

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Environmental Studies Undergraduate Student
Theses

Environmental Studies Program

5-4-2022

Public Health Impacts of the Clothing Industry

Schafer Flowerday

Follow this and additional works at: <https://digitalcommons.unl.edu/envstudtheses>



Part of the [Environmental Education Commons](#), [Natural Resources and Conservation Commons](#), and the [Sustainability Commons](#)

Disclaimer: The following thesis was produced in the Environmental Studies Program as a student senior capstone project.

This Article is brought to you for free and open access by the Environmental Studies Program at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Environmental Studies Undergraduate Student Theses by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Public Health Impacts of the Clothing Industry

An Undergraduate Thesis

By Schafer Flowerday

Presented to

The Environmental Studies Program at the University of Nebraska-Lincoln

In Partial Fulfillment of Requirements

For the Degree of Bachelor of Science

Major: Environmental Studies

Emphasis Area: Masters in Public Health

Thesis Advisor: Name: Hillary Mason

Thesis Reader: Name: Melisa Spilinek

Lincoln, Nebraska

Date: May 4, 2022

ABSTRACT

The clothing industry is worth \$1.5 trillion dollars and rapidly expanding (Statista, 2021). The industry is dominated by fast fashion, which accounts for clothing that is quickly and cheaply produced, based on ever-changing trends. 90% of textiles produced are made in low-income countries, predominantly in South Asia (Seigel, 2011). This systematic literature review looks into the impact this industry has on these vulnerable populations which are working and living in areas where clothing is produced. Environmental and Occupational health hazards and impacts were researched. Environmental impacts occur at each step of the process. Polyester is the most common textile, and is derived from oil, leading to a large carbon footprint. Even natural fibers, such as cotton, require significant amounts of water to grow and use pesticides with additional harmful effects. The dyeing process leads to polluted wastewater being dumped in bodies of water, creating hazards for aquatic life and humans. Occupational hazards arise in part from a lack of regulations in the countries clothing is made in. Hazards present include physical (building collapses and fires), chemical (present in dyes and other processes), ergonomic (long hours with minimal moving and repetitive work), and psychological (low wages and high pressure to meet quotas). Because of these environmental and occupational impacts, the clothing industry is a source of environmental injustice. While wealthier countries create the highest demand for textiles, they are not the populations which are exposed to the hazards. There needs to be a dramatic decrease of consumeristic behavior on our parts as a collective society. Apparel businesses also need to change their sources and methods to account for workers' health and resource sustainability to mitigate this injustice.

INTRODUCTION

The general topic of this thesis is the fashion and clothing industry and the impact it has on our environment. In the simplest terms, this industry involves the creation and selling of apparel. There are multiple approaches to the industry. First, there is slow fashion, sustainable fashion, or eco-fashion. Slow fashion puts a spin on the current method of mass-producing textiles and depending on the company focuses on sustainably sourcing their materials, using less resource intensive materials to begin with, and ethical practices regarding the workers within the factories where the clothing is made. While this approach to the clothing business is becoming more popular as people become more in-tune with environmental issues and where their goods are being made, it is still not the predominant market (Gazzola et al, 2018). Second, there is fast fashion, which is most prevalent right now. Fast fashion refers to apparel that is mass-produced and quickly and cheaply made, based on current trends. Because it is so affordable and accessible, this type of fashion is booming. Stores like H&M and Forever 21 are often used as examples of this type of fashion. This business model in particular is thriving due to widespread access to and convenience of the internet and low costs of garments. Online retailers like Shein gain traction quickly among users of social media due to their cheap prices and trendy clothes. In June 2021, Shein became the United States' leading shopping app, the first to beat out Amazon in sales (Nguyen, 2021).

The apparel industry was a \$1.5 trillion industry in 2021. It is projected to be worth \$3 trillion in the next five years (Statista, 2021). The industry is such a large commodity because virtually every human consumes clothing in some capacity. This makes the impacts of the industry

relevant to everyone, even those who will not see the negative impacts directly. The United States is the largest consumer of clothing both in dollar value of sales and per capita (Bick, 2018). The way we buy, use, and dispose of apparel here in the United States and other high-income countries has a largely negative effect on people and places all the way across the globe. The status quo of accepting, and even promoting fast fashion, results in many violations of human and environmental health. The industry creates more waste than is necessary by using resources on clothing that is not built to last. In addition to using the environment's resources such as water, land, and energy, fast fashion pollutes the air and water throughout the process of creating garments. The pollution from the industry impacts the people living and especially working around these processes. These concepts can be tied into environmental and occupational health. Environmental and occupational health are branches of public health that focus on the role the natural and man-made environments and our occupations play in our health and well-being. Environmental and occupational health seeks to minimize the hazards present in these environments. These hazards can be related to soil, water, and air quality, as well as injuries and illness associated with jobs. The question to be researched is *what are the environmental and occupational health burdens of fast fashion in the countries where the garments are made?* The majority (90%) of clothes are produced in developing countries (Bick et al, 2018). These countries are defined as countries with low economic output and a lower Human Development Index score.

From the literature, clothing consumption habits in certain parts of the world, the environmental impact of the fashion industry, and occupational hazards were subtopics with sources found to be pertinent.

METHODS

The design of this thesis is explanatory as it will seek to define clothing production's effects on health, both human and environmental, and how these health impacts affect developing countries. This research question will be addressed through a systematic literature review. The results of searching on electronic databases will be sifted through to find applicable studies and previous research. Search terms will include "fashion industry", "fast fashion" and "occupational health" "environmental health" or "occupational/environmental impacts" "developing countries" "Bangladesh" "India" "China" and relevant combinations of these terms. Only peer-reviewed, scientific journals will be used. The main databases that yielded the most results include Greenfile, Textile technology index, Academic Search Premier, and Google Scholar.

When a source is found to be relevant, the references of that source will be examined to find more relevant data. This sequence will be followed until the primary research is found.

By executing this literature review, it will be revealed what we already know regarding the environmental and occupational health burdens of the fashion industry, and specifically how this industry disproportionately affects developing countries. Based on this information, it will be determined what information is lacking in current literature to have a well-rounded idea of how this industry impacts everyone, and specifically those in developing countries.

RESULTS

Consumption

The first part of the fashion equation to look at is society's consumption of clothing. Without this societal demand, we would not have such drastic issues with the sustainability of the industry. In recent years however, options have expanded for those looking to be sustainable about their apparel shopping. Thrifting, swapping, and eco-friendly brands have grown in popularity. This is one of the biggest steps in reducing the footprint of the fashion industry. A smaller demand for fast fashion, hopefully in time, will result in less production of textiles. It is apparent how linear the industry currently is because in 2018, 11.7 million tons of textiles were landfilled (EPA, 2020). This is about 70% of the volume of clothing produced in that year.

According to a study of 1,238 individuals, women, Millennials, and Generation Z buyers seem to be more likely to participate in sustainable fashion consumption (Gazzola et al, 2020). However, just because more individuals claim one of their decision-making factors when it comes to apparel is sustainability, may not directly translate into purchasing behavior (McNeill and Moore, 2015). Becoming more conscious consumers could reduce the amount of waste in terms of textiles.

Environment

The fashion industry affects our environment in a multitude of ways. Quantifying the impact of the clothing industry is difficult because of how complex it is. The different materials used, the locations of production, and the manufacturing processes, all contribute to a very tangled web. Each step of the clothing production process requires energy and labor. The growth or

production of textiles themselves have an impact. Once produced, the textiles are often dyed, which affects the environment as well.

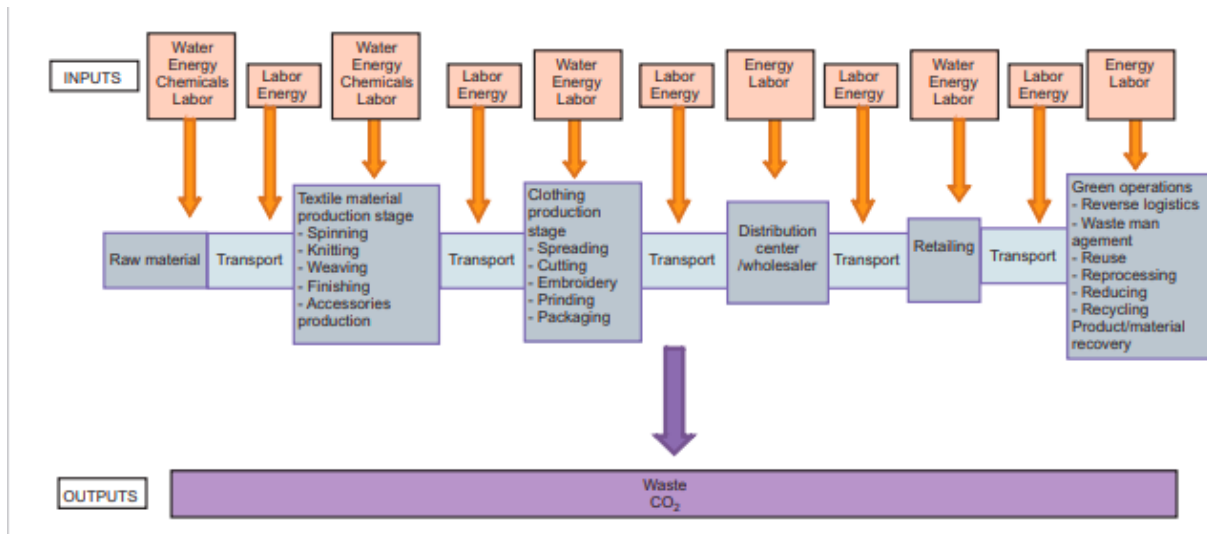


Figure 1: Production of a garment inputs and outputs (Bick et al, 2018).

Both natural and synthetic fibers are used for clothing. Let us begin with cotton. Traditional cotton requires large amounts of water and pesticides to be grown. In a study done by scientists at Tampere University in Finland, researchers found that in just the growing stage, 1 kg of cotton can require anywhere from 7 to 29 tons of water (Kalliala, E., Nousainen, P., 1999). Using statistical data from Finnish textile manufacturers in 1996, researchers used a typical life cycle analysis approach and broke down each step in the creation of cotton, polyester, and 50/50 cotton-polyester blend fibers. Their overall finding was that cotton requires an unsustainable amount of water and harmful pesticides and fertilizers. The most common fiber used is polyester. Representing 30% of total global fiber production in 1975, polyester represented 68% by 2019 (Changing Markets, 2021). Polyester is a synthetic fabric derived from oil. The largest impact of polyester comes from energy usage of sourcing from petroleum and washing the fibers (which leads to microplastics in the water). The largest limitation in this study is that the data is likely

outdated now. Samira Iran wrote about similar findings to the Finnish article in her book; *Sustainable Fashion: From Production to Alternative Consumption*. While less water intensive, polyester and nylon are derived from oil, which – in both extraction and production- emits more CO₂ than natural fibers (Iran, S., 2018). Even though neither cotton nor synthetic fabrics are benign, cotton seems to have the environmental upper hand. The carbon footprint of a single polyester shirt was found to be 5.5 kg compared to 2.1 kg for a cotton shirt (Kirchain et al, 2015). This comparison between cotton and synthetic fibers is important because they are the most widely used textiles; each have important pros and cons to consider in terms of sustainability, but due to the complexities mentioned above, are difficult to directly compare.

Fibre	Energy usage to produce one-kilogram fibre, MJ	Total energy usage per kilogram fibre and fabric production, MJ
Flax	10	102
Conventional cotton	55	147
Wool	63	155
Polypropylene	115	207
Polyester	125	217
Acrylic	175	267
Nylon	250	342
Viscose	100	192

Figure 2: Energy use of different fibers, (Khabbaz, 2010).

Once fabrics are created, even more toxic chemicals are used to get fabric one step closer to being sold. Fabric dyeing is yet another aspect of fashion with a notable environmental footprint. Researcher Dr. Shaikh found both acute and chronic issues with colorant wastewater. Dyes contain many toxic chemicals, such as organically bound chlorine, which are then released in textile wastewater, reducing the oxygen available to organisms in the streams (Shaikh, 2009). Dr. Shaikh also found that some dye fixing agents contain heavy metals, which do not biodegrade, harm aquatic life as well as bioaccumulating in humans. Bioaccumulation occurs when the concentrations of a substance being absorbed is greater than the rate of excretion,

leading to a buildup of the substance in a living animal. In addition, Sana Khan and Abdul Malik looked into the environmental and human health impacts of textile chemicals, specifically dyes and found that 40% of colorants used contain a known carcinogen (Khan, S., Malik, A., 2013). A carcinogen is defined as any substance that has a toxicity threshold of zero, and therefore causes cancer(s) regardless of the dose. They discuss the chemistry related to some of these known toxins to demonstrate how they impact the water, soil, air, flora, and fauna. According to the EPA in 1989, 52% of the toxic pollution from the textile industry was from chemical laden effluent (EPA, 1989). The concern at that time then was that the textile industry was already one of the top ten toxic waste generators and chemicals being used were increasing which would (and has) led to more pollution. This goes to show that scientists have known to some extent the negative impacts of the fashion industry for decades.

After textiles have become dyed fabrics, they are still not done impacting the environment. There is a significant amount of energy used to turn fabric into a garment. An engineering professor in Turkey, Ahmet Cay, conducted a study in 2018 to quantify the energy consumed in sixteen small-scale clothing factories. He found that 0.09 kg of CO₂ were created per piece of clothing cut and sewn together (Çay, 2018). That figure increases to 0.17 kg of CO₂ per piece if the garment is screen printed or embroidered upon. In total, the mean production of carbon dioxide per small factory was 310.3 tons/year. The mean energy use for cutting and sewing of garments was 123.7 Gj/month or 1,484.4 Gj/year per factory. Although this study represents a very small sample of all the clothing factories in developing countries, it is shown that the from fabric to wearable garment alone creates significant amounts of carbon dioxide each year, and

untold damage when multiplied by the over 100 billion pieces of clothing produced each year (Wall Street Journal, 2019).

In the final stage of a garment's life, once the consumer is done with the clothing (which is rather quickly with fast fashion since it is produced so cheaply, and it is not of very high quality), it is typically simply discarded in landfills. In 2018, 11.7 million tons of textiles were thrown in the landfill (EPA, 2020). If even a percentage of that could be diverted, through recycling or donating, it would save significant room in landfills and reduce the need for new textiles to be generated the following year.

Occupational/Human Health and Ethics

Another issue in the fashion industry occurs during the manufacturing stage of clothing production and deals with the humans working in factories to make these clothes. Most of the clothing production happens in developing countries such as India, Bangladesh, and China, making them the vulnerable population. Because clothing is produced in these lower income countries, where environmental controls are lax, not only are garment workers in these countries being exposed to toxins at work, but everyone else living nearby is dealing with toxins in their air and water, even when they are not the large consumers of these products. While there is still much information to be gathered on the associations between the toxins garment workers come in contact with and their health effects, some things are already known. Khan and Malik mentioned above in the environmental impact section, also found that 40% of colorants used globally contain a known carcinogen-organically bound chlorine (Khan, S., Malik, A., 2013). In addition to cancer-causing chemicals, these authors explore other chemicals that cause allergic

reactions in workers or others that come in contact with contaminated wastewater. While not carcinogenic, sandblasting, a common technique in distressing denim, has been found to cause silicosis in otherwise young, healthy individuals (Hobson, 2013). Cases of sandblasting-related silicosis death have shown that the disease develops quickly, often within a couple years, and those dying from this condition are, on average, in their 20s or younger.

Leather tanning is a part of the industry that contributes considerably to the health of workers and those living near factories. Chromium is a hazardous metal that is highly soluble and readily oxidizes. In high enough concentrations, this can lead to health issues such as pulmonary congestion, liver damage, vomiting, and diarrhea (Karunanidhi et al, 2021). Based on a study that collected samples from across South India, 66% of the samples contained unsafe levels of chromium, based on WHO limits (Karunanidhi et al, 2021). Ingestion of chromium contaminated water has more severe risk for children. This means that those living around these tanning factories are susceptible to the hazards created, even if they are not directly working there.

One of the more well-known and more discussed occupational hazards of garment workers is basic safety of the manufacturing facilities. Textile factories have been known to collapse or catch fire due to preventable infrastructure. The article *To Die For? The Health and Safety of Fast Fashion* by John Hobson provides crucial insight to the physical disasters seen in these countries. This article shows how consumers are in part to blame for these deaths by creating the demand for cheap, quick fashion. Solely in Bangladesh, between 2005 and 2012, over 1,800 garment workers were killed due to collapsed buildings and factory fires (Hobson, 2013). Often

before the incidents, the factory workers are aware that their working conditions are unsafe and have asked management to make changes or shut the factories down. Almost none of the buildings in Bangladesh's capital meet local construction standards (Hobson, 2013). Of course, in the United States, the Triangle Shirtwaist Factory fire in New York City gave way to many advances in occupational safety standards, but factories in Asia do not have the same protections. Even the standards that do exist can be woefully inadequate. A factory fire occurring at the Karachi factory in Pakistan killed 289 people in 2012 and the factory had passed an internationally accepted working safety test just weeks before. This safety test was passed even though the workers were locked into the sewing area. This meant the workers were unable to escape when the fire occurred (Hobson, 2013). The article by Hobson compiles tragic case studies of occupational incidents that could have been prevented if safety standards were higher in the countries where fast fashion is largely produced.

In a systematic review of health vulnerabilities in the garment industry in South and Southeastern Asia elaborates on hazards they found among around 20 studies. Hazards seen in these factories included chemical hazards, similar to those discussed above. In addition, they found physical and psychological issues present in garment factories. A dominant physical hazard found in many garment factories are ergonomic hazards. Musculoskeletal disorders and other strains can develop from posture required to do the work and from the constant and repetitive motions (Kabir et al, 2019). In addition, factories often do not provide adequate ventilation and lighting (Kabir et al, 2019).

As for the psychological hazards, ethics play an important role in the occupational side of the fashion industry. Garment workers in these countries are not paid fair wages for their work. A study of Bangladesh garment factories found that the workers there can make between the equivalent of \$9 as a floor worker and up to \$35 in supervisor positions per month (Absar 2001). The World Bank has determined someone living on less than \$1.90 per day is in poverty in Bangladesh. Job insecurity and pressure from administrators to meet quotas takes an emotional toll on workers (Kabir et al, 2019).

As demonstrated by the literature, the issues the fashion industry creates for consumers, the earth, and people involved in the process are immense and intertwined and ought to be further studied and investigated.

DISCUSSION

The systematic literature review conducted presented several themes regarding the environmental and occupational health burdens of fast fashion in the low- and middle- income countries which produce the clothing. The current system of short-lived trends, low prices, and low-quality garments leads to overconsumption in countries such as the United States. This overconsumption then creates a higher demand for these products, exacerbating the environmental resource use and pollution. It also endangers the garment workers further as long as there remains lax occupational health laws in countries like Bangladesh, China, and India.

The importance of environmental justice is the biggest takeaway from this literature review. Environmental justice refers to the goal that everyone, regardless of race, location, or income, has the “same degree of protection from environmental and health hazards, and equal access to

the decision-making process to have a healthy environment in which to live, learn, and work (EPA, 2022). Fast fashion is an issue of environmental justice. Low- and middle-income countries are absorbing the brunt of the impacts from the production of clothing. The outsourcing of clothing production to these countries because of the countries' lack of labor laws and lower wages is an abuse of power by transnational corporations and leads to direct occupational hazards for garment workers, which are primarily young women. In addition, those who do not work directly in the garment industry, but who only live or work near factories are often affected by pollution from the factories. The lack of environmental laws results in unsafe levels of pollutants for workers and nearby residents. The environmental injustices of the textile industry do not end there. Once the clothing has been sold, worn, and then tossed, it is also shipped back to low-income countries. This a separate issue that has yet to be substantially researched.

By identifying the various hazards that those in low- and middle-income countries are exposed to through this sector, we can see there is a need to further quantify how each of these hazards impacts those countries and develop policies and a consumption culture that aids in minimizing or eliminating the impacts. The main limitation of this study on the impact the fashion industry has in developing countries is the lack of primary data. Thus far, there has not been a large enough attempt at quantifying the health outcomes of workers and the areas surrounding clothing factories.

The most common fibers used in the textiles industry have their advantages as well as disadvantages in terms of sustainability. The two most common fibers are cotton and polyester.

Traditional cotton requires a lot of land, water, and pesticides. Cotton, however, eventually biodegrades. Polyester is synthetic and derived from oil. It is sometimes thought to use less water and resources to create, but once disposed of polyester garments will remain in the landfill for hundreds of years. Because of this, there is no obvious solution to the fashion industry through prioritizing one specific type of fiber that it bounds ahead of the rest regarding its sustainability. There are limited studies on the life cycle analysis of specific fabrics and fibers. It is possible that more consistent results on quantifying the environmental impact of fibers could lead us to find an optimal fabric or develop more sustainable practices for producing those which have already been created. There may be a long way to go for the textile industry to achieve environmental justice, but there are some feasible ways that can get us closer to those goals.

A true solution to these environmental and occupational hazards presented will require contributions from all stakeholders. As consumers, everyone has the moral responsibility to be conscious about where we put our money. Consumers and governments must demand these large clothing companies be more transparent of their processes. If we could encourage transparency to become a core value of businesses, companies would be more likely to change their production to be more sustainable. A study by Nielsen Media Research showed that two-thirds of global consumers are willing to pay more for products that are better for the environment (de Freitas Netto, Sobral, Ribeiro, 2020). As in other industries, transparency will inform the public, and consumers will fuel a growing desire for more sustainable options. This public pressure will lead to better practices.

As companies are realizing this, they are resorting to greenwashing instead to keep profits high. Greenwashing is when a brand promotes or claims to be a part of sustainable practices as a way

to deflect how environmentally unsustainable their practices are (de Freitas et al, 2020). This enables the companies to charge more for products that are barely, if at all, better for the planet.

Eliminating greenwashing is only one start to clothing companies taking responsibility.

Companies will also have to completely alter their practices and in order to reduce the impacts.

Companies should commit to Fairtrade standards. These are standards set in place by Fairtrade International, an organization whose mission is to help producers reach their full potential and live secure and sustainable livelihoods (Fairtrade International, 2022). They have developed the Fairtrade Textile Standard, which lays out requirements for the supply chain of a brand to acquire Fairtrade status. These standards address social development, labor conditions, environmental responsibility, and trade. Implementing Fairtrade standards across the board would significantly reduce the environmental injustice seen from the clothing industry as it gives power back to the producers and can help them out of poverty.

Another area of impact is social media. The power social media has over our society also contributes to our fashion consumption. Brands can create targeted ads to encourage purchasing. The people we see on these platforms are also wearing trendy clothes and it only takes a few seconds to go from seeing a gorgeous outfit in a carefully curated Instagram post to clicking the link to those items and have them on the way to your home. Social media also spreads trends as quickly as possible, creating a perceived need, exploiting it, then leaving items that were popular a few months ago already undesirable. The speed of trends changing combined with the poor quality of these trendy pieces and low prices leads to consumers treating clothing as disposable. There does not appear to be research yet on how social media affects fashion consumption.

Social media could instead be utilized to encourage sustainable clothing shopping behaviors. This has been happening to an extent, but not at the same scale that clothing companies have been able to get their message out. Posts encouraging second-hand clothing or just about limiting consumption are typically originally posted by people, rather than popular companies that already have large followings and marketing teams. If we were bombarded by facts and pictures of where our clothes come from and the conditions for the people who assemble our clothes, we would be less inclined to support brands that do not treat their employees like humans.

CONCLUSION

The findings of this literature review demonstrate the importance of conducting further primary research in these vulnerable, developing countries. The review consolidates knowledge already acquired on the negative impacts that textile factories have on the environment and the people exposed. Quantifying the environmental and occupational impacts fast fashion has on these countries will enable us to find ways to best protect workers. A shift in consumer habits that reduces the demand for apparel would greatly reduce waste and pollution generated from the industry. A solution to the hazards garment workers face would be developing occupational health and safety laws that protect workers to the best of their ability. The future of sustainable fashion will be based on a collaborative effort between government, consumers, and clothing brands.

REFERENCES:

- Absar, S. (2001). Problems Surrounding Wages: the ready made garments sector in Bangladesh. *Labour and Management in Development Journal*, 2(7). Asia Pacific Press.
- Bick, R., Halsey, E. & Ekenga, C.C. The global environmental injustice of fast fashion. *Environ Health* 17, 92 (2018). <https://doi.org/10.1186/s12940-018-0433-7>
- Çay, A. (2018). Energy consumption and energy saving potential in clothing industry. *Energy*, 159, 74–85. <https://doi-org.libproxy.unl.edu/10.1016/j.energy.2018.06.128>
- Changing Markets. (February, 2021). Fossil Fashion: the hidden reliance of fast fashion on fossil fuels. Retrieved from: http://changingmarkets.org/wp-content/uploads/2021/01/FOSSIL-FASHION_Web-compressed.pdf
- de Freitas Netto, S.V., Sobral, M.F.F., Ribeiro, A.R.B. *et al.* Concepts and forms of greenwashing: a systematic review. *Environ Sci Eur* 32, 19 (2020). <https://doi.org/10.1186/s12302-020-0300-3>
- Environmental Protection Agency. (2019, October 30). Textiles: Material-Specific Data. Retrieved October 01, 2020, from <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/textiles-material-specific-data>
- Environmental Protection Agency. (2022). Environmental Justice. Retrieved at <https://www.epa.gov/environmentaljustice>
- Gazzola, P., Pavione, E., Pezzetti, R., Grechi, D., (April 2020). Trends in the Fashion Industry. The perception of Sustainability and Circular Economy: A gender/generation quantitative approach. *Sustainability* 2020, 12(7), 2809; <https://doi.org/10.3390/su12072809>
- Haggblade, S. (1990). The Flip Side of Fashion: Used Clothing Exports to the Third World. *Journal of Development Studies*, 26(3), 505. <https://doi-org.libproxy.unl.edu/10.1080/00220389008422167>
- Iran, S. (2018). Sustainable Fashion: From Production to Alternative Consumption. *Sustainable Fashion. Management for Professionals*. Springer, Cham. <https://doi.org/10.1007/978-3-319-74367-13>
- Hobson, J. (July 2013). To die for? The health and safety of fast fashion, *Occupational Medicine*, Volume 63, Issue 5, 317–319, <https://doi.org/10.1093/occmed/kqt079>
- Kalliala, E., & Nousiainen, P. (1999). Life Cycle Assessment Environmental Profile of Cotton and Polyester-Cotton Fabrics. *AUTEX Research Journal*, 1(1), 8-20.

- Karunanidhi, D., Aravinthasamy, P., Subramani, T., Kumar, D., & Venkatesan, G. (2021). Chromium contamination in groundwater and Sobol sensitivity model based human health risk evaluation from leather tanning industrial region of South India. *Environmental Research*, 199, 111238. <https://doi.org/10.1016/j.envres.2021.111238>
- Khabbaz, B. G. (2010). *Life cycle energy use and greenhouse gas emissions of Australian cotton: Impact of farming systems*. University of Southern Queensland.
- Khan, S., Malik, A. (2014). Environmental and Health Effects of Textile Industry Wastewater. *Environmental Deterioration and Human Health*. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-7890-0_4
- Kirchain, Olivetti, Reed Miller, & Greene. (2015). Sustainable Apparel Materials. *Materials Systems Laboratory, Massachusetts Institute of Technology*
- McNeill, Moore (2015). Sustainable fashion consumption and the fast fashion conundrum: fashionable consumers and attitudes to sustainability in clothing choice. *International Journal of Consumer Studies*. 39(3) 212-222.
- Moazzem, S., Daver, F., Crossin, E., & Wang, L. (2018). Assessing environmental impact of textile supply chain using life cycle assessment methodology. *The Journal of The Textile Institute*, 109, 1574 - 1585.
- National Environmental Health Association. (2022). Environmental Health definition. Retrieved from <https://www.neha.org/about-neha/definitions-environmental-health>
- Shaikh, M. (2009). *To Die For? Fashion Industry*.
- Siegle, L. (2011). *To die for: is fashion wearing out the world?*. HarperCollins UK.