

SUSTAINABILITY ISSUES AND APPROACHES IN FASHION SUPPLY CHAINS

by

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ABSTRACT

As the fashion industry grows in size and volume in terms of global production, sustainability issues arise in managing fashion supply chains. This thesis project explores the nature of today's modern fashion supply chain and the environmental and social issues associated with its processes. As consumer demand related to sustainable practices rises, fashion businesses are continuing to innovate in many ways to adopt more environmentally and socially conscious supply chains. Various literature analyzing certain strategies to increase sustainability in fashion supply chains are examined and discussed. Several interviews with fashion supply chain professionals are also conducted in order to gain more insight into the movement of the fashion industry towards sustainability. Through three main strategies, this paper builds a model for how fashion supply chains can continue to be fast, while also integrating sustainable business practices.

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Introduction:

In a modern global market, the fashion industry has undergone immense change in the past 20 years. As a typically low capital, labor-intensive industry, production and manufacturing of apparel quickly moved to developing countries, which are typically marked by fewer regulations and cheap labor. As a result, along with higher demand for short-lived trends, a model called “fast fashion” emerged. Often associated with short lead times, trendy designs, and low prices, well-known fast fashion leaders include H&M, Zara, Uniqlo, and Topshop. In the evolving fashion industry, fast fashion focuses on utilizing and maintaining supply chain efficiency with global procurement and manufacturing of goods. As a result of these drivers to be more efficient, many issues arose in the fashion industry due to the negative social and environmental implications associated with the fast fashion model. Sustainability in the fashion industry is defined as apparel that is manufactured and produced using sustainable practices that take both environmental and social impacts into account. The complex issue of sustainability within the fast fashion model suggests a noticeable tradeoff between such a quick, cheap framework of manufacturing and socially/environmentally responsible standards and processes. Changing consumer perceptions, in terms of corporate social responsibility, encourage major fashion companies to think about sustainability within their supply chains. However, many fashion supply chain managers struggle with supply chains meeting demand in terms of price, speed and trendy styles, while also upholding to environmentally and socially sustainable practices and operations. Although innovative sustainable practices appear more in the fashion industry today, there still remains a gap in research and innovation that attempts to incorporate sustainable practices within a fast

fashion supply chain model. The specific research question this thesis seeks to answer is ‘how can fashion supply chains become more sustainable, while remaining fast?’ As technology within fashion and supply chain management advances, many potential ways arise for fashion companies to build and maintain a sustainable supply chain both socially and environmentally, while keeping costs down and lead times short. This thesis project will analyze research related to fast fashion, the current and future status of the fashion industry, and the potential of sustainability within these fast fashion frameworks. Through an extensive analysis of literature regarding sustainability in the fashion industry, as well as interviews with fashion supply chain professionals, this paper will highlight issues related to sustainability in the fashion industry, while also providing recommendations for future sustainable fast fashion supply chain models. With the current model of a fast fashion supply chain, there is not much room to expand sustainably, as most apparel production is still dependent on manual labor and chemically hazardous processes. This paper argues that the future sustainable fashion supply chain model will implement the development and use of sustainable fibers, production innovations like 3D printing, and the movements back to localized production. These sustainable strategies will allow for positive advancements in Planet, People, and Profit.

Literature Review:

The Luxury Market vs Mass-Market

Throughout the 1900s, the industry has been known to have two distinctive markets: a luxury market with high-end quality items and a mass market with low-end, but more affordable items. Anguelov (2016) researched these markets and noted that items in these markets were clearly distinguishable by price, brand, and quality. Today,

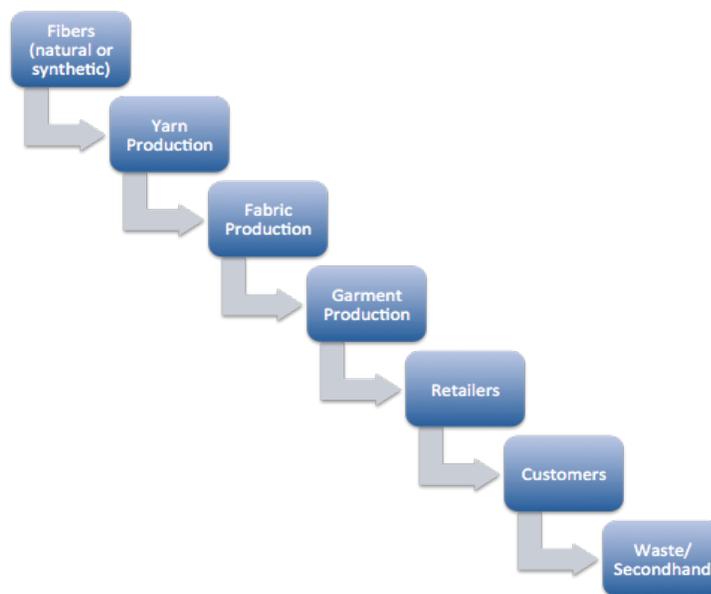
that distinction is less detectable, as items sold in the mass market look more like items sold in the luxury market in terms of trend and design. Nikolay Anguelov (2016) argues that the shrinking life span of trends plays an important role in the decreasing distance between luxury items and mass-market items. In a post-modern society connected by the Internet, trends come and go quickly, taking less time to get to the consumers of the mass-market. This is also evident by the increase in the number of seasons the fashion world follows. In the past, the fashion industry developed around eight traditional seasons (Birnbaum, 2005). Martin Christopher (2004) argues that today fast fashion companies like Zara may launch more than twenty seasons per year. As a result of the Internet and technology creating more space for seasons and trends, demand for short lead times grows exponentially as consumers prioritize trends over quality. In this fast-paced environment, readily disposable clothes have displaced hand-me-downs or more durable garments as the mainstay of dressing (Rosenthal, 2007).

The Fast Fashion Model

As fashion companies in the 1980s began to increase the variety of styles, colors and sizes of their collections, costs related to large quantities of inventory and uncertainty increased (Doeringer and Crean 2006). To alleviate this, the concept of 'lean retailing' was introduced through just-in-time systems that utilized inventory management and demand planning (Desai, et al. 2012). In other words, fashion companies began to focus more on trends and speed, introducing the first frameworks of 'fast fashion.' Joy (2012) defined the term fast fashion as "low cost clothing collections that mimic current luxury fashion trends." Annamma Joy explains fast fashion to be a fast response system that encourages disposability. Some characteristics of fast fashion strategies, according to

Skov (2002), include rapid prototyping, small batches of large variety, efficient logistics, and “floor ready” merchandise. The introduction of offshoring plays an important role in the fast fashion model, as it allowed companies to manufacture their goods in developing nations with cheaper labor and fewer regulations. Desai et al. (2012) explains successful fast fashion companies utilize offshoring, while developing vertical integration within the supply chain to allow for flexibility and transparency with suppliers in terms of orders and demand. A basic typical fashion supply chain is displayed below to present a better understanding of the steps in the fashion value chain.

Figure 1: Typical Fashion Value Chain



Sustainability Issues in Fashion

As fast fashion continues to take over the fashion industry, many people have studied the environmental and social detrimental effects of producing with such short lead times and low cost materials and processes. According to True Cost (2015), a film about the costs of the current apparel industry, “the world consumes about 80 billion new

pieces of clothing every year. This is more than 400% of the amount consumed just two decades ago.” An article by James Conca for Forbes, stated that the apparel industry continues to be the second largest industrial polluter, which makes up 10% of global carbon emissions (2015). These statistics illustrate the large-scale production of apparel, with the rise of fast fashion, contributing to the increased industry created pollution and waste.

Environmental Costs

While manufacturing apparel cause many detrimental effects on the environment, many argue that it starts with the most expensive component of garment production: weaving fibers into fabric. David Birnbaum (2008) studied the 21st century garment industry and found that the process of weaving cotton into fabric is the biggest and most expensive value-adding step in the production of apparel. This is greatly due to the chemical pollutants expelled in the liquid effluents that are products of the runoff processes during textile manufacturing (Khan et al., 2009). Nikolay Anguelov (2016) explains in his analysis of fast fashion that this chemical pollution enhances the already large global carbon footprint of the direct burning of fossil fuels that makes this fabric production possible. Furthermore, Anguelov describes that the most serious environmental products of apparel manufacturing are related to the “wet-finishing” processes of fabric manufacturing. These processes consist of bleaching, mercerizing, and dyeing, which “produce liquid effluent with varying waste composition” (Anguelov, 2016). While producing polluting byproducts due to chemicals used, these processes also demand large quantities of water. In fact, in a study in 2010, Greer found that on average, for every ton of textile produced, 200 tons of water are used. This used water then

typically becomes a part of a runoff process that eventually seeps into the groundwater systems of surrounding regions. Because this used water contains many toxic chemicals as a result of the manufacturing processes, Ibrahim (2008) concluded in his study that the affected groundwater becomes contaminated resulting in extremely harmful effects to entire ecosystems.

According to figures from the Technical Textile Markets, demand for man-made fibers has nearly doubled in the last 15 years. Luz Claudio (2007) specifically researched the harmful effects of man-made, synthetic fibers such as polyester. He found that “the manufacture of polyester and other synthetic fabrics is an energy-intensive process requiring large amounts of crude oil and releasing emissions including volatile organic compounds, particulate matter, and acid gases such as hydrogen chloride, all of which can cause or aggravate respiratory disease.” He goes on to explain that these volatile monomers, solvents, and other by-products of polyester production are discharged in the wastewater of these production plants, which negatively affect the surrounding groundwater, as discussed earlier. Claudio also mentions in his analysis that issues of environmental health and safety also apply to natural fibers. In fact, cotton accounts for “a quarter of all the pesticides used in the United States, according to the USDA” (2007). Pesticides are a large contributor to the increasing amount of pollution in today’s environment.

One of the main environmental issues with the model of fast fashion is the issue of waste at the end of the product lifecycle. With such a fast model of producing apparel, more consumers are demanding more clothes faster, resulting in more waste per person. According to the EPA, the average American throws away more than 70 pounds of textile

product each year. The textile products that do not end up in American landfills, most likely go back to the developing countries they were manufactured in. In fact, the United States dispatches over 500,000 tons of used clothes annually to more than 100 different countries (Rivoli, 2009). Therefore, the final disposal of used clothes disproportionately occurs in the developing world, where there are few, if any, regulatory standards in waste management (Ahmed and Ali, 2004; Henry et al., 2006; Thomas-Hope, 1998).

Social Costs

A major researched aspect in the fast fashion model is the outsourcing of apparel manufacturing to developing nations. While costs are low in terms of labor and production, the social costs of mass production in these developing nations is staggering. Specifically, social costs related to the damage of local economies and industries, as well as the working conditions and treatment of labor within apparel manufacturing factories are heavily associated with fast fashion.

As mentioned in Rivoli's study (2009), the United States dispatches over 500,000 tons of used clothes annually to more than 100 different countries. In Hansen's research (1999), he explains by the mid-1990s, used clothes comprised the sixth largest export of the United States to the entire region of sub-Saharan Africa. While the idea of sending used clothes to developing countries instead of immediately to a landfill may seem more environmentally conscious, many studies show that it is, in fact, extremely detrimental to the local economies and apparel sectors in these developing nations. When studying this issue, Haggblade (1990) found that some developing nation governments have actually banned used-clothing imports in order to offer protection to their domestic textile industries.

Along with the damage to local industries, comes the social cost of poor working conditions for laborers in developing nations where fast fashion is manufactured. While there are many scholarly articles on the poor treatment of workers in the apparel industry, the sheer number of fires, accidents, and deaths that have occurred in apparel manufacturing factories speak for itself. The most well-known accident being the Rana Plaza factory fire and collapse in Bangladesh in 2012, which killed more than 1,100 people. Stewart (2016) further studies this working environment in his research. Stewart states that the Bangladesh government sets the minimum wage for entry-level garment workers at \$38 a month, which are some of the lowest labor costs anywhere. Kathy Chu (2013) reported that the secretary general of Cambodia's state-run Garment Manufacturer's Association spelled out the basic problem as "one of retailers demanding higher operating standards for factories but not wanting to pay more." Chu (2013) also describes the concern that many manufacturers regularly take on larger orders than they can possibly manage. A Wall Street Journal article (Passariello, C., Lahiri, T., & McLain, S., 2013), points out that it isn't just fast fashion retailers that are producing in these factories. It seems that some designer brands like Giorgio Armani, Ralph Lauren, and Hugo Boss also have some of their garments made in Bangladesh factories, which illustrates an issue with the entire fashion industry.

Sustainability Strategies

Eco-fashion

The International Standards Organization (ISO) defines eco-fashions as "identifying the general environmental performance of a product within a product group based on its whole life-cycle in order to contribute to improvements in key environmental

measures and to support sustainable consumption patterns.” The ISO is developing standards for a labeling system to identify garments that meet criteria as environmentally friendly. Several companies are adopting this idea of eco-fashion. As Beard (2008) explains, consumers have become more interested in has been eco-fashion, or ethical fashion, because “eco-fashion increases the utility level of fashion purchases.” There are noticeable trends showing that customers feel better about the purchase if they believe it influences more than just their own wellbeing. To that effect, “making eco-fashion purchases has sociopolitical aspects (Gam, 2011).” Many studies support this movement of consumer behavior towards ethical purchasing habits, suggesting a shift in consumer priorities towards sustainable fashion products (Niinimäki, 2010). Since the market seems to be transforming towards sustainability, fashion companies need to recognize the value in managing supply chains sustainably to keep/gain market share.

Technology

While technology has largely contributed to the damaging environmental byproducts and effects of apparel manufacturing in terms of synthetic fibers and processes, advancements in technology create room for more sustainable practices. The role of technology in fashion typically focuses on speeding up production and decreasing costs. What if technology was instead viewed as a tool for making apparel manufacturing more environmentally sustainable? This idea of technology making fashion more sustainable has become known as “Eco-tech fashion,” as mentioned earlier. Sarah Scaturro (2008) describes eco-tech fashion as an “innovative technological framework containing thoughtful manufacturing processes and consumption patterns.” Studies that have focused on technology within the textile industry vs. the apparel industry have

found some interesting differences. “Unlike the highly automated textile industry, the apparel industry remains predominantly low-tech and highly labor-intensive” (Datta and Christoffersen 2005). In Desai’s (2012) research, he found that the technology used in the apparel industry has barely changed since the 19th century other than computer-aided design (CAD) and automated knives and lasers in cutting. Datta and Christofferson (2005) argue that the apparel industry’s reliance on traditional technology is preventing the industry from utilizing technological efficiency and innovation. This research illustrates a need for technological innovation specifically in the apparel industry.

Sustainable Fibers

Sustainability within fiber production remains a complex aspect of the fashion industry. There continues to be a noticeable tradeoff between yield and environmental sustainability. Even as organic cotton becomes more and more desirable to the consumer, today’s way of growing organic cotton simply cannot meet the world’s demand for cotton better than conventional cotton. Scaturro (2008) realizes this fact when he says, “the reality is that, while organic farming works in local markets on a small scale, its current niche status simply cannot sustain the global demand for cotton.” Cantrell (2006) studied Cotton, Inc. as an organization that claims “that if natural fiber production (aided by technology) cannot meet the textile needs of a growing population, then synthetic and manufactured fibers will.” However, Scaturro (2008) found that the use of genetically modified fibers, more specifically genetically modified cotton, has been argued to increase fiber yield without creating the damaging byproducts of synthetic fibers. More specifically, proponents of GM cotton claim that while GM cotton and conventional cotton produce a similar yield, GM cotton trumps conventional cotton due to its lower

insecticide requirements. There are many concerns with genetically modified crops with regards to possible destabilization of ecosystems and threats to biodiversity (Scaturro 2008). Scaturro also explains “the technology as it stands now is limited to a few proprietary biotech varieties, which means that large companies like Monsanto reap the economic benefits of GM crop production, while smaller farmers do not.” Instead of large companies utilizing GM technology to further environmental sustainability, “the private sector views biotechnology mainly as a source of income and a way to compete with other companies, and only secondly as a tool to solve problems” (International Cotton Advisory Committee (ICAC) 2005). Scaturro (2008) argues that the goal of creating effective technologies with minimal negative environmental impacts can be achieved through the development of synergistic relationships between stakeholders (specifically designers, scientists, engineers, and manufacturers). In other words, new technologies that further environmental sustainability can be achieved through collaboration and innovation. Even Cantrell (2006) in his research found that Cotton, Inc. agrees that most ecological practices inevitably mean fewer inputs, thus translating into a more efficient business model. Veak (2000) supports this idea by encouraging incremental advances in sustainability. More specifically, he says, sustainable fashion advocates should aim “to steer the system from within through subtle hybridizations, not mass revolution” (2000).

Fiber innovations in the fashion industry associated with sustainability are already being seen in fashion supply chains today. Many companies are utilizing several sustainable fibers such as fibers created from recycled plastic water bottles, regenerated cellulose fiber, and strong crops like hemp and linen. Companies like Patagonia, Fossil,

and Haggard partner with a textile company called Repreve, which has recycled more than 10 billion plastic water bottles for its materials. Levi's started producing their famous denim utilizing materials from recycled plastic water bottles as well (Webb, 2013). Regenerated cellulose is making a rise in usage in the fashion industry due to its biodegradable qualities (Lee, 2014). It is made through the conversion of natural cellulose into a soluble that can then be formed into a fiber. A New York based company, Amur, partners with suppliers to use Cupro, a cellulosic fiber made from reclaimed cotton waste. Many retailers have also utilized hemp and linen, as they are strong crops that produce high yield and require very little water, fertilizer, and/or pesticide use. Through supplier partnerships and collaboration, fashion retailers can innovate sustainable practices in the raw materials step of the supply chain.

3D Printing

A new technology known as 3D Printing, or additive manufacturing, emerges slowly in the fashion industry. A type of rapid prototyping, 3D Printing uses a digital design to fuse materials together layer by layer through Selective Laser Sintering (SLS) until an object is formed (Sun, Zhao 2017). This process has the potential to disrupt major parts of the fashion supply chain by cutting out many of the labor intensive and chemically harmful steps in traditional apparel manufacturing. Therefore, integrating 3D printing into the fashion industry may offer more ways for sustainable manufacturing (Lipson and Kurman). 3D Printing also has the potential to increase a customer driven focus in manufacturing through more levels of flexible customization and a quick-response, possibly localized production (Nelson 2014). Bingzi Wang explains, in her analysis of the effect of 3D printing on design, the 3D technology will change the way

the fashion industry thinks about “fit,” as it allows a fit that is completely custom to any body (2014). She also discusses the complex detail and style that can be attained through 3D printing, opening many new trends and markets. The opportunity to be more flexible and customizable, along with the promising effects in sustainability suggest that investment in technology like 3D printing in the fashion industry may have high return in profit, people, and environment.

In terms of sustainability, Sun and Zhao argue, “the core sustainable advantage and nature of this production method are embedded in its approach to minimal wastes and the reduced by-products (2017). 3D printers build objects based on a design from the CAD (computer based designer) file, enabling higher efficiency and a reduced carbon footprint compared to traditional manufacturing. Furthermore, the materials needed for the 3D printers can be obtained through recycled polyethylene-based materials like milk jugs (Lipson and Kurman 2013). In addition, the selective laser sintering process uses powder-based material and 50% of that material can ultimately be recycled with new powder for printing jobs in the future (Sun and Zhao 2017). As reported by Lipson and Kurman, some 3D printers also already have the capability to run on solar energy to power both the printer and the printer’s heat source/laser reducing carbon footprint even more.

While many accessory and footwear markets are adopting 3D Printing, it will take heavy investment before it is seen throughout the whole fashion industry. One issue with implementing 3D printing into mainstream apparel production is the lack of comfort, stretch, and durability associated with the printed materials. The fused materials are not soft, or in the same quality of comfort or stretch as that of traditional woven fabrics.

However, there is still more innovation to be done in terms of the materials and fusing that can be used in 3DP. Many studies on 3D printing are attempting to solve the material problem by innovating certain materials or suggesting a more integrative approach that utilizes both traditional textiles and 3D printing. Several professors from Carnegie Mellon analyze how the two manufacturing techniques can be integrated to create the highest function and value. They specifically explain the value in enhancing 3D printed rigged objects with embedded flexibility through textiles, as well as enhancing soft materials/textiles with functional properties through 3DP (Rivera, et. al 2017). Through several different techniques and integrations, they demonstrate an ability to “control, manipulate and mix fabric with 3D printing,” creating room for design innovations that utilize both traditional textiles, as well as additive manufacturing.

Experimentation with 3D Printing in the fashion industry is already taking place, specifically in the footwear and jewelry industry, as well as in high fashion on the catwalk. Nike has explored 3D Printing in its footwear for over 3 years, excelling in product attributes like performance and innovation (2014). Balenciaga, a high fashion luxury brand, is releasing a line of 3D printed jackets for its Autumn/Winter 2018 collection (Lai 2018). Ministry Supply, an apparel brand that specializes in performance dresswear, utilizes 3D printing to design and produce clothing tailored specifically to a person’s custom body. “Garments are engineered with shape and articulation based on a person’s joints and the strain they put on their clothes throughout the day.” The end product is a customized, durable garment built to last. This practice also cuts down on waste and overproduction (Sustainable Brands 2017).

Movement Back to Reshoring

There are many studies and articles researching the idea of changing the fashion business model from the modern use of global offshoring back to local reshoring. Firstly, consumer demand may align more with localized production in the future. A study by Consumer Reports found almost 8/10 Americans say they prefer to buy American-made (2015). Desai et al. (2012) considered this idea in their research, by explaining that labor prices continue to go up in developing nations, meaning offshoring in the future may not be worth it. He also argues that fashion could be even faster if production was locally sourced because it is a closer-to-market operating framework with better forecasting. A localized production would also result in shorter lead times and greater control over inventory (Sun, Zhao 2017). Joy (2012) researched this topic and found that “when faced with tight delivery demands, fast fashion companies will even use higher-cost local labor and expedited shipping methods.” With the advancement of automation like 3DP, Sun and Zhao predict there will be a shift to localizing manufacturing (2017). In fact, 50% of manufacturing executives considered reshoring to the US again in a survey taken in 2015 (Morris 2015). Industry Week reported that the apparel industry ranks number 6 in industries that have reshored (Moser, Montalbano 2018).

Re-localizing apparel production may impact supply chains in many ways in terms of sustainability. The movement of fashion manufacturing back to the US has the potential “to generate sustainability by reducing costs and environmental impact associated with transportation” (Todeschini et al. 2017). In terms of social responsibility, localized production means working in supply chains that are more regulated in terms of human rights and environmental regulations (Desai, et al. 2012). Furthermore, reshoring

will lead to less waste because the closer-to-market model production forecasts will be closer in meeting demand accurately (Desai, et al. 2012). This research shows a possibility for a new fashion model that may prevent many of the social and environmental issues that often come with offshoring.

Many fashion retailers have already made the movement towards localized production. New Balance, the famous footwear brand, assembles more than 4 million pairs of footwear per year in the US. Producing in the US allows the brand to achieve a high level of quality, as well as customizable product (Schlesinger 2015). “Brooks Brothers reshored 70% of suits from offshore locations due to rising wages, quality issues and lead time” (Moser 2018). Under Armour invested in a product design and development hub in Baltimore and debuted a small-scale line of garments all produced in this hub. According to Under Armour, while such garments typically take 18-20 months to be produced, the line produced in Baltimore took only 3 months (Halzack 2017).

Methods:

In order to obtain a better grasp on the current status of the fashion industry and sustainability’s role in it, three supply chain professionals from large fashion retailers were interviewed. The interviewees will remain anonymous to maintain confidentiality, meaning no identifying data was collected for or reported in this paper. Questions related to apparel manufacturing, fast fashion supply chains, sustainability, and offshoring vs. reshoring were developed for industry interviews, with the desired outcome of qualitative data and primary research surrounding fashion supply chains. More specifically, questions revolved around collecting data related to my research question, ‘how can the

modern fashion supply chain become more sustainable?’ Interviewees were identified and approached through my personal network, as well as connections made through TCU professors and my faculty advisor. All three interviews were conducted over the phone and lasted about 30-45 minutes long.

Results:

Around 10 – 12 of the same questions were asked to all interviewees, however, conversation was free flowing, allowing all kinds of related and unrelated data to the topic of discussion. I will discuss the results of the interviews by consolidating data into four specific areas within fashion supply chains that were addressed in each interview and provided insight into the current status of the modern fashion supply chain, as well as how supply chains can be more sustainable.

Current Environment in Fashion Industry

All three supply chain professionals mentioned the increasing pressure to be fast in modern fashion supply chains. One interviewee from Company C described this pressure as a result of connecting technology like social media, which brings quicker awareness of trends to consumers globally. However, this increased awareness has shortened trend life cycles, as consumers are demanding trends faster. Company B interviewee mentioned the rise of huge fast fashion retailers like Zara, Forever 21, and H&M changing up the typical supply chain by cutting product lead times in half compared to traditional fashion supply chains. He/she said in the current fashion environment, it is mandatory to be fast to respond quickly to the latest trend in color, fit, and style. In addition, globalization and outsourcing production makes inventory

management a high priority in order to keep costs to a minimum. In other words, it is key to create product quickly and to sell product quickly. Company A interviewee explained the internet and online shopping as an indicator as to why fashion supply chains have increased in speed. “E-commerce has really changed the game in terms of speed. Companies like Amazon now set the standard of customer satisfaction to 2-day delivery. That kind of movement puts pressure on everyone to be faster.”

Challenges with Sustainability in Fashion Supply Chains

When asked about challenges associated with sustainability in fashion supply chain, all three interviewees explained challenges related to environmental impact and factory compliance. The individual from Company A explained the area of the supply chain that was the most environmentally harmful was the process of making fabric in the fabric mills. The interviewee said around 80% of all pollution associated with apparel takes place in the fabric mills, which are tier 3 and tier 4 suppliers in the supply chain. Therefore, it is challenging to have visibility into the most environmentally damaging process of making apparel. Company B interviewee said similar things about the traditional process of apparel production. More specifically, he/she explained the lack of environmentally forward innovation in technology in terms of manufacturing apparel being a challenge in pursuing more environmentally sustainable supply chains. In addition he/she said environmentally sustainable practices are very expensive to set up and maintain. Finding suppliers who comply with sustainable standards is one thing, but maintaining and monitoring these levels of service is a major challenge.

In terms of social impact of fashion supply chains, all interviewees discussed the challenges of factory compliance and safety when most apparel production takes place

overseas. All three companies interviewed produce the majority of their merchandise overseas where labor is cheaper, but regulations and safety standards are less structured or strict. The professional from Company B associated many of the challenges with factory compliance for certain safety standards and fair wages with communication issues due to suppliers being overseas. There is not always an agent in the factories making sure everything is going the way it is supposed to, and As a result, measures of compliance can often be miscommunicated or overlooked if not prioritized in correspondence with suppliers. Since social sustainability is cultural, factory management need to fully understand the requirements of the retailer's brand to ensure consistent safe sustainable practices. Furthermore, the interviewee explained that most companies in the industry perform factory audits to achieve compliance. However, many of these factory audits are often regularly scheduled, meaning suppliers are expecting the audits, so many of the results in the reports do not actually give a realistic picture of day to day factory conditions. Company A discussed similar miscommunications and compliance issues specifically with the risk of fire safety and worker safety. The interviewee referenced the Rana Plaza Collapse in 2013 putting pressure on companies to ensure worker safety and factory compliance with safety standards. He/she said this is challenging due to the inconsistencies of regulations and standards across companies and governments, as well as the inconsistencies in audit reports. Company C interviewee talked about the lack of governmental structure and worker rights contributing to challenges with factory compliance. For example, many factories in the garment industry do not even have a computerized time clock in/clock out system in place for workers, making something like

measuring compliance with paying workers fair wages, including overtime, extremely difficult.

Strategies for Sustainable Fashion Supply Chains

When questioned about strategies to build sustainable practices and supply chains, the three interviewees had some similar answers, but ultimately each had something different to say. Firstly, all three interviewees mentioned visibility as a necessary step into sustainable supply chains, in order to visibly see which parts of the supply chain need work in terms of being sustainable environmentally and socially. However, each company interviewee strategized increasing visibility differently. Company A interviewee mainly discussed Company A's program that is specifically focused on supplier compliance and sustainability in supply chains by taking certain steps and evaluations of suppliers to ensure full compliance. More specifically, he/she explained this program must initially approve any new supplier, as well as continually evaluate and monitor supplier performance. Once a supplier is approved, the interviewee prioritized the idea of consistency with suppliers establishing a reliable relationship rather than a transactional one.

The interviewee from Company B discussed an approach more focused on supplier relationships and collaboration. For example, the interviewee from Company B addressed the challenge of not having someone in the factories ensuring all standards and processes are compliant with the company's standards. To assuage this, Company B has representatives regularly visit the factories producing its merchandise several times a year to see what actually occurs on the factory floor from a day-to-day basis. In these meetings, as well as extensive phone and email correspondence, a collaborating

relationship with the supplier is prioritized. This relationship, according to the interviewee, allows for much more innovation and flexibility with factory production and compliance. For example, many factories overseas refuse random factory audits, but the interviewee explained that because Company B prioritizes established relationships, the factories the company partners with allow random audit reports freely. Through a transparent line of communication, continual collaboration with and investment in suppliers integrates goals with one another, allowing suppliers to build successful compliant procedures and practices. Company B also associated investment with suppliers with innovation in technology. He/she explained that when collaboration takes place with suppliers, innovative sustainable measures and practices have room to develop, whether that be incorporating sustainable fibers into fabrics used, or mutual investment in innovative technology like 3D printing.

The Company C interviewee talked about the importance of an overall corporate culture that prioritizes sustainability, which he/she says starts with top management. He/she explained that Company C's success in sustainable practices were only possible because top management pushed the whole company to view every process through a sustainable lens. Furthermore, each business area in the company must ask themselves 'how can we be more sustainable?' whether that be in operations, procurement, or even accounting. This approach leads to more collaboration and innovation within the company, as every employee is working towards sustainability, as an overarching goal, the interviewee explained.

Offshoring vs. Reshoring

The three professionals had somewhat similar opinions about whether there was more value in offshoring or reshoring, localized production currently/in the future. None of the individuals denied that reshoring might be seen in the future, but all 3 individuals concluded that it would be the far future and that several conditions must be met first for reshoring to be worthwhile. The individual from Company A doubted that the apparel manufacturing industry would move back to localized production in the US anytime soon. He/she said the US is not a country that is set up for mass manufacturing anymore, so it would take heavy investment for all the resources needed to start producing here. The professional also discussed that while there may be lower risks because of heavier regulation in the US, many of the same risks in producing in Asia are still relevant in US production. Specifically, he/she described issues with California migrant workers being similarly exploited in apparel manufacturing, as workers in various manufacturing hubs in Asia. However, he/she mentioned the possibility of a new technology like 3D printing taking off and moving production back to the US, but for now large-scale apparel production is still vastly dependent on manual labor. The individual from Company B also doubted that apparel manufacturing would return to localized production in a big way anytime soon. Even with automation, he/she said returning production back to the US is still not cost-effective. He/she gave the example of a t-shirt coming out of Haiti costing about \$1.25 and selling for \$5.00, while a U.S. made t-shirt will retail at minimum of \$40.00. Therefore, he/she explained, it will take a large amount of time and investment, in addition to technology disrupting the supply chain in a big way before reshoring will be a profitable move for large retailers. The individual from Company C

considered reshoring a plausible movement for the fashion industry, as trends get shorter in life. However, for this to happen, the individual explained, consumers have to be willing to pay a higher price, which may be a possibility due to increased consumer concern in matters of social and environmental sustainability.

Discussion:

The initial purpose of this paper's research in both the literature review, as well as the interviews was to find solutions and strategies to increase sustainability in the fashion industry. The results of the interviews were overall informational and affirming of the research conducted in the literature review in many ways. However, the project is slightly limited in the small number of professionals interviewed. If time and networking capabilities had not been limited in terms of searching for professionals with representative perspectives and points of view, the interview results may have included richer detail and in-depth analysis of several professionals' perspectives. In addition, none of the interviewees had vast knowledge on the topic of new technologies like 3DP, which also may have limited this project's research. Overall, though, the research in both the literature review and the interviews give a broad understanding of the status of the current fashion industry in its supply chain and production practices, as well as the future movements and trends in terms of sustainability.

Some of the results of the interviews regarding the factors influencing the pressure of speed were surprising. Specifically, the interviewee who explained the impact of social media and the Internet on the shortening of trend life cycles surprised me. Through the connection of designers, retailers, and consumers, the Internet allows for consumers to find out about trends faster than they would have 50 years ago.

Interestingly, the rise of social media and the Internet may also be influencing consumer awareness in terms of social responsibility of companies. With the advancements of these networks connecting consumers with information, comes demand from consumers for fashion retailers to be faster, cleaner, and transparent. Another surprise from the interviews was the explanation of social responsibility issues regarding worker rights that retailers face even when producing in the US. One of the professionals referred to issues with migrant workers in California not being paid fair wages or having safe working conditions. Since the US has much heavier regulation in terms of manufacturing and worker rights, the finding that retailers struggle with many of the same sustainability issues producing in the US as they do in when offshoring was very surprising. It implies that social responsibility is a common issue in manufacturing apparel, regardless of regulation, possibly due to traditional industry practices and technology worldwide.

Implications:

As discussed in the literature review, as well as in the interviews, there is an observed increased pressure on fashion supply chains to be faster due to customer demand for trendy styles. This pressure encourages fashion retailers to prioritize low costs and short lead times, which is a strategy that in the traditional fashion production is often related to environmentally and socially harmful practices and byproducts. Because of the changing consumer concern for fashion brand's social responsibility, it is important for future fashion supply chains to hold sustainability as a priority in building practices and processes. By integrating the literature review and the interviews, I have developed three specific strategies and measures, which aim to increase sustainability in fashion supply chains both environmentally and socially. Through the investment in and

utilization of sustainable fibers through supplier collaboration, automation like 3DP, and localized production, fashion retailers can achieve sustainable, yet profitable supply chains that excel in the changing consumer market. These three strategies will have several beneficial impacts on a fashion brand's approach to the 3 P's: Planet, People, and Profit.

In terms of Planet, all three recommended strategies will positively benefit a brand's corporate social responsibility. As discussed in the literature review, as well as the interviews, much of the environmental harm that the fashion industry produces starts with the raw materials and the processes those materials go through to become fabric. As most fashion retailers outsource textile manufacturing, there is not always great visibility into the textile factories, which typically make up tier 2 and 3 suppliers. Therefore, a focus on collaboration and transparency with all tier suppliers is important in achieving sustainable practices. Through collaborative and innovation with suppliers, fashion retailers can achieve higher success in designing and producing apparel with sustainable fibers and practices that result in less waste, less water and energy used, and fewer chemically toxic byproducts. By investing in research in sustainable fibers and materials, fashion retailers can create innovative products that excel in quality and performance. Similarly, investing in automation like 3D printing technology, opens fashion supply chains up to be completely reconstructed with sustainability as a focus. 3DP can cut out many environmentally harmful steps of the apparel production process, which will increase efficiency, reduce carbon footprint, and shorten lead times. Investment in automation will make an easier transition back to reshoring, the third strategy to increase sustainability. The movement back to reshoring will cut out many of the environmentally

hazardous effects of apparel production simply through the proximity of the market. A closer-to-market production will allow for reduced transportation costs, as well as more sustainable manufacturing due to heavier environmental regulation in the US. By integrating collaborative sustainable materials, automation, and localized production into fashion supply chains, fashion retailers will see a positive impact on environmental sustainability and responsibility in its practices.

As consumers become more conscious in their purchasing, a brand's impact on People is extremely important for fashion supply chain managers to evaluate and monitor. The fashion industry is known to have several detrimental effects, socially in terms of workers, with the traditional process of manufacturing apparel. Because the process of manufacturing apparel is still extremely labor-intensive, the exploitation of workers in developing countries in the apparel industry is extremely common. Therefore, many issues arise in producing apparel related to worker health and safety presenting fashion retailers with risk when outsourcing. By integrating investment and collaboration in the area of sustainable fibers with suppliers, a space for suppliers to fully understand a brand's standards for responsible practices is created. Retailers and suppliers can then align goals in terms of responsible practices, allowing transparency into labor conditions throughout the supply chain. By incorporating automation into apparel production, many of the issues that arise with worker rights and safety would cease to exist. As discussed earlier, outsourcing to developing countries is shown to be detrimental to the local economies within those developing countries. Incorporating automation may allow local economies in developing countries the space they need to grow, ultimately benefiting entire developing countries industries and economies. By moving production back to the

US, many of the worker health and safety issues would also decrease because of higher government regulation. However, as mentioned in the result of the interviews, issues regarding People (worker rights) can come up just as frequently in the US, so reshoring may not solve the issue of sustainability with People entirely. Returning to localized production does give fashion retailers more transparency into production practices, though, allowing easier control and monitoring of sustainability. Thus, fashion retailers will see increased sustainability in terms of People, by investing in collaborative technology research like sustainable fibers, 3DP and moving production back to the US.

While every fashion company should prioritize minimizing its negative impact on Planet, People, companies must also take the financial effects of increasing sustainability within supply chains, aka Profit. Though there seems to be an observed trade off between sustainability and low costs, the changing consumer perspective and awareness encourages fashion brands to incorporate more sustainable practices into its business model. Through an evolution approach to sustainability, businesses will see a high return financially when investing in sustainable practices and technology. While technology with sustainable fibers is still advancing, investment in and collaboration with suppliers in this area will allow for long-term, mutually beneficial supplier relationships. As discussed by one of the interviewees, a collaborative relationship with suppliers contributes to positive advances in product quality, price, and lead-time. In terms of automation and 3DP, a slow integration approach will be the most financially rewarding. While 3DP technology has not advanced enough to be fully integrated in the fashion industry, finding best practices in design by integrating traditional apparel manufacturing with 3DP will allow for more flexibility, customizable capabilities, and quicker response

to trends and demand. These capabilities will give fashion retailers a competitive advantage in gaining market share, according to the growing consumer demand for trendy designs, customization, and shorter lead times. Moving apparel production back to reshoring will allow for a similar competitive advantage even further. By integrating a closer-to-market approach, fashion retailers can attain a customer driven focus through quick-response production featuring customization. This movement, however, should also be integrated through a slowly evolving process, as it will take time, planning, and investment in order to make the transition to reshoring financially beneficial. Altogether, integrating collaboration in sustainable fibers, automation, and reshoring into fashion supply chains through an evolutionary process, will be positively impacting to Profit as sustainable products appeal more and more to consumers in the future.

Conclusion:

The fashion industry is highly scrutinized for its harmful impacts specifically regarding the environment and worker rights. Visibility into fashion supply chains show chemically toxic practices, high-energy use, and worker health and safety issues. As the current fashion consumer changes, so does the fashion industry. Growing awareness and concern for sustainability in fashion supply chains creates space in the market for fashion retailers to invest in sustainable strategies. Through a literature review and a conducting of interviews, this paper has given a broad understanding of the current fashion industry, exploring many of the irresponsible impacts that apparel manufacturing has and the pressures influencing those practices, while also providing recommendations for how future supply chains can be more sustainable and also meet pressures to be fast. The first recommendation that fashion retailers should immediately consider integrating into its

strategy is collaboration with suppliers in order to create sustainable business practices. The second recommendation, which may be further off into the future, is investment in 3D printing. While this technology still needs time to advance in materials used before it is seen in apparel mass production, consideration of investing in 3D printing is wise for fashion retailers, as this automation will begin to disrupt fashion supply chains in the future. Through collaborative approaches with suppliers and investment in automation, the last recommendation for fashion retailers is to consider reshoring in the further future and building supply chains that support a more localized production framework. Through the integration of these three recommendations of utilizing sustainable fibers with collaborative supplier relationships, 3D printing, and localized production, fashion supply chains will see positive impacts on sustainability efforts in in the future regarding planet, people, and profit.

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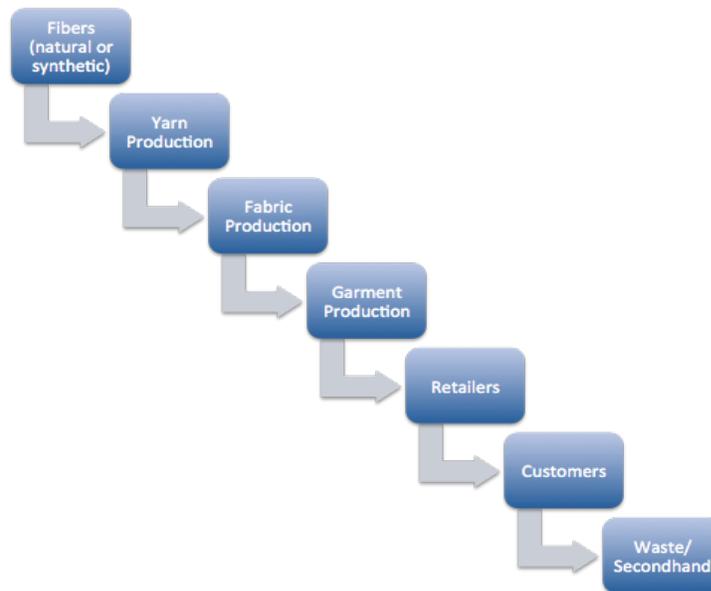
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APPENDIX

Figure 1: Typical Fashion Value Chain



Interview Questions:

1. What is fast fashion?
2. What main drivers do you think have led to the increased pressure for fashion supply chains to be faster?
3. What are challenges with sourcing and producing overseas?
4. How would you define sustainability?
5. Where do you see challenges in sustainability, specifically with production and factory compliance?
6. How can fashion supply chains build more sustainable practices?
7. How do you see the fashion industry changing technologically in manufacturing and production? What technological advancement have you seen with textiles?
8. How has the rise of 3D printing affected the fashion industry?
9. What sustainable fibers are you seeing being used in fashion today?
10. What do you think of the movement back to reshoring?