Fashioning Circularity

A Multi-Criteria Decision Analysis of Disclosure and Targeted Legislation:

Comparing Their Influence on Environmental Outcomes and the Circular Economy

In the

Apparel and Footwear Industry

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Abstract

The apparel and footwear industry is one of the most environmentally impactful sectors globally, spurring closer examination of current sustainability practices. Despite voluntary disclosure's benefits, it fails to adequately address the industry's negative environmental externalities. Legislators around the world have subsequently proposed legislation targeting different segments of the industry's value chain, attempting to advance circular business practices. This thesis examines best-in-class sustainability reports along with five pieces of legislation from the United States and European Union and compares their cost-effectiveness and estimated impact on eight material circularity indicators with a focus on environmental outcomes. The results show that voluntary disclosure generates the least amount of impact, and the five policies vary in impact and cost-effectiveness. Moreover, four of the five policies analyzed fail to address the linear consumption system that underlies the industry's environmental impact. The results reinforce the need for policy and regulation to advance circular systems.

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Chapter 1: Introduction

Background

As of 2019-2020, the global fashion industry was valued at $1.3 trillion USD, providing employment to more than 300 million people globally (Ahmed & Berg, 2018). Over the last two decades or so, clothing production has doubled and accounts for nearly 60% of all textile production. This great increase in production has also been met with substantial increase in consumption, rising to about 62 million metric tons of apparel per year as of 2018 and a projected jump to 102 million metric tons by 2030 (BCG & GFA, 2017; MacArthur Foundation, 2017). This industry's growth has come at a significant environmental cost. The textile and footwear industry accounted for 3,990 million metric ton metric tons of CO_2 equivalent (CO_2eq) greenhouse gases (GHGs), 8.1% of total climate impacts in 2016. The footwear industry is responsible for 700 million metric ton CO_2eq, approximately 1.4% of global climate impacts (Quantis, 2018). The breadth of the sector's impact has prompted more detailed examination of progressive intervention methods.

Over the last three to four decades the fashion industry has undergone a transformation. Up until the mid-1980s, the industry was built on the manufacturing of low-cost, mass-produced standardized garments that did not change frequently and consumers were less sensitive towards style and more concerned with utility (Bhardwaj & Fairhurst, 2010). At that time, the fashion calendar was primarily based on fabric exhibitions and trade fairs that were on Spring/Summer and Autumn/Winter patterns. By the beginning of the 1990s, style-oriented apparel had grown in popularity, reducing demand for the simpler, classic options. With taste exiting the typical calendar, retailers began focusing their product ranges on the newness of fashion trends, adding several mid-season batches of new garments throughout the year (Tyler et al., 2006). The speed

required to satisfy growing consumer demand for specific garments led to a restructuring of supply chains and the implementation of a quick-response strategy. Over the past couple of decades, retailers have shown that outsourcing manufacturing to low-wage nations can still satisfy a quick-response strategy despite long physical distances (Bhardwaj & Fairhurst, 2010). This drastic increase in production and consumption is expressed through the rise of fast fashion.

The fast fashion business model is built on rapidly changing trends and delivering items that meet those trends as quickly as possible. As a result of high trend turnover rate and consumer desire to participate in every trend, clothing is produced at a lower cost and lower quality than it ever has been previously to keep up. Simply put, consumers are buying clothes more frequently than ever but wearing them less frequently than ever, with US consumers purchasing a new item of clothing every 5.5 days on average (Edelson, 2022; Niinimäki et al., 2020).

The expeditious rise of fast fashion is widely thought to be a significant contributor to the negative environmental and social externalities stemming from the apparel and footwear industry, although the same issues existed before fast fashion. It has caused rapid change in consumer behavior and reinforced a system of mass consumption and overproduction, characterized by ever-evolving trends, demand for lower production costs, and high garment turnover rate. Yearly, US consumers dispose of 34 billion pounds of used textiles, 66% of that ending up in landfills. This waste can be sent all over the world, generating pollution, disease, and many other negative impacts as it decomposes (Devoy & Lundberg, 2022; EPA, 2017).

The rise of fast fashion has contributed to a demand to produce garments at the lowest price possible to generate the highest profit margins. To curtail production prices, the apparel and footwear industry has outsourced manufacturing to developing nations that have low-cost

economies and where the cost of labor is low. Additionally, these countries lack the robust regulatory bodies to enforce labor laws and as a result, many of the world's most ubiquitous brands have their clothing produced under inhumane conditions. Employees at these factories are regularly exposed to carcinogenic chemicals involved in dying, paid the lowest wage possible, and forced to work long hours with little to no break (Radhakrishnan, 2015). The environmental and social impacts extend beyond those mentioned but are evidence of the change that many demand in how the fashion industry operates at its core.

Industry professionals agree that action must be taken to address the negative environmental and social externalities that the apparel and footwear industry has given rise to (Kent, 2021). The industry currently operates on a linear model, commonly referred to as the take-make-waste economy. Under this model, resources are extracted to produce garments or shoes, and then the items are thrown away and end up as waste (MacArthur Foundation, 2021b). Changing this model and the ever-growing need for finite resources is at the center of the fashion industry's shift towards sustainability.

Heightened global awareness of climate change, the negative outcomes it creates, and importantly, increased accountability on significant contributors, has sparked social and political movements to reexamine the principles on which society has built its systems. One of the most prominent results of this reexamination has been the support of the circular economy.

The concept of the circular economy is not new as it was first mentioned in the mid-1970s, but over the past several years, it has gained in popularity. The literature discusses several definitions of the circular economy but The Ellen MacArthur Foundation, a leader in advancing circular practices, defines it as a system where materials do not become waste, where products and materials are kept in circulation, creating an economy that can tackle global climate change

and its associated challenges by decoupling economic prosperity from the extraction of finite resources (MacArthur Foundation, 2021a). The European Union (EU) sustains its definition as a system which maintains the value of its product, materials, and resources in the economy for as long as possible and minimizes the generation of waste. Although these definitions vary, the EU has referenced the Ellen MacArthur Foundation's version (European Union, 2021). In the footwear and apparel industry, implementing practices that embody the principles of the circular economy require a shift away from the linear model.

As more attention has been cast on the apparel and footwear industry's negative global impacts, policymakers have begun to respond through legislation mandating the disclosure of important environmental and social metrics. Moreover, legislation targeting specific segments of the apparel and footwear value chain are beginning to gain traction as viable routes to push the industry towards internalization of its negative environmental externalities (Peleg Mizrachi & Tal, 2022). While there is wide support behind disclosure requirements, there has been criticism that the mandates themselves will not lead to a reduced environmental impact, and that targeted regulation and accountability mechanisms are the most viable route to propel the industry into a new time of environmental and social consciousness (K. Pucker, 2022).

Research Objectives:

This thesis explores policy routes to regulate the apparel and footwear industry and the most effective legislation to generate a positive sustainability impact, framed by the objectives outlined in the EU's approach to a circular economy. My guiding research questions are:

- ***How do disclosure requirements and targeted policies vary in their impact on sustainability outcomes as measured by key circularity metrics?***

- ***What role do these two distinct methods play in promoting the strategies that advance the circular economy?***
- ***Can industry policymakers examine methods to estimate relative effectiveness of regulation and target policy in comparison to novel disclosure requirements such as the Corporate Sustainability Reporting Directive?***

My research advances the field of sustainable textiles, apparel, and footwear forward by providing insight for policymakers and industry professionals who are trying to understand how to reduce the industry's global environmental footprint. This thesis aggregates industry leading Corporate Social Responsibility (CSR) and Sustainability Reports to identify the key material metrics that companies use to guide their sustainability efforts. It also utilizes insight from relevant stakeholders across the industry to identify emblematic pieces of legislation that focus on specific segments of the apparel and footwear value chain as well as mandate disclosure and transparency. Stakeholder perspectives also provide important information regarding what metrics currently drive sustainable business practices and how sustainability disclosure along value-chain specific interventions is connected and reliant on one another. I analyze the impact generated by the different policies on the previously identified material metrics, guided by the Strategy for Sustainable and Circular Textiles. The conclusion of the thesis provides industry professionals, practitioners, and policymakers with a clearer picture of how different policy strategies impact metrics, disclosure and policy interrelatedness, and the advancement of the circular economy. Additionally, this research helps bridge the gap between regulation, measurement, and impact. Experts have heavily critiqued market-led mechanisms that are touted as ways to reduce environmental impact without curbing the industry's growth. Effective

regulation is the linchpin of meaningfully reducing the industry's environmental impact and this thesis examines the cost-effective ways to achieve this outcome with a focus solely on impacts and outcomes. This thesis informs future policy directions by shifting the focus of sustainable business practices to impacts generated rather than the financial return gained from such initiatives and moreover, proposes a way to examine impact effectiveness that can help inform how policymakers craft future pieces of legislation.

Chapter 2: Literature Review

The Circular Economy

Literature searches on the circular economy will generate hundreds of different definitions as it is a well-documented area of study. The Ellen MacArthur Foundation, a leader in advancing and implementing the circular economy, provides the following: "an economy that is restorative and regenerative by design," (EMF, 2009). This systemic approach to economic development is designed to benefit businesses, society, and the environment by decoupling growth from consumption and extraction. In the context of the apparel and footwear industry, it represents a paradigm shift in how a garment is viewed at each segment of its value chain. The apparel and footwear industry has traditionally operated under a linear model, where a garment's life is seen as complete when the user disposes of it. Under the circular economy, there is no concept of waste, as what would be previously classified as waste, is now a new set of resources, that can be injected back into its own value chain or the value chain of another product (Gardetti, 2019).

Implementing practices to achieve the circular economy requires intervention at each stage of a product's life from resource extraction, processing, design, manufacturing, distribution, and disposal (Rathinamoorthy, 2019). However it is important to note that although intervention is required at each value chain segment, it is widely recognized that these efforts must be unified in order to achieve a truly circular system (Kent, 2021; K. Pucker, 2023a).

Achieving the Circular Economy

As stated before, regulation and implementing innovative business models have been identified as high priority areas to changing the linear system the fashion industry currently operates on (Kent, 2021). Researchers and industry professionals present business models like

resale, popularized by mobile applications like “Poshmark” and “StockX”, as well as rental, where individual garments are rented per wear on platforms like “Rent the Runway”. However, to date has shown that these businesses do not stay profitable in the long-term, with Rent the Runway losing $46M on $186M in revenue in 2021 (Pucker, 2022). While these models do create positive impacts and have their place in the industry, they do not appear to represent the primary vehicle that will carry the apparel and footwear industry into a circular age (Pucker, 2023a). The central reason for their shortcomings in terms of circularity is that neither of these models addresses the underlying system that is the origin of the fashion industry’s negative externalities, which is based in unfettered consumption and a “make, take, waste” system in which the life of a garment ceases when the consumer is done wearing it.

Advancing circularity first requires a clear understanding of the main segments of impact and the material impacts they generate. Creating a circular system cannot be enacted at just one stage of a value chain. Enacting a data-driven approach to enable circularity at critical points of a value chain is a key factor in the advancement of the circular economy. By doing this, an entity can begin to use the interdependencies of different value chain segments to enable circularity (Niinimäki et al., 2023). This is embodied through the connections between the EU’s Corporate Sustainability Reporting Directive (CSRD), Circular Economy Action Plan, and Strategy for Sustainable and Circular Textiles. The data required as a part of the CSRD has been specifically selected to include aspects of product design, durability, reusability, etc. because those are metrics that to initiate change in, require fundamental changes in the way a product exists. Additionally, as the goal of the EU Commission is to advance circularity, creating a data-driven approach surrounding GHG emissions, water usage, pollution, waste, resource use, and

biodiversity puts the focus on reducing the most material environmental impacts (Directive (EU) 2022/2464 of the European Parliament, 2022; European Commission, 2023b).

Regulation to Advance the Circular Economy

The EU is attempting to address the production and consumption of textiles through the EU Strategy for Sustainable and Circular Textiles. The strategy lays out objectives and actions of the plan to address multiple aspects of the negative externalities associated with the apparel and footwear industry. The strategy aims to reduce the environmental and social impacts of the fashion industry segments that operate on the EU market. The EU Commission presented specific steps and actions to set forth the transition of the European textile market to a circular system. This includes the adoption of eco-design requirements, stringent waste management regulations, and provisions to punish companies for greenwashing and making unfounded environmental claims (European Commission, 2023b). The strategy is meant to cover all textiles sold on the European market and all stakeholders in the value chain including consumers, retailers, suppliers, and manufacturers. By applying the strategy in this way, the Commission aims for it trickle down the textile supply chain and expects global changes to come about. This set of clear objectives and policy actions is the first of its kind for the fashion industry as the EU Commission has set a new standard of regulation for environmental impact. Similarly to the analysis in this thesis, the focus is shifted towards the industry's environmental impact and deliberately delineates from the financial emphasis that has previously been placed on sustainability efforts.

Indicators of the Circular Economy

Rossi et. al. presents several indicators. The indicators are spread across three categories, each with an indicator, sub-indicator, and their measures. Some of the indicators include, reduction of raw materials (measured by raw materials reduced in manufacturing), cost reduction (monetary value provided by cost reduction from raw materials, energy, etc., as a result of circular practices), recyclability (percentage of recycle materials in product composition and percentage of product that can be used after recycled) (Rossi et al., 2020). In Rossi et. al.'s application, the group of indicators identified are all meant to collectively contribute to development and application of circular business models.

Additionally, as part of its Circular Economy Action Plan, the EU has been developing and amending a monitoring framework to track highest priority industries' progression towards circularly. An important segment of this framework is a list of indicators and sub-indicators, which are setting the direction for member state metric tracking as legislation targeting specific industries is proposed and implemented. The indicators present in the framework revolve mostly around material footprint, product footprint, waste generation, and recycling rate as the framework justifies, to not put an unreasonable burden on member states too quickly (European Commission, 2023a). Rossi et. al.'s (2020) framework encompasses metrics that are more aligned with systems level shift that is required to create a circular economy, shown their indicators that encompass each stage of a product's lifecycle (Rossi et al., 2020). In the literature, comparison of the impact generated by tracking these metrics and comparison of the interventions these indicators are housed under is virtually non-existent, emphasizing the importance of the analysis in this thesis to provide a study that identified the most impactful policy activity.

Greenhouse Gas Emissions

Perhaps the most expansive, impactful, critical, and well-documented category of the textile industry's environmental impacts are its greenhouse gas (GHG) emissions. Reducing GHG emissions globally are crucial as they are a primary vehicle that drives the global climate crisis forward. In the fashion industry, GHG emissions are a high priority issue, as the industry is one of the most significant global emitters. Accounting for the 10% of global GHG emissions, the fashion industry has flown under the radar as a high emitter in comparison to other industries like aviation and shipping, which have received public scrutiny for their emissions but combined, do not reach the emission levels of the fashion industry (United Nations, 2018).

Industry players are also recognizing the importance of reducing their GHG emissions. It has become common for global fashion retailers to conduct materiality assessments to comprehend and prioritize the sustainability issues that are the most pertinent to their company, investors, and stakeholders. Assessment results in all three companies indicate GHG emissions as the first or second most material topic to their stakeholders (GUESS, 2023; Hugo Boss Group, 2022; Victoria's Secret, 2022). The urgency to reduce emissions influences companies to understand their contributions throughout their value chain.

Early footprint studies identified the primary hotspot for emissions to be consumer use, but as time has progressed, researchers have found too much variability in this phase to state general levels of impact and some have found that manufacturing segment of industry's supply chain has the most substantial contribution to GHG emissions (Steinberger et al., 2009; van der Velden et al., 2014; C. Wang et al., 2015). In this section, we will briefly cover the various sources of emissions in the textile value chain and the challenges associated with their reduction.

Fiber Production

There is an important distinction to make between the emissions of natural and synthetic fibers. Natural fibers (e.g., cotton, wool, silk) are agriculturally derived materials whereas synthetic fibers (e.g., polyester, acrylic, spandex) are chemically manufactured from fossil-fuel products. To satisfy this difference, polyester will be used to represent synthetic fibers and cotton will be the representative of natural fibers because they are two most commonly used materials in textiles globally today (S. Wang & Salmon, 2022).

Cotton

Producing cotton fibers contributes to GHG emissions predominately through agricultural and industrial processes. Burning fossil fuels to power agricultural equipment to grow the cotton is a contributor to overall emissions. Additionally, electricity generated by burning fossil fuels is used to power machinery that processes, compresses, cleans, combs and twists the cotton before it is spun into yarn (Barrett et al., 2005). Collectively, the processes involved in cotton yarn production account for emissions of 2.23 CO_2eq/kg of yarn (Nigam et al., 2016).

Polyester

The production of polyester fiber presents a more substantial issue than cotton fiber production in terms of each material's emissions. Where cotton requires more water to create, polyester requires much more energy to derive a usable, versatile fabric from petroleum.

The energy demands of polyester production can be mostly attributed creating heat for the necessary chemical reactions to take place. Firstly, polyester's principal ingredient, ethylene, must be derived from petroleum. To do this, the hydrocarbons in the petroleum must be broken down through a process called steam cracking, which takes place at 800-900°C (Woodley, 2021).

Then, the polymerization process takes place, where ethylene is combined with terephthalic acid at a temperature of at least 260°C to create the polymer that will be spun (Clark, 2013). Once the polyester is created, it is allowed to cool to a solid, which is then cut into chips. To prepare the polyester for spinning, it is melted again at about 270°C and pushed through a metal container called a spinneret that creates small strands which are then spun to create the polyester yarn (Kiron, 2013).

Fabric Production

The fabric production process does not greatly differ between natural and synthetic fibers, so they have not been separated as they were for fiber production. Several stages of fabric production like weaving, dyeing, or printing, and finishing rely upon fossil-fuels to create the electricity necessary to power the industrial machinery that carries out these processes and heat large water boilers to above boiling temperatures to create steam to dye and finish the fabrics (O EcoTextiles, 2011). The final stage to transform the fabric into a finished garment is the most labor-intensive step, but has been estimated to account for less than 1% of GHG emissions, justifying some researchers to omit this stage when assessing the footprint of textiles (van der Velden et al., 2014). After these processes, the result is a finished garment but depending on what it is made of, its associated emissions can vary, with a cotton t-shirt accounting for 2.1 kg. CO_2eq of emissions and a polyester t-shirt accounting for 5.5 kg. CO_2eq of emissions (Kirchain et al., 2015).

Transportation and Distribution

The rise of fashion globalization in the 1980s transformed the industry's distribution model. Production phases have become delocalized and presently, most consumers wear clothes that were made on a different, or multiple continents. The transportation between production phases and finally to the end customer represent a significant source of GHG emissions. To facilitate the movement of products and materials around the globe, the fashion industry uses planes, trains, trucks, and railways.

Between individual companies, the emissions associated with their transportation and distribution can vary because of the different modes of transportation a company can utlize. Although this variation exists, transportation and distribution is the primary direct contributor to the fashion industry's GHG footprint (C. Wang et al., 2015). Past cases have shown that delocalization of an individual company's transportation network can lead to it being the main contributor to total GHG emissions (Bevilacqua et al., 2012). Of the modes of transportation, air travel creates the highest levels of GHG emissions, followed by trucks, then ships, and finally trains (Marcketti & Karpova, 2020; C. Wang et al., 2015). The biggest challenge associated with curbing transportation emissions has to do with the urgency to reduce the industry's footprint while it continues to increase in size. As was mentioned previously, fast fashion business model and insatiable hunger for growth puts more pressure on distribution networks to move greater quantities of clothing at a quicker pace, ultimately serving the goal of providing customers the clothes they love as quickly as possible. Once the garments arrive to the consumer, the final stages of their lifecycle also present emissions challenges.

Consumer Use and Disposal

These are the final stages of a garment's lifecycle. As stated previously, the emissions associated with usage can be significant, but are difficult to generalize because how dependent it is on consumer behavior. Several significant factors in the use phase are dictated by consumer habits and behavior including laundering (washing and drying) methods, temperature of laundering, energy consumed to launder the clothing, and the frequency with which it is washed (Muthu, 2020). Although these variable make it difficult to draw generalized conclusions, a large majority of full lifecycle textile studies emphasize the importance of reducing the impact of the use phase (Muthu, 2020). Case studies have been done to showcase the variability these consumer choices generate. Steinberg et. al. (2009) shows that a 20°C increase in washing temperature alone accounts for a 30% rise in washing phase emissions. The type of fabric as well as the type of garment also impact emissions in the use phase, shown by the same study, which considered the emissions of a cotton t-shirt and a polyester jacket. At the conclusion of the study, the results indicated that the t-shirt had consumed a total of 176.39 MJ and the jacket consumed 42.33 MJ (Steinberger et al., 2009).

When a consumer is done wearing a piece of clothing, there is high likelihood that it ends up in a landfill; about 87% of globally discarded textiles are in landfills (Moazzem et al., 2021). For that reason, I will be discussing only the emissions associated with textiles that are disposed of in landfills. Additionally, numerous negative externalities arise from textile waste in landfills, those are covered in the waste and pollution sections of this literature review. Polyester, the most widely used fiber in the world, is derived from crude oil, the process for which we detailed. Since it is synthetic, it does not biodegrade over time like its natural counterparts. Instead, it slowly breaks down, releasing methane, one of the most potent greenhouse gases (CFDA, 2019; Sustainable Fashion Forum, 2023). There are no studies currently published on the emissions

from the disposal of polyester in landfills, likely because the outcomes from methane emissions will occur much more slowly than the problems generated from water and soil pollution.

Water

As the global climate crisis has progressed, it has altered patterns of weather and water around the world. The effects of human activities on the world's water system are now large and expansive, further burdening and quickening the preexisting global water crisis, with global estimates that 1 billion people globally do not have adequate access to clean drinking water (Asian Development Bank, 2016). In 2007, the United Nations reported that global water use over the previous century was growing at twice the rate of population increase (FAO UN-Water, 2007). Continuation of high-water consumption in combination with the effects of the global climate crisis have contributed to water scarcity and security issues around the world, even in places that have not previously experienced water insecurity.

Textile, apparel, and footwear industries consume incredibly large amounts of water, with annual consumption rates totaling 93 billion cubic meters (MacArthur Foundation, 2017). Additionally, the production of one ton of textile requires approximately 200 tons of water consumption (Anguelov, 2015). Much of the industry's consumption can be attributed to raw material cultivation and the wet processes involved in textile manufacturing. The irrigation of raw material cultivation currently uses about 44 trillion liters of water every year, with the most egregious offender of this consumption being cotton. The 44 trillion liters of water accounts for about 3% of worldwide irrigation water use and cotton cultivation is responsible for 95% or about 41.8 of the 44 trillion liters (Niinimäki et al., 2020).

In comparison to other industries, textile, apparel, and footwear industries are among the most water-intensive. The only industries that consume more water than textiles are agriculture, which uses 70% of the world's freshwater supply, and the energy sector (The World Bank, 2022). These industries are so water intensive because water is needed at nearly every segment its value chain. Other water-intensive industries include the meat industry, consumer beverages, mining, and technology manufacturing (US Environmental Protction Agency, 2017). This section will only concern water consumption and its accompanying externalities and not focus on the outcomes associated with pollution.

Water Usage in the Textile Value Chain

Raw Material Extraction

As stated before, the most water intensive crop that is grown for fiber production is cotton. Additionally, cotton is the most common natural fiber used in textiles. Cotton's ubiquity combined with its water footprint make it a significant contributor to the industry's broader water usage. The World Wildlife Fund has previously estimated that the cultivation of one kilogram of raw cotton requires anywhere from 7,000 to 29,000 liters of water (World Wildlife Fund, 2013). That range is wide and significant, but when compared to other natural fibers, context is provided to the sheer size of cotton's water footprint. Other popular natural fibers include wool, silk, and linen, which all consume less water than cotton. Linen, which is derived from flax, requires significantly less water than cotton, primarily because it requires minimal irrigation to grow. Ro, a popular Spanish linen retailer and the Textile Exchange have estimated that 1 kg. of processed flax fiber requires approximately 3783 liters of water, with 2866 liters coming from rainwater (Ro & Textile Exchange, 2021). Another popular fabric, silk, is estimated to consume

1000 liters of water per kilogram (Pilkington, 2022). Furthermore, Mekonnen and Hoekstra (2011) have found in their research that hemp has an average water footprint of 2719 liters per kilogram (Mekonnen & Hoekstra, 2011). Wool's water footprint is less reliable to quantify, based on if the sheep's water consumption is included. Additionally, polyester and other synthetic fabrics have not been included in this section because they do not possess a natural origin like the materials previously mentioned.

Textile Production and Processing

The manufacturing and productions stage occurs when fibers are made into fabrics, and fabrics are then converted to garments. Shown below is a map of key processes in the textile production change, including their inputs and outputs:

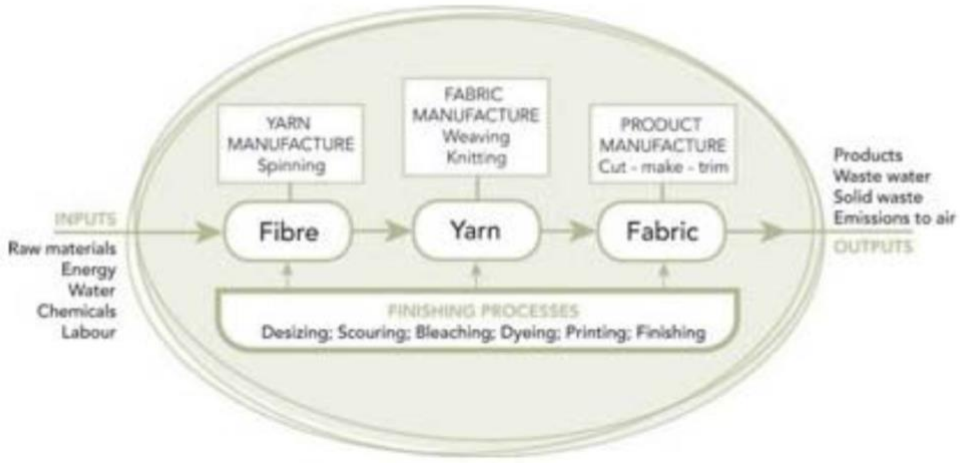

Figure 1. Roadmap inputs and outputs of processes in the textile production value chain (Fletcher, 2008).

The most water intensive portion of the production value chain as depicted in Figure 1 is the Finishing Processes. This segment includes desizing, scouring, bleaching, dyeing, printing, and finishing. When raw material is extracted, it must be converted into a yarn to prepare it for fabric construction. The amount of water needed to clean the fiber for yarn production is

dependent on the material, with natural fibers like wool and cotton requiring more water due to their more hydrophilic nature in comparison to synthetic fibers like polyester.

The next phase of production concerns fabric creation can involve finishing processes like desizing, dyeing, bleaching, printing, and other techniques that are implemented to achieve the desired look, feel and performance. When yarn is created, it is coated with a sizing agent, which is meant to help the yarn resist mechanical stress during the weaving process (Tesfaye et al., 2022). Before dyeing the yarn, that agent must be removed so the yarn does not resist dyes and other chemicals. This process is called desizing and traditionally, requires large volumes of water to continuously rinse the sizing agent out of the yarn (ABC Techno Labs, 2018). Chemicals may be involved in this process to if the sizing agent is not water soluble.

The next step consists of a deep cleaning to remove impurities from the fibers, referred to as scouring. The specific processes and inputs for scouring depend on the type of fiber being cleaned, but they all require significant volumes of hot water, detergents, and other chemicals to remove impurities. (Orzada & Moore, 2008). Another common cleaning process is bleaching, used to remove unwanted coloration and enhance the whiteness of a fabric, commonly executed using chlorine in aqueous media, meaning a water-based solution (Samanta et al., 2019).

Dyeing and printing can be the next phase of textile wet processing protocol, as the process can vary depending on the fabric and need of the manufacturer. At this stage, color and any desired patterns are applied to the fabric. These segments of the production chain are responsible for a large portion of water consumption in textile wet processing (Ding et al., 2020). The water consumption can vary widely depending on the type of fabric being processed as well as the equipment and compounds being used as a dye. A survey of factories in Bangladesh, the second leading global apparel exporter, found that an average of 164 L of water was used to dye

1 kg. of textile fabric (Uddin et al., 2023). It is worth noting that the average water consumption documented by Uddin et al. (2023) accounts for both natural and synthetic fibers, which vary in their water needs. Natural fibers require more water for dyeing than synthetic varieties due to their inherent hydrophilic properties (Cotton: 125 L/kg., Polyester: 30-50 L/kg.) (Osborn, 2021; Qian et al., 2021; Zhu et al., 2022).

The final stage of textile processing is finishing when the fabric is finalized to be ready for use. What constitutes as finishing is dependent upon the fabric along with its desired use and aesthetic. Some finishing processes are executed using chemicals and others require mechanical inputs. Examples of textile finishing include embossing, waterproofing, flame retardancy, and stain resistance (Kiron, 2012). Although water consumption using modern finishing methods is not as high as it was using past techniques, it still accounts for approximately 8% of water consumption in textile processing (Arputharaj et al., 2016).

Negative Externalities of Water Consumption

Resource Depletion and Water Scarcity

There are two typical sources of water for textile manufacturing: groundwater, municipal water supply, and surface water. Modern textile manufacturing has largely been outsourced to a limited number of hotspots, primarily in different parts of Asia. The World Wildlife Fund and Open Supply Hub have found that the densest clusters of textile manufacturing are in Eastern China, several regions of India, and Bangladesh. These regions are also categorized by their urban agglomeration and proximity to natural freshwater sources like river basins (World Wildlife Fund & Open Supply Hub, 2022). Moreover, the results of the report indicate that the highest density clusters were also regions with high water risk, characterized by their increased

drought rate and decreased precipitation (World Wildlife Fund & Open Supply Hub, 2022). This is especially evident in Dhaka, Bangladesh, where daily water use over five years is projected to increase from 2.4 billion L/day to 3.5 billion L/day. Excessive population growth in combination with decreased precipitation and longer drought conditions inflict great stress on local groundwater sources, as they are not able to adequately refill during monsoon season. It is worth noting that in the case of Bangladesh, there is persistence of the philosophy that water is free, so factories dig their own wells, increasing the prevalence of undocumented extraction and a lack of incentive to be efficient. The water demand for the textile industry alone in Dhaka is estimated at three times greater than the private demand (ARUP, 2019; WWF-Sweden & WWF-Germany, 2022). The result of increasing water demand in high water-risk regions in large part due to the textile industry is a significant threat to natural resources and can compound into further issues, especially when those limited resources become heavily contaminated by effluent.

Ecosystem Services and Biodiversity

The rapid reduction of freshwater bodies significantly impacts surrounding ecosystems, their biodiversity, and the services they provide. This is the case for textile manufacturing hubs, where the importance of freshwater bodies is historic and multi-faceted, as they provide a medium for transportation, food, water, and economic prosperity. (Jähnig et al., 2022; WWF-Sweden & WWF-Germany, 2022).

Connections between surface water bodies provide import corridors that serve as connectors between otherwise fragmented ecosystems. These connections can be critical for species population health, many of which are important food sources. Additionally, they offer supporting services in photosynthesis, nutrient cycling, carbon sequestration, oxygen provision,

and flood prevention (Apostolaki et al., 2019). Interference and disruption of these systems severs important connections that are critical to maintaining ecosystem balance and resilience in the face natural disturbances, a notable example of this being the Aral Sea, which was an important source of food through fish like carp and sturgeon, but completely dried up over a 40 year period due to over extraction to irrigate cotton crop (Alieva et al., 2023; Grabish, 1999). Disruption of these critical elements of an ecosystem along with contamination, as we will see, presents a health hazard to humans, other organisms, and negates the services they provide to communities.

Pollution

Environmental contamination and pollution are a significant problem throughout the textile value chain. We have previously discussed the negative outcomes associated with the industry's high-water usage, GHG emissions, and waste, all of which are connected to the broad issue of pollution. Discussing pollution in those sections was deliberately omitted to condense the sources and externalities associated with pollution in this section. Going forward, this section will examine the sources of soil, air, and water pollution in the fashion industry and their outcomes.

Water Pollution

Pesticide and Other Treatment in Raw Material Cultivation

Water contamination is perhaps the most persistent and expansive portion of the fashion industry's pollution related impacts. There are several sources of contamination the textile value chain, mostly in the raw material cultivation and manufacturing processes. In terms of financial

value, previous estimates suggest that 6% of global pesticide production is sprayed onto cotton crops, the most widely used natural fiber. Additionally, cotton crops account for 16% of insecticide use, 4% of herbicides, growth regulators, desiccants, and defoliants, and 1% of fungicides (Pesticide Action Network, 2018). Heavy unmonitored, and unregulated application of these chemicals present a significant source of environmental contamination. Runoff of these chemicals along with fertilizers contaminates rivers, lakes, aquifers, and wetlands, each of which play a critical role in ecosystem health and biodiversity. When these freshwater bodies have a sustained level of contamination, there are serious threats to organisms and ecosystem stability. Continuous exposure to pesticides and other agricultural chemicals contributes to a process called bio-concentration. This is a process in which pesticides build up in animal tissue in much higher quantities than they do in soil or water (Kumar et al., 2019). Fish are sensitive to bio-concentration and predators that eat these tainted fish over time, become increasingly contaminated with the same pesticides (Pritchard, 1993). In the case of the regions in which much of the textile raw material is grown, the predators that eat those fish are humans. Sustained contamination of this level creates a deleterious cycle in which pesticides are applied, they run off into water sources, contaminate organisms in local ecosystems, and then contaminate humans that rely on these freshwater ecosystems for food and economic prosperity. It is precisely these negative self-sustaining cycles that emphasize the need for a regenerative model that prioritizes reducing consumption and the impact of value chain inputs.

Pesticide and insecticide accumulation in the sediment of freshwater bodies like rivers can impact multiple levels of the local ecosystem. Sediment and soil are essential for aquatic ecosystems because of their ability to absorb nutrients. When they are contaminated over a sustained period, it can negatively affect the growth and generation of fish eggs, hormonal

balance, parental behaviors, disease resistance, body weight, and predator avoidance. Damaging the reproductive processes of aquatic organisms in addition to heavy environmental contamination can create scenarios of irreparable damage, minimizing the chance for a species' population to successfully persist over time (Kamel & Hoppin, 2004; Pawan Kumar et al., 2023).

Wastewater From Textile Manufacturing

The inputs and steps of textile manufacturing are responsible for highest proportion of water pollution in the fashion value chain. The textile industry uses over 15,000 chemicals during the manufacturing process, many of which are associated with spinning, weaving, and wet processing (Roos et al., 2019). The primary source of water pollution in the manufacturing process is the improper management of textile mill effluent. The discharge from textile mills can go untreated due to lack of environmental regulation and oversight in nations where a majority of textile products are produced like India and Bangladesh as well as a lack of resources for facilities to have the ability to treat wastewater (Samchetshabam et al., 2016). This effluent contains large volumes of synthetic dyes, finishing salts, nitrates, Sulphur, soaps, bleaches, acetic acid, and heavy metals such as lead, cadmium, mercury, arsenic, and a slew of other chemicals that make it highly noxious, especially when these substances from different steps from manufacturing processes are combined (Khan et al., 2023). Moreover, the heavy use of these chemicals can be justified through cost and efficiency, hindering the ability for manufacturers to use less or safer chemicals that would reduce the toxicity of effluent and make treatment a less daunting process (Hasanbeigi & Price, 2015).

Untreated effluent has several adverse effects on aquatic ecosystems and living organisms (Mudhoo et al., 2020). Dyes are one of most significant components and wastewater pollution.

When dyes are discharged into water bodies, they substantially affect the way sunlight interacts with and is absorbed into aquatic ecosystems. Dye absorption into the environment will increase the water's reflection of sunlight, not allowing it to penetrate the photic zone, not allowing photosynthetic processes to commence. If photosynthesis cannot take place, then aquatic flora species will be unable to grow and mature (Khan et al., 2023). This affects aquatic organisms as the local flora is a primary food source. Moreover, restricted sunlight absorption into water leads to eutrophication, which is an over-density of nutrients in water. This can cause algal blooms, which quickly deplete the amount of dissolved oxygen in the water, leading to the death of aquatic biota from a lack of oxygen (Esteve-Turrillas & de la Guardia, 2017). The previous mentioned impacts and many unmentioned also present significant human health hazards that have led to cancer, respiratory problems, heart disease, and genetic/chromosomal impacts (K. Singh et al., 2023). Like the cycle created by pesticide runoff, persistence of these chemicals in water over time lead to increased build up at multiple levels of an ecosystem, allowing the contaminants to remain in flora, fauna, and humans. The World Wildlife Fund presents a relevant example of this sustained, multi-level contamination in Kapur, India, a leather tannery hub with over 270 active tanneries, where over two thirds of the tannery wastewater is dumped back into local waterways without being treated. This had led to a significant decline in local carp populations, a main food source for the communities. Not only does this contamination turn the water a bright yellow color, it also is significantly damages liver and kidney cells and leads to long-term respiratory inflammation (Wilbur et al., 2012; WWF-Sweden & WWF-Germany, 2022).

Soil Pollution

Textile factories globally produce about 280,000 tons of industrial effluent each year, leading to substantial soil contamination (Annamalai et al., 2018). The three main culprits in soil contamination are azo dyes, heavy metals, and organic compounds. Azo dyes are a subcategory of synthetic dyes that have become widespread in multiple industries including pharmaceuticals, food, textiles, and cosmetics. They have become popular due to their low price, easy application, versatility, and effectiveness to be absorbed into many different types of material (HQTS, 2022). When dumped in textile effluent, they negatively affect soil biology. Azo dyes are organic compounds, meaning that when they are dumped back into an ecosystem, they begin to biodegrade. The byproduct of broken-down azo dyes are highly carcinogenic and mutagenic aromatic amines (Pinheiro et al., 2022). Without proper effluent treatment, these compounds are extremely difficult to break down, allowing them to persist in an environment and their negative effects to accumulate. One of these effects is changes in soil enzyme activity and bacterial diversity. The diversity of bacteria and microorganisms in soil are critical to nutrient balance, breakdown of contaminants, soil structure, and water recycling (Hoorman, 2016). Disruption of these systems as a result of contamination and increased toxicity due to azo dyes leads to the death of soil microorganisms that are critical for agricultural productivity (Alzain et al., 2023). Reduction in crop yield will then lead to increased application of fertilizer and pesticide, contributing to the externalities associated with agricultural chemical use. The outcome caused by the different categories of pollution are substantial; however, the domino effect created by their interaction are much more concerning as they fundamentally change and disrupt ecosystem processes. The change of core ecosystem functions threatens the health of the environment, humans, and other species, contributing to a negative feedback loop where the persistence of one negative outcome exacerbates the next and so on.

Waste

The quantity of textiles produced and consumed globally is consistently and quickly rising. Estimates towards 2050 indicate that textile consumption is expected to triple, catapulting from about 95 million metric tons in 2016 to over 285 million metric tons (Li et al., 2021; Statista, 2023). That increase in consumption will bring an accompanying increase in waste generated. The two largest importers of textiles globally, the United States and the European Union, have traditionally managed their textile waste by exporting it to developing countries, primarily in Africa and Asia, with Europe exporting around 90% of all used and textile waste (Kamal, 2023; Niinimäki et al., 2020). In the context of Asia, several countries in the continent are also where most textiles are produced, and then exported to Western nations. The production and disposal of textile waste in these developing countries presents significant environmental and health hazards. The waste generated in the textile industry can be split into two categories: (1) pre-consumer or production waste, and (2) post-consumer waste. This section will briefly discuss these two individually and then address their environmental impact together. Additionally, this section will cover solid waste, the sources and impacts of wastewater can be found in the pollution section.

Pre-Consumer Waste

Pre-consumer textile waste refers to the waste produced during the manufacturing of garments and other textiles. This can take the form of fiber, yarn, and fabric waste that is trimmed during the production process. Studies have revealed that the pre-consumer waste generated collectively and in different garments can vary. Cooklin (1997) estimates that 15% of the fabric used in production winds up as waste while other studies raise that number to 25-30%

(Cooklin, 1997; Reverse Resources, 2017). For individual garments like jeans and other pants, the fabric waste is approximately 10% and then falls to below 10% for blouses, jackets, and underwear (Abernathy et al., 1999).

A recent, growing source of pre-consumer waste is referred to as deadstock garments. These pieces are new and unworn, but they are unsold. This can be especially common for clothing that has been returned after being purchased online (Niinimäki et al., 2020). Although these garments are new and unworn, they are designated as waste and therefore, face a high likelihood that they are either dumped in a landfill or incinerated.

Post-Consumer Waste

Post-consumer waste represents the larger of the two categories of waste generated by the textile industry. This category of waste represents the garments that are discarded by consumers when they are done wearing or do not want to wear them anymore. The United States, the largest global importer of textiles, sends 11.3 million tons of textile waste to landfills yearly, equating to approximately 81.5 pounds of waste per citizen (EPA, 2017). Additionally, the rate with which clothes are thrown away is higher than ever before, reinforced by the fast fashion trend-oriented state of the industry. Presently, items are worn just seven to ten times before being discarded, representing a 36% decline in 15 years (UN Environment Program, 2021). The continuation of these trends presents waste as one of the most significant negative externalities of the fashion industry. Waste management techniques such as recycling are successful when executed properly and present a solution for a large portion of textile waste, as estimates indicate that 70% of textiles waste could be recycled into new garments; however, in reality, only 1% of textiles are

made into new garments and 12% are downcycled into other products (de Groote, 2021; McKinsey, 2022).

Environmental Impact

A majority of solid textile waste ends up in landfills, where it begins to decompose (Moorhouse, 2020). Since much of the clothing waste is too low quality for use, it is sent to a landfill or an open-air dump. Once there, it will begin to leach gases and chemicals during the decomposition process. The toxic chemicals that come about from dying and textile process leach into soil and groundwater, generating negative environmental and public health outcomes (Devoy & Lundberg, 2022; Kozlowski et al., 2012). Additionally, decomposing clothing will release methane, a gas that is more than twenty-five times as harmful as carbon dioxide (EPA, 2023). Moreover, much of the textile waste is comprised of synthetic, man-made fibers or was heavily treated during its production, elongating its decomposition timelines. This slow decomposition combined with the fact that most of the textile waste ends up in low-to-middle-income countries that lack robust waste management systems, allows for waste to accumulate, putting stress on landfill capacity. The waste can exist outside of the landfill, clogging local waterways, greenways, and contaminating local ecosystems, presenting additional environmental and health hazards.

Researchers have also noted the impacts that can come about from waste management as well, most notably burning. The combustion of synthetic fibers or natural fibers containing chemical dyes or coatings releases toxic chemicals, further polluting the air (Bick et al., 2018). Moreover, Evangelisti et. al. (2014) showcased that incineration is particularly impactful in acidification potential when compared to landfilling. The two gases mainly responsible for rain

acidification are sulfur dioxide (SO_2) and nitrous oxides (NO_x). When textiles are incinerated, a statistically significant higher amount of sulfur dioxide is released than when they are landfilled (Evangelisti et al., 2014). The industry's increased environmental footprint has brought with it a heightened awareness of its negative outcomes.

Sustainability Reporting and Disclosure

The rising threat of the global climate crisis and environmental degradation has made many countries, corporations, and consumers realize the importance of being aware of environmental impacts and sustainable practices. These broad, societal ethical concerns have influenced consumer behavior in the same direction (Joseph, 2019). Consumers have shown positive attitudes towards sustainable clothing communicated through environmental and social labels, coming about from an increased demand for transparency in the apparel and footwear industry (Byrd & Su, 2020) Shareholders and company investors can share similar demands to consumers, resulting in increased pressure for companies to understand their comprehensive environmental impact and implementing ways to reduce it (Buerke et al., 2017; de Oliveira et al., 2023). Moreover, some investors use the presence of a sustainability report as a risk assessment tool, having shown that they are more likely to invest in companies that have sustainability reports (Sumiyati & Suhaidar, 2020).

In the context of this thesis, I am electing to focus on the role sustainability disclosure plays in reducing the industry born negative environmental externalities. Researchers and industry professionals in the literature have expressed the need for disclosure practices foci to shift away from the financial, competitive, and reputational advantages that it provides, which

can all contribute to higher shareholder valuation and rather, prioritize the most material impacts for a given entity, which is the primary lens of this thesis (Marks et al., 2019).

Reporting and Disclosure in Fashion

The fashion industry has experienced similar pressure to understand its environmental impact at each segment of its value chain. That pressure has given rise to an explosion of reports across the apparel and footwear industry (de Oliveira et al., 2023). These reports can go by different titles including Sustainability Report, Impact Reports, Corporate Social Responsibility (CSR) Reports, etc. but they serve the same purpose, for a company to disclose its environmental impact and steps taken to achieve its CSR goals.

To unify efforts on this front, sustainability reporting frameworks have risen in popularity (KPMG, 2023). Some of the most popular reporting frameworks include the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB). In apparel and footwear specifically, the Sustainable Apparel Coalition (SAC) was formed to standardize sustainability assessments, with their theory of change being that standardized corporate reporting would increase shareholder and stakeholder comprehension of environmental issues, therefore directing capital to those companies that can manage their environmental costs (SAC, 2009, 2021).

Benefits of Disclosure

One of the main reported benefits of sustainability disclosure is its link to attracting capital and investment. Sustainability reporting has been seen by some as a risk management tool. In the face of a global climate crisis, investors seek to understand the environmental and

social risks associated with a potential investment. The creation of a sustainability report and implementing transparency practices provide a clearer picture of a company's risk profile, allowing investors to make risk-averse decisions away from companies that pose risk. Additionally, this transparency can create trust between a company and its investors through alignment of values and vision (Galimullina et al., 2019).

Another advantage of sustainability disclosure has been its positive link to reputation and stakeholder trust. Issues and outcomes surrounding environmental performance can often be abstract and a company creating a robust report makes abstract issues more tangible and concrete for their consumers. Whether a company's performance is good or bad, disclosing the necessary information to stakeholders contributes to a relationship that is built on a trust. The foundation of that trust is the belief that by disclosing the information, regardless of its positivity or negativity, inspires accountability within an organization and enables better decision-making (Global Reporting Initiative, 2020). Moreover, an understanding and communication of information within a sustainability report gives organizations and companies a clearer picture on how sustainability issues impact their business and how their business impacts sustainability issues. Understanding these interactions can drive more informed decision-making in brand differentiation, risk mitigation, operational efficiency, and opportunity creation (Deloitte, 2020).

The primary objective of sustainability disclosure for a given entity is to gain a clear understanding of risk to a business through environmental and social impact. Theoretically, because of measurement and disclosure over time, that entity would be driven to take concrete efforts to reduce its impact to communicate to its stakeholders and investors that value environmental, social, and governance principles. The literature presents a divide on whether sustainability disclosure translates to an entity reducing their environmental impact. Previous

evidence suggests mixed results on the interaction between environmental disclosure and environmental performance. Clarkson et. al. (2008) showcases a positive relationship between environmental performance and the level of discretionary sustainability reporting, sampling 191 firms in the five most polluting industries (Clarkson et al., 2008). However, of those five industries, textiles is not reported, which can be attributed to the textile industry not being recognized as the second-most polluting industry behind oil until 2019 (Bailey et al., 2022). Herbohn et. al. (2014) finds a strong relationship between sustainability disclosure and environmental performance in Australian firms, suggesting that by communicating key aspects of environmental performance like proportion of energy consumption that comes from renewable sources to the public and potential investors, that a firm will take action to steer those measurements in a favorable direction, therefore improving both its reputation among stakeholders and environmental performance (Herbohn et al., 2014).

Shortcomings and Critiques of Sustainability Reporting

In their 2022 Global Survey of Sustainability Reporting, KPMG reports that 96% of the world's largest companies now produce a sustainability report (KPMG, 2022). Although the existence of sustainability reports has become normalized and more established, shortcomings in disclosure philosophies have begun to reveal themselves. One of the primary critique of sustainability reports and general disclosure is that its proliferation has not led to a reduction in environmental impacts (K. Pucker, 2023b). The Business of Fashion, a leading publication in TAF industries, publishes an in-depth sustainability index to track the progress of the industry and its largest players. Findings from their report indicate that although most companies have set sustainability goals, their actions lag their ambitions. Lack of standardization and inconsistencies

in reporting make the link between disclosure and measuring impact more ambiguous (Kent, 2021).

An area of focus in sustainability reporting is its impact on financial performance and share price. Lack of standardization and market-led voluntary disclosure has contributed to a positive link between sustainability reporting and share price. Du et. al. showcases this positive relationship between the release of sustainability reports and short-term abnormal stock returns (Du et al., 2017). Additionally, there is a positive association between ESG performance and stock price. However, critiques of the market-led voluntary disclosure have expressed that the definition of high-performance can shift with a focus on financial performance, rather than material sustainability outcomes, and that the outcome necessary to stay within planetary boundaries will not occur with industry led self-regulation (Ng & Rezaee, 2020; K. Pucker, 2023b). This thesis concerns itself only with the material outcomes generated, not financial performance of firms that generate sustainability reports.

Although an emphasis is put on the financial returns associated with disclosure, there is a segment of the literature that attempts to correlate sustainability reporting with sustainability performance or outcomes. Papoutsi and Sodhi (2020) compiled 51 sustainability indicators from the literature and reporting guidelines; they then scored the indicators for 331 companies according to the content of their sustainability reports. Their analysis concluded that high quality sustainability reporting is an indicator of sustainability performance across several indicators including but not limited to GHG emissions, energy consumption, waste production, water consumption, and use of recycled materials (Papoutsi & Sodhi, 2020).

Analyses of sustainability reports has also revealed gaps in coverage pertaining to disclosure in areas that are the most impactful in terms of CO_2 emissions (Scope 3 emissions),

target setting, the integrity of those targets, and comprehensive plans to achieve them (K. Pucker, 2023b). In the apparel and footwear industry, Scope 3 emissions encompass the indirect emissions that occur along the value chain of company, including upstream and downstream activities. Comprehensive understanding of these emissions has proven particularly difficult in the apparel and footwear industry because of the many segments of the industry's global supply chain and the model under which much of the world's clothing is produced, resulting in a lack of primary data and transparency on the most significant segment of emissions (Majamäki, 2022; S. Singh, 2023).

What Needs to Change?

The literature expresses necessary changes in the industry that go beyond disclosure. In other industries such as food, disclosure in the form of explicit calorie labeling has not led to purchasing changes, therefore it may not be a driver for change in TAF industries (Cantor et al., 2015). Researchers and professionals in the field point out deficiencies that can fall into two separate categories of necessary change in apparel: increased regulation and a change in the linear consumption model that the industry currently operates on, where materials flow in one direction from extraction, production, use and disposal (Peleg Mizrachi & Tal, 2022; Pucker, 2023a; Suraci, 2021; Todeschini et al., 2017). Applying regulation and innovative business models to the fashion industry have been identified as important ways to help address previously identified weaknesses (Kent, 2021).

The lack of standardization and regulation in sustainability reporting contributes to the problems in the industry revolving around the availability and robustness of important datasets. Measuring and acting on the industry's environmental impact has been limited by the quality of

data. When it pertains to certain social and governance data issues, there are barriers to acquiring data, but experts have cited better reporting concerning the industry's environmental impact (Baskin, 2023). However, the lack of regulation and accountability can allow companies to conveniently omit data from their reports, including data that speaks to the industry's progression in acknowledging and acting on the issues that are the foundation of environmental impact. ELEVATE, an ESG advisory and analytics company and the Business of Fashion cite that even brands that rank highly in their transparency efforts do not report data that address the "elephants in the room". The withheld data includes production volumes, waste volumes, deforestation rates, and chemical use (Kent, 2023; Thornton, 2023). Omitting the most impactful data points speaks to the need for regulation in reporting and an accountability mechanism to ensure that such standards are met.

While companies purposefully neglect to report data that might be the most damning to their reputation and expose their high environmental impact, they also can engage in reporting practices that can distract readers and consumers by overwhelming them with data. By dumping high volumes of data pertaining to their policies and processes, companies can draw attention away from results and outcomes. By doing this, apparel and footwear companies do not necessarily lie about progression towards environmental goals, but they do not tell a full truth. This selective, deceitful form of reporting is a variety of greenwashing that takes the focus away from the purpose of sustainability initiatives, to reduce environmental impact. Whether it is purposeful or accidental is irrelevant without proper regulation and accountability. The priority is how it contributes to an issue that experts and academics have previously mentioned: reporting data without putting it into the context of progressing towards broader goals allows companies to

proclaim themselves on a path toward environmental sustainability (Baskin, 2023; Carter et al., 2022).

The lack of standardization contributes to narrative-focused reports that place a greater emphasis on the reputational and public relations aspects of sustainability. These areas benefiting from sustainability reporting is not inherently deleterious, but when they are prioritized over communicating the most truthful image of an entity's environmental impact, then the creation of a sustainability report can become a more deceitful action. Standardizing sustainability disclosure would shift the focus to information reported and action taken to impact the most material outcomes. Moreover, prioritizing that standardization with the goals of reducing consumption, advancing innovative business models, and reporting indicators that measure the advancement of the circular economy would aid in unifying the industry around a clear set of goals that are in line with a broader mission.

The Corporate Sustainability Reporting Directive does take steps to address the shortcomings of voluntary disclosure. The directive standardizes reporting practices for large industry players and is based in double materiality, a concept in reporting in which an entity reports self-generated environmental impact along with the environmental impact on the entity (Täger, 2021). The CSRD's shifted focus towards environmental impact and practice standardization aim to directly address some of current reporting's shortcomings. The directive was passed in early 2023 and first full reporting year will be 2025, so its ability to address these problems has yet to be seen; however, disclosure that is focused on impact reinforces the need to compare whether rigorous reporting practices or target policy is more effective from an outcome perspective (Keegan et al., 2023).

Regulation: Where is it? Where is it needed?

Industry professionals and researchers have expressed the need for regulation across the apparel and footwear sector's value chain including natural resource extraction, labor regulation, supply chain, production, disclosure, and disposal (Dobos & Éltető, 2022; Noto La Diega, 2019; Peleg Mizrachi & Tal, 2022; Pucker, 2023). Recent years have seen a rise in policies requiring disclosure and implementing rules to combat "greenwashing," the practice in which brands engage in green marketing that is purposely meant to deceive the public into thinking that the company's products and practices are environmentally friendly (Bey et al., 2023). A prevalent example of this is in the EU, where policymakers have banned the use of generic environmental claims, unproven claims around emissions, durability, repairability, and sustainable certification (Kurme, 2023). There has also been some policy intervention in the United States, where New York legislators have proposed a new law that mandates companies with $100M+ in revenue to track and disclose key metrics associated with a company's supply chain and labor rights; metrics including but not limited to carbon emissions, worker wages, chemical usage, water footprint, and collective bargaining (Lupo et al., 2023). Although negative externalities associated with labor are extensive and policy is taking steps to address them, this thesis focuses solely on environmental outcomes.

Targeted Policy

In the first quarter of 2022, the Spanish government presented a new law targeting waste and the environmental contamination it causes. The legislation, named the "Law on Waste and Contaminated Soil" imposes new restrictions on the avenues taken for textile disposal, chemicals used in production and packaging, and more (EVLOX, 2022). Firstly, the law formulates a

hierarchy of waste to set priorities for future policy. Prevention at the point of generation represents the highest priority, followed by preparation for reuse, recycling, other modes of recovery, and then disposal. The law also bans the destruction of surplus fabrics, requiring that excess fabric waste be sent through reuse channels, or when not possible, prepared for ease of reuse. Moreover, one of the most significant steps forward the legislation takes is direct responsibility for the waste generated on producers. By 2025, producers will be responsible for waste once it leaves the store (EVLOX, 2022; Law on Waste And Contaminated Soils, 2022). The steps taken by the legislation are beneficial, but they must be connected to a broader objective. In the case of EU disclosure policy and the Law of Waste and Contaminated Soil, it is the advancement and implementation of the circular economy (Law on Waste And Contaminated Soils, 2022).

In late November 2023, the European Commission released a techno-scientific assessment of management options and amendments to regulations. These amendments were made to align regulation more closely to the Strategy for Sustainable and Circular Textiles. The strategy lays out several broad actions that the Commission will undertake, multiple of them pertaining to waste. These actions include, discouraging the destruction of unsold or returned textiles, restricting the export of textile waste, and introducing mandatory Extended Producer Responsibility rules for textiles in all member states (European Commission, 2023b). The amended regulations include several performance indicators to measure progress towards waste goals including: amount of waste shipped for recycling in a given year, amount of waste shipped to pre-consent facilities in a given year, the number of non-OECD countries which are included on the list of countries authorized to import waste from the EU, the amount of waste shipped to

these countries, and the number of investigative or coordinated action carried out on illegal shipments of waste (Huygens et al., 2023).

These indicators, along with falling under the Strategy for Sustainable and Circular Textiles, are more broadly part of the EU Circular Economy Action Plan, which was formed using Life-Cycle Thinking (LCT), which is the ability to look at a product over the cycles of its lifetime. Moraga et. al. shows the categorization of different indicators according to an LCT approach, classifying them under different scopes. The indicators presented in the amended regulations fall under scopes that encompass indicators that are in service to the LCT approach (Moraga et al., 2019).

Perhaps the most all-encompassing approach to negative externalities resulting from the fashion industry is Eco-Design for Sustainable Products Regulation (ESPR). The initiative has been built for the design for products to consider and reduce their environmental impact at every stage of their lifecycle. It has been estimated that as much as 80% of a product's environmental impact can be attributed to the decisions made in the design phase (Ellen MacArthur Foundation, 2022; Shedroff, 2009). During this phase, designers make choices on the materials that make up a product, the shape, how many individual parts will be required, and more. It is these decisions that heavily dictate the price to manufacture the product, its durability, repairability, reliability with sustained use, how it can be packaged, and how it will be disposed of or managed at its end of life. The ESPR, currently on track to set effect in 2025, sets requirements to improve a given product's durability, reliability, reusability, repairability, and actions required for disassembly. Additionally, there will Digital Product Passports attached to each product, providing robust information on material usage, where it was created, and associated emissions. In the context of textile and apparel, it would provide verified information on the previously mentioned metrics

along with reuse/repair, proper disposal methods, chemical substances present, and more (Legardeur & Ospital, 2024). The third part of the regulation would mandate producers to introduced unprecedented transparency regarding the destruction of unsold goods. Importantly, this mandate would apply across the industry to cover the entire textile value chain, including e-commerce platforms, where there data of this nature is virtually non-existent (Vivian, 2023).

Through this three-pronged approach, the EU is setting the stage for strict regulation to promote circularly and more importantly, attack the core problems of overproduction and overconsumption in the fashion industry. By implementing requirements that elongate the life of clothing products and footwear, it is less necessary for consumers to constantly buy new garments that continuously serve the same purpose, but for less duration. An important of the policy's proposal was an accompanying impact assessment for the European Commission to estimate the broad implications the ESPR will create. As a result of the requirements that make products last longer, easier to repair, and more transparently provide consumers with sustainability information, the worst performing products will be gradually removed from the market and replaced by high-performing products. The impact assessment communicates that because of these market changes, consumption will be positively impacted. Moreover, because of the Digital Product Passports, it will be easier than ever for consumers to access and purchase truly sustainable and circular products, validating and actualizing the theories that consumer behaviors are influenced by the sustainability of the products they purchase. Lastly, the assessment frames the ESPR impact through cost to producers and how some of that increased cost to consumers. The authors are unable to theorize the costs for producers to comply with the regulation, but some of that cost will be passed onto consumer through product price increases.

As clothing demand, particularly for non-essential items is elastic, consumption will be impacted due to price increases (European Commission, 2022; Ross, 2023).

Multi-Criteria Decision Analysis and Sustainability

As the literature has shown, the impacts of the fashion industry are significant and wide in scope. When examining sustainability problems, several criteria must be considered: not only the several environmental criteria, but multiple stakeholder perspectives and priorities. The complexity of sustainability decisions along with changing priorities and perspectives requires an iterative approach that can adapt with these changing factors. That is why Multi-Criteria Decision Analyses (MCDA) and its variations have become a useful methodology when evaluating different aspects of sustainability, different approaches to sustainability problems, and comparing interventions on criteria that are not directly comparable or conflicting to one another (Estrada et al., 2024). Haase et. al. (2020), Lindfors (2021), Lombardi and Todella (2023), and Ziemba (2022) present applications of an MCDA and their support in decision-making processes through the observation and comparison of different solutions or alternatives (Haase et al., 2020; Lindfors, 2021; Lombardi & Todella, 2023; Ziemba, 2022). Lombardi and Todella (2023) apply an MCDA methodology that is relevant to this thesis, in which they examine the sustainability and circularity of different waste management options in the agriculture industry on different metrics in part, by gathering the perspective of relevant stakeholders across the agriculture value chain (Lombardi & Todella, 2023). A similar approach to compare the effectiveness of different interventions on circularity in the fashion industry is relevant given the current direction of policy but has yet to be actualized.

Chapter 3: Methods

Interviews

Candidate Identification

Following the literature review, I conducted interviews with a range of stakeholders around the industry. This group of stakeholders includes trade group representatives, NGO's, internal sustainability professionals, policymakers, and representatives of third-party assurance reporting standards. Conducting the literature review gave me a clear picture of the relevant organizations and stakeholder groups in the industry that would serve beneficial to the thesis to speak with. I identified candidates through organization/company websites and LinkedIn. Before conducting interviews, I received approval to conduct my research by the Tufts' SBER IRB which approved the interview guide as well as the recruitment materials.

Interview Process

The purpose of the interviews was to aid in identifying relevant pieces of policy for analysis as well as serve as guidance to identify metrics that the industry is using to define environmental impact and the impact of pieces of legislation. In total, I conducted four interviews out of 40 contacted candidates, two being internal sustainability professionals at Adidas, one representative of the Global Reporting Initiative (GRI), and one legislative aide from a California State Senator. Successful response from candidates was an anticipated barrier before beginning outreach efforts. The interviews took place over Zoom and ranged from 30-40 minutes depending on the depth of the candidates' answers. At the beginning of the interview, I read each candidate the SBER IRB Consent Script to obtain verbal consent and establish a rapport. I built two separate interview guides, one for sustainability professionals and one for

policy professionals. The interview guide for sustainability professionals included questions regarding the cost of disclosure, the cost to adhere to certain pieces of legislation, legislation that has impacted their work and company's reporting practices, as well as their opinion on the value of disclosure and its position in reducing environmental impact relative to more targeted policies. When speaking with policy professionals, my questions focused on impactful pieces of legislation that were had been proposed or currently in implementation, what metrics define their impact, and the estimated costs to adhere to the legislation. Additionally, I asked them where they find source material and data when forming a piece of policy and estimating its benefits along with their opinion on if policy needs to have a clearer focus on specific business practices to reduce the fashion industry's environmental impact. Lastly, the legislative aide candidate had particularly intimate knowledge of one piece of legislation that is a part of this thesis's analysis and because of this, I asked them one additional question pertaining to the cost and metrics for the policy they worked on.

One of the anticipated limitations of this thesis and its methodology was accessing data and first-hand insight on how disclosure and targeted policy impacts an individual company's environmental impact. Although I did not administer a formal statistical method to capture the interview data, speaking to a range of stakeholders at different points of the industry's value chain and policymaking provided me with ample insight and guidance on what companies produce high-quality reports and policies to review. Moreover, much of the concrete data that candidates could provide was protected by their employer. Even without concrete data, interview candidates provided context and perspective on disclosure, sustainability practices, and first-hand accounts of legislation's impact on their work at multinational apparel and footwear brands.

CSR Report Identification

The CSR/Sustainability reports were chosen for analysis using a multi-pronged approach. I consulted Ariel Kraten, a professor at Tufts University and a sustainability consultant, with expertise on the apparel and footwear industry. In consulting with her, she was able to provide first-hand analysis and perspective from an industry practitioner on best-in-class sustainability reports and disclosure practices. Additionally, I utilized two resources that rank global apparel and footwear brands based on their degree of transparency along with the behavior and operations of their business and progress towards demonstrable targets. The first resource is Fashion Revolution's *Fashion Transparency Index* (FTI). The FTI is an aggregation of the 250 largest and most influential apparel and footwear brands in the world, ranking and reporting them based on the disclosure of information regarding their environmental policies, practices, operations, and supply chains (Fashion Revolution, 2023). The second resource used to select reports for analysis was Re/make's Fashion Accountability Reports. This publication's methodology places sole focus on concrete actions that brands have taken to progress towards their previously set targets. Moreover, the report also heavily weights the operations of a brand's business model, considering not only progression towards targets, but how that progression is achieved. By deliberately shifting focus away from disclosure as much as possible, there is an emphasis put on the action or change in behavior that metric-tracking informs and leads to. When examining the overlap between these two reports as well as first-hand analysis, I gained a clearer picture of the brands that are the most transparent and forth coming about their business operations as well as the brands that are the most committed to their sustainability goals. The brands that rank highly in both reports can be characterized by their high-level of transparency,

quality of disclosure, and commitment towards changing behavior and backing up their talk with concrete changes to business practices and operations that help them progress towards targets.

At the conclusion this multi-pronged selection process, I reduced the vast pool of possibility to four best-in class CSR reports from Nike, Levi Strauss & Co., H&M, and Puma that sufficed to provide a cross-referenced sample. When reading through each report, I was solely focused aggregating all environmental metrics that each company tracked as a part of their sustainability efforts. Due to the lack of standardization in reporting format and content, gathering metrics varied slightly for each company, and in some cases, particularly H&M, their environmental data was spread out across 2 reports, the H&M Group Sustainability Report, and its Sustainability Disclosure Report, as well as some data on their corporate website. I implemented the same depth of research into each company to ensure that I found all possible data publicly available.

Policy Selection

As previously stated, the policy selection process was informed by the literature review and stakeholder interviews. The literature review served as the starting point to gain a grasp of the legislative landscape in the apparel and footwear industry, both in the United States and Europe. This aggregation included disclosure policies of different kinds as well as targeted business-practice policies that were aimed at specific segments of the apparel and footwear value chain. Moreover, because of gathering relevant policies, it was also necessary to understand past regulation efforts, their benefits and shortcomings, and what academics and industry professionals believe to be the highest priority areas for policymakers to target in the future. Along with segments of the industry that need to be targeted for regulation, it was clear that

stakeholders like trade groups and sustainability professionals believed that in addition to targeted policy, crafting legislation that shifts the industry away from its linear consumption model is necessary. The literature review also revealed the most material environmental categories of the industry's impact. Isolating these categories to serve as broader classification for future metric identification ensured that the environmental categories to be included were of high priority to industry players and stakeholders.

Multiple questions in the interview process for both sustainability and policy professionals centered around legislation in the apparel and footwear industry. One question asked candidates for what the most impactful recent policies from their perspective and across multiple candidates referred to the same pieces of legislation that were prevalent in their work. Those policies were much of the time the same that were prevalent in the literature review; this overlap represents policies that relevant to this thesis's analysis. Additionally, SB707 (California Responsible Textiles Recovery Act of 2023) was prevalent during the literature, and I was able to complete an interview with a legislative aide who has been instrumental in generating support of the bill. It is because of this and the fact that is one of the first extended-producer responsibility (EPR) bills that has been introduced in the United States that it is included in the analysis.

Two more pieces of legislation that were prevalent in the both the literature and interviews originate from the United States and European Union. Bill S7428A (New York Fashion Act) presents a new level standard of fashion accountability in the United States. Both groups of sustainability and policy professionals spoke of the New York Fashion Act as a piece of legislation that when implemented, will achieve some of the most substantial form of regulation and accountability in the fashion industry. A primary reason for this is because it specifically targets large industry operators (global revenue of $100 million+). As a result of this

condition, the bill addresses one of the most significant shortcomings in the fashion's sustainability efforts: isolated, non-standardized initiatives from companies that do not have a great enough market share to generate impact. Moreover, the bill imposes regulation and accountability mechanisms for failed compliance in areas that were covered in the literature review as particularly impactful segments of the industry's value chain including chemical use and supply chain emissions.

The second piece of legislation is the EU Corporate Sustainability Reporting Directive (CSRD hereafter). When reading about discussing disclosure requirements with industry stakeholders, the CSRD was the most comprehensive and took the largest leap forward to requiring measurement and disclosure of important topics. Although the bill is not specifically targeted at the apparel and footwear industry, the philosophy of the bill and its five environmental standards are aligned with the goals of this thesis. The CSRD's five environmental standards are the Climate Change (energy use, Scope 1, 2, and 3 emissions), Pollution, Water and Marine Resources, Biodiversity and Ecosystems, and Resource Use and Circular Economy. The bill's overarching philosophy is to focus on the most material impacts for a given company. The alignment of the bill's environmental standards in the context of its driving philosophy made it an ideal piece of legislation to include as part of this thesis's analysis. Additionally, it was used as a benchmark to measure the effectiveness of more targeted policy, similarly to how in the European Union, it is being used as a foundation of standardized, transparent, and high-quality public reporting to measure the environmental impact of large industry players.

In mid-2022, Spanish government published Law 7/2022, the Law on Waste and Contaminated Soil. I selected this piece of legislation because of its positioning to address the

foundational pieces of the apparel and footwear industry's environmental impact. Much like the California Responsible Textiles Recovery Act, Law 7/2022 establishes an extended producer responsibility program with important measures including deposit and return of the product for reuse and total responsibility for product waste management. However, it goes further by incorporating limits on plastic use in product as well as packaging along with measures on the design of a product. By widening its scope and broadening the definition of a "producer", it aims to address the industry's linear consumption model, reduce mass consumption and production, and establishes the principles of the circular economy.

The European Union's Eco-Design for Sustainable Products Regulation (ESPR) is an expansive legislative framework that addresses how some of society's most widely used products are designed and constructed. Sustainability professionals cited the ESPR as an important standardized framework to advance circularity in textiles and build a value chain that addresses its environmental impacts at each segment. In the context of apparel and footwear, the ESPR is a crucial step in implementing the Strategy for Sustainable and Circular Textiles. This is because it will standardize requirements that are essential to forming a circular system at the design phase including recyclability, repairability, and the presence of substances or compounds that inhibit circularity. Additionally, it will establish Digital Product Passports, which will include important information about a product's environmental sustainability that goes beyond convention environmental labeling. As a result of this, it addresses one of the most significant barriers that sustainability professionals have stated in building a circular system that puts responsibility on brands, genuinely engaging the consumer in a product's entire lifecycle by informing them on the environmental impact of a product and giving them avenues to facilitate the repair or regeneration of their product into something new.

Report Analysis

Given the lack of standardization of report formatting, structure, etc., each report required a slightly different approach, but all generated the same result. As previously addressed, utilizing first-hand expertise guidance, the FTI and re/Make's Accountability report allowed me to select the industry's best-in-class reports whose authors were the most forthcoming with company information and those whose data and claims are the most connected to action taken. The overlap of these three sources led me to select four of the best-in-class sustainability reports from NIKE, H&M, Levi Strauss & Co., and PUMA. It is worth noting that I intended to use an Adidas Sustainability report rather than PUMA because two interview candidates were sustainability professionals at Adidas even though Adidas as a company was ranked lower than PUMA in both the FTI and re/Make Accountability Report. However, I ended up choosing PUMA because of the specificity of their data, especially around total consumption, was more robust and Adidas had not produced a standalone sustainability report since 2016, rather they have opted to make sustainability a brief section of their annual report which focuses more broadly on the company's economic health and financial standing.

After aggregating the reports, each corporation's sustainability targets, progression to achievement, and environmental data/tracked metrics were isolated for analysis. This process varied slightly for each report as each report was uniquely different from the next. In all the reports however, I isolated the sections of the report dealing in environment, climate, water, energy, chemicals, materials, etc. Going through each of the reports, I noted each metric they were using to track performance across all aspects of their environmental impact. With all the reports, I was required to go outside of the report or to its Appendix to aggregate the metrics the company was using. When I was forced to navigate outside the report, it was to a section of the

company's website where they held data that was not published in the report. In the case of H&M, they published two long separate reports, one on Sustainability and the other on Sustainability disclosure. The latter was the where meaningful data was kept and the former was more narrative based and focused on every dimension of brand sustainability, not solely environmental. At the conclusion of going through the reports, I was left with an aggregation of all available metrics tracking environmental sustainability from best-in-class reports.

Metric Identification

As policy surrounding the advancement of the circular economy has received more attention and been proposed, so have frameworks and methods to track progression. They consist of metrics that are pre-existing, as well as new indicators that have never previously been measured. I identified metrics to be included in the MCDA table by utilizing The OECD Inventory of Circular Economy Indicators. The OECD created this inventory of 447 indicators that are classified into five categories: Environmental, Governance, Economics and Business, Infrastructure and Technology, and Jobs, with the primary purpose to be a dynamic tool that is used by its members and businesses to build circular economy strategies and measurement procedures (OECD, 2021). More than a third of the indicators presented in the inventory are in the environmental category, aiding to its relevance to this thesis's focus on environmental impact.

In choosing metrics to be in the MCDA table, I highlighted overlap between the OECD Indicator Inventory, existing sustainability reports, and the targeted policy to be included in the analysis. The result was eight metrics spread over four categories. The metrics used to track progress in each of the five pieces of legislation were aggregated to isolate the information that

was the highest priority for analysis. Each set of metrics were cross-referenced against the OECD's Circular Economy Indicator Inventory, highlighting segments of overlap. By doing this, circularity is prioritized when analyzing each policy's impact. The choice to limit the number of metrics included was to remain in the scope of this thesis, as there were more than the eight indicators present when examining the overlap.

When analyzing existing reports, I similarly cross referenced the aggregated metrics tracked in the reports and highlighted segments that overlapped with OECD Circular Economy Indicator Inventory.

Additionally, the categories environmental metrics (Figure 1) were chosen according to materiality assessments the four companies conducted as a part of their sustainability efforts, to ensure that aspects I chose as part of the MCDA were of high importance to the businesses' success and stakeholders. In each of four companies' materiality matrices, all categories of material indicators chose ranked in the quadrant that indicated high importance to stakeholders and high importance to business success (H&M Group, 2023b; Levi Strauss & Co., 2022; Nike, 2023; PUMA, 2022).

Material Indicator	
Greenhouse Gas Emissions	Gross GHG Emissions Reduction
	GHG Emissions from Production Reduction
Water	Water Consumption
	Water Regeneration
Waste	Material Waste Generation
	Reduction in Landilling & Incineration
Circular Products and Materials	Recycling Rate
	Reuse of Textiles

Figure 2. Final eight material indicators spread across the four most material categories of the fashion industry's environmental impact.

Building the Multi-Criteria Decision Analysis

Defining Costs of Policies and their Cost-Effectiveness

In the case of two EPR policies included, the Law on Waste and Contaminated Soil and the Responsible Textile Recovery Act, the total annual cost for producers was adapted from an EPR Cost-Benefit Analysis (CBA) conducted by Eumonia Research and Consulting for The Waste and Resources Action Programme (WRAP), a U.K. based climate action NGO. In conducting their analysis, the authors developed a proprietary economic model to forecast the costs and impacts of four different EPR policy options.

To assure that their report's findings could be applied to the policies examined in this thesis, I spoke with authors of the report who developed the model. As the model is proprietary, I was not able to access it directly, but was repeatedly assured that the assumptions of their model

could be applied to the policies I analyzed. I did not obtain consent from the authors of the report to disclose their identity so they will remain anonymous. Out of the four policy options presented in the report, the two I chose were "Target EPR" options, that being a majority of the costs associated with running and managing an EPR scheme are passed onto the producer (WRAP, 2022). This is the principle that the Law on Waste and Contaminated Soil and the Responsible Textile Recovery Act are aligned with as well. The difference between the two "Target EPR" options was the inclusion of eco-design principles to increase repairability, recyclability, and disassembly. The policy option with these increased supporting measures was applied to the Law on Waste and Contaminated Soil since it is of European origin and eco-design requirements are currently in proposal. Additionally, the inclusion of eco-design requirements along with the EPR requirements aligns the legislation with the EU Strategy for Sustainable and Circular Textiles, reinforcing the advancement of circular systems.

To estimate the EPR policies' cost effectiveness to impact the eight environmental metrics I chose, I extrapolated the impact generated by the two Target EPR options onto the two EPR policies included in my analysis. This included a simple calculation of dividing the total cost of the policy by the impact generated on each given metric after the first five years of the policy's implementation. The cost-effectiveness was not calculated for metrics that were not part of the CBA report.

Regarding the Corporate Sustainability Reporting Directive, the EU has done much more research on its implementation and impact. When proposing amendments to the Non-Financial Reporting Directive, which then becomes the CSRD, the European Commission conducted an impact assessment. Part of that assessment was the annual recurring cost to comply with the

directive. I used this annual recurring cost of €3.6 million ($3.94 million USD) as the annual cost to be included in the analysis.

Voluntary sustainability disclosure has existed for longer and as a result, there is more research and documentation of the required expenditure to create sustainability reports. Environmental Resources Management (ERM) is one of the world's largest purely sustainability-focused consulting firms and in early 2022, conducted a survey for Ceres and Persefoni to inform mandatory climate disclosure guidelines and methods to be developed by regulators and standard setting institutions. The scope of the survey was to reveal private sector expenditure on measuring and managing key climate change data and disclosure activities. Of the corporate respondents, their average expenditure was $533,000, and that is the value I used as the annual cost of current disclosure (ERM, 2022). The expenditure values from the ERM survey and the European Commission's CSRD Impact Assessment were the accepted data values I used when estimating the cost of disclosure.

The novelty of the policies I examined in this thesis presents data limitations, particularly on their estimated impact since many of them have yet to be implemented and are in the process of review to approximate their contribution to environmental impact. This limitation required extrapolation from existing impact assessments and literature to rate the impact of novel policy interventions. Extrapolation to estimate these impacts was required for the New York Fashion Act, the Corporate Sustainability Reporting Directive (CSRD), and the Eco-Design for Sustainable Products Regulation (ESPR). Although this is a limitation, the methodology used to compare outcomes requires less specificity in the data and is more reliant on the reliability of the comparison itself.

In the case of the CSRD and its accompanying Environmental Sustainability Reporting Standard (ESRS), the European Commission conducted an impact assessment in Spring of 2021 to approximate the costs, benefits, and outcomes across segments of industry, member states, the environment, consumers, and more. Moreover, the assessment presents the estimated environmental outcomes of mandated disclosure against pre-existing voluntary disclosure, which allowed me in combination with the literature on voluntary disclosure's impact on sustainability performance, to estimate the current GRI reports' impact on material indicators in the MCDA.

Impact Rating

As some of the policies that I examined do not have cost estimates, I was unable to evaluate their cost effectiveness on the eight material environmental indicators. Instead, I created a separate impact rating table that aggregated information from the previously mentioned methods to assess each policy's impact. To evaluate the impact of current GRI reports and the CSRD, the literature review and interviews were critical to gathering empirical and anecdotal evidence. The empirical evidence comprised of publications across existing literature that aggregated dozens to a couple hundred of sustainability reports and ran regression analysis on the level reporting and its relationship to sustainability performance. Moreover, conducting interviews with stakeholders across the apparel and footwear industry provided me with firsthand perspective on how sustainability reporting is influencing internal environmental initiatives and the progression of large companies' to reducing their environmental impact. It was these interviews along with existing impact assessments that gave me enough resources to estimate the impact of disclosure as the CSRD comes into effect.

Having quantitative data on the cost-effectiveness on the two EPR policies included aided in the analysis of their impact on material indicators. Also, I had the opportunity to interview a legislative aide from Senator Josh Newman's (CA) office. Senator Newman is the primary author of the Responsible Textile Recovery Act and interviewing a legislative aide from his office gave me direct insight into the goals of the bill, its inspiration, and what its intended results will be when it exists the proposal stage that informed my analysis of its impact, its shortcomings, and its position relative to the Law on Waste and Contaminated Soil.

As a part of the ESPR's proposal, the European Commission conducted an impact assessment to clearly communicate the broad impacts of the regulation, its benefits, challenges, and its position in the broader context of transitioning EU industries to a circular economy. A central factor in the formulation of the regulation is the environmental impact of the fashion industry. I heavily utilized this assessment and reports created by institutions with proprietary internal industry data and stakeholder feedback that aided my estimate of its environmental impact. Additionally, I was able to gain perspective and candid feedback from internal sustainability professionals on how the ESPR will impact their work and their company's sustainability performance.

Lastly, when estimating the influence of the New York Fashion Act, understanding the requirements of the bill, which are detailed further in the Results and Conclusions, was the most important aspect of my assessment. Moreover, the requirements of the bill in relation to the Science-Based Target Initiative (SBTi) was critical to estimating the breadth of its reach. Being that they are so close to one another, understanding the impact of the bill required me to examine the scope of the science-based targets companies have set. The concreteness of the science-based targets helped me confidently estimate the impact the bill will have since the verified targets set

by fashion companies were limited and covered few aspects of the industry's environmental impact.

Limitations

In the analysis of this thesis, there are data limitations pertaining to the cost and quantifying the estimated impacts of some of the policies examined. This was anticipated as this has been a past barrier encountered by researchers. Moreover, many of the policies I examined are in the proposal or stakeholder engagement phase, and therefore are subject to amendment upon their implementation. Because of this, it is possible that the impact of policies changes. Moreover, the limited amount indicators I included could portray a given policy as less impactful than it would be if it was examined across all metrics in the Circular Economy Monitoring Framework or the OECD's Circular Economy Indicator Inventory.

Chapter 4: Results

The findings of the analysis will first the cost effectiveness of EPR policies along with the cost of voluntary and mandated disclosure practices. Following that, I will discuss the culmination of the previously mentioned methods: the impact rating for each piece of legislation and the reasons behind the variation in their influence on each of the environmental indicators. Lastly, I will contextualize the results in their influence on circularity, the role they play in reducing consumption, and implications for future policy.

Cost Effectiveness

Responsible Textile Recovery Act and Law on Waste Contaminated Soil

When examining the cost effectiveness of the Responsible Textile Recovery Act and the Law on Waste and Contaminated Soil, it is relevant to discuss their results in tandem with one another as they are both different versions of the same kind of legislation. All things considered, Table 1 reveals that the Law on Waste and Contaminated Soil is predominately the most cost-effective measure in mitigating negative environmental externalities. Extrapolating the assumptions of the previously mentioned WRAP CBA Report estimated the total annual cost of each policy to be $42,690,827 and $35,541,068 respectively. By themselves, these expenditure values seem high, but relative to the fashion companies that these policies will apply to, it is a drop in the bucket. Out of the companies that I examined in this report, Levi Strauss & Co. generates the least amount of revenue and profits, with their 2023 financial reports indicating $6.179 billion in revenue and $3.515 billion in profit (Levi Strauss & Co., 2024). Although it is unclear how costs will change because of a company's primary product, it is apparent that those changes will not generate any significant impact on a brand's revenue or profit.

The Law on Waste and Contaminated Soil is the more cost-effective policy measures on six out of the eight material indicators that were included in the analysis. This increased cost-effectiveness can be primarily attributed to the more thorough supporting measures that are included in this version of EPR. These supporting measures include eco-design for durability, disassembly, and modularity, eco-labeling, and the collection and reporting previously undisclosed supply chain data (WRAP, 2022). It also should be noted that there are other supporting measures present included in the report that were not included in the model's assumptions, but if included, would most likely increase cost but their effect on cost-effectiveness cannot be assumed. When these supporting measures are included, they increase the cost, but those increased costs are specifically meant to decrease the material environmental impact across and product's entire value chain. This explains the increased cost-effectiveness in reducing gross and production GHG emissions, water consumption, and waste generation.

Recycling rate and the reduction in landfilling were the only indicators that the Law on Waste and Contaminated Soil was more cost-effective in. While unexpected, there is reason for this variability. The Responsible Textile Recovery Act does not include the same supporting measures as the more robust Law on Waste and Contaminated Soil, especially in the waste generation. One of the primary foci of the bill is to increase recycling and create more robust infrastructure for textile recycling to reduce landfilling and incineration, the most environmentally impact waste management techniques (Newman et al., 2023). On the other hand, the Law on Waste and Contaminated Soil is aimed more precisely at reducing consumption overall, therefore reducing waste generation altogether and putting less reliance on waste management infrastructure. While there still is positive impact on recycling rates and reduction in landfilling, the inclusion of supporting measures that aim to reduce waste generation

altogether contributes to the lessened cost-effectiveness of waste management technique. Moreover, the Responsible Textile Recovery Act aims to increase recycling, a form of mitigation to the waste generated by the fashion industry. It is clear in the literature and in internal sustainability reports that show recycling rate increases but emissions from waste rising, that mitigation techniques are not sufficient in offsetting accelerated production from increased consumption by fast-fashion companies like H&M (H&M Group, 2023a; Nike, 2023; K. Pucker, 2022).

An unexpected area of impact was each policy's contribution to lower consumption. The WRAP Report indicates that a portion of the cost to operate and monitor an EPR program will be passed onto consumers through product price increases. The assumptions of their model suggest that 50% of the cost increase per ton of textile will be passed onto consumers. In the case of the Responsible Textile Recovery Act, this will be approximately $537 per ton of textiles and the Law on Waste and Contaminated Soil, the passed on cost will total about $1,067 per ton of textile (WRAP, 2022). It is assumed that the elasticity of demand for clothing is such that consumers respond to changes in price by increasing or decreasing their purchasing habits (Fadiga et al., 2005; Ross, 2023). The increased costs of eco-design, eco-labeling, etc. in the Law of Waste and Contaminated Soil more aggressively increase clothing price, therefore having a greater impact on reducing consumption.

Material Indicator		Law on Waste & Contaminated Soil	Responsible Textile Recovery Act	CSRD	Current Disclosure
Greenhouse Gas Emissions	Gross GHG Emissions Reduction	$14.72/ ton of GHG reduction	$16.92/ ton of GHG reduction	-	-
	GHG Emissions from Production Reduction	$39.17/ ton of GHG reduced in production	$64.15/ ton of GHG reduced in production	-	-
Water	Water Consumption	$88,386/ million m³ of water reduction	$144,476/ million m³ of water reduction	-	-
	Water Regeneration	-	-	-	-
Waste	Material Waste Generation	$1205.51/ ton of reduced waste generation	$1973.63/ ton of waste generated reduction	-	-
	Reduction in Landilling & Incineration	$97.02/ ton of avoided landfill & incineration	$89.52/ ton of avoided landfill & incineration	-	-
Circular Products and Materials	Recycling Rate	$296.46/ ton of recycled textiles	$246.81/ ton of recycled textiles	-	-
	Reuse of Textiles	-	-	-	-
Consumption (Material Footprint)		$1083/ ton of reduced consumption	$1773.24/ ton of reduced consumption		
Annual Approximate Cost of Policy/Disclosure		$42,690,827	$35,541,068	$3,940,000	$533,000

Table 1. Total cost and cost effectiveness of legislation and current disclosure across eight material indicators. Blank cells indicate segments where the cost per unit of impact could not be calculated. NY Fashion Act has been omitted because data regarding its cost of compliance was unavailable. Note that these figures do not consider net savings over time or scale.

Impact Rating

Table 2 showcases the impact rating of the each of five policies across the eight material indicators that were chosen as part of the analysis as well as overall consumption. The leaf icons given to rate the impact of each policy are a result of aggregating information from the literature review, legislative text, and interviews. The rating system is out of five, five corresponding to the highest level of impact and minimizing negative environmental externalities. Given that the impacts of these policies are estimates and aggregated across multiple sources prior to their implementation, I did not have the confidence to rate the impact on any material indicators with the maximum of five impact units.

Material Indicator		Law on Waste & Contaminated Soil	Responsible Textile Recovery Act	Eco-Design for Sustainable Products	NY Fashion Act	CSRD/ESRS	Current Disclosure
Greenhouse Gas Emissions	Gross GHG Emissions Reduction						
	GHG Emissions from Production Reduction						
Water	Water Consumption						
	Water Regeneration						
Waste	Material Waste Generation						
	Reduction in Landilling & Incineration						
Circular Products and Materials	Recycling Rate						
	Reuse of Textiles						
Consumption (Material Footprint)							
Sum of Created Impact Units		19.5 x	9 x	30.5 x	4 x	10.5 x	4 x

Table 2. Impact rating of five pieces of legislation and current disclosure practices across eight material environmental indicators.

Law on Waste and Contaminated Soil

The impact rating from the Law on Waste and Contaminated Soil is estimated by aggregating information from the literature, legislative, text, the previously mentioned WRAP CBA Report, and its connection to other bills and frameworks implemented by the European Union. The legislative text of the bill details as that the entire life cycle of the product must be considered in its design phase such that the waste generated in manufacturing and subsequent use, waste generated is reduced and that it is reduced in a manner that makes recovery and disposal as easy as possible. These interventions at the design phase will improve a product's durability, reusability, repairability, modularity, and more (Law on Waste And Contaminated Soils, 2022; WRAP, 2022). Moreover, the specific requirements regarding these circular properties are not set as they will be set by the ESPR, but they will most likely be achieved in part my utilizing more sustainable materials such as recycled materials rather than virgin materials and minimize the use of plastic-based like polyester. These multi-pronged interventions that occur before the product even reaches the waste management phase will reduce its gross GHG emissions throughout its lifecycle. Additionally, the avoidance of virgin materials in favor of recycled inputs and raw materials that have been cultivated in a less environmentally impactful manner will reduce the GHG emissions from production.

In terms of water consumption, there no specific provisions of the bill that pertain to the volume of water used in production. However, there are segments of the bill that require the reduction in quantity of waste generated that can be classified as hazardous or polluting substances. As we have seen in the literature review, a significant segment of the industry's environmental impact comes from the volume of waster consumed the chemicals used in dyeing and finishing. When defining the parameters for waste to be classified as hazardous, the bill

explicitly mentions substances that are toxic when emitted into the water or mixed with an acid (Law on Waste And Contaminated Soils, 2022). This is crucial as many of the chemicals used in textile processing are toxic bases and are mixed with appropriate acids in waste treatment to balance their pH (Luongo, 2015). Moreover, the bill's principles state that waste management must be carried out without endangering the health of the environment listing water, air, soil fauna, and flora as the five most central environmental segments (Law on Waste And Contaminated Soils, 2022). These provisions combined with the eco-design principles will generate a moderate impact on water consumption (Refer to Table 2). The bill at no point makes mention at water regeneration or water recycling to be put back into the environment or municipal water supply so there is no impact generated on water regeneration.

As is in the name of the bill, the material indicator that will be impacted the most is waste generation and reduction in landfilling and incineration (Refer to Table 2). In the bill, the producer of the waste is responsible for the treatment of the waste as well as the collection and delivery of the waste to proper treatment locations. Additionally, the producer hold responsibility to design products using eco-design principles as we have mentioned along with labels and products that are suitable for multiple uses. To ensure that products are developed for multiple uses to elongate their life, producers are required to make products, when they become waste, to be easily disassembled and separated by material used so they are efficiently prepared for reuse and recycling in a manner that is appropriate for environmentally friendly recovery and disposal. The producers are also held responsible for the establishment of deposit systems to collect items for reuse or treatment, the acceptance of reusable and waste products, the subsequent management of the waste and the financial expenditure associated with these interventions. They must also make information regarding these systems available to the public along with

information for reuse, repair, and disposal in an environmentally friendly manner. When the producer collects the appropriate materials, they must use that waste in the manufacturing of new products, of which the minimum quantity is yet to be determined but when it is set, the information will be made publicly available. A critical portion of the waste management segment of the bill is the expanded governance of exported waste, which is a central problem in fashion's waste problem, as is detailed in the literature review (Law on Waste And Contaminated Soils, 2022). The expansive and detailed provisions in the bill propagating reuse, recycling, repair, and limitations on harmful waste management practices make its impact on waste generation and reduction in landfilling the most significant.

Responsible Textile Recovery Act

The Responsible Textile Recovery Act (SB 707) impacts many of the same indicators as the Law on Waste and Contaminated Soil, but to a lesser degree (Refer to Table 2). One the key distinctions is the sole focus of SB707 on postconsumer textiles. The only products that are covered by the legislation are postconsumer apparel and postconsumer textiles that are no longer desired by the consumer. However, there are provisions placing responsibility on the producer to establish repair services (Newman et al., 2023). Therefore, there is only half an impact unit placed on the GHG emissions reduced in production. In terms of gross GHG productions, impact is given to reducing the emissions by avoiding landfilling waste and reusing postconsumer textiles into new garments. This impact is also put into the reuse of textiles, both have half an impact unit each. The more significant difference in impact units between SB 707 and the Law on Waste and Contaminated Soil is the absence of eco-design principles and the restrictions on the export of waste. Although there are no restrictions put on waste exports, Senator Newman's

legislative aide communicated to me that a likely metric included in the bill is the volume of weight sent to developing countries, which will be a beneficial step towards greater transparency and possibly an intervention that will result in external pressure onto producers (Senator Newman's Legislative Aide, personal communication, January 31, 2024).

There are no provisions in the bill related to water consumption; however, the model from the WRAP Report indicates that the elongated lifecycle of garments even without eco-design intervention reduces water consumption keeping materials in the value chain for longer and lessening the need to consumer water to dye and finish virgin materials (WRAP, 2022). There are no mentions of water regeneration in SB 707, so it generates no impact units on this indicator (Refer to Table 2).

The impact SB 707 made on material waste generation and reduction in landfilling is positive but limited in scope (Refer to Table 2). As is stated in the bill and communicated to me during the interview, producers will be held to a minimum number of collection sites, a minimum of 10 per county or one site per 25,000 people. Additionally, producers must track the total weight of covered products deemed reusable as well as the total weight of covered products collected (Newman et al., 2023). However, as stated earlier there are no limits put on exporting waste to developing countries and producers do not play as significant of a role in the waste management once the collected textiles have reached a recycling facility. Additionally, it is unclear if the collection sites will be staffed spaces or how frequently the producers will gather the materials consumers drop off. This is a point of concern as counties in California drastically vary in population, and it is possible that counties with high populations would quickly overload the site. Moreover, the legislative aide communicated to me in our interview that the numbers for minimum collection sites was arbitrarily selected from another bill, unclear if it will be adjusted

for California's specific needs (Senator Newman's Legislative Aide, personal communication, January 31, 2024).

Regarding recycling rate, producers will be held to a recycling efficiency rate that has yet to be determined. Additionally, producers must disclose the total weight of covered products that were collected and recycled (Newman et al., 2023). I gave it two impact units on recycling rate primarily because of the minimum rate to be achieved by producers, putting the responsibility on them to ensure that recycling infrastructure is robust enough to comply with the regulations. In contrast, I only gave it half an impact unit on the reuse of textiles because although there is a minimum recycling efficiency, it is unclear how producers will be held regulated to inject those recycled materials or collected items back into the textile value chain.

New York Fashion Act

The impact generated by the New York Fashion Act on the material indicators is limited in scope. The legislation, rather than set novel standards for the industry, mandates adherence to preexisting standards that have become widely adopted my fashion companies as well as due diligence measures. As with the other policies examined in this thesis, the initial application of the mandates will apply only to the largest players in the industry, with the New York Fashion Act only applying to companies operating in New York with $100M+ in yearly revenue. The bill only produces two impact units each in reducing gross GHG emissions and GHG emissions associated with production (Refer to Table 2). This can be attributed to the bill's relevant environmental regulations extending as far mandating the fulfillment of verified science-based targets that fashion companies have already set. Verified science-based targets refer to environmental goals that have been approved by the Science-Based Targe Initiative (SBTi), an

NGO that provides companies with defined pathways to reduce their emissions in line with the 1.5°C goal set by the Paris Climate Agreement (Science-Based Target Initiative, 2023; The New York Fashion Sustainability and Social Accountability Act, 2023). Along with SBTi's primary focus on GHG emissions, all the company report I examined in this thesis only had SBTi verified targets pertaining to their Scope 1, 2, and 3 emissions. Mandating the fulfillment of these goals will create impact as many of the goals are set to be completed by 2025 or 2030. Additionally, the emissions reduction for Scope 1 and 2 range from 50-90% with Scope 3 emissions goals ranging from 30-40% (H&M Group, 2023b; Levi Strauss & Co., 2024; Nike, 2023; PUMA, 2022). Each of the four companies are at different state of goal completion with Nike most recently reporting emissions increases year over year for the past three years (Nike, 2023). Importantly, the impact of the legislation will be most effective its mandate, as the SBTi targets are verified, but not legally binding, which can result in companies shifting goals or abandoning them altogether if they cannot be completed.

Corporate Sustainability Reporting Directive

The upcoming CSRD generated moderate impact across all the material indicators, except water regeneration (Refer to Table 2). An important segment of the CSRD's impact is its basis in double materiality and reporting standardization. Double materiality extends the key concepts of reporting and accounting to include not only the environment's impact on a company, but the company's environmental impact (Täger, 2021). By building the philosophy of the legislation around double materiality, it creates a significant increase in stakeholder engagement and a company's ability to gain a comprehensive picture of their impact and extend their understanding of material matters. There is agreement in the literature and internal

sustainability professionals that the impacts of the CSRD will be beneficial, but shortcomings persist. The CSRD will tackle long-standing shortcomings of sustainability reporting: standardization, information overload, and greenwashing. In each of the four sustainability report I analyzed, each of them had their own narrational focus, painting a beneficial portrayal of the company. Additionally, there were some cases of information overload. As was mentioned in the literature review, companies can publish too much data without connection to a broader goal for the reader to draw any significant conclusions. This is particularly egregious for H&M, which published two separate reports with seemingly different foci both titled sustainability reports (H&M Group, 2023b, 2023a). By minimizing information overload and creating a standardized reporting system, the most important information is prioritized, the areas that are the most material and the most impactful and moreover, increases accountability and clarity on the best performing industry players (Delgado-Ceballos et al., 2023; Förster, 2023).

From an industry professional perspective, both internal sustainability managers from Adidas I interviewed strongly agreed with the philosophy of "you can only manage what you measure." Additionally, one of the participants when speaking about the value of disclosure, communicated that the increased regulation surround transparency will help put additional pressure on companies by tracking and disclosing the highest-priority metrics or areas that companies have purposely omitted in the past due to poor performance (Adidas AG Sustainability Manager, personal communication, January 30, 2024; Adidas AG Sustainability Manager, personal communication, February 1, 2024.)

Current Disclosure

The four existing sustainability reports were the least impactful on the material indicators in the analysis, generating 4 impact units in total (Refer to Table 2). The lack of uniformity across the reports, critiques from sustainability professionals in interviews, and the shortcoming presented in the literature contributed to the limited impact given to the reports. I interviewed a staff member from the Global Reporting Initiative (GRI), and they stated that the GRI covers a large majority of the Environmental Sustainability Reporting Standard (ESRS) requirements that are utilized in the CSRD. However, one Adidas sustainability manager presented conflicting information when speaking on the effectiveness of reporting and the drastic changes that are coming about because of the CSRD (Adidas AG Sustainability Manager, personal communication, February 1, 2024; Global Reporting Initiative Representative, personal communication, January 30, 2024).

Although they explicitly stated that their statements were their opinions and did not represent the view of Adidas, they were adamant regarding the ineffectiveness of sustainability reporting in reducing environmental impact of fashion companies, particularly multinational firms comparable to the size of Adidas. They presented many of the same critiques that can be found in the literature review. Lack of standardization and accountability leads to rampant greenwashing, omission of metrics and data that negatively affect the company's image, and a tool that aids in reducing environmental footprint, but is not nearly an adequate solution to achieve the necessary change. Moreover, they stated that Adidas is guilty of some these critiques and that sustainability as a selling point is losing its value, as their exposure to proprietary consumer reports expressed that young consumers in Gen Z and Gen Alpha expect fashion companies to be producing in an environmentally friendly manner (Adidas AG Sustainability

Manager, personal communication, February 1, 2024). Although there is conflicting information amongst stakeholders, professionals on the front lines of sustainability at industry leading firms are unsatisfied with reporting's current role and perceived contribution.

Eco-Design for Sustainable Products Regulation

The EDSPR generated the most impact on material indicators relative to the other polices, totaling 30.5 impact units (Refer to Table 2). Content from the literature review, interviews, and the regulation's content in the context of EU's lager strategic frameworks make it the most targeted policy and the greatest contributor to reducing environmental impact throughout the entire textile value chain. The provisions set in regulation and the metrics used to measure a product's compliance stretch across the entire value chain and the entire lifecycle. Some of the key indicators of performance include ones that are commonplace like GHG emission from manufacturing, energy usage and efficiency, water usage and efficiency, as well as pollution to air, water, and soil. However, the regulation sets forth more in-depth metrics like contribution of post-consumer recycled materials, share of material demand satisfied by secondary raw materials, and use of material from recycling activities. Importantly, it also outlines unprecedented principles and measurements that have beneficial implications for the future of the fashion industry. As we have covered, the EDSPR presents parameter pertaining to a product's intrinsic durability, maintenance, repair, upgrade options, and requirements for disassembly (Directorate-General for Environment, 2022). Moreover, it places responsibility on the producers to track and disclose the avoidance of activities that are detrimental to the reuse and recycling of products along with requirement on minimum guaranteed lifetime, modularity, tools needed for disassembly, and material efficiency, or how much its value can extracted from a

product before it is reused or recycled. By implementing these measures at multiple stages of the value chain, most importantly design, the lifetime of a given product is significantly extended, universally reducing its environmental impact.

Interview candidates shared similar sentiments, that the targeted nature of policy like the EDSPR is where the industry is headed if its stakeholders are truly committed to reducing its impact. One of the Adidas sustainability managers I spoke with stated targeted policy like the EDSPR is most beneficial because it forces companies to change their core business practices. Additionally, this type of regulation orients its goals towards impact and that goal setting combined with its precision, gives companies a clear goal to invest resources towards (Adidas AG Sustainability Manager, personal communication, February 1, 2024). As a result of its precision and orientation towards the entire textile value chain and lifecycle, the EDSPR begins addressing the core problems of overproduction and overconsumption in the textile industry, therefore creating the most impact.

Chapter 5: Discussion and Conclusions

The findings of this thesis largely align with those that present the most constructive criticism of the fashion industry's historic approach to sustainability. Similarly to the sentiments presented by Pucker (2023) and Kent (2021), this thesis concludes that the current approach to sustainability reporting and most policy measures are not aggressive enough in regulation or broad enough in scope to address the foundational aspects of the fashion industry's environmental impact (Kent, 2021; K. Pucker, 2023b; K. P. Pucker, 2021). However, this thesis presents more novel findings regarding the relative effectiveness of disclosure and policy interventions. As legislation further standardizes sustainability practices in the industry, it is imperative to analyze the effectiveness of these interventions through a common lens in reducing the most environmentally impactful segments of the fashion value chain and the advancement of circular systems.

The common lens used in this thesis proves to be a useful approach, but the current data limitations and novelty of the legislation proves to impede estimating the true scope of their effectiveness. Over time, the effectiveness of these policies will become clearer, emphasizing the need for analysis like the one in this thesis to inform future policy directions that create beneficial outcomes. Frameworks and strategies influencing current policy directions realize that the focus must be put on reducing environmental impact and generating positive outcomes. The clear next step is examining the effectiveness through a common lens, that lens being the advancement of a regenerative system where inputs remain in the value chain for as long as possible before their lifecycle concludes.

In all but one of the policies I examined in this thesis, none directly address overproduction and overconsumption in the fashion industry. The two EPR policies indirectly influence consumption by passing price increases onto consumers, but that is still an avoidance

of the problem that the world's largest industry players produce too much clothing at too low of quality, creating a system of planned obsolescence, and pushing towards consumers towards the need to more frequently buy the same garments.

Only the ESPR directly faces the need to produce less clothing by elongating the life and existing garments and creating a regenerative system for new clothing. Industry professionals make it clear in the literature and in personal communication, that the current interventions, particularly in the United States, are not enough to achieve the reductions in environmental impact necessary. Through the Circular Economy Action Plan and Strategy for Sustainable and Circular Textiles, I think the EU sets the blueprint for regulation in the fashion industry. Voluntary or self-imposed regulation of any kind will not work, it has not nearly ever sufficed in any industry, and it is foolish to believe that it will work for companies who see their sole responsibility as to grow and deliver ever-increasing value back to their shareholders.

The fashion industry, a realm of creativity and self-expression, has become marred by the insidious cycle of overproduction and overconsumption. Present policies and disclosure mechanisms, while touted as solutions, we have seen that they fall woefully short in addressing the core problems plaguing the industry. In an era where fast fashion reigns supreme, the relentless pursuit of profit comes at the expense of potentially irreparable environmental degradation

Fashion giants have been allowed to operate with impunity, churning out garments at an alarming rate. The lack of transparency in supply chains conceals the true cost of fashion, shielding consumers from the harsh realities of environmental devastation. Token gestures towards sustainability, such as recycling initiatives and greenwashing campaigns, do little to mitigate the industry's voracious appetite for cheap labor and finite resources.

Moreover, the emphasis on conspicuous consumption perpetuates a culture of disposability, where garments are treated as disposable commodities rather than cherished investments. This disposable mindset fosters a throwaway culture, where clothes are discarded after minimal use, exacerbating the already staggering waste crisis. As landfills overflow with discarded textiles and synthetic fibers leach into waterways, the fashion industry stands guilty of perpetuating ecological ruin on a global scale.

However, amidst the bleak landscape of overconsumption and environmental degradation, the Eco-Design for Sustainable Products Regulation presents hope for the industry. This groundbreaking legislation heralds a paradigm shift in the way consumers perceive and interact with fashion, paving the way for a truly regenerative circular economy. At its core, the ESPR embodies the principles of sustainability, mandating that products be designed with their entire lifecycle in mind. By prioritizing durability, reparability, and recyclability, the regulation seeks to minimize waste and maximize resource efficiency. Furthermore, stringent requirements for transparency and traceability empower consumers to make informed choices, holding brands accountable for their environmental and social impact.

By promoting eco-design principles, the regulation catalyzes a shift towards a more mindful and holistic approach to fashion consumption. The policies that I have examined in this thesis showcase the need for targeted policy that is built on the backbone of regulation and accountability. The fashion industry through policies like the ESPR has the chance to serve as a leader in addressing overproduction and overconsumption in modern linear economies; it must take the hardest steps forward towards a truly regenerative and circular system.

This thesis also presents a novel method of analysis to compare policy interventions. Given the novelty of the policies examined in this thesis, creating a common lens of comparison

solely focused on environmental outcomes showcased clear differences between the legislation despite their novelty and lack of data on implementation. As these policies are implemented over the next half-decade and more robust data is released to show their effectiveness or lack thereof, comparative analyses of this nature would be useful when deciding on how to form future regulations in the fashion industry. This would prove particularly useful in the United States, which lacks the comprehensive frameworks that the EU has created on the circular economy and industry-specific goals. To actualize a circular system that can reduce consumption in the apparel and footwear industry, policy and regulation efforts must be built around a set of aspirational values and goals.

Appendix

Interview Recruitment Email

SUBJECT: Nate Newman | DATE | Research

Dear [*NAME],*

I hope this email finds you well. My name is Nate Newman and I am a graduate student engaged in research, which centers around comparing the impact of disclosure requirements and targeted business practice policy on key material indicators and the advancement of the circular economy in the apparel and footwear industry. An important part of the methodology is interviewing a range of stakeholders to gain their perspective on topics that are relevant to the project. Your position at *[COMPANY NAME]* will do just that, which is why I ask for approximately 30 minutes of your time for an informal interview. I understand that the holiday season is an extremely busy time, so I do not plan to start interviews until January 29, 2024, but wanted to reach out as early as possible. Please let me know at your earliest convenience if you are willing to speak with me and your availability. Thank you and happy holidays!

Sincerely,
Nate

Interview Guide: Internal Stakeholders

1. In your opinion, what is the value of sustainability disclosure, tracking of key metrics, and the creation of a CSR report?
2. In your experience, has reporting over a period led to a reduction in environmental impact or key environmental metrics?
3. Has the cost to create CSR Reports increased year over year?
4. What does “COMPANY NAME” spend per year creating their sustainability report?
5. What is the estimated cost to adhere to the GRI framework?
6. Have policies that specifically target business practices impacted your work as a brand’s internal sustainability professional?
7. Given that some pieces of legislation require more robust metric tracking on areas that have proven to be difficult in the past, do you believe the cost to create reports will increase?
8. Do you think that increased cost will translate to a reduction in environmental impact?
9. Do you believe policies targeting specific business practices would be more effective in reducing environmental impact?

Interview Guide: Policy Professionals

1. What do you feel are the most impactful recent policies that have been proposed or are currently being implemented?
2. What is the impact generated by these policies and what metrics define their impact?
3. Do you know the estimated costs to adhere to these policies?
4. As someone with first-hand analysis, where do you find direction, source materials, or data that will help you to estimate the costs and benefits of a policy?
5. As a policy professional, do you think policy focus should be shifted to decouple the link between disclosure and share price and have a narrower focus on reducing environmental impact?
6. Do you know of any industry-related bodies that are opposed to and lobbying against disclosure requirements or other legislation in the textile, apparel, and footwear industries?

FOR REPRESENTATIVE OF SENATOR NEWMAN'S OFFICE:

1. Do you know what the added cost is to adhere to the Responsible Textile Recovery Act?

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