



Refashion

Extending the Life Cycle of Clothing and Revaluing Waste

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Abstract

The global apparel industry's energy intensive manufacturing and distribution of clothing uses vast amounts of water, toxic chemicals and fossil fuels through socially unjust practices while creating dangerous emissions and enormous amounts of textile waste. These negative impacts are intensified by the accelerated consumptive and disposal rates of countries in the Global North. Various solutions under the umbrella of eco-fashion are growing in an effort to address the problems created by conventional clothing, such as ecological sourcing of raw materials and creating clothing out of post-consumer textile waste. Growing consumer awareness is positively influencing textile recycling as well as collaborative efforts to set and enforce industry standards through accurate and informative labeling. Positive changes need to be practiced on a large scale in order to reduce the environmental impact of the global clothing industry.

Ecological and Human Health Impacts of the Clothing Industry

Culture in the Global North relies heavily on the attainment of material goods for their symbolic, rather than instrumental, meaning. Globalization is accelerating the production, consumption, and disposal of goods, which use vast quantities of resources and negatively affect social and environmental systems worldwide. One of the fastest growing sectors in the consumer culture of industrialized nations is apparel. The production and distribution of textiles for clothing is dependent on fossil fuels and uses large amounts of pesticides, fertilizers, water, and toxic chemicals. The ecological devastation caused by the clothing industry is enhanced further by the enormous amount of waste produced.

Cotton is the most widely used crop in clothing. This water intensive plant uses one fourth of all pesticides in the United States (Claudio 2007). It is estimated by the Environmental Protection Agency that producing a single T-shirt uses 150 grams of pesticides and 2,700 liters of water (Meadows 2010). The pesticide aldicarb is used on cotton fields in more than 25 countries. It is so potent that it can kill an adult with one drop on the skin. A regularly used insecticide, endosulfan, is connected to thousands of cotton farmer deaths, as well as the deaths of their families (Lee 2009).

Synthetic textiles like polyester, are the most widely used fibers worldwide (Claudio 2007). Polyester, or polymer polyethylene terephthalate, is made from petroleum-derived plastics that require high energy use for production (Claudio 2007, Lee 2009). Dangerous and toxic emissions are released into the atmosphere through this process, including volatile organic compounds (VOCs), carcinogens, heavy metals, hydrogen chloride, nitrous oxide and other acidic gasses (Claudio 2007, Lee 2009). These substances are linked to many problems including cancer, respiratory disease, low IQ levels, acid rain and climate disturbance.

The manufacture of clothing uses risky chemicals and produces dangerous emissions and hazardous wastes that create toxic environments (JEH 2014). A variety of hazardous solvents, chemical compounds and other poisonous by-products are discharged in wastewater at textile manufacturing plants (Claudio 2007). Per Fluorinated Chemicals (PFCs), which make clothing wrinkle free and stain resistant, are one example of the toxic chemicals used in textile manufacturing (Ahearn 2011). Many of these chemicals including those used in the dyeing process continue to leach out of the garment throughout its lifetime, further contaminating the environment (Ahearn 2011). The surfactant used in many textiles, nonylphenol ethoxylates (NPEs), is released through the process of washing clothing and is not treated in wastewater handling facilities, which pollutes waterways and lifeforms. NPEs have been found to accumulate in fish and create disorders in the functioning of hormones (TCE 2013).

Around the globe, competition for business in the clothing industry often means that environmental laws are lessened or not enforced in order to increase revenue, as seen in the use of hazardous restricted chemicals (Dickson, Waters, Lopez 2012). Polychlorinated Biphenyls (PCBs) are a by-product of synthetic dyes that were banned from the U.S. more than 35 years ago (JEH 2014). PCBs have been linked to cancer, inhibiting immune systems and decreasing IQ levels. Despite this ban, PCBs have been found in almost every researched sample of clothing sold in the U.S. (JEH 2014). This prevalent chemical leaches into people's bodies and the environment, causing constant exposure through contact.

The clothing industry also increases ecosystem degradation and loss of biodiversity

in ways that are more indirect and unseen. The demand for clothing made of cashmere provides an example, as it negatively affects native species in Central Asia. This high fashion fabric has caused a rapid decline of eight endemic species, six of which are endangered, in the grasslands and deserts within the Himalayan Mountains of India, Mongolia and the Tibetan Plateau of China (Berger, Buuveibaatar, Charudutt 2013). The decline is caused by changes in land use, as domestic goat herds are increased to keep up with the demand for cashmere. Multiple areas of study within Central Asia now estimate native ungulate populations at less than five percent (Berger, Buuveibaatar, Charudutt 2013).

Social Health

Social injustices surround the fashion industry, where people are forced to work in hazardous conditions for little pay. Many clothing manufacturers get union-free and benefit-free labor through Export Processing Zones located in impoverished nations (EC 2008). One of the largest exporters of clothing is China, where factory workers often make just \$0.12 to \$0.18 an hour in poor working conditions (Claudio 2007). One single factory in China produces over 10,000 pairs of jeans a day in effort to keep up with demand (Claudio 2007). Workers in this facility are exposed to large amounts of toxic dust from the practice of sanding and mechanically weathering jeans to give them a distressed appearance. Workers in Bangladesh and Mexico often make an even smaller wage than those in China due to competition in the globalized fashion market (Claudio 2007).

In order to meet consumer demand, it is common practice to require unreasonably long working hours in unsafe environments and the use of child labor (Claudio 2007). These facts are exemplified in Dhaka, Bangladesh, home of the deadliest tragedy directly related to the fashion industry, to date. As covered in a report from the Institute for Global Labour and Human Rights, an eight story garment factory collapsed on more than 3,500 workers, killing over 1,100 people and injuring thousands more in April of 2013. The majority of the victims were young women who worked near 100 hours a week at \$0.24 an hour. Men and children comprised 20% of the workers, making as little as \$0.12 an hour (GLHR 2014).

Fast Fashion

Many garments produced today are inexpensive due to the outsourcing of production and subsidized fossil fuels for shipping (Schor 2011). Cotton growers in the U.S. also receive subsidies, creating a misleadingly inexpensive product that has little value attached to it (Claudio 2007). These low monetary costs paired with constantly changing trends create what is referred to as “fast fashion”. In a world of fast fashion it is easy for people to continually purchase and dispose of their merchandise rapidly (Claudio 2007). A contributing factor of this quick turnaround is the two week span from the design stage to the retail store, providing a constant supply of new and trendy designs (Morgan 2009). Fast fashion intensifies industrialized nations’ throwaway culture and disposable life mindset.

The effects of fast fashion lead to alarming statistics; in 2007, Americans made a new garment purchase every 5.4 days (Schor 2011). That same year, 254 million tons of used fabrics were thrown into the trash, amounting to 78 pounds per person and 85% of all discarded clothing (Meadows 2010, Schor 2011). Apparel has entered the category of fast

moving consumer goods, like toothpaste, toilet paper and other products that are designed to be used up quickly and disposed of (Schor 2011). Fast fashions are not only cheaply priced, but cheaply made, as they are meant to be disposable, worn less than ten times before they begin to lose their quality (Morgan 2009). This planned obsolescence has progressively changed the way that clothing, once considered a valuable commodity, is viewed and treated.

Overabundance with Little Value

Most clothing that is damaged or appears worn in any way is usually thrown away instead of recycled (Morgan 2009). Aside from taking up a large amount of space in landfills, discarded natural fibers release the potent greenhouse gas methane and synthetic textiles do not decompose at all (Morgan 2009). Although a large amount of clothing enters the waste stream directly, an enormous amount of used apparel is donated to second hand clothing stores. These second hand thrift stores cannot keep up with the overflow and are only able to resell one fifth of donations (Claudio 2007).

Some clothing is recycled. Estimates from 2006 are that 2.5 billion pounds of post-consumer fabric was recycled in the U.S. (Claudio 2007). What is not recycled is often shipped to the Global South in large bales that are purchased for resale. This often hurts the domestic fabric industries of these countries, which are one of the largest manufacturing employers (Claudio 2007). Historically, clothing was a quality item of worth that had a long and productive life cycle; it has now become virtually valueless as a new item often costs the same as a used one (Schor 2011). As countries in the Global North consume and dispose of more clothing each year, second-hand apparel becomes oversaturated, also losing value in the countries of the Global South (Claudio 2007).

Searching for Solutions

In this literature review research paper, I explore effective solutions to the negative impacts caused by the clothing industry, as well as the beneficial changes that the recycling and fashion industries are making to become more environmentally and socially responsible. Using a combination of peer reviewed and popular articles, as well as specific company websites, I argue that while some consumers do not link the clothing they purchase to broader social and environmental impacts, there are a growing number of people who are aware of these negative consequences and are creating solutions.

Many of these solutions include buying eco-fashions, which have positive impacts but do not necessarily address the issue of clothing being discarded as waste. Designers who create garments out of textile “waste” tackle this massive problem by reducing the amount of discarded material going to the landfill. These designers also influence consumers by bringing their attention to the problems created by high consumption and textile waste which in turn, pushes the textile recycling industry and fashion industry towards more socially just and environmentally responsible practices.

For the purpose of this research I searched the academic database EBSCO and the Fort Lewis College general library search engine to find both peer reviewed and popular articles from a variety of disciplines. I used combinations of the following keywords in my research: apparel, behavior, chemicals, clothing, consumer, consumption, design, eco-fashion, ecological, environment, ethical, fabric, fashion, garment, globalization, impact, industrial, labeling, life-cycle assessment, material, purchasing, recycle, re-use, social,

stakeholders, supply chains, sustainable, sweat shop, textile, trash, upcycle, value and waste. Through some of these articles, I came across specific textile recycling companies and fashion designers. Using their names as keywords, I searched for them in the Google search engine.

Eco-Fashion: A Response to Conventional Clothing

While numerous people are unaware of the impacts of fast fashion and the apparel industry as a whole, there are a growing number of people who are conscious about these issues. In an effort to counteract negative effects, many people often utilize techniques such as clothing swaps, second-hand market shopping, or buying eco-fashion made from materials like organic cotton and hemp (see table 1).

Buying vintage is one form of eco-response to conventional clothing. Vintage is usually set apart from other types of used clothing due to its reference to a particular era, quality of construction and tailored fit in comparison to the mass-produced clothing of today. These distinctive and unique garments have value (DeLong, Heinemann 2005). The motivation of buying nothing new and the goal of not participating in the dominant consumptive culture are often stated as the main drivers for purchasing vintage clothing (DeLong, Heinemann 2005). Purchasing secondhand and vintage clothing eliminates the effects from the production of raw materials and reduces the amount of fabric entering the landfill. This is an environmentally responsible way to buy clothing despite the fact that it is not usually advertised as eco-fashion.

Clothing that is marketed as eco-fashion is often regarded as a way to change fashion and its impacts from the source. This category includes hemp, bamboo, organic cotton, and textiles made from corn that can be composted, although not easily (Claudio 2007). These fibers are more environmentally friendly than conventional cotton and synthetics, due to the healthy growing practices for producing non-toxic fibers. However, large amounts of fossil fuels are often used in distribution and the clothing itself is often inaccessible to many populations due to its high price.

Another movement striving for sustainability in the fashion industry is slow fashion. This form of eco-fashion promotes a shift from quantity to quality, which slows down both production and consumption. This deliberate pace produces clothing that is designed to last, which increases the value and lifespan of the garment. Slow fashion uses fewer natural resources and reduces worker exploitation by minimizing the excessive speed needed to keep up with increasing demand of more cheap products (Jung, Jin 2014). An alternative way to slow the production of clothing while still addressing people's desire to wear fashions that are new to them comes from the ideals of the sharing economy. Companies like Rent the Runway lend clothing to over 4 million members, decreasing a portion of textile production and disposal problems (TM 2015).

Many environmentalists believe that fashion embodies obsolescence and that eco-fashion is an oxymoron. While there is truth to this, fashion shows have also been used as activist statements to bring awareness to environmental and social justice issues. Nancy Judd, the founder of Recycle Runway provides a good example, as she creates statement piece fashions that are educational and interactive. For instance, her eco-flamenco dress is made of discarded parachute straps and has ruffles created from painted cereal boxes that contain over 5000 pledges for ecologically responsible behaviors (RR n.d).

Environmental psychologists have found that setting goals and commitments, as seen in the pledges on cardboard ruffles, are effective ways to change behavior (Steg, Van Den Berg, Groot 2013). The eco-flamenco dress is one of Judd's many captivating pieces that are exhibited in crowded places throughout the U.S., such as airports and shopping malls that promote a strong message about waste (RR n.d).

Designing clothing out of non-textile waste is clearly beneficial. It is not just a way to bring awareness to the issues of consumption and waste; it also gives waste a new life. However, none of the previously mentioned clothing options directly tackle the massive amount of textile waste created by conventional fashion. Clothing made from discarded textiles does address the issue of waste.

Table 1. Pros and cons of various forms of eco-fashions

	PROS	CONS
Second hand thrift	<ul style="list-style-type: none"> •affordable •accessible •fewer raw materials produced •less textile disposal in landfill •less fossil fuel use for distribution 	<ul style="list-style-type: none"> •may or may not be a quality item •lower value •less choice if wanting specific
Vintage	<ul style="list-style-type: none"> •affordable •accessible •slows production of raw materials •less textile disposal in landfill •usually quality construction and high value 	<ul style="list-style-type: none"> •less choice if wanting specific •may have been shipped far, increasing fossil fuel use
Ecologically sourced raw materials	<ul style="list-style-type: none"> •fewer toxic chemicals •less water used (material dependent) •better for land health •can be better for biodiversity •less fossil fuels in manufacture 	<ul style="list-style-type: none"> •wide distribution may increase fossil fuel use •may not curb excess consumption •more expensive than conventional mass produced clothing

Upcycled	<ul style="list-style-type: none"> •decreases textile waste • increases value •custom and unique •fewer raw materials produced •often similar price as raw materials 	<ul style="list-style-type: none"> •can be time intensive •usually smaller scale •may have been shipped far, increasing fossil fuel use
Redeployed and Reprocessed fibers	<ul style="list-style-type: none"> •decreases textile waste •slows production of raw materials •less energy intensive than production of raw materials •technology increasing towards efficiency 	<ul style="list-style-type: none"> •more energy intensive than second hand & upcycling •can be produced on a larger scale •current technology can be ecologically destructive or have a long process time, increasing cost

Fabric Waste Turned in to Fashion

In response to the large amount of wasted fabric from fashion producers and consumers, many designers consciously re-create new designs from unwanted clothing. Throughout history many people have remodeled old clothing and other materials into new garments, but this was usually done for economic reasons or simple necessity. What is new about this practice is that it is now an activist approach to consumption motivated by ecological reasons (Hubbell 2010). There are many different designers who use textile waste in their clothing. The following examples present a general overview of variety in practice, materials and scale.

Small-scale

The growing Do-It-Yourself (DIY) movement has many people turning old materials into new clothing, often created from resources that they already have. This process is known as upcycling. DIY clothing is often made on a personal or family scale but is also a growing trend in small business (Hubbell 2010). Etsy, Artfire and other online marketplaces for art have recently seen a dramatic increase in upcycling. In the span of one year, the amount of products that had the word upcycled as a description term rose from almost 8,000 to 30,000 on Etsy (Wang 2011). Upcycling customizes discarded apparel through reconfiguration and reassembly, which increases the value of the garment (Thomas 2008, Lee 2009). Similar to upcycled apparel is redeployed clothing, which is also altered through the deconstruction of garments into re-usable pieces and sometimes re-

dying, before it enters the clothing stream to be resold (Thomas 2008). The term redeployed also refers to clothing that has been reprocessed into fibers that are woven into new fabric for clothing (Lee 2009).

Smaller scale designers tend to get their materials from secondhand stores or yard sales to recombine in creative ways (Hubbell 2010). The founders of Junky Styling are an example of clothing designers in this category. These creators use the term wardrobe surgery for the transformative upcycling they perform. Their unique and stylish designs are made from both pre and post-consumer textiles (Archard 2013). Because their pieces are unique, it is difficult to sell them in bigger department-style stores. However, the small market base is not seen as a downside. The hope of these designers is that there will one day be many shops like theirs that bring back quality custom tailoring. Aside from selling their designs in a store, these innovators released an inspirational book that promotes upcycling clothing and teaches how to find material, deconstruct clothing and create patterns (FAL 2011).

Large-scale

Kathleen Tesnaki's company, 'e ko logic clothing is an example of a company that purchases used, post-consumer waste clothing in bulk before it gets shipped overseas. Tesnaki only buys textile waste that has traveled 150 miles or less to cut down on fossil fuel use. (Hubbell 2010). Tesnaki's main focus is on recycling high quality cashmere in to new innovative designs. Cashmere clothing is deconstructed then recombined in pieces to make high quality designs, from hats and fingerless gloves, to dresses, skirts, and sweaters. She also has a line of clothing made from recycled cotton knits. Prices are comparable to first generation cashmere products, with hats starting at \$64 and sweaters at \$240 (EL n.d).

While some companies like 'e ko logic recycle post-consumer fabric waste into new garments, other companies, like From Somewhere, make fashions from pre-consumer waste cloth. Their designs are made from the ends of fabric rolls, scraps leftover from cutting out patterns, and outdated materials. This company operates on a large scale and sells its designs to a large retail chain in the United Kingdom (Meadows 2010). Their pieced together designs range from panel skirts at 180 British Pounds to long sleeve raglan shirts at 110 British Pounds (FS n.d). The garments made by From Somewhere are more expensive in comparison to many fashions made from raw materials sold in the U.S., as 110 British Pounds equates to about \$160 (EXR n.d). However, the leftover textiles that they use are from the luxury fashion industry's manufacturing mills, accounting for part of the higher cost (FS n.d).

Looptworks company upcycles apparel and accessories from unused factory textile waste and other unwanted items (Wang 2011). On the Looptworks website, a blended polyester and cotton upcycled T-shirt is \$28 and an upcycled cotton long sleeve button Henley shirt is \$42. The purchase of each shirt is said to conserve 400 gallons of water. These prices are reasonable, especially since they come with a lifetime guarantee. The Looptworks mission statement page says that they provide a guarantee because high quality products mean less waste in the long run (LPW n.d). Their practices are catching on in the surrounding business world, as they are being approached by other factories who are asking for effective ways to switch from a disposable model of business to a closed loop cycle (Wang 2011).

The studio and shop of Alabama Chanin uses only local labor and materials for their upcycled designs, with a focus on organic cotton and natural dyes. This company is an example that embraces as many different aspects of sustainable fashion as possible (AC n.d). It represents slow fashion of quality and value, upcycling textile waste, supporting local employment and sourcing, and promoting the use of nontoxic materials and dyes. The old textile factory that they reopened also has a café that serves local food and is a venue that hosts exhibits, workshops, luncheons and tours that focus on educating others about sustainable living (AC n.d). Each piece is custom and hand-stitched to order, reducing unwanted stock. Prices reflect quality and high value, from \$290 for an organic jersey cotton long sleeve button-up, to dresses ranging from \$485 to over \$6,000 (AC n.d). These artisans also have a partnership with Patagonia. Through the recycling program, Common Threads Partnership, Alabama Chanin upcycles damaged, down jackets that have been returned and cannot be repaired into scarves that cost \$99 (PGN n.d).

An additional expression of eco-fashion is the growing “trashion” trend, which consists of apparel made deliberately from trash, without trying to disguise it. Plastic, seatbelts, bottle caps and countless other items that are considered garbage are assembled to make trashion (Ahearn 2011). TerraCycle is the largest company in the world that focuses on repurposing non-recyclable garbage into products like backpacks made out of junk food wrappers. The company’s scientists are constantly looking for innovative ways to use refuse in diverse products, proving that there is room for innovation (Wang 2011).

Well-known Brand Names

Aside from upcycling down jackets into scarves, Patagonia also upcycles other fabrics into many of their designs. Since 2011, they have partnered with TAL apparel, one of the biggest clothing manufacturers in the world, to make their reclaimed cotton T-shirts (PGN n.d). TAL saves all of the cotton pre-consumer scraps from their factories in China and Malaysia, which are then spun into fabric. One cotton shirt can be made from the scraps of 16 shirts, scraps that were once thrown away. Patagonia uses a blend of this re-spun cotton with organic cotton for their reclaimed cotton T-shirt line. Calamai Tech Fabrics works with Patagonia to make quality products from reclaimed wool (PGN n.d). This outdoor company also recycles polyester fibers and plastic bottles into their clothing and works with the Nature Conservancy and other groups to ensure responsibly sourced and traceable merino wool and cashmere (PGN n.d).

Using recycled materials is even gaining popularity with H&M, the creator of the fast-fashion model (Marati 2012). Their clothing line, Conscious Collection, is made from recycled scraps of polyester, tencel, and organic cotton. In 2011, H&M became the largest purchaser of organic cotton in the world, a record previously held by Walmart. They also represent one of the founders of the Better Cotton Initiative, are members of the Fair Labor Association and are moving towards corporate transparency (Marati 2012). Despite these accomplishments and credentials, there have been recent investigations into dumping toxic chemicals into Chinese rivers, poor working conditions in Cambodia and claiming that genetically engineered cotton was organic (Marati 2012).

Larger, well-known designers that are not in the outdoor clothing industry have also taken to redefining old fashions into new. Gary Harvey, Levi Strauss’ previous creative director in Europe, provides an example. At Fashion week in London, Harvey presented high end couture gowns made from discarded denim, athletic textiles, Hawaiian shirts, and

laundry bags, among others (Hubbell 2010). He wanted to especially bring awareness to sportswear, as it is made of non-biodegradable synthetic fibers and is thrown away in large numbers. This is due, in part, to constant uniform design changes, often at the end of each season. Harvey openly declares that he is a supporter of an ethical fashion revolution (Hubbell 2010).

As the largest producer of jeans in the world, Levi's decided to develop two new lines, the Water<Less jeans and Waste<Less jeans, after having a life cycle analysis (LCA) performed on a few of its best-selling products in 2007. LCA measures the environmental impact of a product from birth to grave, including; removal of resources, fabrication of materials, production of electricity, collection of discarded apparel, the processing and distribution of textiles, as well as their ultimate disposal (Woolridge, Ward, Phillips, Collins, Gandy 2006, BD n.d).

The LCA revealed that almost half of the lifetime water use came from growing cotton, triggering them to join the Better Cotton Initiative (Berfield 2012). This group helps international cotton farmers' use less water when growing cotton. A portion of this low-water cotton is blended into their Water<Less jeans that cost around \$58 (LV n.d). Finding ways to use less water in the manufacturing process followed. Distressing jeans takes four liters now, in comparison to the 45 liters it used to take (Berfield 2012). The LCA also showed that 45% of a pair of jeans lifetime water usage came from consumers laundering. This sparked the company to change its labels and start a campaign persuading people to wash in cold, wash less often, and line dry, as 60% of the energy used in the life of a pair of jeans is from consumer laundering (Berfield 2012). These new labels also recommended that consumers donate old jeans to Goodwill rather than throw them away (Berfield 2012).

Levi Strauss' changes towards more sustainable practices were not just a result of the LCA performed, but also came from environmental and organizational pressures and the realization that resources are becoming increasingly scarce (Berfield 2012). Like many clothing manufacturers, Levi's organic cotton jeans were discontinued because they were too expensive. After this discontinuation, the Waste<Less jeans were developed. These pants have eight recycled plastic bottles woven into each pair, adding a hint of the plastic's color into the fabric (Marati 2012).

Stella McCartney, is a well-known designer who is often portrayed as the "queen of eco-fashion," due to her stance against animal cruelty, her designs for the Green Carpet Challenge and for her offices, studios, and stores that are powered by wind and other renewable energy sources (Marati 2012, Lolli 2015). McCartney's website advertises eco-products, like shoe soles that biodegrade when placed in mature compost, has links to environmental causes like "meat-free Mondays" and encourages textile recycling (SM n.d). Despite her position as spokesperson for eco-fashion, her designs have been linked to sweatshops through her collaborations with Adidas. She has also been criticized for both her statement about how being too extreme in environmental practice gets in the way of business and for her limited use of organic cotton, because she views it as too expensive (Marati 2012). Nevertheless, McCartney admits to continually looking for ways to improve and is a recurring designer for the Green Carpet Challenge catwalk event at London Fashion Week.

Eco-activism on the Catwalk

Luxury High Fashion has been slow to get on board with sustainability, but the Green Carpet Challenge and London Fashion Week are striving to change that. Participating designs must be certified sustainable or recycled to be in the Green Carpet Challenge (ST n.d). High-end couture fashion designers in New York City also want to show that good quality, responsible fashion is attainable. Sustainability advocates, Earth Pledge, created an initiative called Future Fashion that showcased 28 popular designers who created apparel from recycled post-consumer fabrics and low impact, low pollution fabrics in the Veradopolis Green City Fashion Show (NNN n.d).

Promoting textile waste awareness through catwalk events can be powerful and they occur on all scales, from high-end luxury couture in large cities to affordable and accessible clothing in small towns. For example, in the small town of Moab, Utah, Wabi Sabi thrift store address the problem of overflow and waste through its annual fashion shows that utilize only castoff donations from the store (WSM 2015). Aside from fashion shows, this group's mission is to revalue and redistribute goods that would otherwise be seen as waste to non-profits and other community organizations (WSM 2015).

Fashion shows can also educate the public on many different initiatives. In Great Britain, the well-known ethical designer, Emmeline Child teamed up with a vintage wholesaler, other designers, the Textile Recycling Association, and the Salvation Army Trading Co. (SATC) for a catwalk event and exhibit. The sponsors announced partnerships with water saving companies, school district programs, and waste companies, all of which provided educational materials and the SATC endorsed its free apparel collection service at this event (LWR 2012).

All individuals and groups who play a part in the design, production, consumption, distribution, and disposal, or lack thereof, influence each other and can continue to create positive changes in the clothing industry at large. Designers and consumers can choose from a variety of clothing that aims for sustainability. Recycling companies can increase their efficiency and availability to influence consumers and designers and help close the loop between production and disposal.

Textile Recycling

Textile recycling does require energy, but is a much less energy intensive process than the production of clothing from new materials. LCAs that compare energy used show that the process of textile reuse and recycling saves a substantial amount of energy in comparison to brand new clothing made from virgin materials (Woolridge, Ward, Phillips, Collins, Gandy 2006). In the comparison of new versus recycled polyester, 90kWh is saved and recycling cotton saves 65kWh. Recycling textiles saves resources and energy and creates jobs in the circular economy.

Almost all textiles can be recycled (Lee 2009). There are different categories in the broader context of textile recycling, including redistributed clothing, up-cycled, redeployed and down-cycled fabrics (Lee 2009, Thomas 2008). Textiles are sorted into different qualities and components, with the highest qualities sold to vintage retailers and deconstructionist designers (Lee 2009). The second hand market and upcycled clothing have been discussed as viable textile recycling options. Down-cycling clothing decreases value as garments are reprocessed into rags, stuffing, and other non-wearable fibers (Thomas 2008, Lee 2009). Some materials, such as cotton, viscose and linen can be

repurposed into paper pulp as well as fabric (Morgan 2009).

New fabrics can be woven from previously made materials through the process of redeployment, such as the cotton T-shirt scraps that are re-spun by Patagonia. This process works best when the fibers are of one type. Up until recently, reprocessing fabrics that are a blend of cotton and polyester has been difficult, as it usually obliterates the quality of the material and these garments are destined to end up as rags and shredded insulation (Lee 2009). Separating natural fibers from synthetic ones usually requires the use of potent acids, solvents and chemicals that are ecologically destructive (Sankauskaite, Stygiene, Tumeniene, Krauledas, Jovaisiene, Puodziuniene 2014). Using cellulose enzymes to destroy cotton fibers that are blended with polyester is a more environmentally friendly option. The downsides of this new technology are that it requires high concentrations of enzymes and has a long process time (Sankauskaite, Stygiene, Tumeniene, Krauledas, Jovaisiene, Puodziuniene 2014).

While there are drawbacks to reprocessing fabrics, recycling technology is advancing towards a more efficient system. Some companies, such as Worn Again in the U.K. are putting their efforts into closed-loop textile recycling and manufacturing (WA n.d). Worn Again is working with various corporations to develop technology to improve the process of turning used clothing back into yarn, which will create a circular textile supply chain. This process will only be for synthetic fibers, but they will be re-used continually and it has the potential to greatly decrease the amount of new synthetic fibers from being made (WA n.d). As textile recycling technology advances it will greatly slow production of virgin materials, create less ecological destruction, become more efficient in its process and produce fabrics that are more durable than re-processed fabrics from previous technologies.

Locations, Barriers and Programs for Recycling

There are not enough recycling companies who collect textiles in the U.S., which poses a barrier in keeping fabrics from entering the landfill. The company U'SAgain encourages textile reuse and recycling in 14 states with more than 8,500 collection bins. They sort through this material to sell to wholesalers, thrift stores and graders in the U.S. and overseas (Wallander 2011). U'SAgain estimates that even though they collect over a half a million tons of cloth per year, 85% of discarded garments are thrown away in the trash. They believe this is because there are few collection programs, unlike the relatively widely available collecting receptacles and drop off stations for glass, plastic, paper, and aluminum (Meadows 2010). Trans-America, the U.S.'s largest textile recycler provides textile recycling containers and transportation at no cost to more than 20 municipalities in the U.S. (Claudio 2007, TA n.d). This business, like many other textile recycling companies, provides support to charities by purchasing used clothing from them (TA 2015). The breakdown of Trans-America's products are as follows: 45% of clothing collected is resold at a wholesale price to vintage buyers, clothing designers and overseas exporters; 30% of materials are turned into wiping rags, 20% is sold to fiber converters and 5% is categorized as other (TA n.d).

The non-profit Council for Textile Recycling was founded in 1992 as the only advocacy group in the U.S. that focuses on promoting textile recycling. This organization works with government organizations, consumers, retailers, textile producers, charities, academic institutions and textile recyclers to increase public awareness about textile waste

(CTR n.d). In hopes to reach the goal of zero textile waste entering the landfill by 2037, this organization is working to introduce the concept of zero clothing waste and promote interaction among the groups it works with (CTR n.d). There is much to be done in order to reach this organization's goal, such as increased accessibility and educational programs that encourage textile recycling.

Many cities are beginning to provide collection bins for textiles in places that are easy to access. In 2011, the Bloomberg administration initiated a New York City sponsored program that provided donation bins for housing complexes at no cost. Nonprofit and for-profit companies also have collection programs throughout the city. Companies continue to be formed to accommodate the city's textile recycling needs (Flynn 2014). Some of these programs provide tax deductible receipts and others offer a portion of their sales back to donating members. Most companies monitor the bins and some of them are made to not be affected by bedbugs, rust, or graffiti. However, many have received complaints about poor maintenance or illegal placement on public property, as well as false claims about their connection to various charities (Flynn 2014). As collection bins become more commonplace, these types of problems will likely be addressed in a positive manner.

An effective way to provide education about textile waste is in school environments. The Salvation Army Trading Company in the UK promotes textile recycling with its educational children's program and colorful and informational collection bins at over 347 participating schools. This program is also a way for schools to earn money for various projects, as recycling companies purchase the used clothing from the schools (Hosking 2014). This type of program would be beneficial in the promotion of textile recycling in the U.S. because children would learn the importance of recycling and the collection bins would provide easy access for families all over the country.

Like other types of recyclable items, collection bins for textiles need to be provided in many settings to increase clothing recycling. If a drop-off location is not easily accessible, many people will choose to throw their cloth into the garbage. Aside from public institutions, retail clothing stores need to promote textile recycling by providing collection bins and information on the importance of recycling. Some clothing stores, such as The North Face and H&M are beginning to provide this service at select locations (ECT n.d). Other possible examples that would increase fabric recycling are to require textile manufacturers to make recycling available for the disposal of their products, as is done in France, and to have retailers provide incentive gift certificates for consumers who bring unwanted clothing back to their stores, as is done by some stores in the UK (Lee 2009).

Fashion Industry Responds with Positive Changes

Growing awareness of textile waste has led to educational changes in design schools. A sustainability class at Parson's School of Design teaches zero waste techniques that show students how to lay pieces of a pattern on fabric in a puzzle like manner. This eliminates or greatly reduces the amount of leftover scraps of fabric that are wasted (Ahearn 2011). The Fashion Institute of Technology also teaches a zero waste design course that gives leftover fabric a new purpose instead of becoming trash. For instance, the concept of "spinning" cuts leftover fabric into thin strips to use in threading seams (FC 2014). Both of these solutions focus on diminishing pre-consumer textile waste. An estimated 80% of a garment's environmental impact can be determined at the design phase (EC 2008). It is immensely important for designers to be taught to make conscious and responsible

decisions, especially if their designs will be made from virgin raw materials. Decisions to be considered include fabric choice, the chemicals and dyes that will be used, and whether the garment can be easily deconstructed for easier repurposing through upcycling and redeployment.

Changes in the fashion industry also come from consumer and environmental organization demand. A protest was organized after the release of a report from Greenpeace that exposed the chemicals regularly used in fashion. Due to the pressure caused by this event, the largest international fashion group, Inditex pledged to eliminate all dangerous chemical releases from its activities by 2020, whether or not they are regulated (TCE 2013). The substances that will be phased out include those that are toxic, disrupt hormones, accumulate in living organisms, and or are capable of causing cancer. The promised elimination of chemical discharges applies to the lifecycle, including production and use of the garment, such as the washing process (TCE 2013). Other agencies are becoming strict on the use of chemicals in clothing, as well. The European Union Water Framework Directive now prioritizes nonylphenol and other hazardous substances to be made public by suppliers. This agency works on publishing and regularly reviewing a list of dangerous chemicals throughout the textile industry (TCE 2013).

Clothing Labels

Accurately labeling clothing has been proposed as the best way for consumers to make informed choices, which would in turn affect the way that clothing is produced. In response to eco-labeling demands, the company REI uses eco-sensitive tags in the U.S. to show which of their clothing is made from eco-friendly fibers, such as bamboo, hemp, and organic cotton (SRA 2008). However, simply labeling the components of an article of clothing does not capture the impacts along all phases of the supply chain that created the garment. The solution of precise labeling poses some complications, especially with a lack of clarity in common descriptive terms. Other issues are that there can be many fibers that make up the content of clothing and the process of manufacture can be lengthy. It would require an incredibly long tag to describe the source of the fibers, process and components of manipulation, labor, shipping and further distribution (Thomas 2008). Some advocates suggest using symbols, whose meanings could be defined at the store itself, on their website, or by scanning with a hand-held device (Thomas 2008).

One proposed labeling system is to provide information on the ethical and environmental production of the garment at retail locations. At the time of purchase, the consumer would also be given the option to donate an extra amount of money to be put in a fund for the garment workers themselves or to an environmental organization. (Aspers 2008). Proponents of this solution say it is direct and simple and eases the load on administration. This labeling system would also allow consumers to have more choice, while promoting awareness (Aspers 2008). The International Standards Organization, who is developing labeling systems for clothing based on the products' whole life cycle, passed regulations in the European Union in 2007 that require both clothing producers and importers to classify and measure the chemicals used in production (Claudio 2007).

An accurate footprint from a complete LCA is needed for truly informed, universal labeling (Lee 2009). Great Britain's Continental Clothing Company launched the first carbon footprint label for its clothing in 2009. The external auditor, Carbon Trust, verifies the amount of greenhouse gases discharged in the process of production, fabrication and

distribution of labeled garments. The label has a number that represents the total GHG emissions to promote awareness of climate change and to allow consumers to make conscious decisions (WBS 2009). For clothing producers to stay on this labeling program, they must commit to a five percent reduction in carbon emissions every two years. Monitoring carbon in Europe is developing and spreading quickly. Continental Clothing Company, among others, believe that this will also become standard practice in the U.S (WBS 2009).

As transparency with GHG emissions in the clothing industry becomes routine, consumers are also demanding transparency in regards to ethical fair trade and organic sourcing (WBS 2009). Consumers who do not want to purchase clothing that came from a sweatshop often have to rely on their best judgment due to a lack of information. Concerned consumers have pushed for clothing to be certified and labeled Fair Trade, ensuring that it is meeting those standards, just as a food products are (Shaw, Hogg, Wilson, Shui, Hassan 2006). Ensuring certified Fair Trade apparel would provide living wages and good working conditions, avoid child labor exploitation and afford equitable trading agreements between sellers and buyers of apparel (Shaw, Hogg, Wilson, Shui, Hassan 2006). Steps are slowly being made to address trade that is fair in impoverished nations. The International Trade Center's Ethical Fashion Program focuses on lifting women out of poverty through empowerment by connecting them to international fashion houses that pay a fair wage and provide long-term employment (Cipriani 2008).

Discussion and Recommendations

The clothing industry's irresponsible environmental and social practices are no longer acceptable to a growing number of concerned citizens. Many conscious designers and consumers have actively chosen to address the toxic, wasteful and unjust practices of what has become conventional fashion through various alternatives. Textile recycling availability and technology is growing. Likewise, positive transformations are occurring in every stage within the clothing industry's supply chain. However, these favorable alterations are merely the beginning stages of lasting change and are presently small in scale in comparison to the enormity of the current practices of the global apparel industry. Despite the daunting nature of the conventional fashion industry, encouragement of the beneficial transitions that are in place will propel the world towards sustainable fashion.

The most effective way to influence the consumption and disposal habits of consumers, especially young adults, is for the media to bring attention to the social and environmental impacts of the clothing industry. In order to increase textile recycling, municipalities and recycling companies need to work together to make responsible disposal easier by providing textile bins next to other common receptacles, such as glass, paper and aluminum. Businesses that sell clothing should also encourage recycling by providing incentives and collection bins at their retail locations and providing incentives. Clothing designers should form more partnerships with the second hand clothing market and textile recycling companies to make clothing out of post-consumer textile waste as often as possible. Designers should also construct garments with consideration of ease of deconstruction later in the life of that garment. Design schools must implement zero waste, fair trade, and environmentally responsible practices in their curriculum as common practice and not simply an option.

Collaborative networking efforts between all stakeholders in the supply chain of the

global apparel industry must continue to expand in order to increase knowledge. Sustainability objectives and procedures must be concretely defined to avoid miscommunication among members (Dickson, Waters, Lopez 2012). Environmental, social, and economic performance standards can become enforceable policy. Specific measures such as regular auditing by a third party must be carried out to ensure compliance to standards. Transparency along the supply chain is necessary and can only be achieved with full disclosure and public reporting of these audits (Dickson, Waters, Lopez 2012).

Common descriptive terms for clothing need to be concretely defined before truthful labeling can begin. These definitions can be agreed upon by the stakeholders and organizations that are setting standards. Complete LCA footprints for the use of energy, chemicals, water and carbon are necessary for accuracy in labeling. These footprints can be communicated to consumers through symbols or numbers that are openly described in retail stores and through media advertising. Transparent information for the entire supply chain of organic sourcing and ethical fair trade practices is also needed and must be readily available for informed consumer choice. This information should also be on clothing labels as well as advertised within retail stores.

Until accurate labeling becomes standard, consumers will need to research their purchases to the best of their ability, as well as demand better practices from retailers and manufacturers. Suggestions on the type of clothing to purchase include second hand and vintage items first, as this is the least energy intensive option. It is also important to support designers who create upcycled and redeployed fashions. This art form decreases textile waste by extending the life cycle of previously made clothing, which also increases consumer awareness. Attire that is made from reprocessed fibers is also recommended as it is becoming a more efficient option that is durable and closes the loop between production and disposal. If the purchase of clothing made from raw materials is necessary, it is crucial to ensure that the components of the garment are ecologically sourced and did not travel long distances for distribution.

Most importantly, consumers need to change their mindset to one that is less consumptive and does not view clothing as disposable. Harnessing the principles of slow fashion will bring appreciation and value back to clothing that is made with integrity, as it is made to have a long life.

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