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The Unsustainable System of Garment Waste in Landfills in the United States

Term Paper

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THE UNSUSTAINABLE SYSTEM OF GARMENT WASTE IN LANDFILLS IN THE UNITED STATES

Executive Summary

The clothing production industry is an unsustainable system that harms the environment in many ways. While there are many unsustainable aspects of clothing production, this paper centers on the disposal of garments that result in millions of tons of clothing in United States landfills every year. This paper assesses the natural, human, and industrial aspects that lead to clothing in landfills and the impact this has on the environment. Policy recommendations are then provided based on expert opinion, research, and existing successful policies in other countries. To address the unsustainable disposal of garments in United States landfills, policies should be implemented to divert and recycle discarded clothing, generate demand for recycled goods for purchase through procurement policies and marketing, and invest in recycling technologies that create high-quality recycled textiles.

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Introduction: The Unsustainable System of Clothing Waste

The global clothing industry is estimated to be worth more than 1.8 trillion dollars, produces over 82.782 trillion kilograms of product annually, and, as of 2019, is still growing (Mortlet, Opsomer, Hermann, & Balmond, 2017; Reichart & Drew, 2019). The production of clothing (defined as clothing, leather, and shoes) increased by 60 percent from 2000 to 2014 (Nathalie Remy, Eveline Speelman, Steven Swartz, 2016; Reichart & Drew, 2019). As production and consumption of clothing increases, so does the amount of waste. Projections based on current activity estimate that globally by 2050, more than 150 million tons of clothing will be sent to landfills or burned, and between 2015 and 2050 the weight of clothing produced will be more than ten times the weight of today's world population (Mortlet et al., 2017). Globally, consumers are losing up to 460 billion dollars each year by throwing away clothing that they could continue to use (Mortlet et al., 2017). In 2015 the United States produced 16.03 million tons of textiles, 65 percent went to a landfill (United States EPA, 2018). The current unsustainable clothing production system is described in detail through the exploration of five sub-systems below:

Materials

Clothing production begins with the harvest of raw materials like cotton and refined oil (Cobbing & Vicaire, 2016). Previously, cotton comprised 43 percent of material for clothing production but was recently surpassed by polyester, which is now used for 60 percent of garments (Cobbing & Vicaire, 2016; HM Foundation, 2016; Sajn, 2019, 2019). Water scarcity, chemical pesticides, fertilizers, and average greenhouse gas emissions of 20 kilograms of CO_2

per 1 kilogram of textiles, are all unsustainable components of this sub-system (HM Foundation, 2016; Mortlet et al., 2017).

Production and Delivery

During production, materials are spun, woven, dyed, and assembled into the desired garment, often fueled by coal-based power stations (Cobbing & Vicaire, 2016). Garment production uses large volumes of water and over 1,900 chemicals, many of them hazardous (Cobbing & Vicaire, 2016; Sajn, 2019). There are two streams of textile waste created from garment production—the scraps that fall to the cutting room floor and, later, the garment itself once discarded (Mortlet et al., 2017; Sajn, 2019). Upon completion, garments are transported and distributed to retail locations and warehouses (Cobbing & Vicaire, 2016). According to the Pulse of the Fashion Industry report, the transportation process only accounts for two percent of climate impacts from the total process, though this statistic does not account for the GHG emissions from tags, hangers, and packaging (Lehmann et al., 2019; Sajn, 2019).
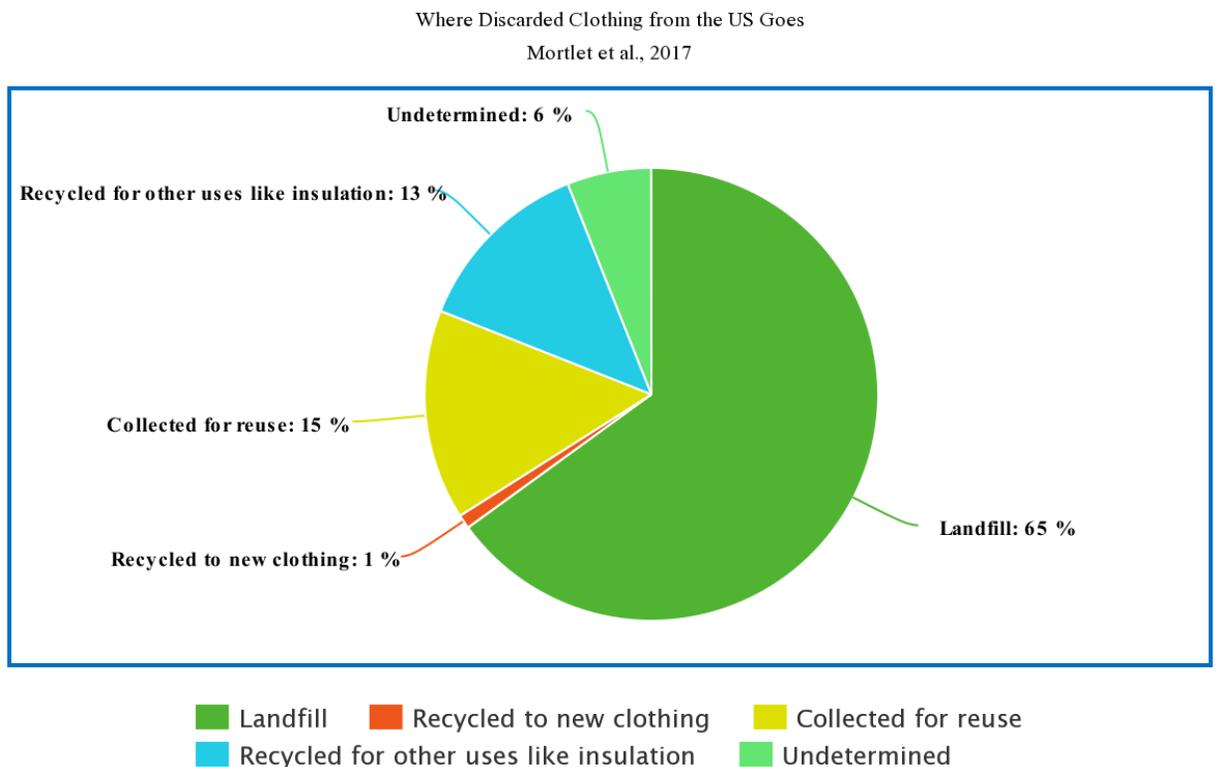
Usage

Once purchased, the environmental impact of the clothing item depends on how the user maintains it—how frequently it is washed, the temperature of the wash, if it is air dried or machine dried, and if it is repaired and reused by the consumer (Cobbing & Vicaire, 2016; Mortlet et al., 2017; Sajn, 2019). Environmental impact is also determined by how long the user keeps the garment. In the United States the average consumer purchased 64 garments in 2013 and data indicates garments are kept half as long as 15 years ago (Cobbing & Vicaire, 2016).

Disposal

While more research is needed, many studies cite that less than one percent of textiles from clothing are recycled into new clothes, a very low recycling rate even compared to other

industries, like single-use plastic, which is recycled at two percent (Mortlet et al., 2017; Sajn, 2019). On average in the United States, 65% of garments are sent to the landfill (Peters, 2016; United States EPA, 2018). Approximately 13 percent of clothing gets down-cycled into insulation, mattress padding, or wash rags, and only between ten and fifteen percent is collected for reuse (Mortlet et al., 2017; Sajn, 2019). A visual breakdown of where used clothing goes is illustrated in Chart 1.

Chart 1: Where Discarded Clothing from the U.S. Goes

Where Discarded Clothing from the US Goes
Mortlet et al., 2017

Undetermined: 6 %
Recycled for other uses like insulation: 13 %
Collected for reuse: 15 %
Recycled to new clothing: 1 %
Landfill: 65 %

Landfill
Recycled to new clothing
Collected for reuse
Recycled for other uses like insulation
Undetermined

meta-chart.com

Of the 10 to 15% of clothes collected for reuse, 70 percent is reusable, and of that, 20 percent is sold domestically (Mortlet et al., 2017). The remaining clothes are shipped overseas where 70 percent are used and the rest are discarded in landfills (Mortlet et al., 2017). The data for where collected discarded clothing from the U.S. goes is illustrated in Chart 2.

Chart 2: Where Collected Clothing from the U.S. Goes

Where Collected Clothing in the US Goes
Mortlet et al., 2017
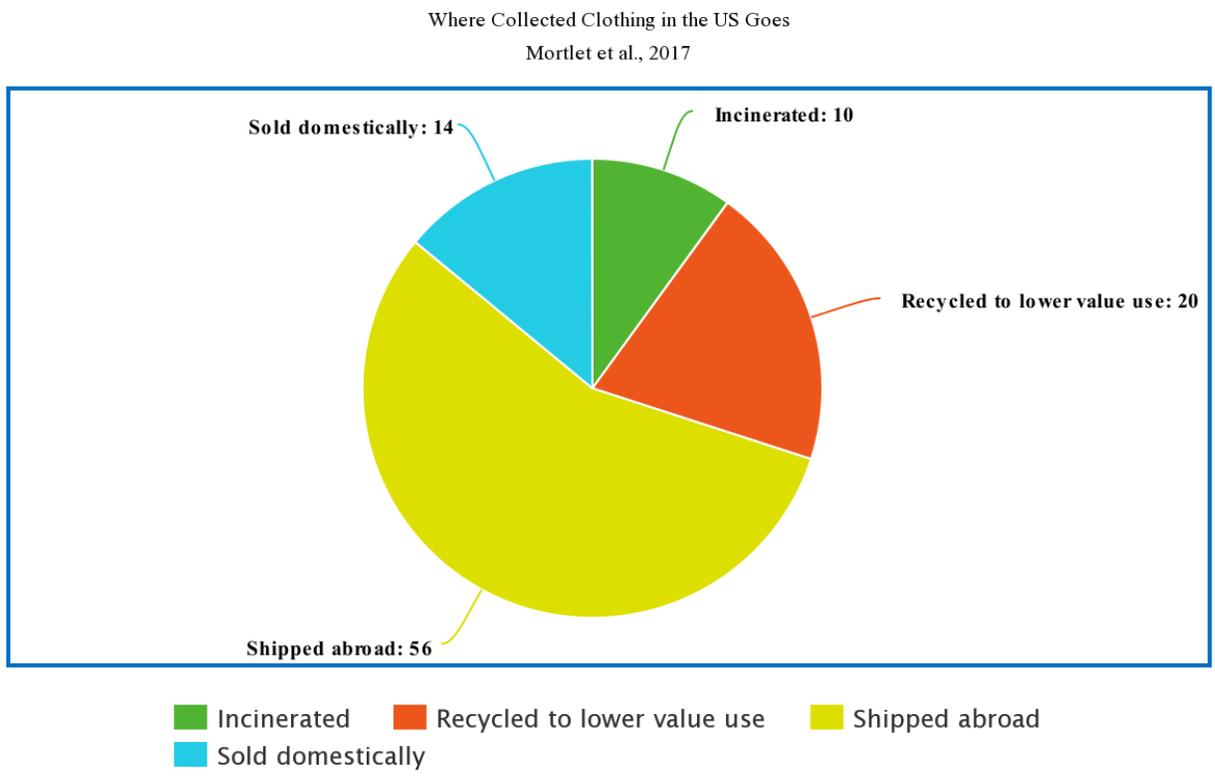
The beginning of the garment production system is beginning to receive attention from sustainability-minded organizations, primarily to find ways to continue to produce high-volumes of clothing with less water and less harmful chemicals (Mortlet et al., 2017). Less attention is paid to the lack of circularity of the overall system, particularly around clothing waste and recycling (Mortlet et al., 2017).

This paper focuses on the current state of clothing waste in U.S. landfills, the systems that have led to this waste, the negative impacts discarded clothing in landfills have on the environment, and propose solutions to reduce and eliminate clothing waste from landfills. The discard sub-system is important to examine in detail because the amount of clothing produced

and consumed is ever increasing while space available to contain the waste continues to shrink. Further, the environmental consequences from this waste are vast and perpetuated by human, industrial, and natural systems which are examined in detail in the next section.

Natural Systems Influences

While clothing waste is not the number one contributor to landfill waste (the top three are food at 21% of waste, plastic at18%, and paper at 13% of landfill waste), as of 2015, clothing waste created 10.53 million tons of waste in U.S. landfills, or 7% of landfill waste (United States EPA, 2018). In New York City, more than $20 million a year is spent on landfilling or incinerating clothing (Mortlet et al., 2017). Projections based on current trends indicate that clothing waste will be an increasing burden for the environment if the system is not made more sustainable (Mortlet et al., 2017). When clothes enter a landfill, they enter a system that is rapidly running out of space across the United States (Thompson, 2018). According to an estimate performed in 2018 by the Waste Business Journal, by 2021 only 15 years of landfill capacity from existing landfills will remain for the entire United States (Thompson, 2018).

In 2019 China declared it would no longer accept recyclables from the United States because of high contamination rates, thus diverting much of the recyclable aluminum, glass, and plastic into US landfills and shortening the 15 year landfill capacity timeframe to 10 years (Semuels, 2019; Thompson, 2018). Regionally, the Northeast is most affected, losing 30% of their capacity over the next five years due to the increase. The Midwest will lose 24% of their capacity over the next five years, and the western part of the United States will lose 8% of their capacity, which means they are estimated to have 22 years left after 2021 before reaching landfill capacity (Thompson, 2018).

Clothing does not decompose in the same way food waste might (Mortlet et al., 2017). While many believe landfills mimic the decomposition found in nature, the reality is that many kinds of waste including clothing, tend to mummify and not decompose in landfills ("Impacts of Municipal Solid Waste—CMAP," 2013). Clothing decomposition rates are affected by the material composition of the clothing. Cellulose-based fibers degrade naturally over time, while plastic-based fibers like polyester can remain in landfills for centuries, by some estimates for over 200 years (Mortlet et al., 2017). Not only do plastic-based fabrics take a long time to break down in the environment, but there is research to indicate they break down into microplastics (Cobbing & Vicaire, 2016; He, Chen, Shao, Zhang, & Lü, 2019; Mortlet et al., 2017). Studies indicate that landfills become a source of microplastics and not a final resting place as previously thought (He et al., 2019). The additional features on clothing such as buttons, zippers, and stitching are often not biodegradable and also remain in the landfill taking up space (Cobbing & Vicaire, 2016; Mortlet et al., 2017).

Natural fibers such as cotton and wool release methane and carbon dioxide as they break down (Mortlet et al., 2017). According to one EPA estimate, these decomposing textiles produce the equivalent carbon dioxide of 7.3 million car emissions in the U.S. alone (Wicker, 2016). If not properly captured at the landfill site, the release of methane and carbon dioxide emissions go directly into the environment (Mortlet et al., 2017).
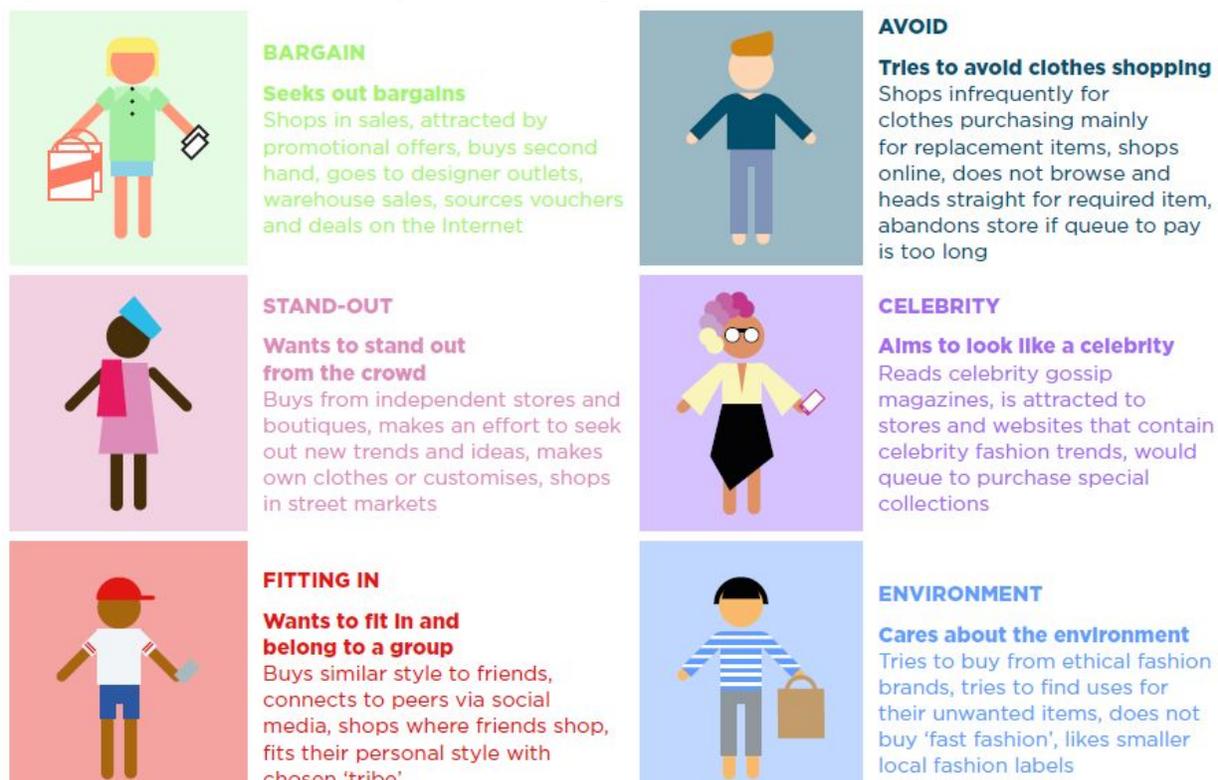
Chemicals from the clothing production process leech into the environment when clothes are discarded in landfills (Mortlet et al., 2017). Chemicals exist in the garments from the production and dying process where they are used to create wrinkle resistance, water-repellence, coloration, or other finishing elements of the garment (Mortlet et al., 2017). Many of these chemicals are

classified as "substances of concern" and can damage the local environment if not properly disposed of, and can also prevent the garment from decomposing (Mortlet et al., 2017). It is estimated that decomposing textiles in landfills release over 2,000 tons of hazardous colorants into the environment every year (Mortlet et al., 2017).

Human Behaviors Influences

Human behaviors influence clothing waste in landfills through the purchase, use, and discarde of clothing. The motivations and habits leading to purchase, use, and disposal patterns can be divided into six personas: 1)bargain, 2) avoid, 3) stand-out, 4) celebrity, 5)fit-in, and 6) environment (Figure 1) (Mortlet et al., 2017). These profiles are based on research compiled by the Ellen MacArthur Foundation and are designed to help inform what motivates customers to purchase items and at what volume and cadence. Once understood, the waste habits of each persona can be used to infer the societal behavioral influences that lead to clothing waste in landfills.

Figure 1: Customer Persona Types and Clothing Purchase Motivations

BARGAIN

Seeks out bargains
Shops in sales, attracted by promotional offers, buys second hand, goes to designer outlets, warehouse sales, sources vouchers and deals on the Internet

AVOID

Tries to avoid clothes shopping
Shops infrequently for clothes purchasing mainly for replacement items, shops online, does not browse and heads straight for required item, abandons store if queue to pay is too long

STAND-OUT

Wants to stand out from the crowd
Buys from independent stores and boutiques, makes an effort to seek out new trends and ideas, makes own clothes or customises, shops in street markets

CELEBRITY

Aims to look like a celebrity
Reads celebrity gossip magazines, is attracted to stores and websites that contain celebrity fashion trends, would queue to purchase special collections

FITTING IN

Wants to fit in and belong to a group
Buys similar style to friends, connects to peers via social media, shops where friends shop, fits their personal style with chosen 'tribe'

ENVIRONMENT

Cares about the environment
Tries to buy from ethical fashion brands, tries to find uses for their unwanted items, does not buy 'fast fashion', likes smaller local fashion labels

Source: Shaw, D. and Koumbis, D., *Fashion buying: From trend forecasting to shop floor* (2013), p.126

The bargain persona is motivated by finding sales and using discount vouchers (Mortlet et al., 2017). Because this persona is motivated by deals, they are likely to purchase unneeded items in excess at a high volume which can result in high contributions to landfills (Mortlet et al., 2017). This persona is influenced by the retailing strategy to overstock and quickly clear merchandise through large sales often implemented by large retailers (Mortlet et al., 2017). Similar personas at risk of purchasing and discarding high-volumes of clothing are the celebrity and stand-out personas (Mortlet et al., 2017).

The celebrity persona is motivated to purchase clothing based on trends and align themselves with trends as a form of self-expression (Mortlet et al., 2017). Because trends move

quickly, one of the fastest being Zara who releases new products twice a week, this persona is also at high-risk of purchasing and discarding high volumes of clothes in order to stay on-trend (Howland, 2017; Mortlet et al., 2017). The stand-out persona is motivated by looking different as a form of self-expression and actively seeks new trends and ideas (Mortlet et al., 2017). This persona purchases clothing from a wide variety of local and chain establishments and creates styles themselves; ultimately because they chase trends, they are also at risk of a high turnover of clothing. These three personas are motivated to purchase high volumes of clothing by societal structures that enable its continual consumption and results in high volumes of clothing waste in landfills (Mortlet et al., 2017).

The moderate-risk personas are fitting-in and environmental. The fitting-in persona will consume in a similar pattern to those around them and therefore their consumption pattern can vary (Mortlet et al., 2017). The environmental persona is also considered moderate-risk because even though they are shopping ethically and finding alternative uses for their clothes before ultimately disposing, they are still active shoppers in a non-circular clothing production system and are still contributing to the clothing waste in landfills (Mortlet et al., 2017).

The lowest contributor to clothing waste in landfills is the avoid persona because they only purchase the products they truly need after thoroughly using the previous product and only if the circumstances are aligned to do so (Mortlet et al., 2017). This group does not chase the social trends the other personas do, does not tie self-expression to their clothing, and does not seem to be influenced by more common social pressures to consume clothing at a high rate (Mortlet et al., 2017). Ultimately, those who consume the least amount of clothing are contributing the least to clothing waste in landfills.

While there is a high demand for new clothes, there is a very limited demand for clothes made from recycled materials (Cobbing & Vicaire, 2016; Mortlet et al., 2017). The lack of demand for recycled clothing further perpetuates the problem of clothing waste in landfills because if there is no desire or pressure on clothing producers to sell clothing from recycled materials, then there is not a lot of financial incentive for them to invest in and produce recycled clothing. Attitudes and preferences are beginning to change in the United States towards recycled clothing as is seen in the rising popularity of companies like Rothy's and Everlane. As preferences begin to surface, the demand is generated within a limited social group that is both aware of the benefits of recycled clothing and has the economic ability to purchase these currently premium-priced goods. And yet, these recycled-product companies are not recycling old clothes but rather recycling plastics, which means that discarded clothing remains in the landfill. Regardless of purchase pattern, each persona is still likely to have the majority of their clothing end up in the landfill, even if they extend the garments life by a handful of uses because the industrial clothing system is not set up for clothing to end up somewhere else besides a landfill, either near or far (Cobbing & Vicaire, 2016; Mortlet et al., 2017; Sajn, 2019).

Industrial Systems Dynamic Influences

The amount of clothing waste in landfills is a direct result of the ability to cheaply mass-produce clothing (Cobbing & Vicaire, 2016; Lehmann et al., 2019; Mortlet et al., 2017). This ability has generated an industry valued at over $1.8 trillion dollars worldwide (United Nations Economic Commission for Europe, 2018). Massive profits incentivize increases in production which further contributes to waste in landfills. An effective, circular recycling system for clothing products does not exist in the United States due to limited infrastructure, limited

demand for recycled clothes, underdeveloped technology, and lack of awareness of the need (Cobbing & Vicaire, 2016; Mortlet et al., 2017). In instances when clothing waste does not enter U.S. landfills, it is shipped it abroad to lower-income countries, effectively pushing issue of clothing waste off on someone else (Mortlet et al., 2017).

In the United States, there are several pathways a discarded clothing item can take: head directly to the landfill, head to a second-hand store for a few more uses before heading to the landfill, head to a facility where it is shredded and put in mattress filling or used as insulation before going to the landfill, or be packaged up and shipped abroad to a lower-income country where it may get a few more uses before also going into a landfill (Cobbing & Vicaire, 2016; Lehmann et al., 2019; Mortlet et al., 2017). None of these options are sustainable, even if they extend the life of the material for a few more uses.

Additionally, there are no federal-level "take back" laws in the United States dictating that companies must reclaim and dispose or recycle clothing. Instead, the end user is responsible, and they have limited ability to recycle clothing themselves. This situation results in a commons tragedy where everyone fails to take action to address the issue and everyone suffers the consequences of clothing waste in landfills (de Vries, 2013). Other industrial factors that contribute to clothing waste in U.S. landfills are around supply chain and technology. For clothes to be diverted from landfills, there must be a designated way to collect and transport them to an appropriate recycling facility. Presently, there are very limited drop-off and recycling systems that exist and if they do the burden is on the consumer to move the clothing to the recycler. The retailer H&M now offers used clothing collection points at all stores in the United States to collect, recycle, and divert clothing from landfills (Cobbing & Vicaire, 2016; Lehmann et al.,

2019; Mortlet et al., 2017). Even if a system were established to collect discarded clothes and the technology was available to fully recycle the discarded clothing into new clothing, there is still a supply chain barrier from an inconsistent volume of donated clothing to process. If a company builds their supply chain around donated clothes and the donation rate fluctuates, the production of recycled clothing could be in jeopardy.

A lack of technology to effectively recycle clothes into new clothing is another industrial system factor that contributes to waste in U.S. landfills. There are many challenges that must be solved to effectively recycle used clothing, and while there are companies solving these issues, they are not yet able to operate at scale in a cost-effective manner (Mortlet et al., 2017). One of the first technological challenges around recycling clothing is knowing what the garment is made of. Garments today are made with blends of various textiles and often the complete composition of these garments is unknown due to inconsistent labeling policies (Mortlet et al., 2017; Sajn, 2019). This is a challenge for the recycling process because if the material is unknown, it becomes difficult to effectively recycle it (Cobbing & Vicaire, 2016).

Many chemicals are used in the garment creation process to make fabrics wrinkle free, water resistant, hold their color, and more which can pose challenges to the recycling process (Cobbing & Vicaire, 2016). The acceptability of certain chemicals has changed overtime which impacts the recycling process because recycling a garment opens the possibility of releasing previously banned harmful chemicals into the environment (Mortlet et al., 2017). This makes it very challenging to recycle clothing with unknown compositions because if the recycling center is not equipped to handle that kind of material or chemical it could become dangerous for the

workers, for the new user of the recycled garment, and for the environment (Cobbing & Vicaire, 2016; Mortlet et al., 2017).

Further, there is a technological barrier in using recycling fibers for new garments (Cobbing & Vicaire, 2016). The present recycling process shortens the fiber length, reducing quality and durability of the textile and requiring the recycled material to be blended with virgin materials to hold its integrity (Mortlet et al., 2017). This is a solvable innovation problem, but it will cost time and money solve. There are companies who are working to recycle old blended clothes such as The Blend Re:wind separation process from RISE IVF, and Ambercycle's Polyester Digester, but they are not yet to the point where a fully scalable product or process is ready for use by large companies like H&M who may be in a better place to begin using their services ("Ambercycle," 2019; "Blend Re," 2017).

Policy Recommendations and Implementation Strategies

There are many opportunities to improve the garment creation process to create a "new textiles economy" where the production, lifecycle, and disposal of clothing items is circular (Mortlet et al., 2017). This can ultimately reduce and eliminate clothing waste in United States landfills and beyond. The new textiles economy is built on the idea that clothing should be used until it is no longer usable and instead of discarding the item, it is recovered and recycled into a new, equally usable clothing item (Mortlet et al., 2017). This framework ensures that the garments retain their value after use and never end up as waste in a landfill (Mortlet et al., 2017). In order to create a circular system for clothing many changes need to be implemented throughout the sub-systems in the garment production lifecycle, but for the purposes of this

paper, recommendations are only provided to improve the discard sub-system with the goal of reducing and ultimately eliminating clothing waste in U.S. landfills.

For policies to be successful, communities in the United States need to be aware of the problem, understand the extent of the problem, and feel informed and motivated to act to address the problem (Sajn, 2019). For these reasons, it is important to create an integrated communications campaign that spans the national and local levels to educate the population and create a dialogue. The dialogue is important because it has been shown that communication can affect one's choice to participate or defect from an activity (Dawes, 1980; Shankar & Pavitt, 2002). The messages from the campaign should be tailorable at local levels to initiate local dialogues around the issue. Studies have shown that adults can be motivated to act to improve the environment by social pressure, not because it's the right thing to do or because it is needed (Goldstein, Cialdini, & Griskevicius, 2008; Sidique, Lupi, & Joshi, 2010).

In addition to creating a messaging campaign about clothing waste in landfills, a simultaneous marketing campaign will run to increase demand for recycled clothing. A marketing campaign will help increase the demand for recycled clothing which will put pressure on producers to invest in creating high-quality recycled clothing (Cobbing & Vicaire, 2016; Lehmann et al., 2019; Mortlet et al., 2017).

As demand for recycled clothing grows, a supply chain to divert clothing from landfills and towards recycling centers must be created by providing an alternate location for discarded clothes to go, ideally back to the retailers themselves. Referred to as an extending producer responsibility (EPR) system, this method of clothing collection requires the clothing companies to collect the clothing they previously sold, to recycle (Mortlet et al., 2017; Sajn, 2019). While

EPR laws for various products have been successfully implemented in the United States, none have been implemented at a federal or local level for clothing ("U.S. State EPR Laws," 2019). Implementing a federal EPR can help to reduce and eliminate clothing waste in landfills. As of 2018, France is the only country in the world to have a textiles-focused ERP (Mortlet et al., 2017; Richard, 2018; Sajn, 2019). Passed in 2006, France's ERP has increased the amount of textiles diverted from landfills from 18 percent, to 36 percent in 2017 (Richard, 2018). In the United States there are already companies who offer this service at their own behest. H&M launched the "Recycle Your Clothes" initiative in 2013 which creates clothing drop off opportunities at every store in the United States and even offers a coupon towards future purchases for those who drop off discarded clothing at their store (Mortlet et al., 2017; Sajn, 2019). The program has collected over 45,000 tons of clothes since inception, and has set a goal of collecting 25,000 annually by 2020 (Mortlet et al., 2017). Further, the clothing dropped off doesn't need to be H&M clothing only, it can be from any brand. Patagonia has a similar program where customers can mail-in discarded Patagonia wear to their headquarters to be repaired or recycled, though this service is reserved only for products from Patagonia.

Once discarded clothes are diverted from the landfill and are collected at the point-of-purchase they will need to be recycled into new clothes. At the time of this writing there are no silver-bullet solutions that exist that can recycle any potential discarded clothing into a new clothing item but there are a variety of methods in research and development that may prove promising soon. From a policy perspective, to further the efforts of textile recycling research and development, opportunities through the form of grants should be offered. Companies are approaching the issue of clothing waste in landfills from different perspectives and the one thing

they all have in common is the need for more funding. By dedicating federally funded dollars towards the issue of recycling textiles to eliminate clothing from U.S. landfills, not only is the funding issue being addressed, but it elevates the need for recycled clothing materials by having the focus of the United States government on this issue.

Procurement policies that require federally-procured clothing, like military uniforms, to come from 90 percent recycled materials and work up to 100 percent as technology improves, can be put in place to increase demand for recycled clothing. As technology continues to improve to recycle textiles, additional procurement policies can be put in place to further increase the demand for recycled clothing.

Policies can also be put in place to help identify the composition of a garment which will make it easier to recycle. Modern fabrics are composed of blends of synthetic and natural materials and because existing labeling laws are inconsistent, it is not always clear what the composition is of a garment (Mortlet et al., 2017). While policy could be put in place that requires detailed labeling on the tags of clothing items, this has limited value if a garment is damaged, the tag is worn or missing, or if the tag itself is made from a different material in which case it would need its own tag. Instead, a more modern approach is proposed: to weave the composition of the garment into itself through RFID technology that would allow the recycler to scan the garment for its RFID tag to understand the composition of materials and properly recycle it. Progress and standardization is already being made on this technology by Circular ID™, which works to identify textiles and help products to be more circular ("EON | Digital Identity Platform | IoT Services | Circular Fashion," 2019). This kind of tracking and

identification technology will help improve the quality of garments created by recycled materials by ensuring the source material is recycled in the most appropriate manner (Mortlet et al., 2017).

The policies and implementation actions suggested in this paper have the potential to dramatically change how the United States thinks of, interacts with, and ultimately discards clothing for the better. The strength of this approach lies in its many prongs as outlined in Table 1—the communications campaigns to educate the general population about the problem, the marketing campaign to create demand for recycled clothing, procurement policies aimed at generating demand, ERP policies aimed at tying the disposal of waste with the clothing producers, and investing in the technologies that can make fully recycling discarded clothing items possible. The policies and implementation strategies outlined above provide a solution from multiple angles based on already successful programs found elsewhere and expert recommendations (Cobbing & Vicaire, 2016; Lehmann et al., 2019; Mortlet et al., 2017; Sajn, 2019).

Table 1: Summary of Suggested Policies to Reduce and Eliminate Clothing Waste in US Landfills

1.	Implement a communications and education campaign at national and local levels in inform the American people about the unsustainability and consequences of continuing to discard clothing in landfills.
2.	Increase consumer desire for recycled clothing through a targeted marketing campaign.
3.	Establish an ERP with medium and large-sized US clothing retailers requiring them to collect and reprocess old garments into new garments to eliminate waste.
4.	Create procurement policies that require only recycled garments (ex. Military uniforms).
5.	Implement tracking technology in all newly made garments to identify the material composition to enable better recycling.
6.	Invest in research and development of textile recycling technologies through federal grants and awards.

The strength of this plan is also its weakness—for it to work, each policy must be implemented, and it can be difficult to enact policies that cost large companies equally large amounts of money in the United States. While all policies need not be enacted at the exact same time, they do build and reinforce one another, so the success of the plan will be less than its potential if all policies are not implemented in series within a reasonable timeframe.

Conclusions

Clothing waste in United States landfills is a symptom of the unsustainability of the existing clothing production system and is detrimental to the environment. Clothing waste takes up valuable space in U.S landfills and releases methane, carbon dioxide, production chemicals, dyes, and other pollutants as it decomposes. If made of synthetic materials, as most of the clothing now is, it will take hundreds of years to degrade and will release microplastics into the environment over time.

Landfills in the United States contain 2.34 million tons of clothing from the existing industrial, societal, and natural systems that enable discarded clothing to collect and pollute the environment (United States EPA, 2018). Industrial systems are not in place to divert, capture, and recycle the discarded clothing while societal systems are in place that promote the excessive purchase and discard of clothing items at an ever-increasing pace (Cobbing & Vicaire, 2016; Mortlet et al., 2017; Wicker, 2016). The environmental impact from these systems continues to mount as discarded clothes release methane, carbon dioxide, harmful production chemicals, dyes, and microplastics into the environment.

Policies and plans can be implemented to curb the amount of clothing discarded in landfills, reduce the environmental impact, and modify the behavior and industrial systems that

lead to this waste. A communications and marketing plan to educate the public about the problem and motivate them to act through social pressure, while increasing the demand for recycled clothing will help to shift the social factors that contribute to the non-circular system. Additional policies can be put in place to clearly tie the responsibility of properly disposing clothing to its manufacturers through an ERP that encourages the diversion of clothing from landfills to recycling centers. Procurement policies can be enacted by the government requiring recycled clothing to be used for uniforms and other clothing needs, and grants can be available to those who are already working on improving textile recycling technology to ensure it matures and is able to scale appropriately. The evaluation of the uncircular clothing production and waste system through the lens of environmental, societal, and industrial factors has led to a better understanding of the scope of the problem and the possible paths forward to begin addressing it.

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