Green Jeans? A Life Cycle Assessment of Fast Fashion Denim

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EXECUTIVE SUMMARY

Do you know all the steps involved in making your denim jeans? What about all the people impacted along the way? This report breaks down the entire denim supply chain and everything we need to know as consumers to make ethical and sustainable choices. Our capitalist economic system means that companies will always choose to make more profit over ethical production. Therefore, all other concerns, such as environmental degradation or social harms are overlooked in favour of economic gain. The denim obsession has serious environmental and socio-economic impacts highlighted in this report. These findings can be extrapolated to the greater fast fashion industry, illustrating large-scale trends and concerns of globalized supply chains. Recommendations to address this problem can be found on page 12.

Key Findings

DENIM, MADE FROM COTTON, IS ONE OF THE MOST WATER- AND PESTICIDE-HEAVY CROPS GROWN FOR MASS PRODUCTION.

HARMFUL CHEMICALS ARE USED IN EVERY STEP OF DENIM MANUFACTURE, CAUSING WATER SYSTEMS TO BE HEAVILY POLLUTED.

THE FASHION INDUSTRY EMITS SIGNIFICANT GREENHOUSE GASES DUE TO FOSSIL FUEL DEPENDENCY DURING PRODUCTION, MANUFACTURING, AND TRANSPORTATION PHASES.

FAST FASHION RELIES ON CHEAP LABOR THAT IS OFTEN LOCATED IN COUNTRIES WITH POOR GOVERNMENTAL AND REGULATORY STRUCTURES.

Introduction

Fast fashion is the epitome of capitalism. It's a system that responds quickly to consumer desires and encourages a constant stream ofinnovation while promoting disposability and embracing obsolescence.1 Increased demand for large amounts of inexpensive clothing has resulted in environmental and human impacts throughout the supply chain. Studies report that "if the garment business were a nation, it would be the fourth largest climate polluter on Earth."2 From 2000-2014, clothing production doubled, and the fashion industry is expected to triple its resource consumption by 2050.3 While this industry is inherently exploitative, its cousin, fast fashion, has gone even further. It has developed an agile supply chain that streamlines the garment lifecycle to such an extent that in a few decades, fashion brands have gone from two collections per year (summer and winter) to upwards of 20.4 Much of this streamlining ability has been a result of globalizing capitalism and a dedication to the 'race to the bottom,' where firms undercut competitors' prices through sacrifices in product quality and rational socio-economic decisions.5 A key feature is offshoring operations to areas with lower labour costs, regulatory standards, and accountability measures.



Resource Consumption Set to Triple by 2050

The socio-economic and environmental implications associated with and exacerbated by the fast fashion industry are best illustrated through a lifecycle assessment of denim jeans. Since jeans will exemplify the broader fast fashion industry, this assessment accounts for all steps in the supply chain; resource procurement, production processes, transportation, consumption and disposal.6

Resource Procurement

Jeans are often made from 100% cotton. However, the cultivation of cotton causes environmental issues due to the amount of water and pesticides used. Under weak management practices cotton can contribute to overconsumption of water. The global average water footprint of seed cotton is 3,644 cubic metres per tonne, the equivalent of nearly 1.5 Olympic swimming pools.7 This means that 7,000-10,000 litres of water are needed to manufacture a single pair of jeans.8

Furthermore, the use of pesticides and fertilizers can cause eutrophication, enrichment of water with nitrogen, which poisons drinking water for people and animals alike.9 Additionally, they can decrease biodiversity, fertility, plant and insect health.10 6% of global pesticide use is applied to cotton crops, which is considered "the most toxic crop in the world."11 Additionally, the energy used to produce fertilizer contributes ~1.5% of the world's energy consumption.12 The production rates necessary for fast fashion mean that any damage to crops can be disastrous, therefore fast fashion multinational corporations (MNCs) opt for pesticide use to protect their income rather than choosing environmentally friendly options.





Finally, there are humanitarian concerns related to the health effects of picking cotton. Workers often report symptoms such as nausea, gastroenteritis, and vomiting.13 As fast fashion brands seek new methods of undercutting their competition, labour rights are often greatly compromised. The offshoring that accompanies the race to the bottom features a trend of locating factories and hiring workers in countries with weaker labour regulations, allowing corporations to disregard the externalities they create.

> The rate of production for both natural and synthetic resources needed to keep up with the fast fashion industry uses enormous amounts of water, causes heavy pollution and environmental degradation, and has severe consequences for human health. However, the race to the bottom prioritizes profits over environmental protection. Cotton production generally occurs in developing countries because the economic gains they receive through MNC outsourcing incentivizes them to allow environmental and social costs. This is beneficial in the short-term, but causes detrimental long-term effects.



Textile Manufacturing

Textile manufacturing refers to the weaving, dyeing, sewing, and assembly of garments. The textile industry is arguably the largest polluter of all mass consumption goods production. This has worsened due to the increasing speed of fashion trend cycles. The fast fashion industry creates more toxic chemicals per item produced than any other industrial product.14 The World Bank has identified 72 toxic elements emitted during production, 30 of which cannot be purified.15 20% of all water pollution is created, and 15% of all production of dyes is lost, during wet and runoff processes.16 Additionally, petrochemicals used in production are a prominent source of ocean microplastic pollution.17 Microplastics are tiny particles of plastic that detach from synthetic clothing throughout its lifecycle.18 The manufacturing process causes 80% of a garment's climate impact and 92% of its toxicity impact.19

Denim undergoes a particularly energy-intensive manufacturing process, which emits the highest CO2 emissions of any portion of the jean lifecycle, with 56% of emissions coming from this process.20 During wet processes, substantial amounts of indigo dye are released from factories, where river water becomes darker due to the slow decomposition of the dye.21 This deprives the flora and fauna of sunlight and oxygen, resulting in further environmental degradation. Furthermore, mordants, a dye fixative, destroy plants and can poison sea life and neighboring organisms when rivers, groundwater and ecosystems are contaminated with them. The production phase also has human costs. The health and human rights of workers are often neglected, due to the geographical and cultural distance between workers and consumers.22 Wet processes directly expose local populations to chemicals that contaminate their bodies, lands, and waters. Textile workers are obliged to wear skin, eye, and lung protection when dealing with dyes. However, these dyes can then enter water sources and pollute the foods that humans consume. Furthermore, globalization of supply chains has led to a concentration of manufacturing

facilities in the Global South. This exports both pollution and precarious working conditions to these communities, leaving them to bear the burden of environmental health hazards.23

For example, jean manufacturers in poorly regulated developing countries often engage in sandblasting, a process which fades denim, despite it being illegal in most countries because it causes silicosis, a pulmonary disease.24

Jeans are one of the most popular fashion items, meaning their production is lucrative and requires efficiency. Slowing that pace would mean giving up economic gains. When the negative environmental and health-related externalities do not cause economic harm to companies, they overlook these in favour of profit.

Once garments have been manufactured from cotton or synthetic fibres, they then need to be transported to consumers. Transportation emissions are largely due to the fact that natural fibres are often grown in one country, shipped to a second for manufacture, then shipped to a third country to be sold. This often occurs because countries in the developing world, such as Bangladesh, face international pressure to keep their labor prices low.25 The major corridors for clothing transport and distribution are highlighted below. 26

Major global flows of embodied emissions in clothing

Transportation and Distribution



Note: Excludes emissions associated with consumption in the same region as production. Source: Carbon Trust Analysis; CICERO / SEI / CMU GTAP7 MRIO Model.

Clothing that is transported as air freight rather than transported on cargo ships have significantly higher emissions.27 Increased time pressures of the fast fashion industry means this option is more often chosen. For example, 80% of exported US cotton is reimported in the form of ready-made garments. intensifying the frequency and environmental impacts of global transportation and distribution processes to reap economic benefits.28 Additionally, transport to and from retail stores accounts for ~11% of a garment's total climate impact.29

Therefore, the time constraints and economic pressures of the fast fashion industry encourage the use of globalized supply chains. This increases the overall carbon footprint of each item of clothing, particularly if air transport is used. Additionally, lack of labour oversight and regulatory compliance in developing countries remains a ripe temptation for MNCs to exploit workers to receive greater economic benefits.

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Consumption

This phase of the garment lifecycle is where the product is serving its intended purpose. While this might seem innocuous, a significant portion of CO2 emissions of garments come from washing and drying during the use cycle. One pair of jeans accounts for ~12kg of CO2e throughout their lifecycle.30 Jeans are washed approximately 25 times in their lifecycle, roughly every ten wears, making the impact of this stage important in the environmental degradation caused by jeans.31

Washing and drying textiles also has other environmental impacts. Microplastics detach from synthetic textiles when clothes are washed. This wastewater is returned to nature littered with microplastics. The spread of these fibres has become ubiquitous over the last several decades, causing environmental degradation in all types of ecosystems.32 The rise of fast fashion has rapidly decreased the use life of many garments from several decades to only 3-4 years, which has led to surges in the amount of disposed textiles in the past 20 years.33 On average, consumers bought 60% more, but kept 50% less clothes as they did in 2000.34

Therefore, the everyday practice of washing clothes creates significant CO2 emissions and environmental degradation. This is partly due to cost-cutting measures firms engage in that result in a lower quality of material, as well as the carbon-heavy energy grids worldwide. While consumers often have knowledge of the processes that occur prior to consumption, the use period of the lifecycle of a pair of jeans also has negative environmental impacts.



Average Consumer Bought **60%** More Clothing in 2014 Than in 2000, But Kept Each Garment Half as Long

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Disposal

Fast fashion particularly emphasizes disposability, and as a result the average American throws away ~80lbs of clothing and textiles annually.35 The disposal of large amounts of unsold stock through incineration or landfill deposits contributes to making fashion one of the highest impact industries on the planet.36 Clothing that is not properly disposed of becomes solid waste, clogging rivers, and green spaces, creating the additional environmental health hazards.37 Simultaneously, clothes in landfills excrete chemicals into nearby groundwater, and incinerated clothes release those same toxins into the air.38

Denim that is made purely of cotton decomposes fairly quickly when put in a landfill. However, denim that is sent to landfill may leach chemicals into the ground, or alternatively, it may be incinerated. Often this waste is shipped out of developed countries to developing countries. Ironically, countries that accept exported garbage often heavily overlap with countries that engage in garment production, shading the negative impacts of fast fashion for consumers. This imposes environmental effects for fast fashion on those who do not consume it.39 Recycling and donating is often seen as a sustainable alternative to throwing clothes away. However, the reality is that only 6% is resold locally, ~33% is repurposed into insulation materials and >50% ends up being exported back to the Global South.40

Fast fashion relies on disposability through poorer quality and rapid trend cycles to encourage overconsumption of their products. While this is economically beneficial to MNCs, it causes enormous amounts of waste and chemical pollution. Like the rest of the lifecycle, the majority of these negative externalities are not felt by the consumers but rather developing countries in the Global South.



Assessment of Ongoing and Proposed Solutions

Due to the environmental impacts highlighted above, the fashion industry has come under public scrutiny in recent years. Many designers and clothing brands have announced voluntary initiatives such as carbon neutrality targets and emissions reductions goals. In 2019, 32 of the world's biggest fashion brands signed on to the Fashion Pact, pledging 100% renewable energy by 2030, among a host of other pledges.41 Additionally, there has been a slew of collective action to address environmental impacts of the fashion industry. For example, The Better Cotton Initiative involves >50 retailers and brands and nearly 700 suppliers in setting standards for environmental, social, and economic responsibility in cotton production.42

However, attempts to ensure voluntary or regulatory compliance have been mediocre. The WTO's guidelines for discharge levels and water quality standards are often ignored as there is no compliance mechanism imposed for violations.43 In 2018, the establishment of the UNFCCC Fashion Industry Charter for Climate Change was intended to align with Paris Agreement goals. Unfortunately, implementation and compliance of this agreement has been relatively unsuccessful.44

The ability to mitigate the impacts of the fast fashion industry within a global capitalist economy lies in strengthening international governance and collaboration. A major barrier to a sustainable fashion industry is the large geographical distance between sourcing and selling markets. This blurs lines of communication and makes accountability harder to attain. Additionally, the divisions between the public and private sectors, as well as between the Global North and the Global South, result in a conflict of interest, which strains negotiations and limits the ability to regulate the fashion industry.



Conclusion

Jeans continue to be a staple in the wardrobes of many. The environmental impacts of this product, and other fast fashion products, are significant and widespread, covering pollution, overconsumption of water, carbon emissions, and waste production. There are also negative human consequences ranging from health hazards to human rights violations. The race to the bottom that forms the basis of fast fashion encourages companies to continue creating these negative externalities. Governments and regulatory bodies have not yet successfully altered this situation. Potential ways to reduce these negative impacts can be found next.



Recommendations



Regulation

- Enforce adherence to UN SDG 12, which calls for sustainable consumption and production as part of national and sectoral plans, sustainable business practices, and the reduction and elimination of fast fashion should all be a target of global environmental justice advocates.50
- Adopt industry-wide certification criteria that encourages environmental protection and human safety throughout the supply chain.51
- Engage in policy intervention to apply incentive structures in favor of sustainable actions
- Promote supply chain democracy in regard to political, social, and economic accountability
- Eliminate designer copyright infringement through legal avenues.

Design/Manufacturing

- Return to the original timeline of two collections per year.45
- Sustainable fibres that are comparable in quality and price, such as Lyocell - a wood pulp product, should be utilized more in textile production.46
- Products should be designed with the whole lifecycle in mind, including disposal.47
- Adopt closed-loop technology, where textile is recycled to produce the same product it originally was.48
- Reduce air freight during transport and opt for cargo shipping. 49



Consumption

- Brands can use their social capital to become sustainability leaders in the fashion industry and encourage the adoption of 'slow fashion.'
- Encourage consumers to invest in one pair of high quality jeans from a company that has publicly stated its sustainability practices (i.e. Levi's).
- Increase support for denim recycling programs like Blue Jeans Co Green, and reuse systems, like shopping second-hand.
- Educate consumers on the number of washes needed to ensure that clothing is not over washed.52



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