of sources (2017)

[2] https://abcnews.go.com/WN/truth-donated-clothes-end/story?id=2743456

atmosphere and cause global warming, leading to environmental impacts such as rising sea levels, extreme weather events, and habitat disruption. When it comes to disposal of garments made of PET, we run into some decomposition issues. The earth's oil can't absorb oil derived plastics, simply because reconstituting hydrocarbons creates materials that are foreign to the microbes in our planet's water and soil. This renders them unable to recognize its components, which means they can't digest it, and thus can't turn into water and carbon dioxide. Unfortunately, this inability results in oil-derived plastics needing years or even decades to decompose fully.

There is much attention on the West African country, Ghana. When charities in the US, Europe, Australia and China are unable to sell donated clothing, it is exported by ship for them to sell in second-hand clothing markets. In the notorious Kantamanto Market located in capital Accra, Ghana, close to 40% of the bales of clothing do not get sold. This creates 160 tons of textile waste every day. Unsold clothing in a second-hand market is as final as it gets. Their last stop – a local dumping grounds 2 hours north of Accra, where it sits and releases methane gas into the atmosphere. There are burns of the clothing that paint the sky black for days at a time. When heavy rains hit the region, it washes unwanted clothing into the city's sewers and chokes the waterways, causing issues for boaters, swimmers and marine life. They don't like to wear black.[3]

Another country that is experiencing foreign dumping atrocities is Chile. They are the biggest importer of secondhand clothing in South America, and between 2020 and 2021 it was the fastest-growing importer of used clothing in the world.[4] Neighboring countries restrict or forbid the import of used clothes, but not Chile, and is becoming an international dumping ground as much of the global fashion industry waste gets sent there. The used garments are sent in bales and are received in Iquique's port, estimating a range from 60,000 to 44 million tons annually. Up to 80% of the garments in a bale are usable, and sometimes the opposite is true. It is estimated 85% of the used clothing imported into Iquique remains unsold. Chilean federal law states it's illegal to dispose of textiles; they are experiencing both unjust environmental penalties by forces outside of their borders and some very broken policy inside. As the bales of ropa americana, or secondhand clothes, are distributed and then dumped in the Atacama Desert, trash pickers go there to collect garments that they resell at their vendor stalls in open air markets. This is an unclean practice and another negative trickle-down issue caused by overproduction.

[3] https://abcnews.go.com/WN/truth-donated-clothes-end/story?id=2743456
[4] https://www2.deloitte.com/us/en/insights/industry/financial-services/future-of-shopping-malls.html

Case Examples in Industry

My case-study and qualitative research focus on H&M Group, who exemplify an enterprise-scale sustainability initiative, and The Ellen Macarthur Foundation of the United Kingdom, are at the forefront of fashion reporting in the circular economy.

Many companies are adopting circular economy principles to minimize waste and maximize the lifespan of products. The circular economy model encourages corporations to commit to using recycled textiles and addresses the overproduction business models. The textile recycling firms keep the clothing circular and reusable, but the items that get shipped off to second-hand markets in places like Ghana or Chile, sell what they can and dump or incinerate the rest. In the era of fast fashion, the amount of clothing that ends up in foreign landfills is alarming. Within borders, companies like Nuuly, Rent The Runway, Poshmark and eBay serve as online platforms for clothing rental and resale. This circular solution differs from the chemical treatment of used fabrics, such as polyester, turned into recycled polyester. Environmentally-conscious alternative fabrics to conventional materials like polyester and lyocell are being engineered. Then there are bio-based fibers derived from renewable sources, such as bamboo or hemp, and require no more thought than harvesting the crop itself.

The issue of under-utilized clothing was identified by the Ellen MacArthur Foundation and is described as the lack of times that a garment is worn before it is no longer worn again.[5] Many low-income countries have relatively high rates of clothing utilization, but in wealthier countries such as the US and China, clothes are only worn for around a quarter of the time than the global average. This means that clothes are worn for short periods of time and are disposed of sooner than the garment's actual time it can be worn. Increasing the average number of times clothes are worn emerges as the most direct approach to capturing value and eliminating waste and pollution in the textile system. This is an important cultural shift, and can be achieved by designing and producing clothes of higher quality and making them accessible through innovative business models. Such initiatives can help transform the perception of clothing from a disposable item to a durable product, fostering a more sustainable approach to fashion. These worn pieces should be cherished and serve as hand-me-down pieces for dear friends and family. Reimagining a new textiles economy, clothes, textiles, and fibers would be kept at their highest value during use, and re-enter the economy afterwards, never ending up as waste.

[5] https://emf.thirdlight.com/file/24/IwnEDbfI5JTFoAIw_2QI2Yg-6y/A-New-Textiles-Economy_Summary-of-Findings_Updated_1-12-17.pdf

In today's new shopping landscape, consumers have moved their shopping from the malls to online. Even before the pandemic, malls were facing closures as retailers struggled to compete with the convenience and variety offered by online shopping platforms. Many malls were already grappling with declining foot traffic and sales. Retail giants that come to mind like Shein and Amazon are dominating the online market and do not show signs of stopping. The rise of fast fashion and direct-to-consumer brands have made it difficult for many malls to stay open, especially after the pandemic. In my personal experience, I find this to be a slight loss for society, as having a stocked and community-catered-to shopping mall is an experience that shouldn't be overlooked. I suppose those who know the feeling of putting on a perfectly fitted pair of jeans and grabbing a drink afterwards will relish in the glory of that, more exclusively.

Some of these fast fashion companies however, brand with environmental initiatives in mind. H&M may very well be the north star of this, with plans to halve their emissions by 2030 and reach a net-zero impact by 2040. The H&M Group was started by Swedish entrepreneur Erling Persson in 1947. After being inspired by his visit to New York City the previous year, Persson inaugurated a new women's clothing store in Västerås, Sweden. Naming it Hennes, translating to "Hers" in Swedish, Persson himself designs the soon-to-be-recognized Hennes logotype. In 1968, Hennes purchased the Stockholm-based retailer specializing in hunting apparel and fishing equipment, Mauritz Widforss, leading to a rebranding as Hennes & Mauritz. This expansion sees the introduction of men's and children's clothing, catering to the fashion needs of the entire family. It wasn't until 1974 that the stores were rebranded with the abbreviation "H&M".[6] H&M group includes eight clearly defined brands – H&M, COS, Monki, Weekday, & Other Stories, Cheap Monday, H&M Home and ARKET.[7] Many of their brands draw style inspiration from their European markets, with heavy presence in the UK and Nordic countries. This residency was also observed when looking at companies that H&M have stock in – Re:newcell of Sweden, Worn Again in the UK, Ambercycle in Los Angeles, CA, and Infinited Fiber of Finland. These companies differ from the H&M Group because they are developers of their own machine technology to create new materials that are sourced from recycled textiles. For example, Re:newcell has engineered their CIRCULOSE® garment material, which replaces the use of virgin materials such as wood pulp or cotton. It is a 'dissolving pulp' that can be used to make viscose, lyocell, modal, acetate, and other types of regenerated fibers (also called man-made cellulosic

[6] https://hmgroup.com/about-us/history/

[7] https://about.hm.com/content/dam/hmgroup/groupsite/documents/en/Digital%20Annual%20Report/2017/Annual%20Report%202017%20Our%20brands.pdf

fibers). These fibers are then spun into yarns, woven or knitted into fabrics and finally cut and sewn into new high-quality textile products.[8]

On February 25th, 2024, Re:newcell filed for bankruptcy due to an uncertainty with the necessary liquidity and capital to ensure operations going forward.[9] This shifted my attention to Ambercycle, another textile recycling company. They've created cycora®, a high-quality regenerated polyester, and their first product that offers the same strength and versatility as virgin polyester, at less than half the CO2 emissions associated with petroleum-based fibers.[10] The European Center for Innovative Textiles (CETI) in France, a prominent research institution in the field of textiles, has verified that the circular material cycora® matches the quality of virgin materials and surpasses the standards set for recycled materials.[11] Polyester is such a commonly used material in clothing that it would have been an easier classification process with regard to the integrity of the fabric and would certainly be an easy classification for marketing in comparison to Circulose®. Marketers may have had issues with presenting Circulose® material integrity, as it may have been difficult to keep track of its classification when considering all of the different cellulosic fibers that it could be turned into. These textile recycling companies should maintain integrity by trying to recreate existing textiles into nearly identical recycled versions, as Ambercycle has seamlessly replaced conventional polyester.

On October 25, 2023, Ambercycle announced its partnership with Inditex, a Spanish multinational clothing company, to help scale textile to textile recycled polyester. They signed a three-year agreement to buy a significant portion of the annual production of cycora® for more than 70 million euros. Inditex is the parent company of Zara, along with six other brands, and will first incorporate this material in the Zara Athleticz line, featuring technical pieces crafted with up to 50% cycora® content. Inditex aims to have 100% of its textile products to be made exclusively from materials with a smaller environmental footprint by 2030. As part of this commitment, the Group expects to have 25% of the textile fibers made from next-generation materials that do not yet exist at an industrial scale. Cycora® will serve as a direct substitute for traditional polyester. This purchasing agreement will play a crucial role in backing the establishment of Ambercycle's first commercial-scale textile regeneration facility.[12]

While making the shift towards regenerated fabrics, we should understand the numerous benefits of recycling textiles. By diverting materials away from landfills and

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[8] https://circulo.se/en/about/

[9] https://www.renewcell.com/en/renewcell-decides-to-file-for-bankruptcy/

[10] https://www.ambercycle.com/technology

[11] https://www.ambercycle.com/news/ambercycles-circular-polyester-on-par-with-virgin-materials-sets-new-standard-for-recycled-textiles

[12] https://www.ambercycle.com/news/inditex-signs-a-three-year-agreement-to-buy-textile-to-textile-recycled-polyester-cycora-r-for-over-eu70-million

incinerators, we are reducing the demand for virgin fibers by prolonging the lifespan of existing ones. To initiate the recycling process, textiles are first sorted based on their material composition and color. This color-based sorting eliminates the need for additional dyeing, thereby conserving energy and reducing the use of dyes. Once sorted, the textiles are shredded and magnets are utilized to extract zippers and buttons from the shredded material. Natural textiles, such as cotton or wool, undergo a thorough cleaning process before being combined through "carding," a mechanical technique that breaks up clumps of fibers and aligns them parallel to one another. The resulting product is then spun into yards of thread, ready to be utilized in the weaving or knitting of new textile products.

We can slash emissions from synthetic plastic production and its inability to properly decompose by moving towards bio-based plastic production. Bio-based plastics for textiles offer several environmental advantages, including a reduced reliance on finite fossil fuel resources and a lower carbon footprint. Polylactic Acid (PLA), Polyhydroxyalkanoates (PHA), Polyethylene Furanoate (PEF) and Polybutylene Succinate (PBS) are bio-based polymers that derive from renewable biomass sources such as plants, crops, or microorganisms. More specifically, these sources include corn starch, sugarcane, bacteria, or vegetable oils. These fibers can be used to make a variety of clothing items, including sportswear, outdoor apparel, and casual wear. These fibers may be blended with other natural or synthetic fibers to create textiles with specific properties and performance characteristics. For example, PLA or PHA fibers may be blended with cotton, bamboo, or polyester to enhance strength, durability, or moisture-wicking properties. Blending also allows for greater flexibility in manufacturing and design. Natural fibers are also bio-based and are made from materials such as bamboo, cotton, linen, hemp. A movement towards manufacturing bio-based clothing would be beneficial for the environment as the clothing can biodegrade under certain conditions, especially at composting facilities. Industrial composting facilities provide the ideal conditions for the biodegradation of natural fibers, resulting in the production of compost that can be used as soil conditioner or fertilizer. If not this, recycling textiles is possible with companies like Worn Again and their chemical treatment processes for used polyester and cotton. Donation and reuse of clothing is an industrial crisis averted, but when the clothing does not fit any of these options, we are faced with our final options of dumping and incineration.

Conclusions: Paths Forward

The Global South should not be burdened by our irresponsible dress code. It is possible that we could move some clothing recycling operations there, like the sorting that is done with Worn Again for polyesters, as it would certainly tackle that trash mound rotting of methane gas all day and night. We should continue producing the new eco-friendly patented fabrics, like cycora®, within borders (EU, US). In order to set up shop elsewhere, we should have reinforcing, circular business models be known, and widespread. We will be counting on Chile's Ministry of the Environment to make a new strategy and make it compulsory for importers to dispose of their clothing waste, responsibly. This is in line with the extended producer responsibility (EPR) goals coming out of the EU, and making a connection there would be productive. Reform in Chile and Ghana are long overdue.

The Environmental Protection Agency (EPA) reports that Americans generate 16 million tons of textile waste a year. On average, 700,000 tons of used clothing gets exported overseas and 2.5 million tons of clothing are recycled. Over 3 million tons are incinerated and 10 million tons get sent to landfills. In order to reduce these figures, we should implement a collective system and infrastructure to capture the value of used textiles. There have been rules proposed in California, New York, Sweden, the Netherlands, and Italy that would make fashion companies have to fund textile recycling programs by paying for the volume of clothing they produce. These "extended producer responsibility" (EPR) are modeled after programs for other hard-to-recycle goods such as batteries, mattresses and medical sharps – requiring brands to pay fees based on their product output, or to set up their own recycling programs. Advocates of Extended Producer Responsibility (EPR) programs for textiles hope they will curb overproduction, lead to recycling innovations and incentivize companies to manufacture higher-quality goods. It's also likely that EPR fees will be transferred to consumers, whose thirst for cheap clothing is exacerbating overconsumption.[13]

Fashion ranks among the top industries contributing to pollution globally. Pollution in the fashion industry arises from various stages of the supply chain, including textile production, dyeing processes, transportation, and disposal of clothing. The 2016 Paris Accord, initiated by the United Nations, aims to cap the rise in global average temperature to well below 2°C by the century's end. In order to stay in alignment with this goal, it's imperative to adopt a design-thinking approach. This would be a call to businesses, stakeholders, policymakers, educational institutions, NGOs, and international bodies to make collaborative efforts that will encourage the development, testing, refinement, and scale-up of effective solutions. The research conducted by the Ellen MacArthur Foundation on system-level change theory and practice, along with

[13] https://www.bloomberg.com/news/articles/2023-05-25/clothing-waste-is-a-problem-fashion-brands-could-force-you-to-pay-for-it?sref=PJUU2CLn&leadSource=uverify%20wall

H&M's current business practices may serve as a starting point for getting the circular economy on a roll.

We cannot recycle the problems away, and simply put, the solution is to stop overproducing. When tackling the current business model, ground zero are academic institutions, where we can further embolden businesses, stakeholders, policymakers, educational institutions, NGOs, and international bodies to make collaborative efforts that will encourage the development, testing, refinement, and scale-up of effective solutions. These various organizing bodies can reinforce each other with circular policy in mind. Reviewing Corporate Social Responsibility (CSR) statements by various fashion brands would be a good starting point in order to understand where their priorities lie. From looking at the materials they are using, their labor practices, efforts to reduce waste, transparency, consumer education, and ultimately how they are contributing to the circular economy, we can process these vital touch points when assessing the fast fashion giant at large. Sleuthing through these public statements, websites and documents can lay a foundation for the next era of fashion business. For the brands that are touting best practices, we can conduct further on-the-ground investigation for insurance that they are serving what they say. The policy of Environmental Social Governance (ESG) is up and coming, will work conjunctively with CSR, and news of these would signal an exciting debut of environmental business coalitions. Orchestrating the standard of Environmental Social Governance (ESG) with a brand like H&M, who has their toes dipped in many pools, can be the place where we transition business practices in fashion. We can identify bad actors who put out distasteful fashion trends with unsavory production processes and partner with the brands who use sustainable fabrics and ethical practices.

Not only working with CSR and ESG with business, but looking at Environmental Impact Statements (EIS) that are written by federal governing bodies for the nation's infrastructure projects, will also serve as landmark pieces of information that provide factual, concise, and scientific data. The U.S. Army Corps of Engineers (USACE) was the lead federal agency in charge of writing an EIS for the permit to build the Two Forks Dam and Reservoir in Denver, Colorado. This dam would divert water from the mountain peaks of the Continental Divide into the Eastern Slope, where 90% of people in Colorado live. The Corps began preparing the systemwide EIS in November 1982, with the assistance of the USFS, BLM, US Fish and Wildlife Service (FWS), EPA, Colorado Department of Natural Resources, Colorado Department of Health, and the Denver Regional Council of Governments. Ultimately, the Two Forks Dam project was not built and officially canceled in 1991, as it faced significant opposition from environmental groups and Native American tribes due to its potential impact on the surrounding

ecosystems and cultural sites.[14] In contrast, the USACE has had success in cleaning up the recent collapse of the Francis Scott Key Bridge in the Port of Baltimore, Maryland due to a ship ramming the bridge. This occurred on March 26th, 2024 and in less than a month, they were able to clear the removal of a 560-ton section of structural steel and enough wreckage from a 35-foot-deep Limited Access Channel (LAC). They've authorized clearance for 80% of ships to use the channel once again.[15] These are excellent case studies for deeply understanding the way teams can work together and make advancements.

With regard to fashion conglomerates, we should continue to study best business practices while staying compliant with instated policies within and outside US borders. Testing the EPR structure could turn into a lot of good policy that incentivizes customers to want to buy more sustainably. Looking closely at the behind-the-scenes of fashion production can lead to consistent and honest business practices across the globe, and stoke a social change in the way people shop, walk and socialize. Rather than needing to feel on trend with fast fashion, perhaps we can create an air of trends on classic, chic, fun – qualities of dress that capture American values, with clean lines, hardware, versatility and uniqueness.

[14] https://www.epa.gov/sites/default/files/2015-05/documents/twoforksfd.pdf
[15] https://www.nab.usace.army.mil/Media/News-Releases/Article/3752210/us-army-corps-of-engineers-clears-wreckage-from-limited-access-channel-in-port/